Version：0.1

TECHNICAL SPECIFICATION

MODEL　NO. : PT023TX1

The content of this information is subject to be changed without notice.

Please contact E Ink or its agent for further information

☐ Customer's Confirmation

Customer _____

Date _____

By _____

☐ E Ink's Confirmation

Dep	PM	FAE	Panel Design	Electronic Design	Mechanical Design	Product Verification	Prepared By
Sign	馮致華 12/23	劉豊發 12/20	李文陽 12/20	稅正言 12/20'13	鄭云華 12/13	傅淑貞 12/23'13	曾耀霆 12/13

Revision History

Rev.	Issued Date	Revised　　Contents
0.1	December 12,2013	Preliminary

TECHNICAL SPECIFICATION

CONTENTS

1. Application：

The **PT023TX1** applies to a color TFT LCD module which has octagonal outline. **PT023TX1** module applies to OA product, GPS, which require high quality flat panel display. If you must use in high reliability environment can't over reliability test condition.

2. Features：

. Pixel in stripe configuration
. Slim and compact
. Wide viewing angle
. High Brightness
. Octagonal LCD
. Driver IC：LI9341

3. Mechanical Specifications：

Parameter	Specifications	Unit
Screen Size	2.3" TFT LCD	inch
Display Format	240×(R, G, B)×240	dot
Display Colors	65,536	
Active Area	D = 57.96 (Circular)	mm
Pixel Pitch	0.2415×0.2415	mm
Pixel Configuration	Stripe	
Outline Dimension	75.60(W)×75.70(H)×7.64(D)	mm
Weight	TBD	g
Surface treatment	Anti-glare and wide-view film	
Back Light	2-LED,150mA	
Display mode	Normally white	
Gray scale inversion direction	6 [Refer to Note 12-1]	o'clock

