PRODUCT SPECIFICATION

CDTECH Model:	**S028BQ37EN**
CUSTOMER Model:	-
Description:	**2.8" TFT-LCD Module**
Version:	**1.0**

CDTECH	PREPARED BY	CHECKED BY	APPROVED BY
SIGNATURE			
DATE	2022.5.25	2022.5.25	2022.5.25

	SIGNATURE	DATE
CUSTOMER APPROVAL		

Record of Revisions

Version	Revise Date	Description	Page
1.0	2020-06-08	First Release	-

Contents

1. General Specifications

1.1 LCM General Information

Item	Specification	Unit
LCD Size	2.8	inch
Number of Pixels	240 (H) RGB x320 (V)	pixels
Display Mode	Normally Black, Transmissive	-
Viewing Direction	Free	o' clock
Interface	MCU	-
Display Colors	65K	colors
Outline Dimension	50.00 (H) x 69.20 (V) x 2..49 (D)	mm
Active Area	43.20 (H) x 57.60 (V)	mm
Pixel Pitch	0.1800 (H) x 0.1800 (V)	mm
Driver IC	ST7789VI	-
Operation Temperature	-20~70	℃
Storage Temperature	-30~80	℃

Note1:Requirements on Environmental Protection: RoHS Compliant

2. Absolute Maximum Ratings

Item	Symbol	MIN.	MAX.	Unit	Note
Analog Supply voltage	VDD	-0.3	5.0	V	Note 1
Digital supply voltage	IOVCC	-0.3	5.0	V	Note 1

Note 1:

Permanent damage may occur to the LCD module if beyond this specification.

Functional operation should be restricted to the conditions described under normal operating conditions.

3. Elecrical Characteristics

3.1 Recommended Operating Condition for TFT LCD

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Analog Supply voltage	VDD	2.5	2.8	3.3	V	
Analog supply current	I_{VDD}	-	TBD	-	mA	VDD=2.8V
Logic supply voltage	IOVCC	1.65	1.8	3.3	V	
Logic supply current	I_{IOVCC}	-	TBD	-	mA	IOVCC=1.8V
Logic input voltage	VIH	0.7*IOVCC	-	IOVCC	V	
	VIL	GND	-	0.3*IOVCC	V	

3.2 Recommended Driving Condition for Backlight

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Driving Current	I_F	-	50	-	mA	
Driving Voltage	V_F	10.8	-	13.6	V	
Power consumption	W_{BL}	0.54	-	0.68	W	
LED Life-Time	N/A	30,000	50,000	-	Hours	Ta=25℃ Note 1

Note 1:

LED lifetime is defined as the module brightness decay 50% of original brightness at Ta=25 degree, typical current.

Note 2:LED circuit :
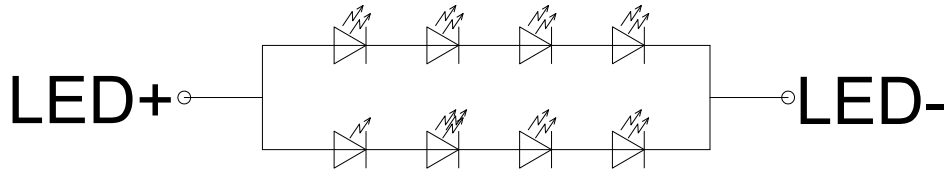
4. Interface Pin Assignment

4.1 LCM Pin Assignment

Recommended connector：FH12-32S-0.5SH manufactured by HIROSE

No.	Symbol	Description
1	IOVCC	Power Supply
2	VDD	Power Supply
3	CS	Chip select input signal
4	RS	Data/Command Selection pin, Low: Command H: Parameter
5	WR	WRX pin, serves as a write signa
6	RD	Serve as a read signal
7	RST	Reset signal
8-25	DB0-DB17	Data bus
26	IM0	Select the interface mode. Note.1
27	IM1	Select the interface mode. Note.1
28	GND	Ground
29	GND	Ground
30	LED-	Power for LED backlight (Anode)
31	LED+	Power for LED backlight (Cathode)
32	ID	Identification for supplier

Note.1

The MCU II Interface mode select.
IM3 is tied high in module for MCU II Mode.
IM2 is tied low in module for MCU II Mode.

