

MDT013000	240 x 240	SPI Interface	TFT Module
Specification			
Version: 1		Date: 20/03/2023	
Revision			
1	18/03/2023	First issue	

Display Features			
Display Size	1.30"		
Resolution	240 x 240		
Orientation	Round		
Appearance	RGB		
Logic Voltage	1.8V		
Interface	SPI		
Brightness	500 cd/m ²		
Touchscreen	---		
Module Size	42.10 x 38.00 x 2.30 mm		
Operating Temperature	-20°C ~ +70°C	Created By	Checked By
Pinout	12 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 ST7789V display driver specification.(Provided Separately)

Display Accessories	
Part Number	Description
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



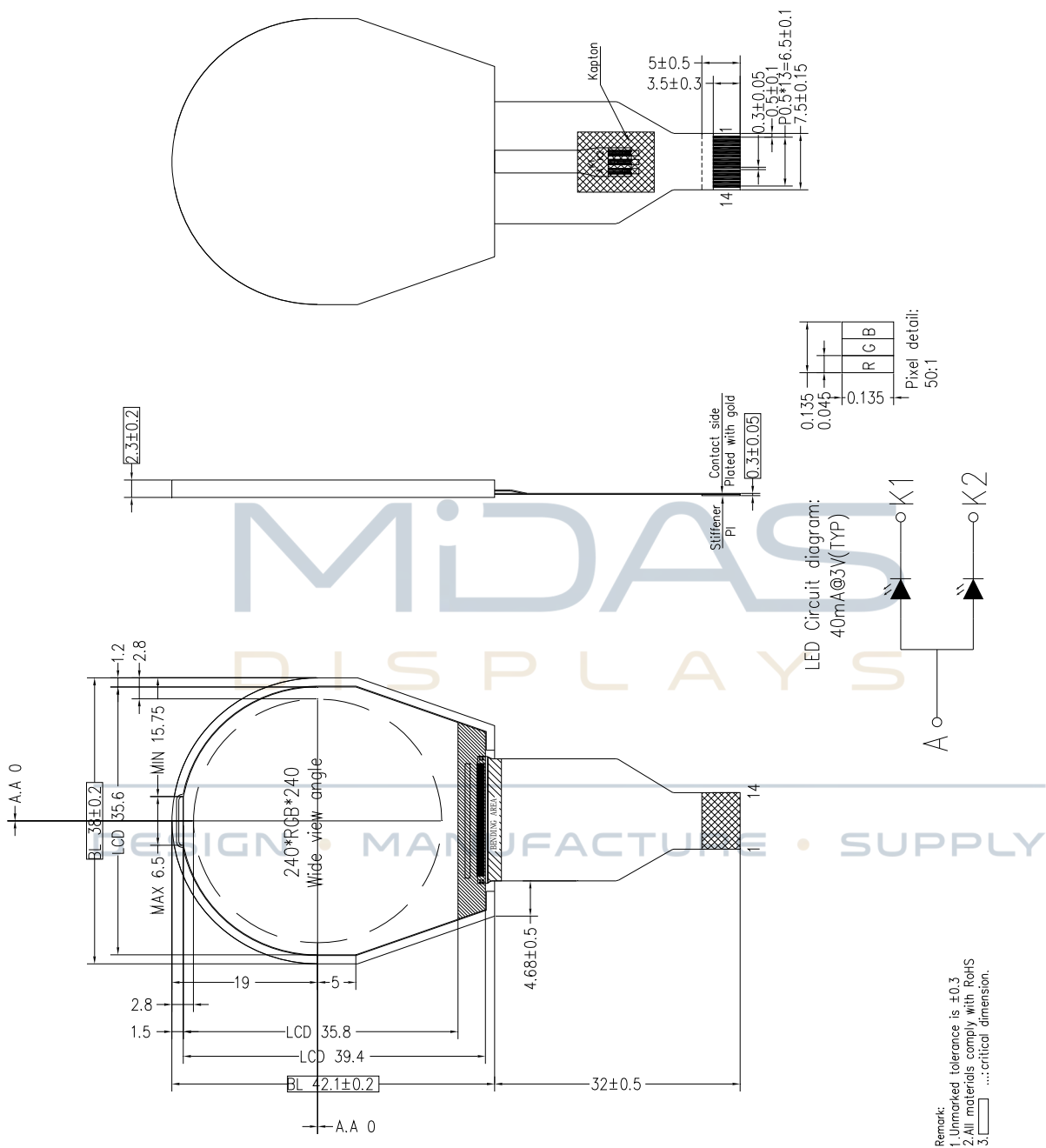
1. GENERAL SPECIFICATIONS

Item	Contents	Unit
LCD Type	TFT/TRANSMISSIVE	-
Module size(W*H*T)	42.10*38.00*2.30	mm
Panel outline dimension(W*H*T)	39.40*35.60*0.50	mm
Active Screen size	32.40 diameter	mm
Sub-Pixel size	45*135	μm
Pixel arrangement	RGB-stripe	-
Pixel driving element	α -Si TFT	-
Resolution	240RGB*240	pixel
Driver IC	ST7789V	-
Interface type	SPI interface	-
View direction	Wide view angle	-
Backlight type	2-DIES White LED	-
Touch panel type	Without	-

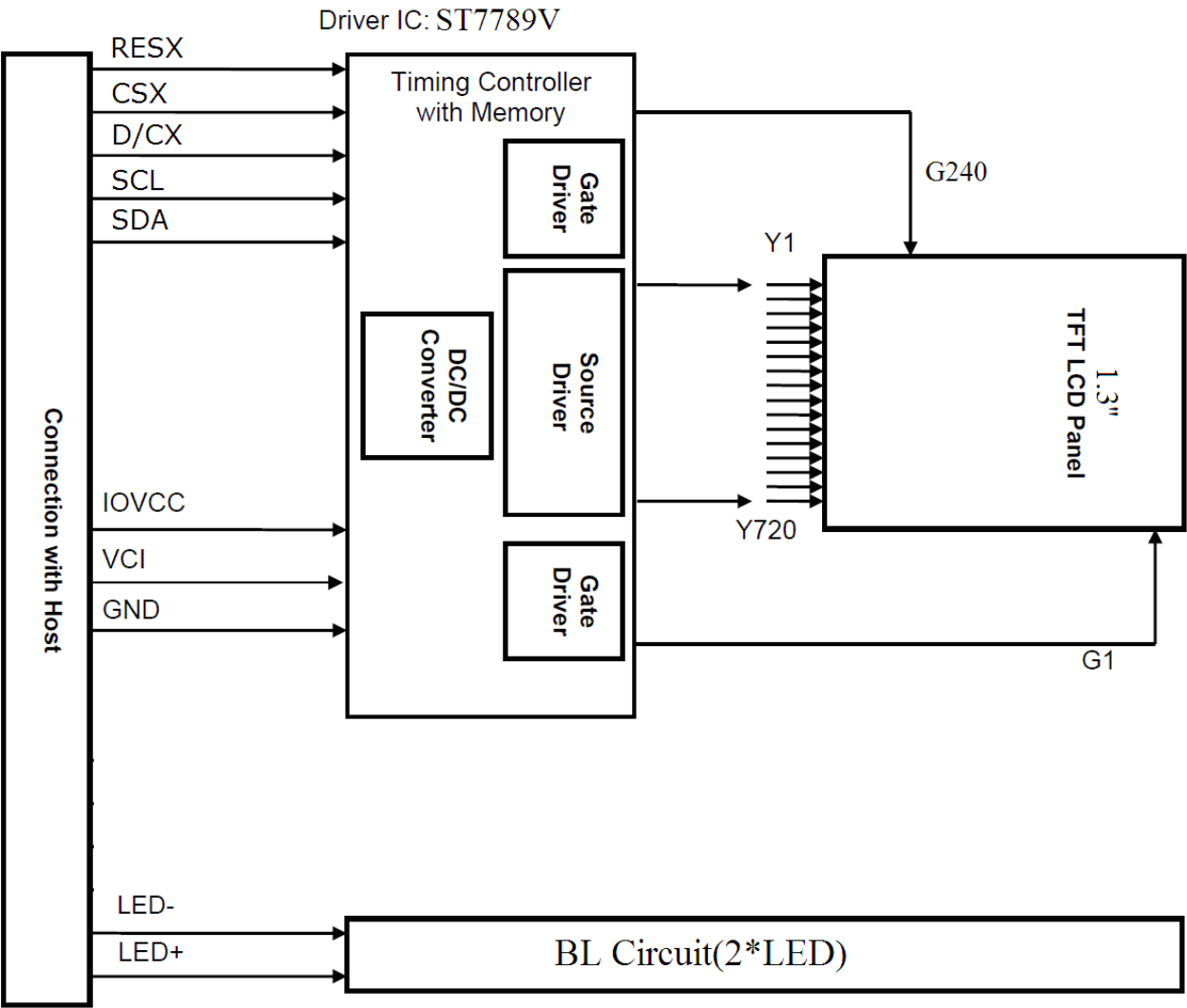
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2. EXTERNAL DIMENSIONS