4. Mechanical Drawing of TFT-LCD Module
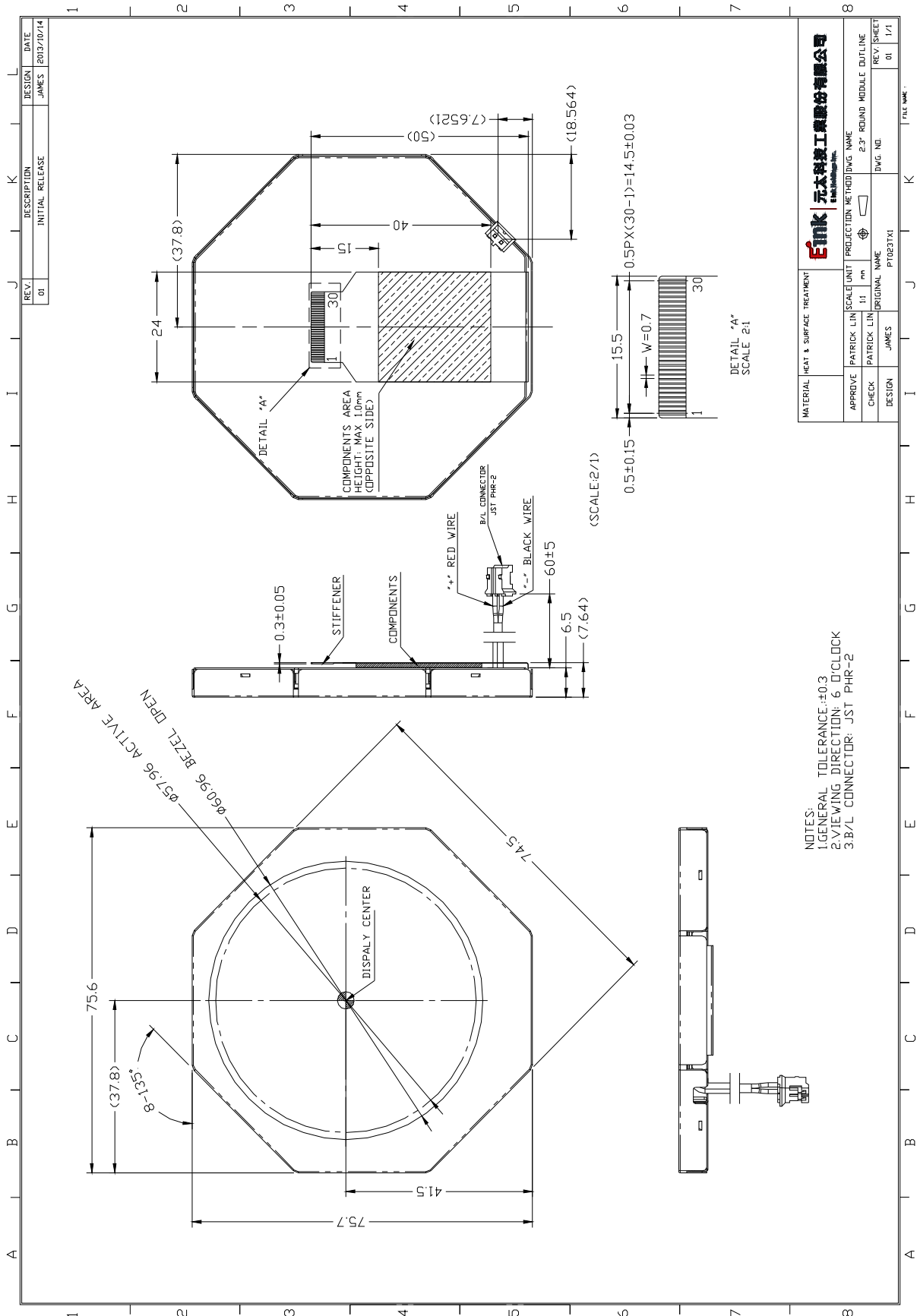
5. Input / Output Terminals：

LCD Module Connector
FPC Down Connect, 30 Pins

Pin No.	Signal	Pin Function	Remark
1	VSS	Ground	
2	VSS	Ground	
3	RESX	Reset Input Pin	
4	Dummy	N.C.	
5	D15	Parallel Data Bus (R4)	
6	D14	Parallel Data Bus (R3)	
7	D13	Parallel Data Bus (R2)	
8	D12	Parallel Data Bus (R1)	
9	D11	Parallel Data Bus (R0)	
10	D10	Parallel Data Bus (G5)	
11	D9	Parallel Data Bus (G4)	
12	D8	Parallel Data Bus (G3)	
13	D7	Parallel Data Bus (G2)	
14	D6	Parallel Data Bus (G1)	
15	D5	Parallel Data Bus (G0)	
16	D4	Parallel Data Bus (B4)	
17	D3	Parallel Data Bus (B3)	
18	D2	Parallel Data Bus (B2)	
19	D1	Parallel Data Bus (B1)	
20	D0	Parallel Data Bus (B0)	
21	Dummy	N.C.	
22	RDX	Read Signal Pin	
23	WRX	Write Signal Pin	
24	DCX	Register Index or Register Command Select	
25	CSX	Chip Select Pin	
26	Dummy	N.C.	
27	VCI	Power Supply (Typ. TBD V)	
28	VCI	Power Supply (Typ. TBD V)	
29	VSS	Ground	
30	VSS	Ground	

6. Absolute Maximum Ratings：

The followings are maximum values, which if exceeded, may cause faulty operation or damage to the unit.

VSS=GND=0V , Ta = 25℃

Item	Symbol	Value	Unit	Remark
Supply Voltage	VCI	V	-0.3~+4.6	-
Supply Voltage(Logic)	VDDI	V	-0.3~+4.6	-
Supply Voltage(Digital)	VCORE	V	-0.3~+2.0	-
Driver Supply Voltage	VGH-VGL	V	-0.3~+32	-
Logic Input Voltage Range	VIN	V	-0.3~VDDI+0.3	-
Logic Output Voltage Range	VO	V	-0.3~VDDI+0.3	-

7. Electrical Characteristics：

7-1.Operation condition：

VSS=GND=0V , Ta = 25℃

Item	Symbol	Unit	Condition	Min.	Typ	Max	Remark
Analog Operating Voltage	VCI	V	Operating Voltage	2.5	TBD	3.3	
Logic Operating Voltage	VDDI	V	I/O Supply Voltage	1.65	TBD	3.3	
Digital Operating Voltage	VCORE	V	Digital Supply Voltage		1.5		
Gate Driver High Voltage	VGH	V	-	12.0	-	21.0	
Gate Driver Low Voltage	VGL	V	-	-12.5	-	-7.0	
Driver Supply Voltage	-	V	VGH-VGL	-	-	32	

Note 7-1：VCOM　must be adjusted optimize display quality, crosstalk, contrast ration and etc.

7-2 Power consumption：

| Parameter	Symbol	Min	TYP	MAX	Unit	Remark
Supply voltage of LED backlight	V_{LED}	-	-	(7.6)	V	Note 7-4
Supply current of LED backlight	I_{LED}	-	150	-	mA	Note 7-5
Backlight Power Consumption	P_{LED}	-	-	1140	mW	Note 7-6

Note 7-4：The I_{LED}=150 mA (Constant current)