IM3	IM2	IM1	IM0	MPU Interface Mode	Data pin
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]

5. Interface Characteristics

5.1 8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus
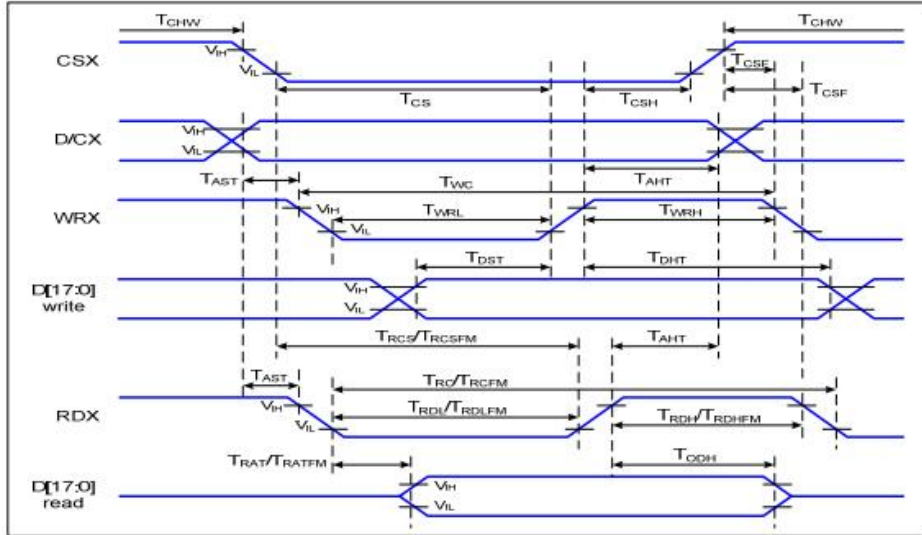

Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

VDDI=1.65 to 3.6V, VDD=2.4 to 3.6V, AGND=DGND=0V, Ta= 25 ℃

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	

Table 4 8080 Parallel Interface Characteristics
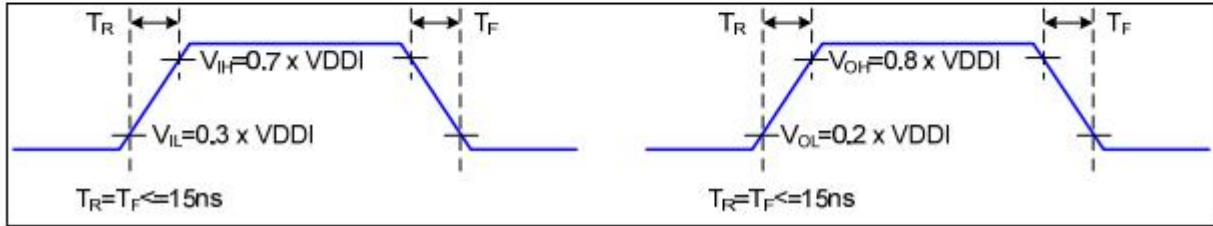
Figure 2 Rising and Falling Timing for I/O Signal
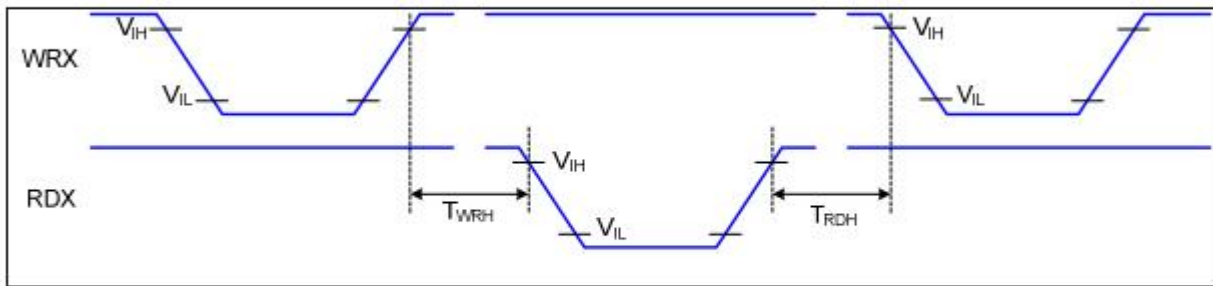
Figure 3 Write-to-Read and Read-to-Write Timing

Note: The rising time and falling time (Tr, Tf) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

5.2 Power Sequence

VDDI and VDD can be applied in any order.

