

TFT MODULE

MODULE NO. :

KSET02803N-A16

Customer:
Approved by:

Approved by	Checked by	Prepared by



CONTENTS

1. GENERAL SPECIFICATIONS	4
2. INPUT/OUTPUT TERMINALS	5
3. ABSOLUTE MAXIMUM RATINGS	5
4. ELECTRICAL CHARACTERISTICS	5
5. TIMING CHART	7
6. OPTICAL CHARACTERISTICS	9
7. ENVIRONMENTAL/RELIABILITY TESTS	12
8. MECHANICAL DRAWING	13
9. PACKING	14
10. PRECAUTIONS FOR USE OF LCD MODULES	15

1. GENERAL SPECIFICATIONS

Feature		Spec
Display Spec	Size	2.8 inch
	Resolution	320(RGB) x 240
	Interface	4-SPI
	Technology type	a-si TFT
	Pixel pitch(mm)	0.18 x 0.18
	Display colors	TN
	TFT Driver IC:	ST7789V2
	Viewing Direction	12 O'clock
Mechanical Characteristics	LCM(W x H x D)(mm)	69.20 (W) x 50.00 (H) x2.30max
	Active Area(mm)	57.60(W) x 43.20 (H)
	Weight (g)	TBD
	LED Numbers	4 LEDS

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

Note 2: Requirements on Environmental Protection: RoHS.

Note 3: LCM weight tolerance: +/-5%.

2. INPUT/OUTPUT TERMINALS

Pin No.	Symbol	Description
1	GND	System Ground
2	RS	Register select RS = 0...Instruction register RS = 1...Data register
3	CS	Chip select input pin ("low" is enable)
4	IOVCC	Power supply for logic operation
5	VCC	Power supply
6	LEDA	Backlight LED Cathode
7	LEDK	Backlight LED anode
8	RESET	Reset PIN
9	SCK	Serial clock PIN
10	SDA	Serial data PIN
11	GND	System Ground
12	XR	Touch panel PIN
13	YD	
14	XL	
15	YU	
16	GND	System Ground

3. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	MIN	MAX	Unit	Remark
Supply Voltage	V_{DD}	-0.50	+4.6	V	
Supply Voltage(Logic)	V_{DDI}	-0.50	+4.6	V	
Driver Supply Voltage	VGH-VGL	-0.30	+30.0	V	
Operating Temperature	T_{OPR}	-20	70	°C	
Storage Temperature	T_{STG}	-30	80	°C	

4. ELECTRICAL CHARACTERISTICS

4.1 Driving TFT LCD Panel

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Digital Supply Voltage	V_{DD}	2.8	3.0	3.3	V	
TFT Common Electrode	V_{COM}	4.0	4.5	6.4	V	
TFT Gata ON Voltage	V_{GH}	12.2		14.9	V	
TFT Gata ON Voltage	V_{GL}	-12.5		-7.16	V	

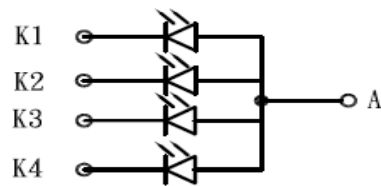
4.2. Driving Backlight

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	-	60	80	mA	Note
Forward Voltage	V_F	2.9	3.1	3.2	V	
Backlight Power consumption	W_{BL}	-	135	-	nW	

Note: 1. The figure below shows the connection of backlight LED.