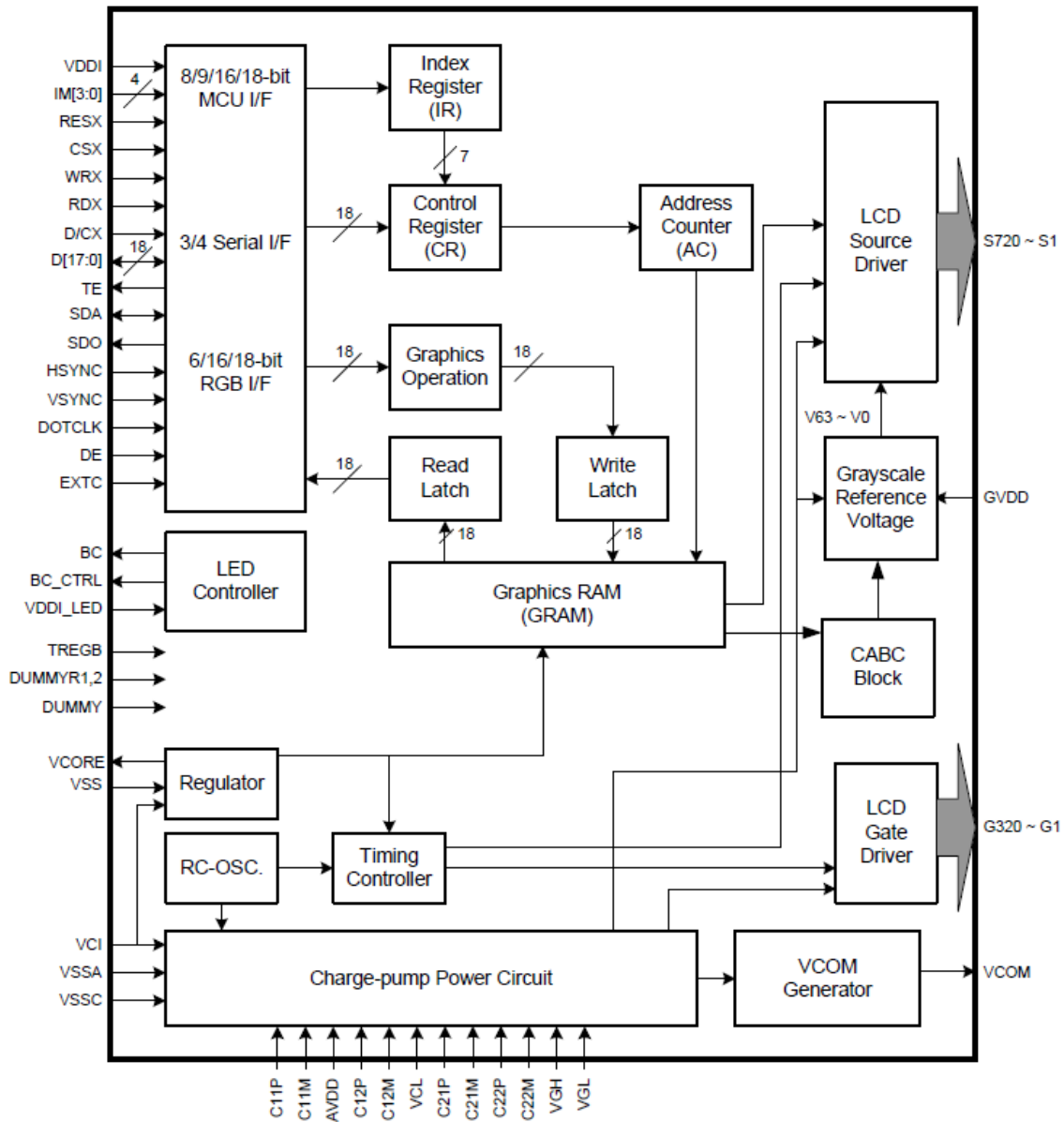Note 7-5：LED B/L applied information

Note 7-6：$P_{LED} = V_{LED} * I_{LED}$

Parameter	Symbol	Conditions	TYP.	MAX.	Unit	Remark
Supply current for source driver and gate driver	I_{CI}	V_{CI} = TBD V	TBD	TBD	mA	
Backlight Power Consumption	P_{LED}	-	-	TBD	mW	
Total power consumption	-	-	-	TBD	mW	