3. BLOCK DIAGRAM



4. PIN ASSIGNMENT

NO.	SYMBOL	DESCRIPTION	I/O
1	GND	Power ground	P
2	IOVCC	Power supply for I/O port,1.8V/2.8V	P
3	RESX	Reset signal pin	I
4	CSX	Chip select	I
5	D/CX	Display data/command selection	I
6	SCL	Serial clock	I
7	SDA	Serial data	I
8	VCI	Power supply for I/O port,2.8V	P
9	GND	Power ground	P
10	LEDA	Power for led backlight(anode)	P
11	LEDK	Power for led backlight(cathode)	P
12	GND	Power ground	P

I: Input, O: Output, P: Power

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5. OPTICAL CHARACTERISTICS

5.1 Parameters and specifications

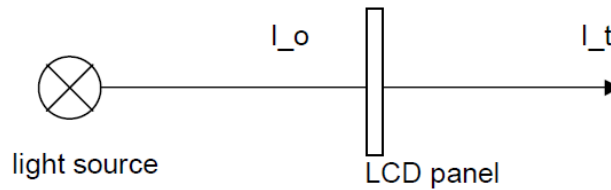
Item		Symbol	Specifications			Unit	Note
			Min.	Typ.	Max.		
Transmittance*		T%	-	4.0	-	%	*[1]Here the data are design value and with Polarizer [2]Chromaticity measuring machine: CFT-01. Reference Only
Contrast ratio*		Cr ($\Theta=0^{\circ}$)	400	600	-		
Response time (25℃)*		T _r + T _f	-	35	50	ms	
Viewing angle (Cr≥ 10)*		Θ21	60	80	-	deg	
		Θ22	60	80	-		
		Θ12	60	80	-		
		Θ11	60	80	-		
Chromaticity of CF	Red	x	0.613	0.633	0.653	-	
		y	0.300	0.320	0.340		
		Y	14.1	19.1	24.1		
	Green	x	0.272	0.292	0.312		
		y	0.563	0.583	0.603		
		Y	55.3	60.3	65.3		
	Blue	x	0.129	0.149	0.169		
		y	0.107	0.127	0.147		
		Y	11.5	16.5	21.5		
	White	x		0.298			
		y		0.327			
		Y		32			
Color gamut of CF (NTSC%)		S		60		%	
Luminance		L		500		Cd/m²	



5. 2 Definitions and measuring methods

[1] Transmittance (T%)

The transmittance of the panel including polarizers is measured with electrical driving.



The Transmittance is defined as:

$$Tr = \frac{I_t}{I_o} \times 100\%$$

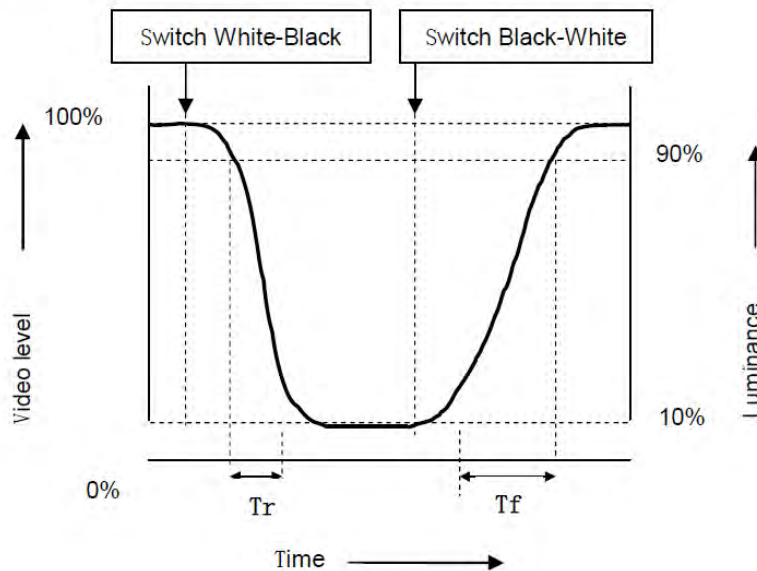
here,

I_o : the brightness of the light source.

I_t : the brightness after panel transmission.