2. One LED: $I_F=15\text{mA}$, $V_F=3.1\text{V}$

3. The lifetime of LED: 50,000 hours

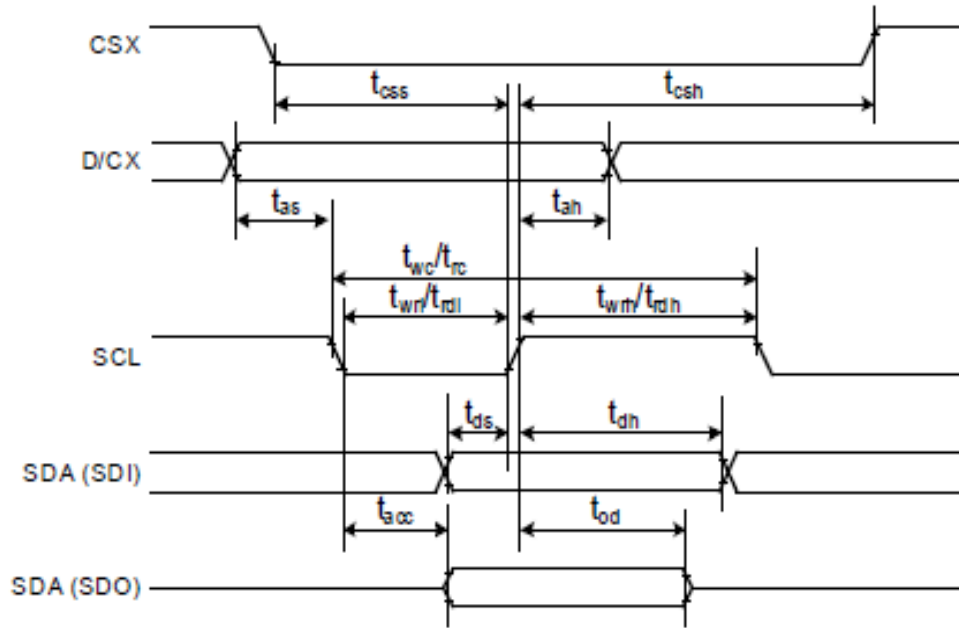


$I_F = 4 * 15\text{mA}$



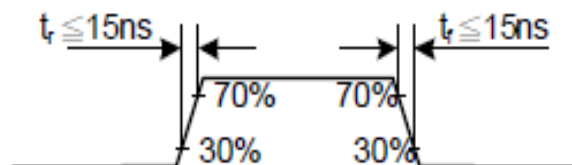
5. TIMING CHRART

5.1 Display Parallel 4-Line serial Interface Timing Characteristics

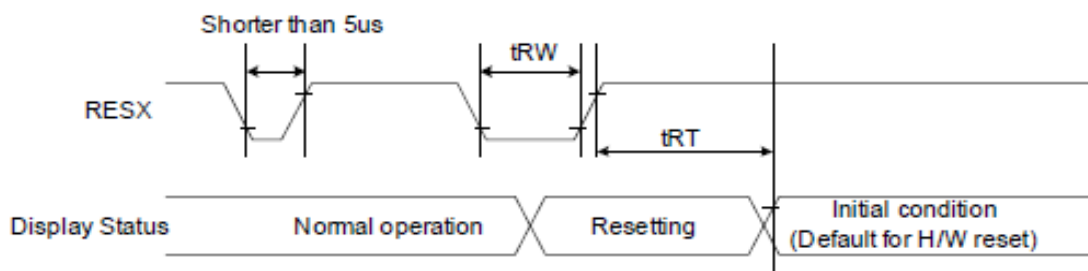


Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tcss	Chip select time (Write)	40	-	ns	
	tcsh	Chip select hold time (Read)	40	-	ns	
SCL	twc	Serial clock cycle (Write)	100	-	ns	
	twrh	SCL "H" pulse width (Write)	40	-	ns	
	twrl	SCL "L" pulse width (Write)	40	-	ns	
	trc	Serial clock cycle (Read)	150	-	ns	
	trdh	SCL "H" pulse width (Read)	60	-	ns	
	trdl	SCL "L" pulse width (Read)	60	-	ns	
D/CX	tas	D/CX setup time	10	-		
	tah	D/CX hold time (Write / Read)	10	-		
SDA / SDI (Input)	tds	Data setup time (Write)	30	-	ns	
	tdh	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns	For maximum CL=30pF
	tod	Output disable time (Read)	10	50	ns	For minimum CL=8pF

Note: $T_a = 25\text{ }^\circ\text{C}$, $V_{DDI}=1.65\text{V to }3.3\text{V}$, $V_{CI}=2.5\text{V to }3.3\text{V}$, $AGND=VSS=0\text{V}$



5.2 Reset Timing



Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5)	mS
				120 (note 1,6,7)	mS