## 8. Pixel Arrangement：
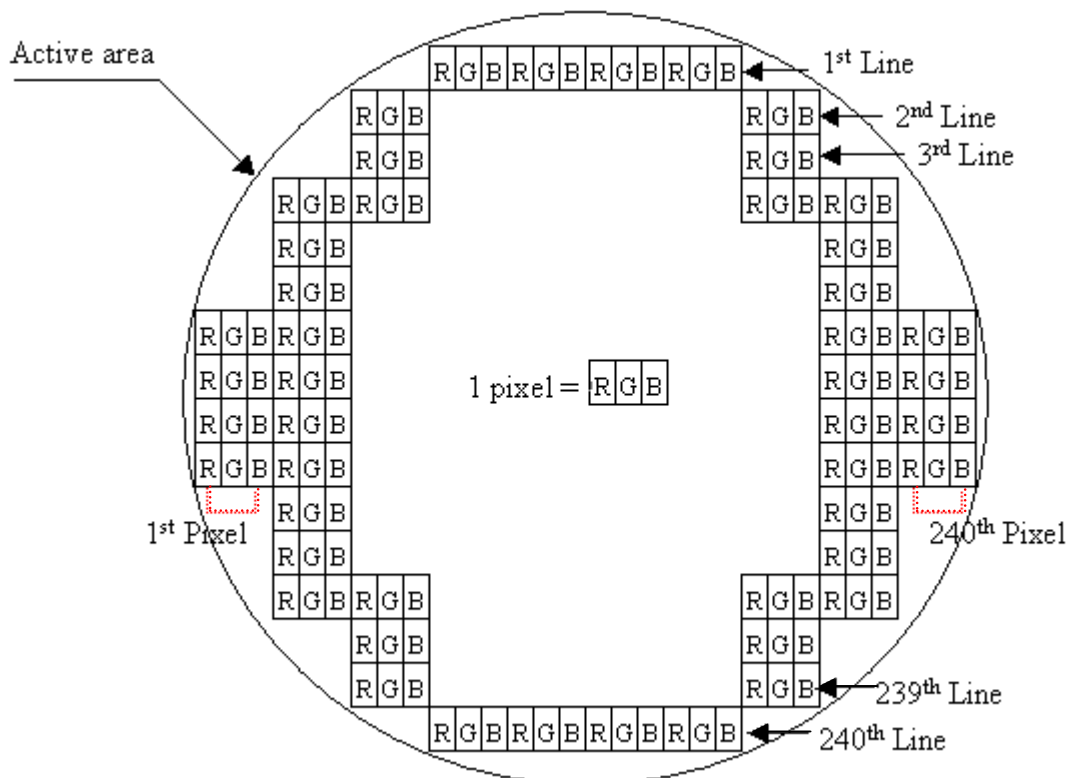
9. Block Diagram：

10. Timing specification：

10-1. AC Characteristics：

10-1.1 80-system Bus Interface Timing Characteristics：

| Signal	Symbol	Parameter	Min	Max	Unit	Description
DCX	Tast	Address setup time	0	-	ns	
	That	Address hold time(write/Read)	0	-	ns	
CSX	Tchw	CSX "H" pulse width	0	-	ns	
	Tcs	Chip select setup time(Write)	15	-	ns	
	Trcs	Chip select setup time(Read ID)	45	-	ns	
	Trcsfm	Chip select setup time(Read FM)	355	-	ns	
	Tcsf	Chip select wait time(Write/Read)	10	-	ns	
WRX	Twc	Write cycle	66	-	ns	
	Twrh	Write control pulse H duration	15	-	ns	
	Twrl	Write control pulse L duration	15	-	ns	
RDX(FM)	Trcfm	Read cycle(FM)	450	-	ns	
	Trdhfm	Read control pulse H duration(FM)	90	-	ns	
	Trdlfm	Read control pulse L duration(FM)	355	-	ns	
RDX(ID)	Trc	Read cycle(ID)	160	-	ns	
	Trdh	Read control pulse H duration	90	-	ns	
	Trdl	Read control pulse L duration	45	-	ns	
D[17:0] D[15:0] D[8:0] D[7:0]	Tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	Tdht	Write data hold time	10	-	ns	
	Trat	Read access time	-	40	ns	
	Tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

10-2. 80-system Bus Operation：
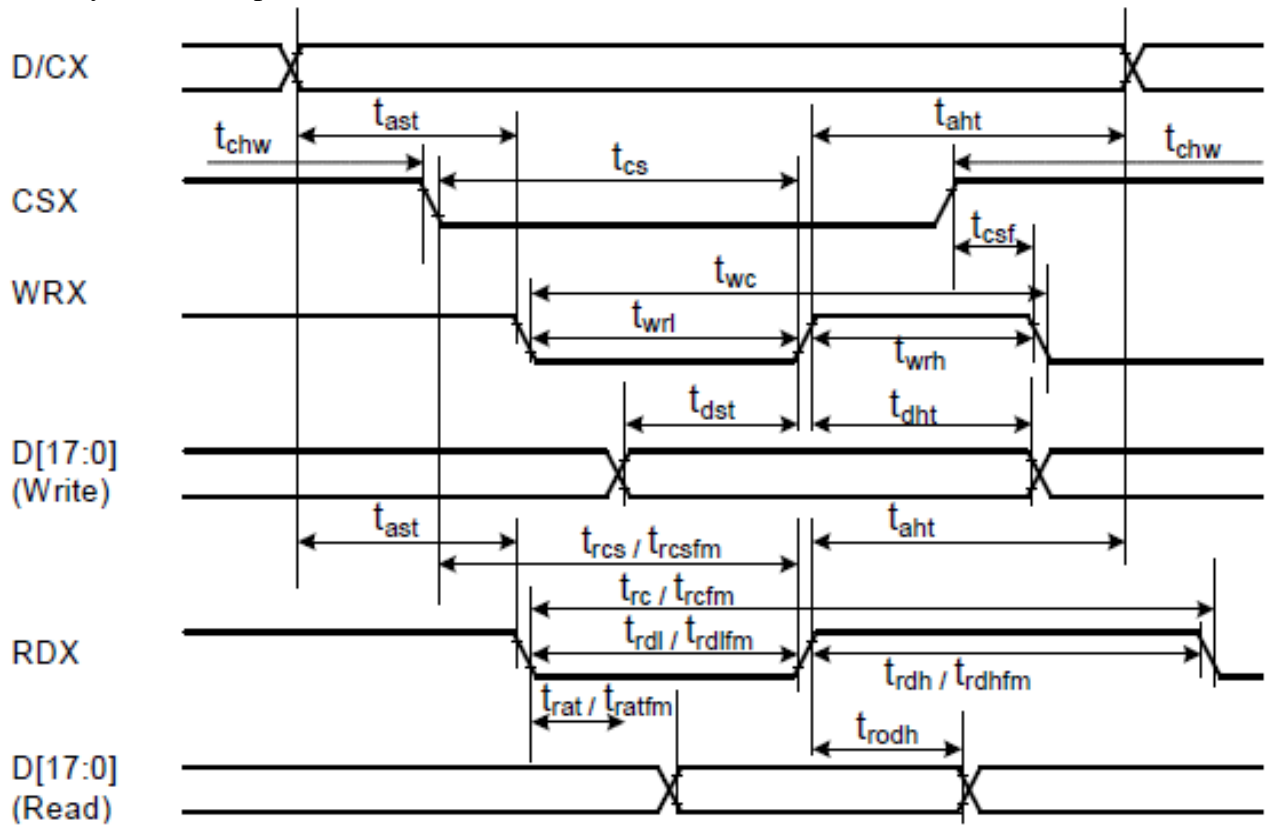
11. Interface specification：

