深圳市显创液晶显示有限公司

PRODUCTION SPECIFICATION OF LCD MODULE MODULE NO.: TL019FQV01-B1263A

Customer Name:		
Customer Part Number:		
Approved By:	Date:	

Prepared By	Checked By	Approved By

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Revision History

Rev	Issued Date	Description	Page	Editor
1.0	NOV 24, 2018	First release	All	

Module No.: TL019FQV01-B1263A

	Feature	Specifications
	LCD type	1.9 inch
	Resolution (H*V)	170(RGB) ×320
Display Spec.	Technology Type	a-Si TFT /IPS
Display Spec.	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	Transmissive / Normally Black
	Viewing Direction	ALL
	OutlineDimensions (H xV x T) (mm)	25.8*49.72*1.36
Mechanical Mechanical	Active Area(mm)	22.7*42.72
Characteristics	With /Without Touch screen	Without
	Backlight Type	White LED
	Weight (g)	TBD
Electrical	Interface	4L-SPI/8Bit-8080 MCU
Electrical Characteristics	Number of color	262K
Characteristics	Driver IC	ST7789V

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180 degree shift.

2 Pin Assignment

NO.	PIN NAME	I/0	Description		
1	GND	P	Ground		
2	VCI	P	Power Supply 2.8V Voltage		
3	IM2	I/O	when IM1=0, IM2=0 , 8080-8bit;		
4	IM1	I/O	when IM1=1, IM2=1, 4-line SPI serial		
5	RESET	I/O	LCM Reset input signal		
6	CSX	I/O	Input pin for chip selection signal		
7	DC(SPI-SCL)	I/O	When connecting to an 8080-series microprocessor, this pin receives the data/command selection pin .This pin is used to be serial interface clock in 4-line serial interface		
8	WR (SPI-RS)	I/O	When connecting to an 8080-series microprocessor, this pin receives the write signal. Display data/command selection pin in 4-line serial interface.		
9	RD	I/O	When connecting to an 8080-series microprocessor, this pin receives the Read signal. Read operation is initiated when this pin is pulled LOW and the chip is selected. When serial interface is selected, this pin must be connected to Ground.		
10	SDA	I/O	SPI interface input/output pin. The data is latched on the rising edge of the SCL signal.		
11-18	D0-D7	I/O	MCU parallel interface data bus.		
19	SDO	I/O	SPI interface output pin.		
20	LEDA	Р	LED Anode		
21	LEDK1	Р	LED Cathode		
22	LEDK2	Р	LED Cathode		
23	LEDK3	Р	LED Cathode		
24	LEDK4	Р	LED Cathode		
25-29	NC		No Connect		
30	GND	P	Ground		

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Note1: I/O definition: I----Input O---Output P----Power/Ground

3 Absolute Maximum Ratings

GND=0V, Ta= 25°C

Item	Symbol	Value	Unit
Power supply voltage for logic	V_{DD}	1.6~3.3	V
Input voltage	Vin	V _{DD} +0.3	V
Operating temperature	Topr	-20 to 70	°C
Storage temperature	Tstg	-30 to 80	°C

4 Electrical Characteristics

4.1 DC Characteristics (VDD=2.8V,Ta=25°C)

Item	Symbol	Min	Туре	Max	Unit	Test condition
Operating voltage	V_{DD}	2.6	2.8	3.3	V	-
Supply current	I_{DD}	-	-	25	mA	V _{DD} =2.8V,Ta=25°C
Input voltage	V _{IH}	0.8VDD	-	VDD	V	
	V_{IL}	0	-	0.2VDD	V	-
Input leakage current	I _{IL}	-1.0	1	1.0	μΑ	V _{IN} =V _{DD} or V _{SS}

Note: Voltage greater than above may damage the module.

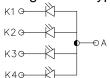
All voltages are specified relative to VSS=0V.