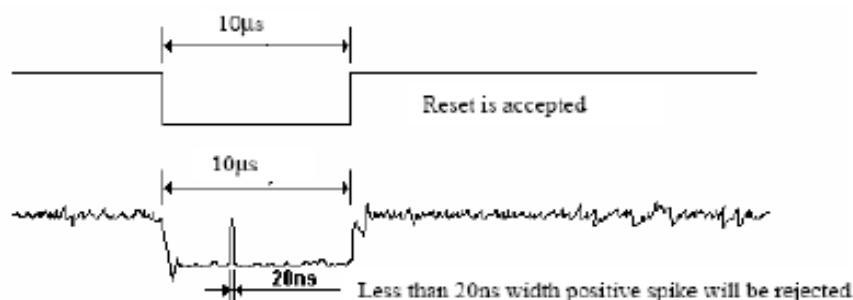
Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below: -

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts

Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In -mode.) And then return to Default condition for Hardware Reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:



Note 5: When Reset applied during Sleep In Mode.

Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

6. OPTICAL CHARACTERISTICS

Items	Symbol	Condition	Specifications			Unit	Remark
			Min.	Typ.	Max.		
Contrast Ratio	CR	$\theta = 0$	180	200	-	-	Note
Response Time	T_R	25°C	-	20	30	ms	
	T_F		-	20	30	ms	
Chromaticity	Red	X_R	0.611	0.613	0.615	-	
		Y_R	0.333	0.335	0.337	-	
	Green	X_G	0.305	0.307	0.309	-	
		Y_G	0.558	0.560	0.562	-	
	Blue	X_B	0.133	0.135	0.137	-	
		Y_B	0.158	0.160	0.162	-	
White	X_W	0.324	0.326	0.328	-		
	Y_W	0.364	0.366	0.368	-		
Viewing angle	Hor.	$\phi R(3 \text{ o'clock})$	15	35	-	deg.	
		$\phi L(9 \text{ o'clock})$	15	35	-		
	Ver.	$\theta U(12 \text{ o'clock})$	15	35	-		
		$\theta D(6 \text{ o'clock})$	10	15	-		
Uniformity	U		75	80			
NTSC ratio				50		%	
Luminance	L_v		200	220		cd/m ²	

Note 1: Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

L63: Luminance of gray level 63

L0: Luminance of gray level 0

$$CR = CR(10)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note 5.

Note 2: Definition of Response Time (T_R , T_F):

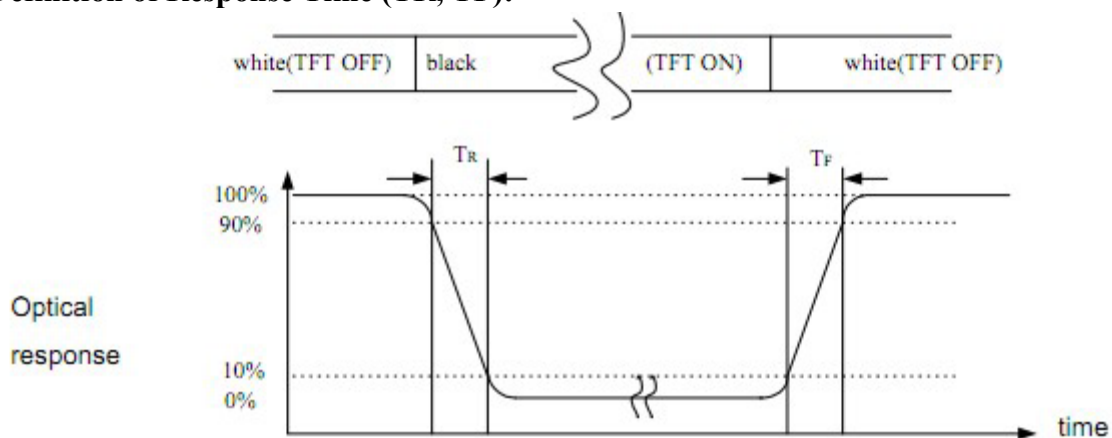


Figure 2

Note 3: Viewing Angle:

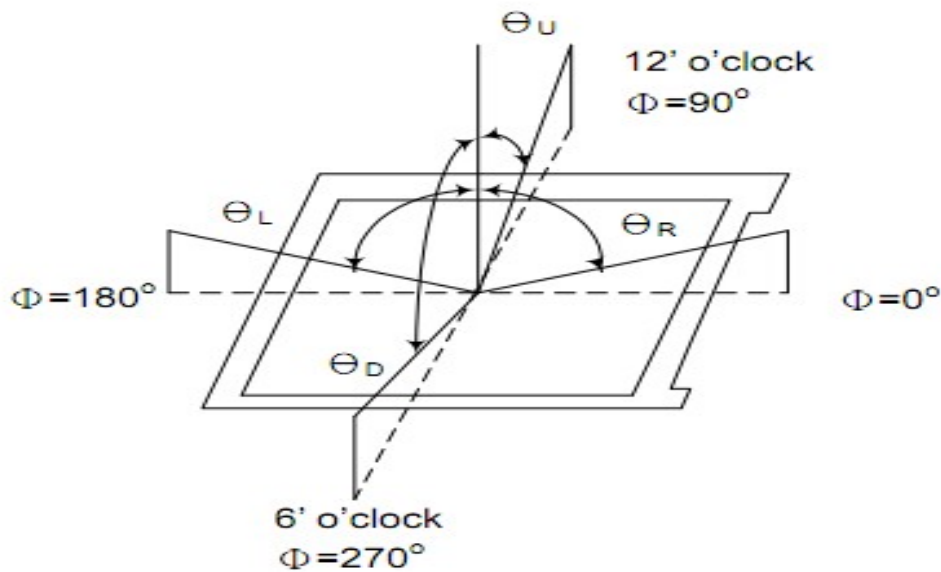


Figure 3

The above “Viewing Angle” is the measuring position with Largest Contrast Ratio; not for good image quality. View Direction for good image quality is 6 O’clock. Module maker can increase the “Viewing Angle” by applying Wide View Film.

Note 4: Measurement Set-Up:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

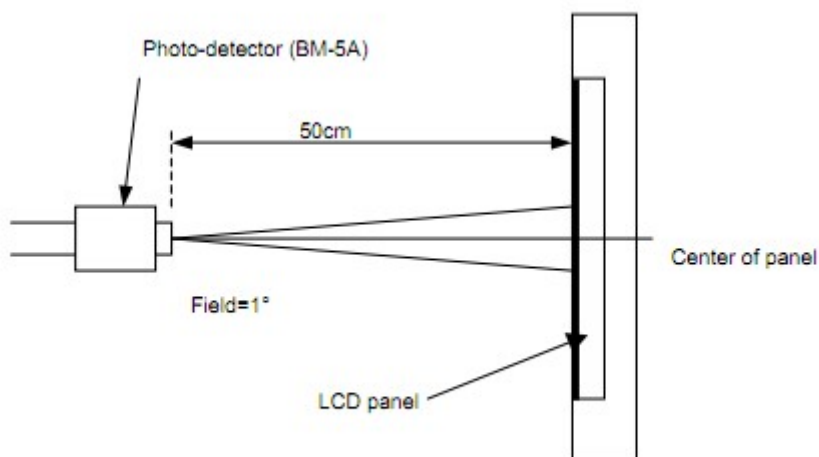


Figure 4

Note 5: Definitions of colder 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.