11-1. 16-bit bus interface：

The 8080-I system 16-bit parallel bus interface of ILI9341S can be selected by setting hardware pin IM[3:0] to "0001".The following shown figure is the example of interface with 8080-I MCU system interface.
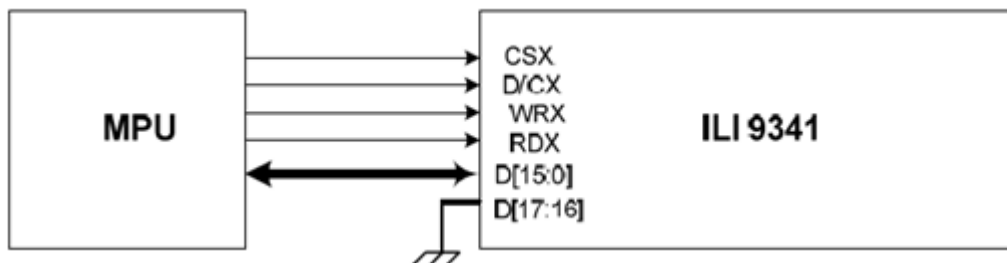
Different display data format is available for two colors depth supported by listed below.

-65K-Colors,RGB,5,6,5 –bits input data.
One pixel (3sub-pixels)display data is sent by 1 transfer when DBI[2:0]bits of 3Ah register are set to "101"

Count	0	1	2	3	…	238	239	240
D/CX	0	1	1	1	…	1	1	1
D15		0R4	1R4	2R4	…	237R4	238R4	239R4
D14		0R3	1R3	2R3	…	237R3	238R3	239R3
D13		0R2	1R2	2R2	…	237R2	238R2	239R2
D12		0R1	1R1	2R1	…	237R1	238R1	239R1
D11		0R0	1R0	2R0	…	237R0	238R0	239R0
D10		0G5	1G5	2G5	…	237G5	238G5	239G5
D9		0G4	1G4	2G4	…	237G4	238G4	239G4
D8		0G3	1G3	2G3	…	237G3	238G3	239G3
D7	C7	0G2	1G2	2G2	…	237G2	238G2	239G2
D6	C6	0G1	1G1	2G1	…	237G1	238G1	239G1
D5	C5	0G0	1G0	2G0	…	237G0	238G0	239G0
D4	C4	0B4	1B4	2B4	…	237B4	238B4	239B4
D3	C3	0B3	1B3	2B3	…	237B3	238B3	239B3
D2	C2	0B2	1B2	2B2	…	237B2	238B2	239B2
D1	C1	0B1	1B1	2B1	…	237B1	238B1	239B1
D0	C0	0B0	1B0	2B0	…	237B0	238B0	239B0

11-2. Display on Flow：

TBD

12. Optical Characteristics：

Ta=25℃

Parameter		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remarks
Viewing Angle	Horizontal	Ɵ11、Ɵ12	CR≥10	70	75	-	deg	Note 12-1
	Vertical	Ɵ22		45	50	-	deg	
		Ɵ21		65	70	-	deg	
Contrast Ratio		CR	At optimized view angle	200	400	-	-	Note 12-2
Brightness		L	θ=0°	800	1000		cd/㎡	Note 12-4
Uniformity		U%	θ=0°	70	75	-	%	Note 12-5
Response time	Rise	Tr	θ=0°	-	15	20	ms	Note 12-3
	Fall	Tf		-	20	30	ms	
White Chromaticity		x	θ=0°	0.29	0.33	0.37	-	
		y		0.31	0.35	0.39	-	
LED Life Time		-	+25℃	20000	30000	-	hrs	Note 12-6

Note 12-1: The definitions of viewing angles are as follow


Gray scale inversion direction
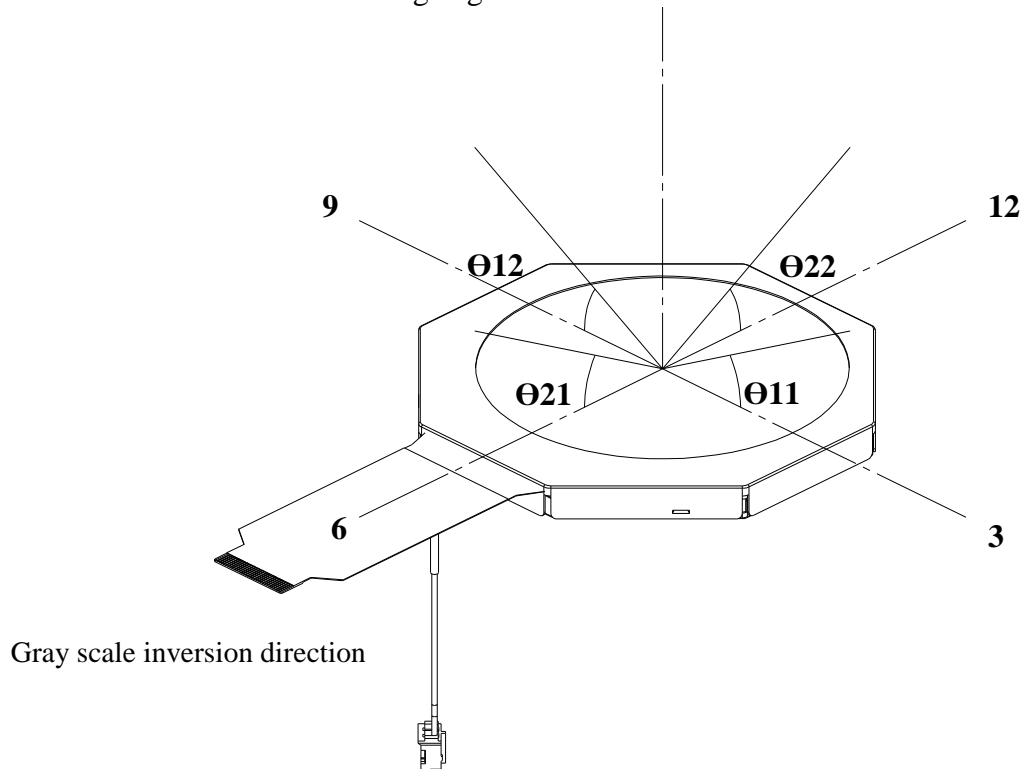
Note 12-2: The definition of contrast ratio：$CR = \dfrac{\text{Luminance at White Pattern}}{\text{Luminance at Black Pattern}}$