In CABC function application, VDD need to be applied first and then applied VDDI.

VDD and VDDI can be power down in any order.

During power off, if LCD is in the Sleep Out mode, VDD and VDDI must be powered down minimum 120msec after RESX has been released.

During power off, if LCD is in the Sleep In mode, VDDI or VDD can be powered down minimum 0msec after RESX has been released.

CSX can be applied at any timing or can be permanently grounded. RESX has priority over CSX.

Note 1: There will be no damage to the display module if the power sequeces are not met.
Note 2: There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.
Note 3: There will be no abnormal visible effects on the display between end of Power On Sequence and before receiving Sleep Out command. Also between receiving Sleep In command and Power Off Sequence.
Note 4: If RESX line is not held stable by host during Power On Sequence as defined in the sequence below, then it will be necessary to apply a Hardware Reset (RESX) after Host Power On Sequence is complete to ensure correct operation. Otherwise function is not guaranteed.

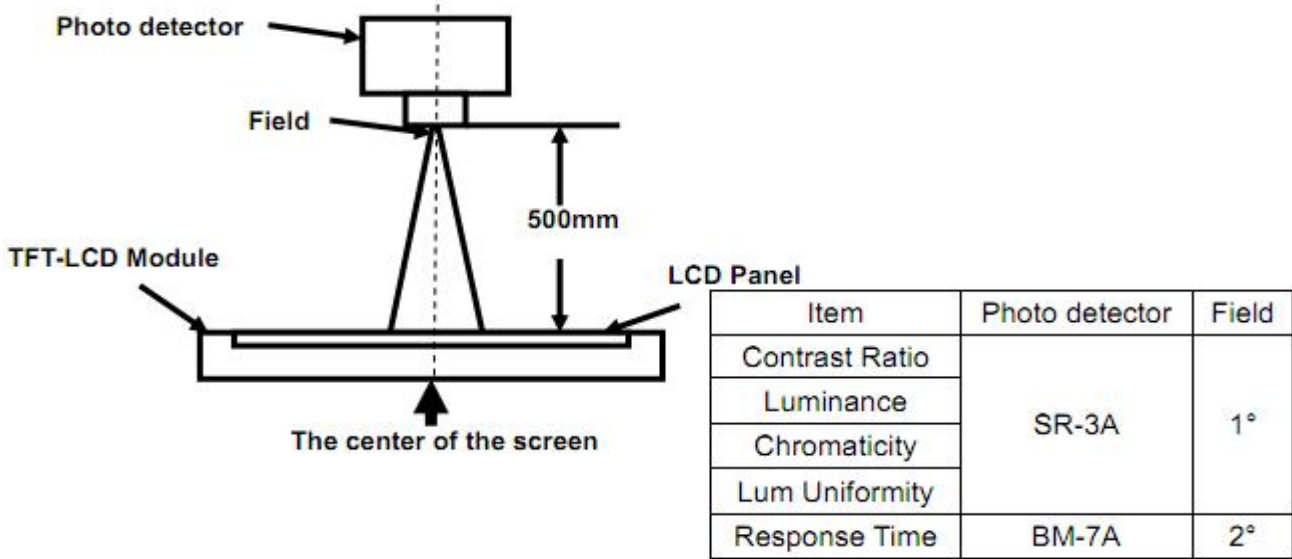The power on/off sequence is illustrated below
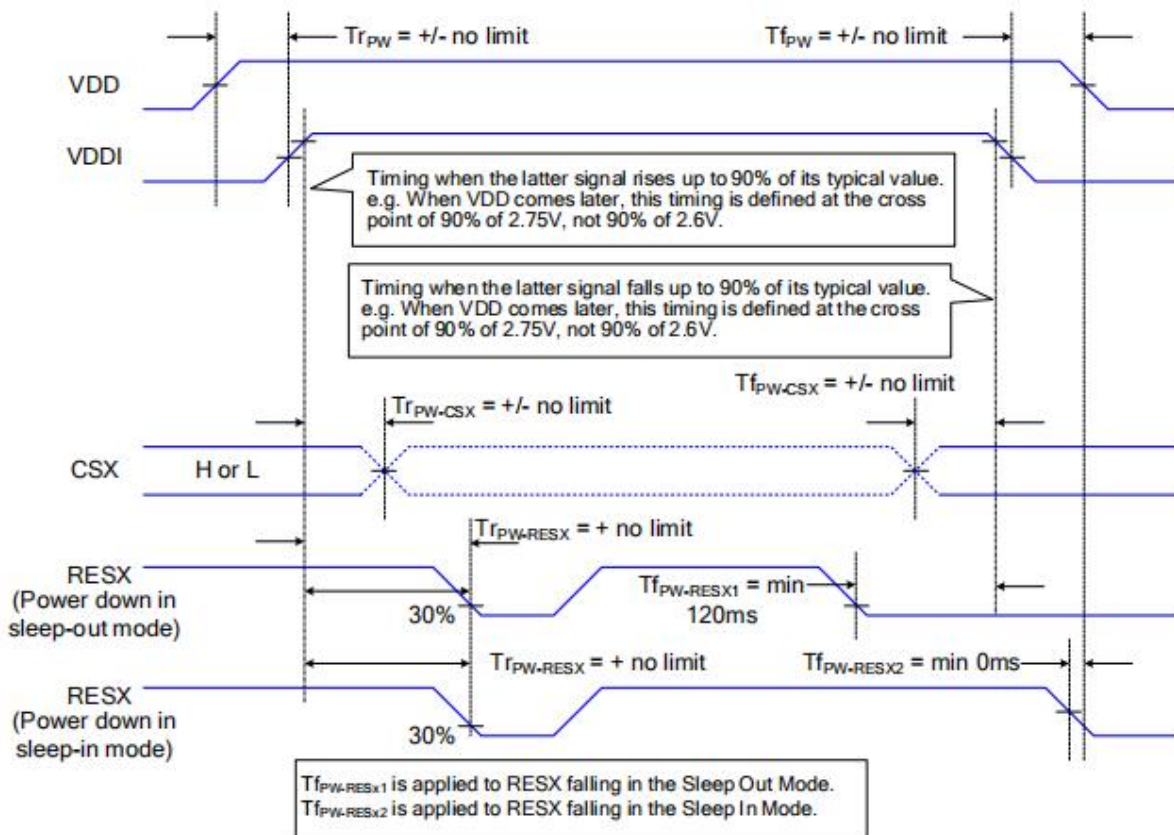
6. Optical Specifications