$$\text{Luminance Uniformity}(U) = L_{\min}/L_{\max}$$

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

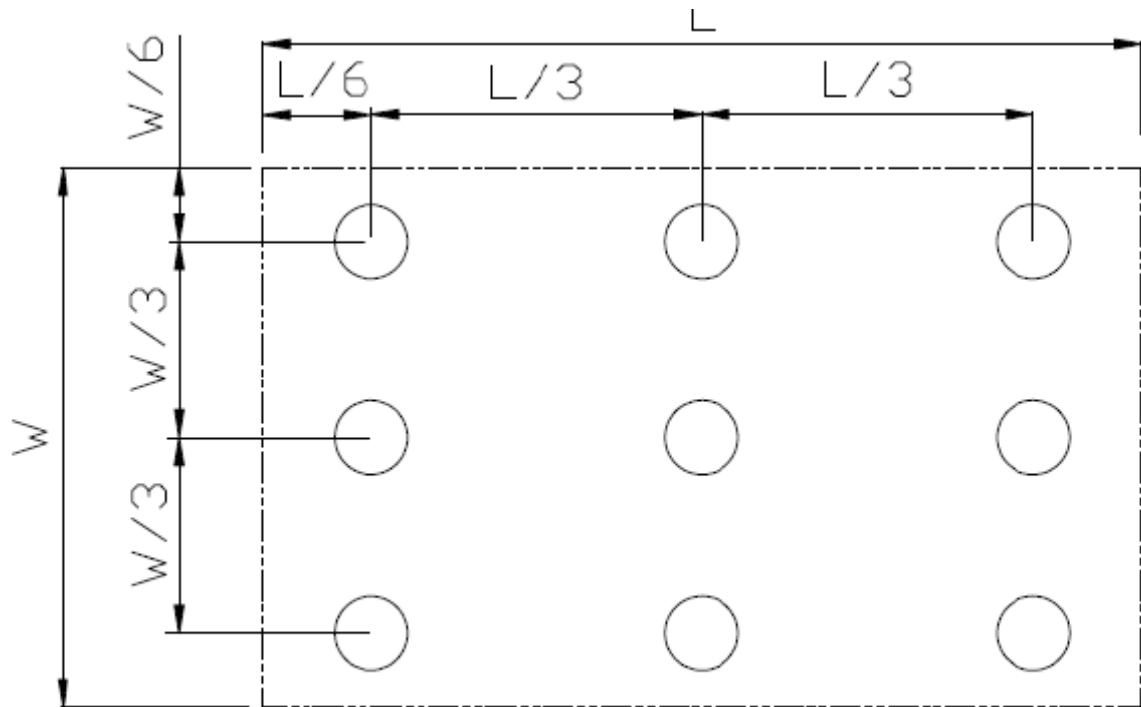


Fig. 2 Definition of uniformity

Lmax: The measured maximum luminance of all measurement position.

Lmin: The measured minimum luminance of all measurement position.