4.2 Driving Backlight

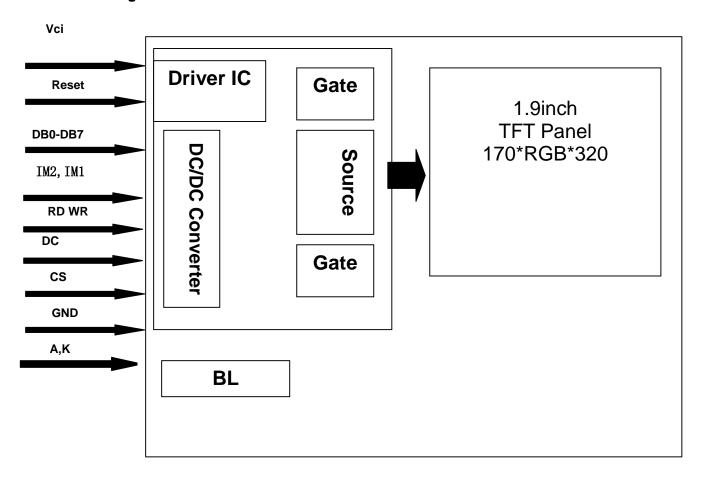
Ta=25°C

Item	Symbol	Min	Тур	Max	Unit	Remark
Forward Current	I _F		80	100	mA	
Forward Voltage	V_{F}	ı	3.2	1	V	
Connection mode	Р		4 Parallel			
LED number	/		4		pcs	

Note1: Optical performance should be evaluated at Ta=25°C only .If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

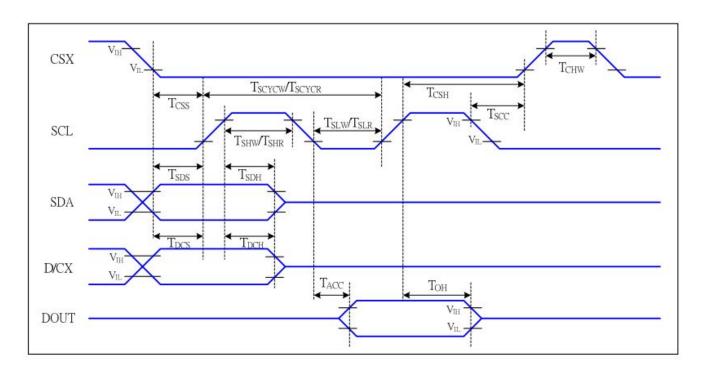


4.3 Block Diagram



5 INTERFACE TIMING

5.1 SPI interface



Signal	Symbol	Parameter	MIN	MAX	Unit	Description
	T _{CSS}	Chip select setup time (write)	15		ns	
	T _{CSH}	Chip select hold time (write)	15		ns	
CSX	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	
	T _{SCYCW}	Serial clock cycle (Write)	66		ns	write command 9 data
	T _{SHW}	SCL "H" pulse width (Write)	15		ns	-write command & data
001	T _{SLW}	SCL "L" pulse width (Write)	15		ns	ram
SCL	T _{SCYCR}	Serial clock cycle (Read)	150		ns	
	T _{SHR}	SCL "H" pulse width (Read)	60		ns	-read command & data
	T _{SLR}	SCL "L" pulse width (Read)	60		ns	ram
DICY	T _{DCS}	D/CX setup time	10		ns	
D/CX	T _{DCH}	D/CX hold time	10		ns	
SDA	T _{SDS}	Data setup time	10		ns	
(DIN)	T _{SDH}	Data hold time			ns	
DOLLT	T _{ACC}	Access time	10	50	ns	For maximum CL=30pF
DOUT	Тон	Output disable time	15	50	ns	For minimum CL=8pF

MCU interface:

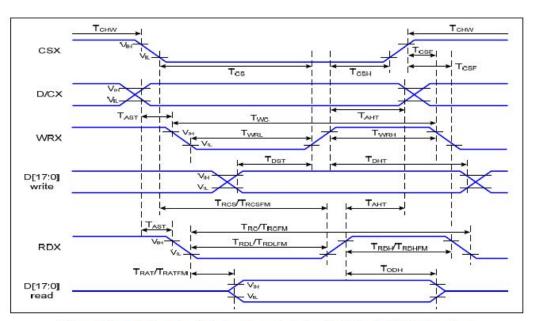


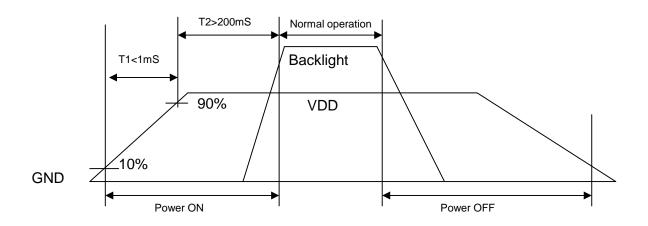
Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