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR≥10) B/L ON	θ_T	Φ=90°(12 o'clock)	70	80	-	deg	Note2
	θ_B	Φ=270°(6 o'clock)	70	80	-	deg	Note2
	θ_L	Φ=180°(9 o'clock)	70	80	-	deg	Note2
	θ_R	Φ=0°(3 o'clock)	70	80	-	deg	Note2
Response Time	T_{ON}	Normal θ=Φ=0°	-	15	17	msec	Note4
	T_{OFF}		-	15	18	msec	Note4
Contrast Ratio	CR		500	800	-	-	Note1 Note3
Color Chromaticity	W_X		TBD	TBD	TBD	-	Note1 Note5
	W_Y		TBD	TBD	TBD	-	Note1 Note5
Luminance	L		900	1000	-	cd/m²	Note1 Note7
Luminance Uniformity	Y_U		75	80	-	%	Note1 Note6
NTSC	-		65	70	-	%	-

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	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

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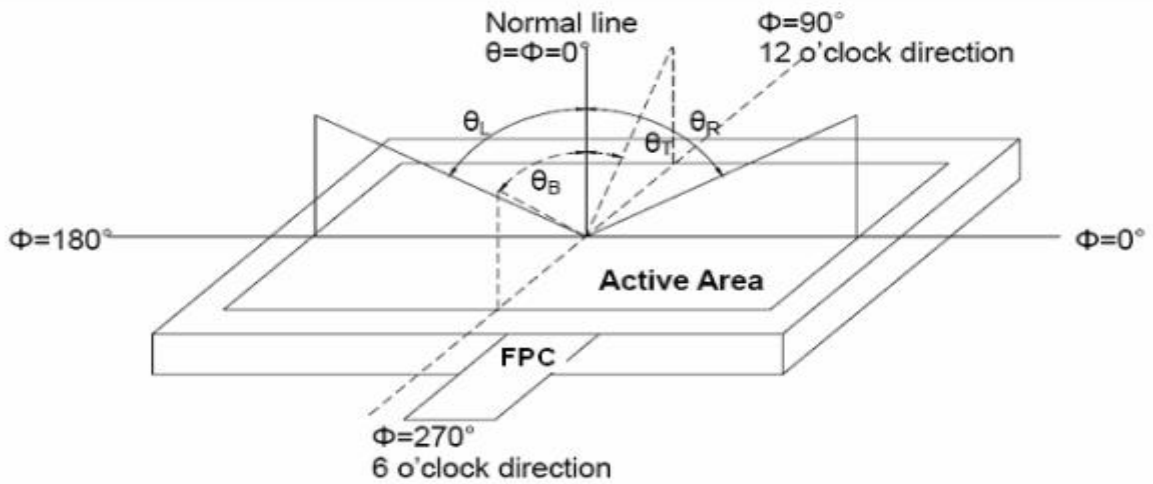viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

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%.
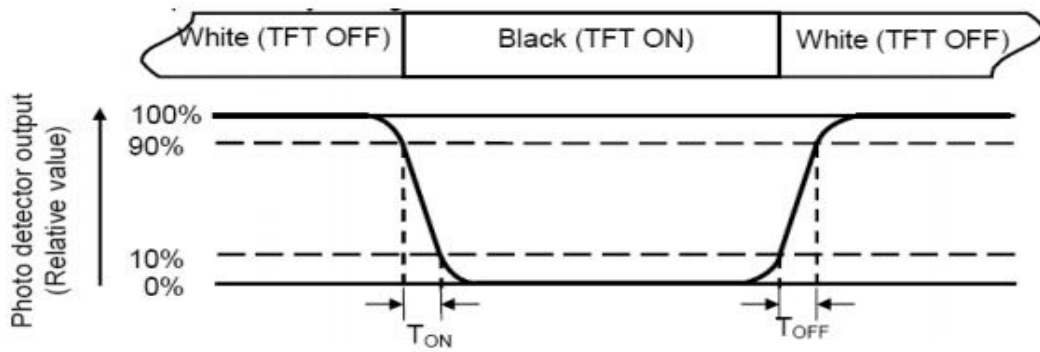
Note 5: Definition of color chromaticity (CIE1931)
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance. For more information see FIG.2
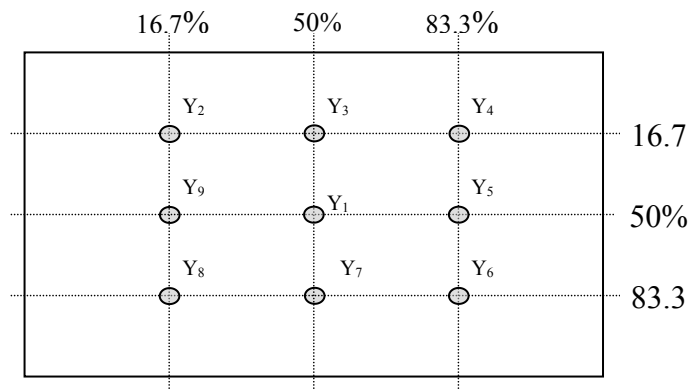

Fig. 2 Definition of points

Note 7: Definition of Luminance (Refer Fig. 2):
Surface luminance is the luminance with all pixels displaying white.
Lv = Average Surface Luminance with all white pixels(P1,P2,P3, ...,Pn)