Note 12-3: Definition of Response Time Tr and Tf：
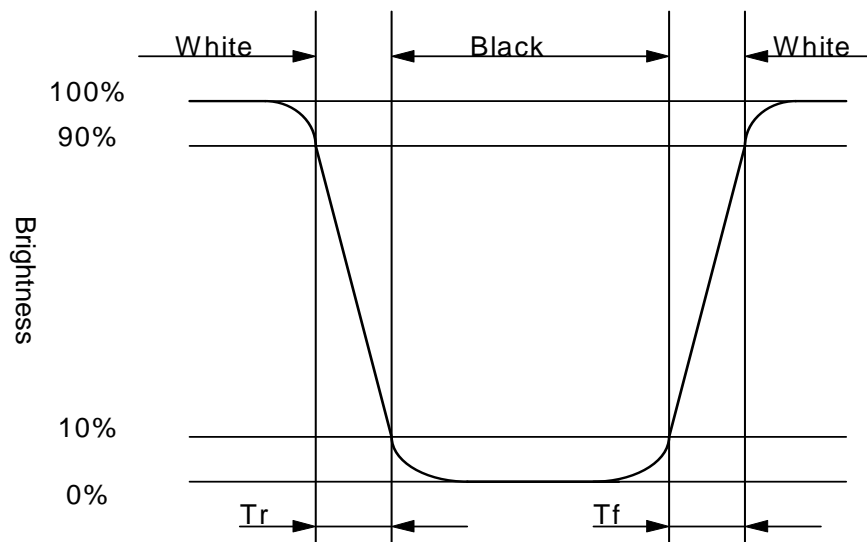
Note 12-4: All optical measurements shall be performed after backlight being turned-on for 30 mins. The optical characteristics shall be measured in dark room (ambient illumination on panel surface less than 1 Lux). The measuring configuration shows as following figure.
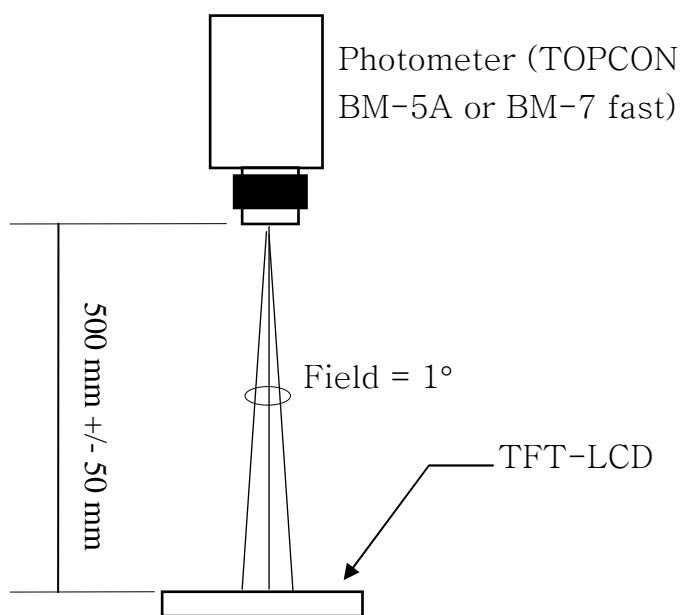
Optical characteristics measuring configuration