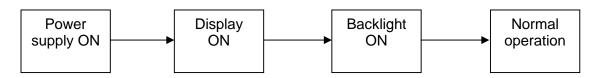
VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta= -30 to 70 $^{\circ}\mathrm{C}$

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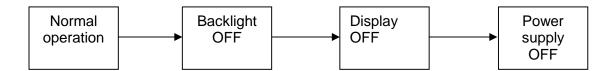
Signal	Symbol	Parameter	Min	Max	Unit	Description		
DICY	T _{AST}	Address setup time	0	8	ns	9890		
D/CX	T _{AHT}	Address hold time (Write/Read)			ns	1-11		
	T _{CHW}	Chip select "H" pulse width	0		ns			
	T _{CS}	Chip select setup time (Write)	15		ns			
CCV	T _{RCS}	Chip select setup time (Read ID)	45		ns			
CSX	T _{RCSFM}	Chip select setup time (Read FM)	355		ns			
	T _{CSF}	Chip select wait time (Write/Read)	10		ns			
80	T _{CSH}	Chip select hold time 10			ns			
	T _{wc}	Write cycle	66		ns			
WRX	T _{WRH}	Control pulse "H" duration	15		ns			
	T _{WRL}	Control pulse "L" duration	15		ns			
	T _{RC}	Read cycle (ID)	160		ns			
RDX (ID)	T _{RDH}	Control pulse "H" duration (ID)	90		ns	When read ID data		
	T _{RDL}	Control pulse "L" duration (ID)	45		ns			
DDV	T _{RCFM}	Read cycle (FM)	450		ns	100		
RDX (FM)	T _{RDHFM}	Control pulse "H" duration (FM)	90		ns	When read from		
	T _{RDLFM}	Control pulse "L" duration (FM)	355	D C	ns	frame memory		
D[17:0]	T _{DST}	Data setup time	10		ns	For CL=30pF		

5.2 Power ON/OFF Timing





Power ON sequence



Power OFF sequence

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6 Optical Characteristics

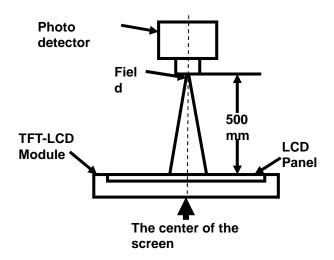
Item	Symbol	Condition	Min	Тур	Max	Unit	Remark
	θТ		80		ı		
View Angles	θВ	CR≧10	80		ı	Degree	Note 2
view Arigies	θL		80		ı	Degree	NOIE Z
	θR		80		ı		
Contrast Ratio	CR	θ=0°	700	900	-	-	Note1 Note3
Response Time	T _{ON}	25 ℃		30	35	ms	Note1
Nesponse fille	T _{OFF}						Note4
Uniformity	U	-	70	80	-	%	Note1 Note6
NTSC	-		60	65	-	%	Note 5
Luminance	L		300	350	-	cd/m ²	Note1 Note7

Test Conditions:

- 1. $V_F=3.2V$, $I_F=80mA$, the ambient temperature is 25° C.
- 2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio		1°
Luminance	SR-3A	
Chromaticity	SK-SA	
Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system. viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

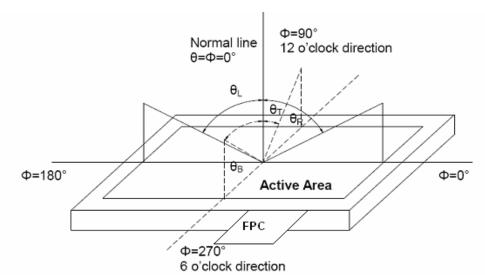


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

Contrast ratio (CR) = Luminance measured when LCD is on the "White" state Luminance measured when LCD is on the "Black" state

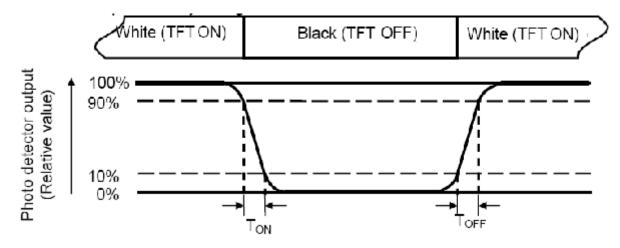
"White state ":The state is that the LCD should be driven by Vwhite.