7. Reliability Test Items

Test Item	Test Conditions	
High Temperature Storage	Ta= +80℃	96hrs
Low Temperature Storage	Ta= -30℃	96hrs
High Temperature Operation	Ta= +70℃	96hrs
Low Temperature Operation	Ta= -20℃	96hrs
High Temperature and Humidity Operation	Ta= +60℃, 90% RH	96hrs
Thermal Shock (Non-operation)	-30℃/30 min ~ +80℃/30 min for 20 cycles Start with cold temperature, end with high temperature	
Electro Static Discharge	Contact = ± 4 kV, class B Air = ± 8 kV, class B R=330Ω,C=150pF	
Vibration	Sweep: 10Hz~55Hz~10Hz Stroke: 1.5mm 2 hrs for each direction of X .Y. Z.	
Mechanical Shock	60G 6ms,±X,±Y,±Z 3 times for each direction	
Package Drop Test	Height: 60 cm, 1 corner, 3 edges, 6 surfaces	

Notes:

1. The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours without load. No condensation shall be accepted. The sample will not be accepted if appear these defects:
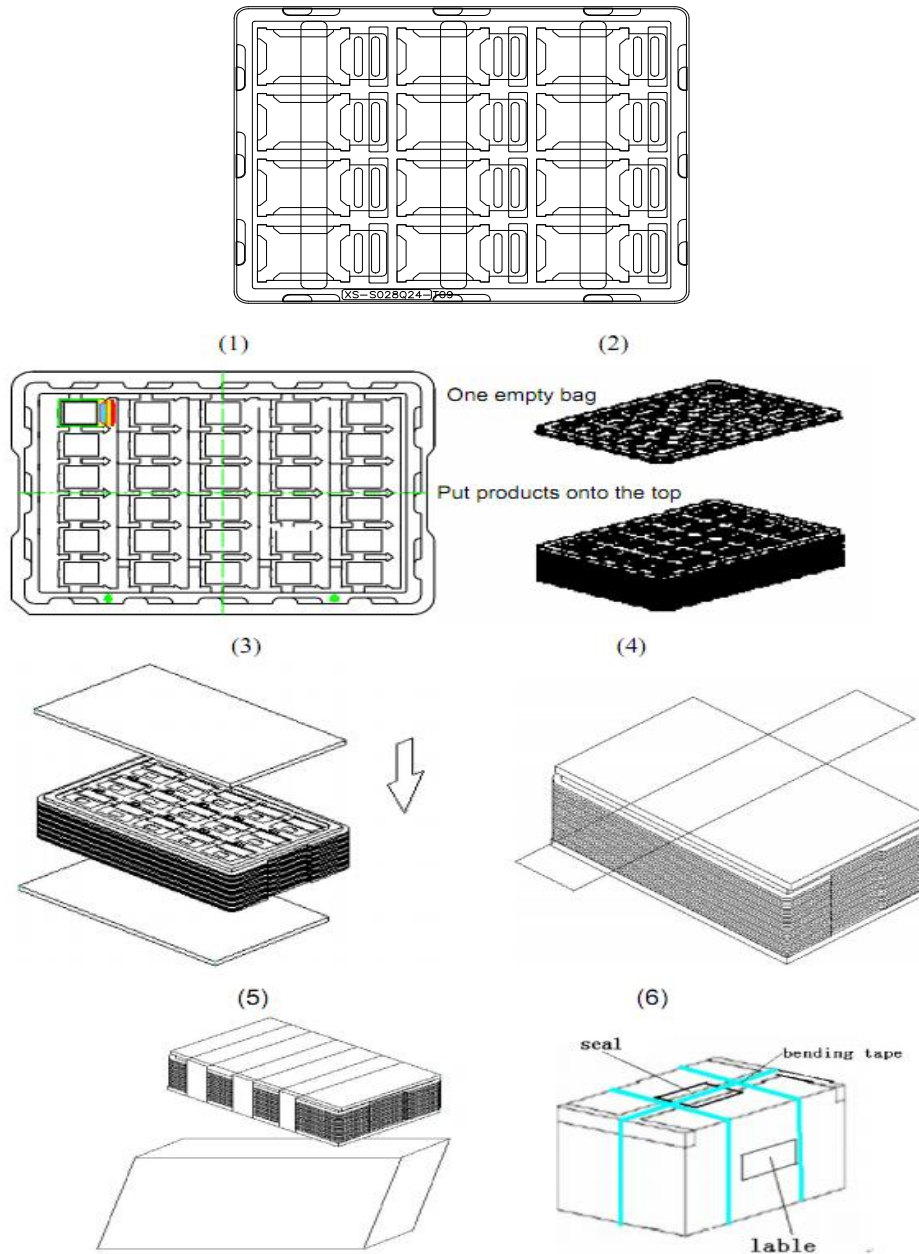
1).Air bubble in the LCD;