Note 12-5：The uniformity of LCD is defined as

$$U = \frac{\text{The Minimum Brightness of the 9 testing Points}}{\text{The Maximum Brightness of the 9 testing Points}}$$
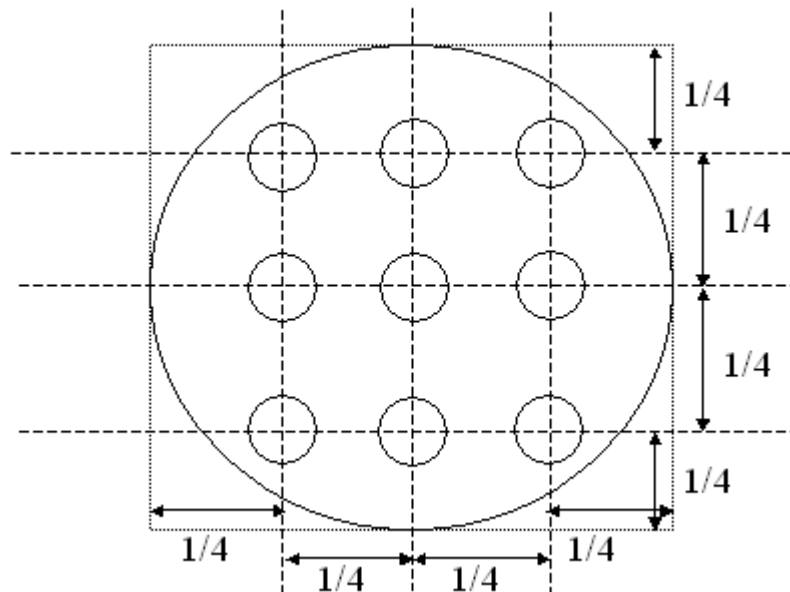
Luminance meter：BM-5A or BM-7 fast (TOPCON)

Measurement distance：500 mm +/- 50 mm

Ambient illumination：< 1 Lux

Measuring direction：Perpendicular to the surface of module

The test pattern is white.

Note 12-6：The "LED Life time " is defined as the module brightness decrease to 50% original Brightness that the ambient temperature is 25℃ and I_{LED} = 150mA.

13. Handling Cautions：

13-1) Mounting of module：
   a) Please power off the module when you connect the input/output connector.
   b) Polarizer which is made of soft material and susceptible to flaw must be handled carefully.
   c) Protective film (Laminator) is applied on surface to protect it against scratches and dirt.
   d) Please following the tear off direction as figure 13-1 to remove the protective film as slowly as possible, so that electrostatic charge can be minimized.

13-2) Precautions in mounting：
   a) When metal part of the TFT-LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth.
   b) Wipe off water drops or finger grease immediately. Long contact with water may cause discoloration or spots.
   c) TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface. Please handle with care.
   d) Since CMOS LSI is used in the module. So take care of static electricity and earth yourself when handling.

13-3) Adjusting module
   a) Adjusting volumes on the rear face of the module have been set optimally before shipment.
   b) Therefore, do not change any adjusted values. If adjusted values are changed, the specifications described may not be satisfied.

13-4) Others：
   a) Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours.
   b) Store the module at a room temperature place.
      As open the packing, must assembly within 3 month
   c) The voltage of beginning electric discharge may over the normal voltage because of leakage current from approach conductor by to draw lump read lead line around.
   d) If LCD panel breaks, it is possibly that the liquid crystal escapes from the panel. Avoid putting it into eyes or mouth. When liquid crystal sticks on hands, clothes or feet. Wash it out immediately with soap.
   e) Observe all other precautionary requirements in handling general electronic components.

13-4) Polarizer mark：
      The polarizer mark is to describe the direction of wide view angle film how to mach up with the rubbing direction.
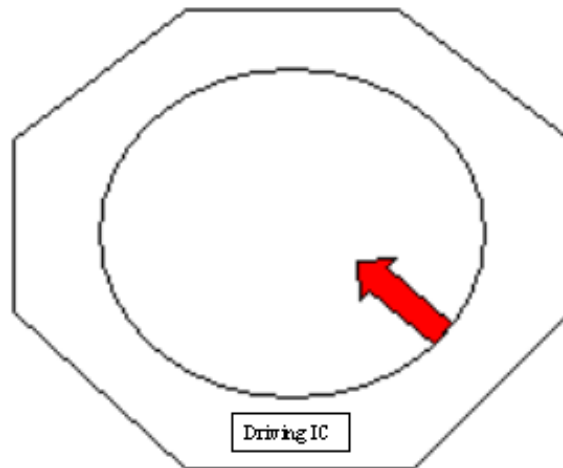
Figure 13-1 the way to peel off protective film

14. Reliability Test：

No	Test Item	Test Condition	Remark
1	High Temperature Storage Test	Ta = 85℃, 240 hrs	
2	Low Temperature Storage Test	Ta = -40℃, 240 hrs	
3	High Temperature Operation Test	Ta = 80℃, 240 hrs	
4	Low Temperature Operation Test	Ta = -30℃, 240 hrs	
5	High Temperature & High Humidity Operation Test	Ta = 60℃, 95%RH, 240 hrs (No Condensation)	
6	Thermal Cycling Test (non-operating)	-30℃ → +80℃, 200 Cycles 30 mins 30 mins	
7	Vibration Test (non-operating)	Frequency : 10 ~ 55 H_Z Amplitude : 1 mm Sweep time : 11 mins Test Period : 6 Cycles for each direction of X, Y, Z	
8	Shock Test (non-operating)	100G , 6ms Direction : $\pm X$, $\pm Y$, $\pm Z$ Cycle : 3 times	
9	Electrostatic Discharge Test (non-operating)	200pF , 0Ω $\pm$200V 1 time / each terminal	

Ta：ambient temperature

[Criteria]
In the standard conditions, there is not display function NG issue occurred. (including：line defect ,no image)All the cosmetic specification is judged before the reliability stress.