"Black state": The state is that the LCD should be driven by Vblack.

Vwhite: To be determined Vblack: To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = Lmin/Lmax

L----- Active area length W---- Active area width

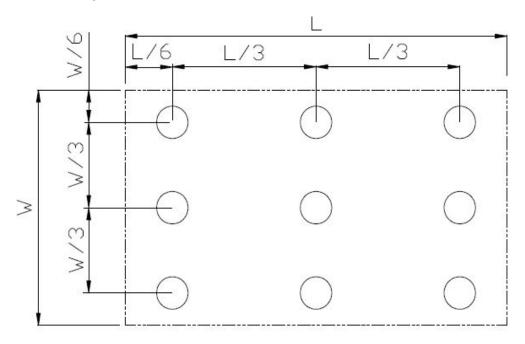


Fig. 2 Definition of uniformity

Lmax: The measured maximum luminance of all measurement position.

Lmin: The measured minimum luminance of all measurement position.

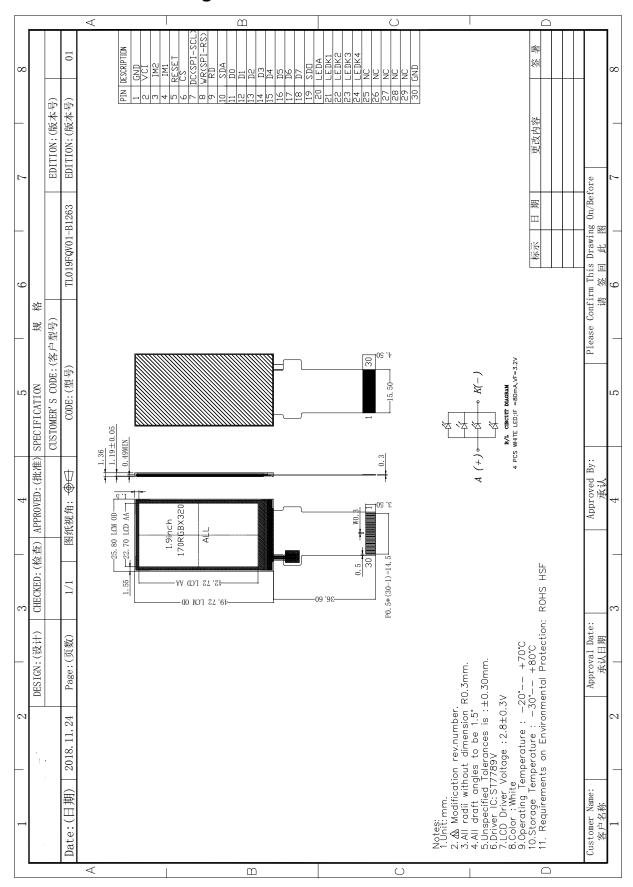
Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

7 Environmental / Reliability Test

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	120	No abnormalities in functions and appearance
High temp. Operating	70°C	120	
Low temp. Storage	-30°C	120	
Low temp. Operating	-20°C	120	
Humidity	40°C/ 90%RH	120	
Thermal Shock(Non-operation)	-20 °C ← 25 °C \rightarrow 70°C (0.5 hour ← 5 min \rightarrow 0.5 hour)	10cycles	

8 Mechanical Drawing



9 Precautions For Use of LCD Modules

- 9.1 Handling Precautions
- 9.1.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

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- 9.1.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- 9.1.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 9.1.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 9.1.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
 - Isopropyl alcohol
 - Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents
- 9.1.1.6 Do not attempt to disassemble the LCD Module.
- 9.1.1.7 If the logic circuit power is off, do not apply the input signals.
- 9.1.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
- 9.1.1.9 Be sure to ground the body when handling the LCD Modules.
- 9.1.1.10 Tools required for assembly, such as soldering irons, must be properly ground.
- 9.1.1.11 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
- 9.1.1.12 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.
- 9.1.1.13 Storage precautions
- 9.1.1.14 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 9.1.1.15 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:
- 9.1.1.16 Temperature : 0° C $\sim 40^{\circ}$ C Relatively humidity: $\leq 80\%$
- 9.1.1.17 The LCD modules should be stored in the room without acid, alkali and harmful gas.
- **9.2** Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.