Specification for Colour TFT Display module
4.2'' Circular TFT Display Module

Manufacturer	Data Image Corporation
Part n°	FG040210DSSWMG01
Ordering n°	FG040210DSSWMG01
Customer Part n°	n/a
Revision n°	1.0
Issue Date	2018/02/12

Customer's Approval

Company name	
Printed name	
Job title	
Signature	
Approval Stage:	This product is approved for the following production stage: - ☐ Sample / Prototype ☐ Pre-Production ☐ Mass Production
Approval Date	

Supplied by Anders Electronics plc
Manufactured by Data Image Corporation

DATA IMAGE CORPORATION

TFT Module Specification
Preliminary

ITEM NO.: FG040210DSSWMG01

Table of Contents

Customer Companies	QA Approved	DQA Check	R&D Approved	R&D Check
	Betty Lin	*Huong*	*Alex*	*Thomas*
Customer Approved by	Version:	Issued Date:	Total Pages:	Prepared
	1	12/FEB/18'	22	*Rudy*

2. RECORD OF REVISION

Rev	Date	Item	Page	Comment	Source
1	12/FEB/18'	All 13	All 23	Initial Preliminary Modify Outline Drawing from Rev.1 to 2. 2) Modify 1、6、7 pin define. Modify B/L FPC location bore and pad design. Modify TFT FPC design. Modify dimensions from 10.37mm to 8.37mm、74.3mm to 67.3mm. Modify mylar area.	ESR0607015

3. GENERAL SPECIFICATIONS

Parameter	Specifications	Unit
Screen Size	4.2 (Diameter)	inch
Display Format	720 x (R,G,B) x 720	dot
Active Area	105.84(H) 105.84(V)	mm
Pixel Pitch	0.147(H) ×0.147(V)	mm
Pixel Configuration	Stripe	
Outline Dimension	128.50(H) x128.50(V) x6.30(D)	mm
Back-light	LED	
TFT-LCD Display mode	Normally Black	
Weight	TBD	g
View Angle direction(TFT)	All	
IC Part Number	HX8249+HX8695	
Our components and processes are compliant to RoHS standard		

4. ABSOLUTE MAXIMUM RATINGS

Ta-25°C

Parameter	Symbol	Min.	Max.	Unit	Remark
Power supply voltage	VDD	-0.3	3.96	V	
Operating temperature	Top	-30	85	°C	
Storage temperature	Tst	-30	85	°C	

5. ELECTRICAL CHARACTERISTICS

5.1 Operating Conditions

GND=0V,Ta=25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply voltage	VDD	2.7	-	3.6	V	
"H" level logical input voltage	V_{IH}	0.7VDD	-	VDD+0.3	V	
"L" level logical input voltage	V_{IL}	-0.3	-	0.3VDD	V	

5.2 Backlight Driving Consumption

Ta= 25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED voltage	V_F	-	-	21	V	
LED current	I_F	-	130	-	mA	
LED dice Life Time		-	50,000	-	hr	

LED A — LED K
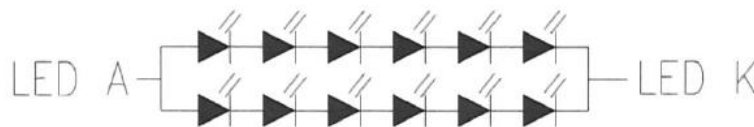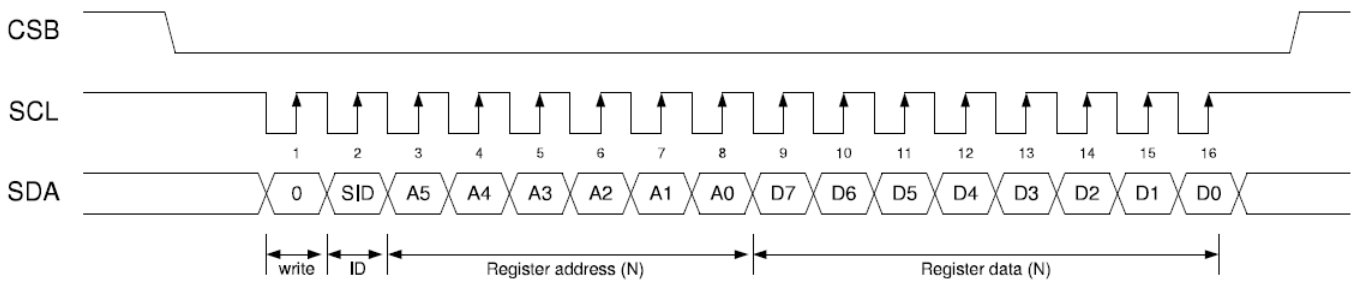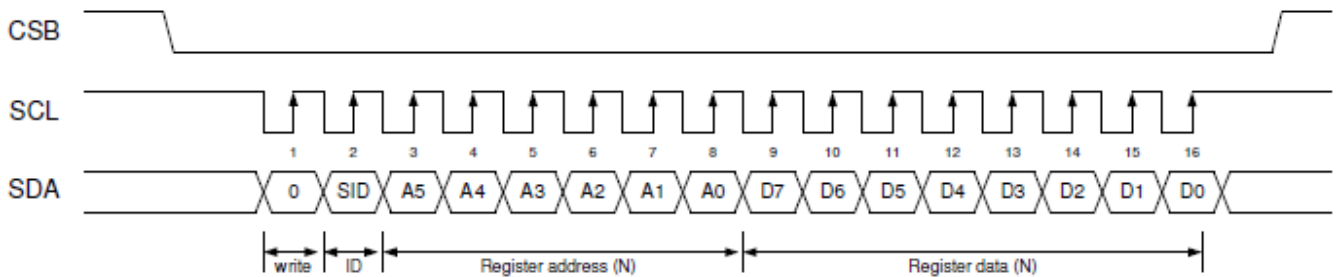
VF : 21V Max.
IF : 130mA
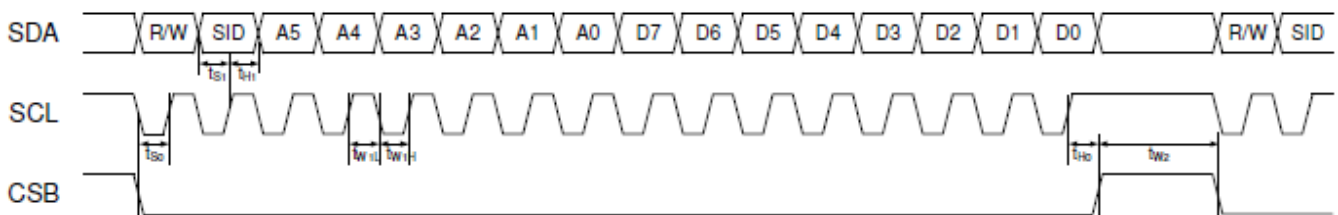
6. INPUT SIGNAL TIMING