[2] Response Time(Tr , Tf)

The rise time ' Tr ' is defined as the time for luminance to change from 90% to 10% as a result of a change of the electrical condition. The fall time ' Tf ' is defined as the time for luminance to change from 10% to 90% as a result of a change of the electrical condition.

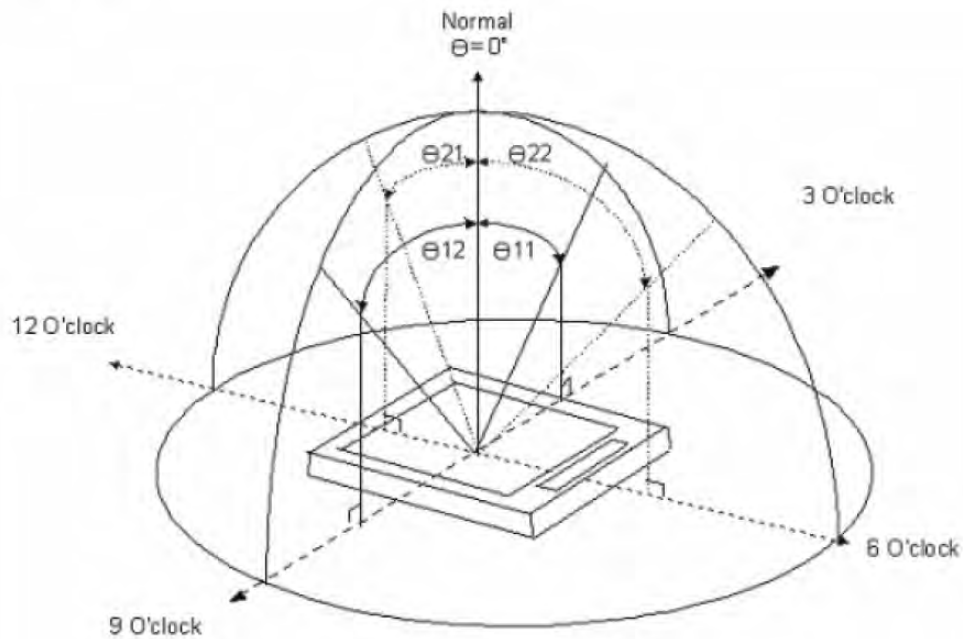


[3] Contrast ratio (Cr)

The contrast ratio (Cr), measured on a module, is the ratio between the luminance (L_w) in a full white area ($R=G=B=1$) and the luminance (L_d) in a dark area ($R=G=B=0$):

$$Cr = \frac{L_w}{L_d}$$

[4] Viewing angle diagram



[5] Definition of color gamut

Measuring machine: CFT-01. NTSC'S Primaries: $R(x,y,Y)$, $G(x,y,Y)$, $B(x,y,Y)$.

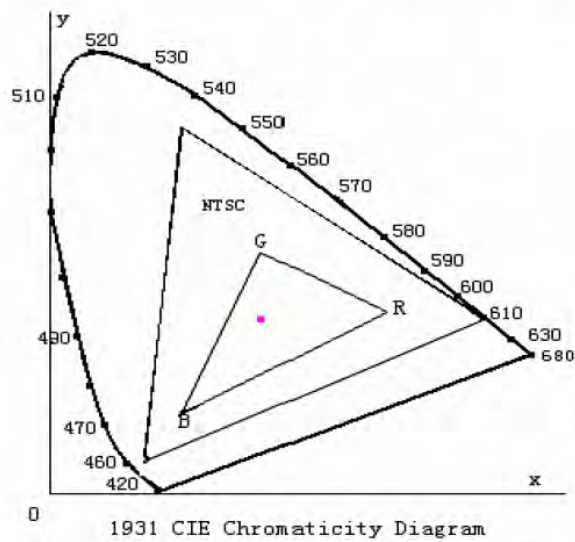


Fig. 1931 CIE chromaticity diagram

$$\text{Color gamut: } S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$$



6. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Supply voltage for analog	VCI	-0.3	4.6	V
Supply voltage for logic	IOVCC	-0.3	4.6	V
Operating temperature	T_{OP}	-20	+70	°C
Storage temperature	T_{ST}	-30	+80	°C