Note 7: Definition of Luminance

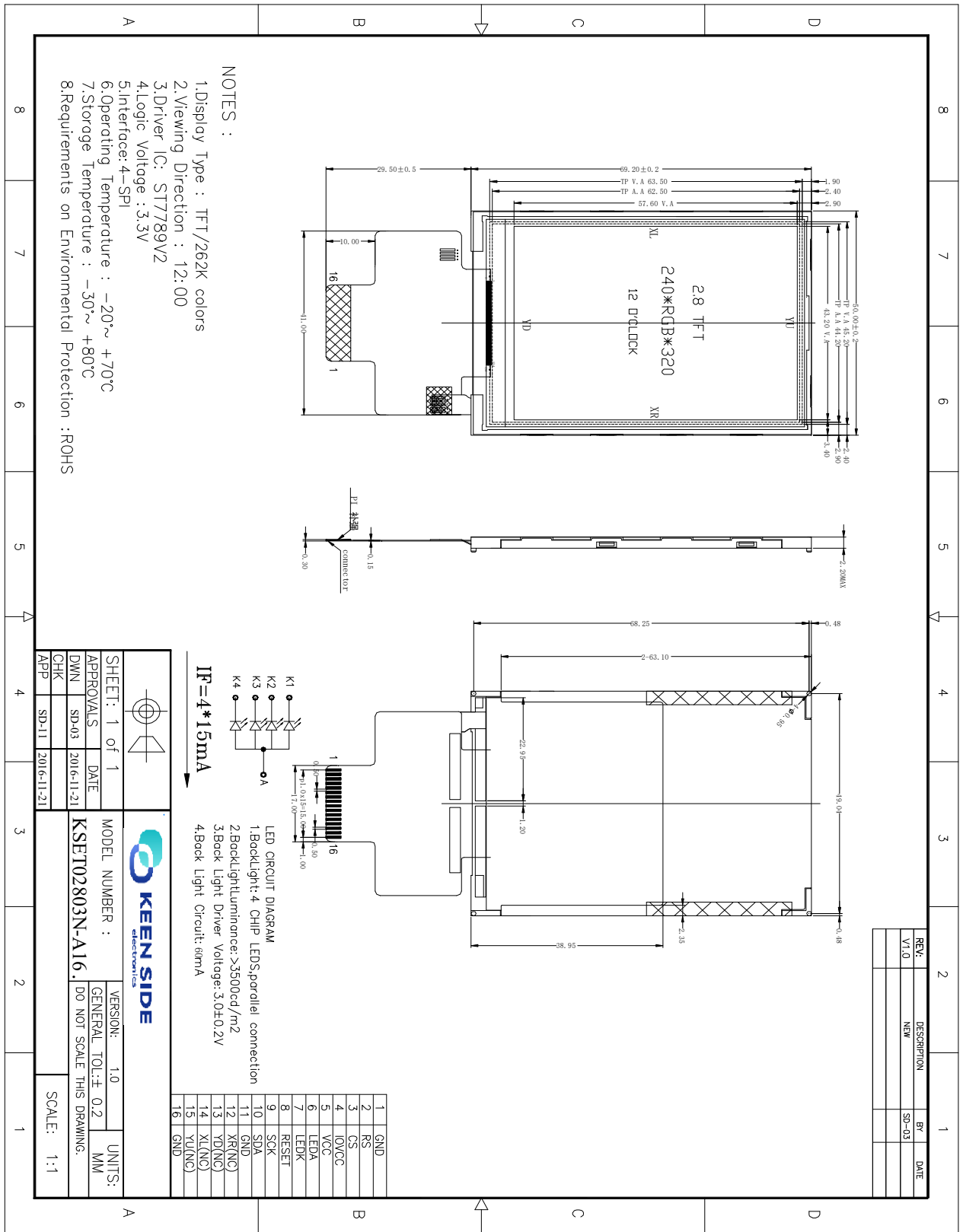
Measure the luminance of white state at center point.

7. ENVIRONMENTAL/RELIABILITY TESTS

No	Test Item	Condition	Remarks
1	High Temperature Operation	T _s = +70°C, 240hrs	Note 1 IEC60068-2-2, GB2423. 2-89
2	Low Temperature Operation	T _a = -20°C, 240hrs	Note 2 IEC60068-2-1 GB2423.1-89
3	High Temperature Storage	T _a = +80°C, 240hrs	IEC60068-2-2 GB2423. 2-89
4	Low Temperature Storage	T _a = +70°C, 240hrs	IEC60068-2-1 GB/T2423.1-89
5	High Temperature & Humidity Storage	T _a = +60°C, 90% RH max, 160 hours	IEC60068-2-3 GB/T2423.3-2006
6	Thermal Shock (Non-operation)	-30°C 30 min ~ +80°C 30 min Change time: 5min, 30 Cycle	Start with cold temperature, end with high temperature IEC60068-2-14, GB2423.22-87
7	Electro Static Discharge (Operation)	C=150pF, R=330 Ω, 5 points/panel Air: ±8KV, 5 times; Contact: ±4KV, 5 times; (Environment: 15°C ~ 35°C, 30% ~ 60%, 86Kpa ~ 106Kpa)	IEC61000-4-2 GB/T17626.2-1998
8	Vibration (Non-operation)	Frequency range: 10~55Hz, Stroke: 1.mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X .Y. Z. (package condition)	IEC60068-2-6 GB/T2423.5-1995
9	Shock (Non-operation)	60G 6ms, ± X, ± Y, ± Z 3 times for each direction	IEC60068-2-27 GB/T2423.5-1995
10	Package Drop Test	Height: 80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8-1995

Note: 1. T_s is the temperature of panel's surface.
2. T_a is the ambient temperature of sample.