2).Seal leak or Glass crack

3).Non display or abnormal display

4).Brightness reduction >50%

8. Mechanical Drawing

CIRCUIT DIAGRAM

LED+
LED-

LCM NOTES:
1. DISPLAY TYPE: 2.8 INCH TFT /NORMALLY BLACK
2. BACKLIGHT: 8 CHIP WHITE LED, 4S2P
   IF = 10.8~13.6V/IV = 50mA
3. OPERATING TEMP: -20°C~+70°C
4. STORAGE TEMP: -30°C~+80°C
5. LCD IC: ST7789Vi
6. Luminance:1000cd/m2 typ.
7. LED life-time: 50000 Hrs typ.
8. "( )"reference dimension
9. RoHS Compliant

Front view

*32.80±0.5
*69.20±0.2 LCM OD
63.88±0.2 LCD TFT — 1.70
60.36±0.2 LCD POL — 1.90
57.60 LCD AA — 3.10
*14.54±0.5
*50.00±0.2 LCM OD
46.20±0.2 LCD TFT
45.80±0.2 LCD POL
43.20 LCD AA
5.00±0.5
16.50±0.1
2.8"TFT
240*RGB*320
IPS
Stiffeners
Pull Tape
2.10
1.90
3.40

Side view

0.30±0.05 FPC+PI
*2.49±0.15 LCM

Rear View

P0.5*(32-1)=15.50±0.1
W=0.35±0.05
3.50±0.3
2-0.50±0.1
Ink Printing
S028BQ37EN
YYYY MMDD
XXXXXXXX (BL code)
YYYY MMDD

Drawing Title Block

REV.	1.0		
DATE	2022.05.20		
MODIFICATION	First Issue		
INTERFACE	MCU Interface		
FPC Connector	(FH12-32S-0.5SH)		
VIEWING DIRECTION	ALL		
Gray DIRECTION			

DWN ZHOUJING 2022.05.20
CHKD
Li Huang 2022.05.23
Material code: TBD
PART NO. S028BQ37EN
REV. 1.0
SHEET OF 1/1
PROJECTION 3rd ANGLE
TOLERANCE UNLESS SPECIFIED ±0.2
UNIT mm
SCALE 1:1

深圳市思迪科科技有限公司
SHENZHEN CDTECH ELECTRONICS

Pin Table

NO.	PIN NAME
1	IOVDD
2	VDD
3	CS
4	RS
5	WR
6	RD
7	RST
8-25	DB0-17
26	IM0
27	IM1
28	GND
29	GND
30	LEDK
31	LEDA
32	ID

9. Packing

Packing Method

Steps:

1. Put module into tray cavity:

2. Tray stacking

3. Put 1 cardboard under the tray stack and 1 cardboard above:

4. Fix the cardboard to the tray stack with adhesive tape:

5. Put the tray stack into carton.

6. Carton sealing with adhesive tape

10. Precautions for Use of LCD modules

10.1 Handling Precautions

10.1.1. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2. 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.

10.1.3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5. 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
- Ketene
- Aromatic solvents

10.1.6. Do not attempt to disassemble the LCD Module.

10.1.7. If the logic circuit power is off, do not apply the input signals.

10.1.8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

10.1.8.1. Be sure to ground the body when handling the LCD Modules.

10.1.8.2. Tools required for assembly, such as soldering irons, must be properly ground.

10.1.8.3. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.1.8.4. 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.

10.2 Storage Precautions

10.2.1. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2. 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:

Temperature : 0℃ ～ 40℃   Relatively humidity: ≤80%

10.2.3. The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid

excessive press, water, damp and sunshine.