Note: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

7. ELECTRICAL SPECIFICATION

7.1 INPUT POWER

Item	Symbol	Min	Typ.	Max	Unit	Applicable terminal
Supply voltage for analog	VCI	2.4	2.75	3.3	V	
Supply voltage for logic	IOVCC	1.65	1.8	3.3	V	
Input voltage	V_{IL}	GND	-	0.3VCI	V	
	V_{IH}	0.7VCI	-	VCI	V	

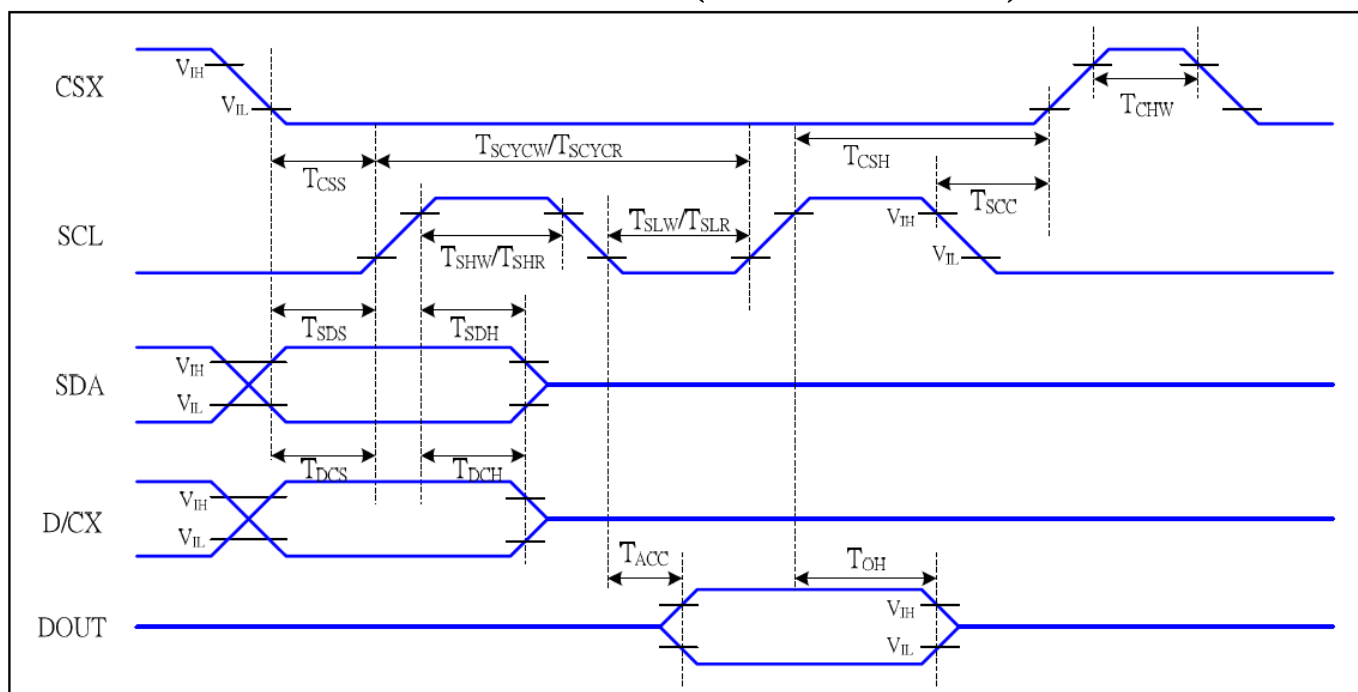
7.2 BLACKLIGHT DRIVING CONDITIONS

Item	Symbol	Value			Unit	Remark
		Min	Typ.	Max		
Voltage for LED backlight	V_L	-	3.0	-	V	$I_L = 20\text{mA}$
Current for LED backlight	I_L	-	40	-	mA	-
Power consumption	P	-	0.12	-	W	-
LED life time	-	30,000	-	-	Hr	Note

Note: brightness to be decreased to 50% of the initial value at ambient temperature $T_A = 25^\circ\text{C}$

8. TIMING CHARACTERISTICS

SERIAL INTERFACE CHARACTERISTICS (4-LINE SPI SYSTEM)



VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70 °C

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)	66		ns	-write command & data ram
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		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	10		ns	
	T_{SDH}	Data hold time	10		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	Test Condition	Check Time
1	High temp storage	T=80°C	240Hrs
2	Low temp storage	T=-30°C	240Hrs
3	High temp operation	T=70°C	240Hrs
4	Low temp operation	T=-20°C	240Hrs
5	High temp & high humidity	T=60°C 90%R.H.	240Hrs



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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 substances 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.