15.Packing
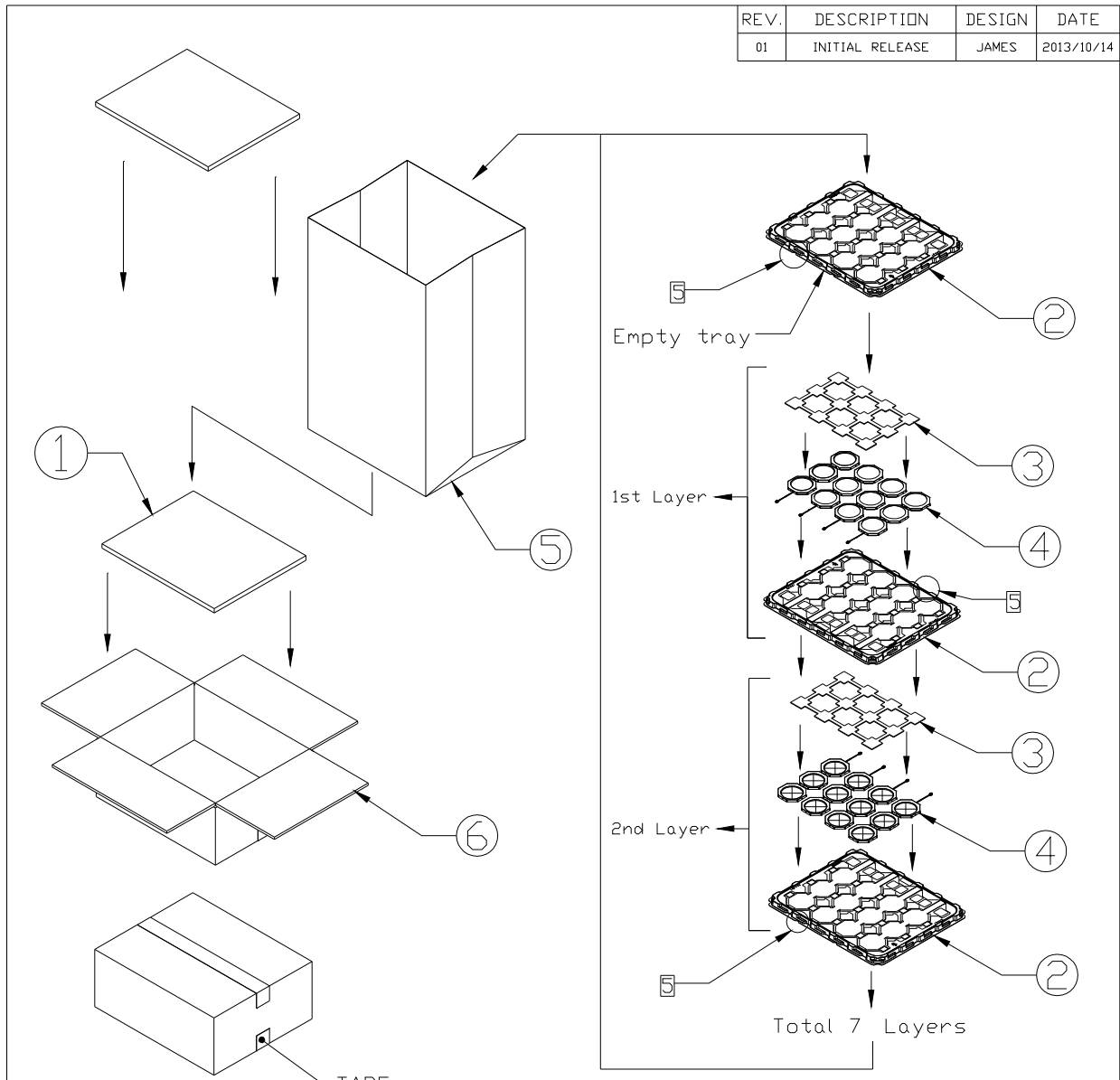
REV.	DESCRIPTION	DESIGN	DATE
01	INITIAL RELEASE	JAMES	2013/10/14

Empty tray

1st Layer

2nd Layer

Total 7 Layers

TAPE

NOTE:
1. ONE LAYER INCLUDE:1 PIECE OFCUSHION SHEET, 12 PCS MODULE & 1 PIECE OF TRAY.
2. Q'TY:84 PCS PANEL/CARTON.
3. DIMENSION: 455*375*190mm.
4. WEIGHT: 6.0 Kg.
5. TRAY 需180交叉堆疊,疊堆後可從側邊檢視圓弧防呆方向是否正確

ITEM	DESCRIPTION	Q'ty	REMARK
6	CARTON INTERNAL	1	
5	摺口袋	1	抗靜電
4	PT023TX1	84	
3	EPE CUSHION SHEET	7	抗靜電
2	TRAY	8	抗靜電
1	EPE FOAM	2	

MTL.SPEC.	UNSPECIFIED TOL.		REMARK		
	ANGLE				
	ROUGHNESS				

APPROVE	PATRICK LIN	SCALE	UNIT	SHEET	DWG.TITLE
CHECK	PATRICK LIN			1 OF 1	2.3" ROUND MODULE PACKING DRAW
DESIGN	JAMES	MTL.NO. PT023TX1			DWG.NO.

REV. 02   A4 SIZE