8. MECHANICAL DRAWING



REV.	DESCRIPTION	BY	DATE
V1.0	NEW	SD-03	

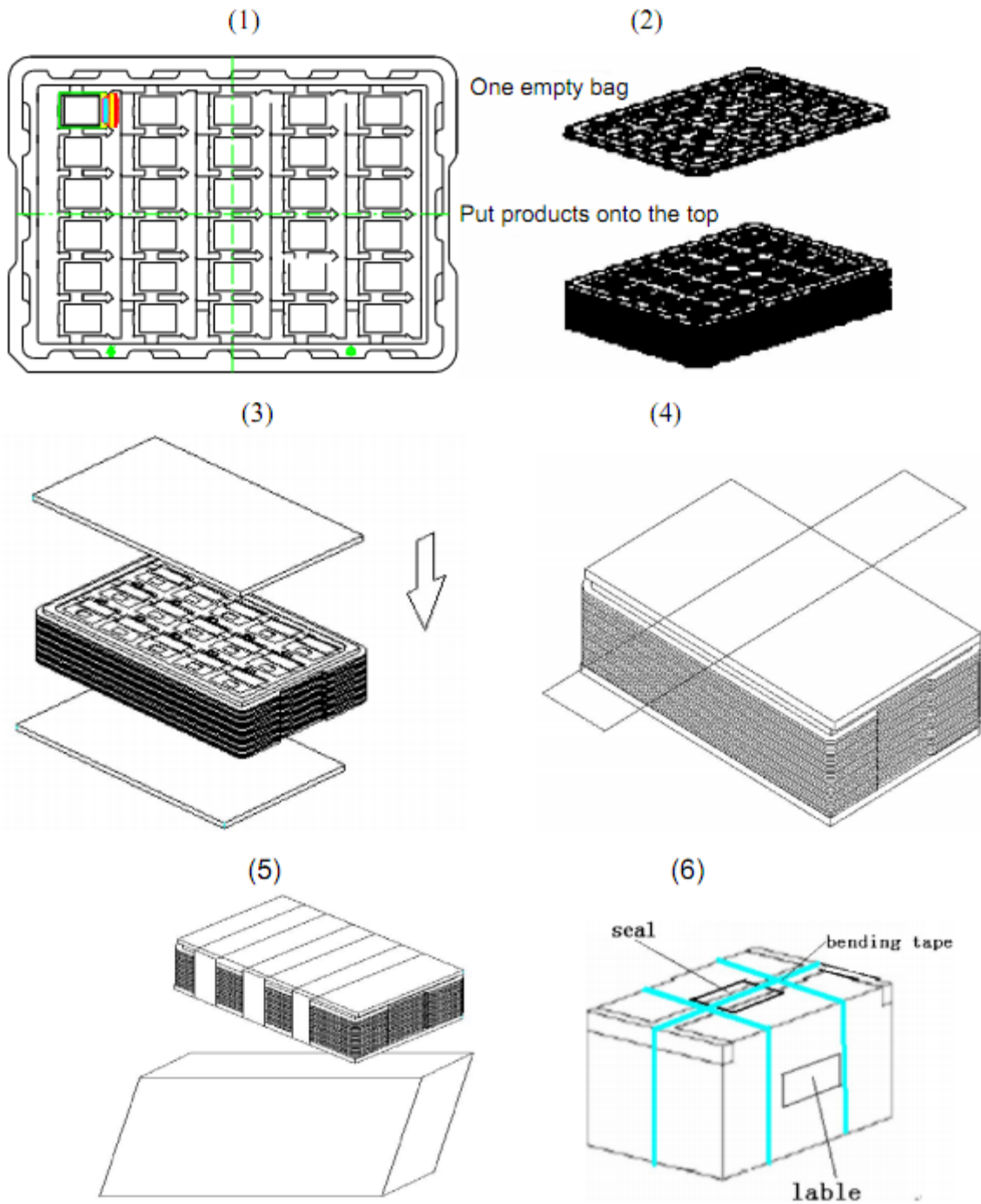
SHEET: 1 of 1		MODEL NUMBER :	
APPROVALS	DATE	VERSION: 1.0	
DWN	SD-03	GENERAL TOL: ± 0.2	
CHK	2016-11-21	DO NOT SCALE THIS DRAWING.	
APP	SD-11	SCALE: 1:1	
		UNITS: MM	



MODEL NUMBER : KSET02803N-A16

9. PACKING

Packing Method



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.