6.1 SPI normal write / read mode

### 6.1.1 SPI normal write mode
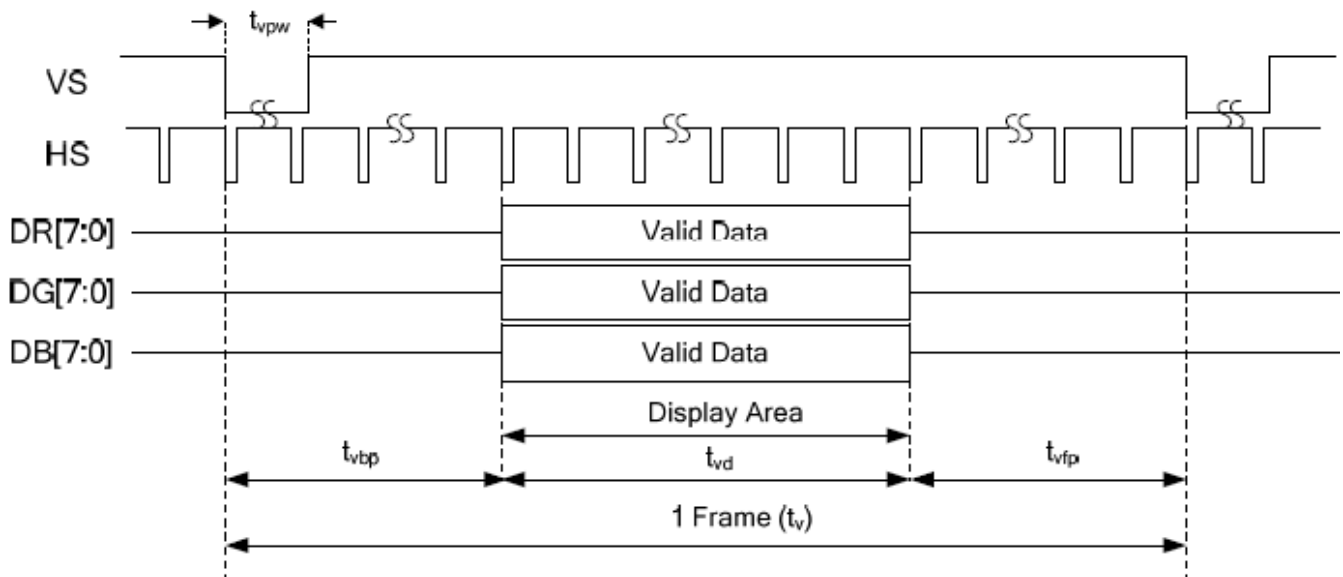

6.1.2 SPI normal read mode

6.1.3 SPI timing

Parameter	Symbol	Conditions	Spec.			Unit
			Min.	Typ.	Max.	
SDA setup time	t_{S0}	CSB to SCL	60	-	-	ns
	t_{S1}	SDA to SCL	60	-	-	ns
SDA hold time	t_{H0}	CSB to SCL	60	-	-	ns
	t_{H1}	SDA to SCL	60	-	-	ns
Pulse width	t_{W1L}	SCL pulse width	75	-	-	ns
	t_{W1H}	SCL pulse width	75	-	-	ns
	t_{W2}	CSB pulse width	1	-	-	µs
Clock duty	-	-	40	50	60	%

6.2 RGB interface characteristic

- Horizontal
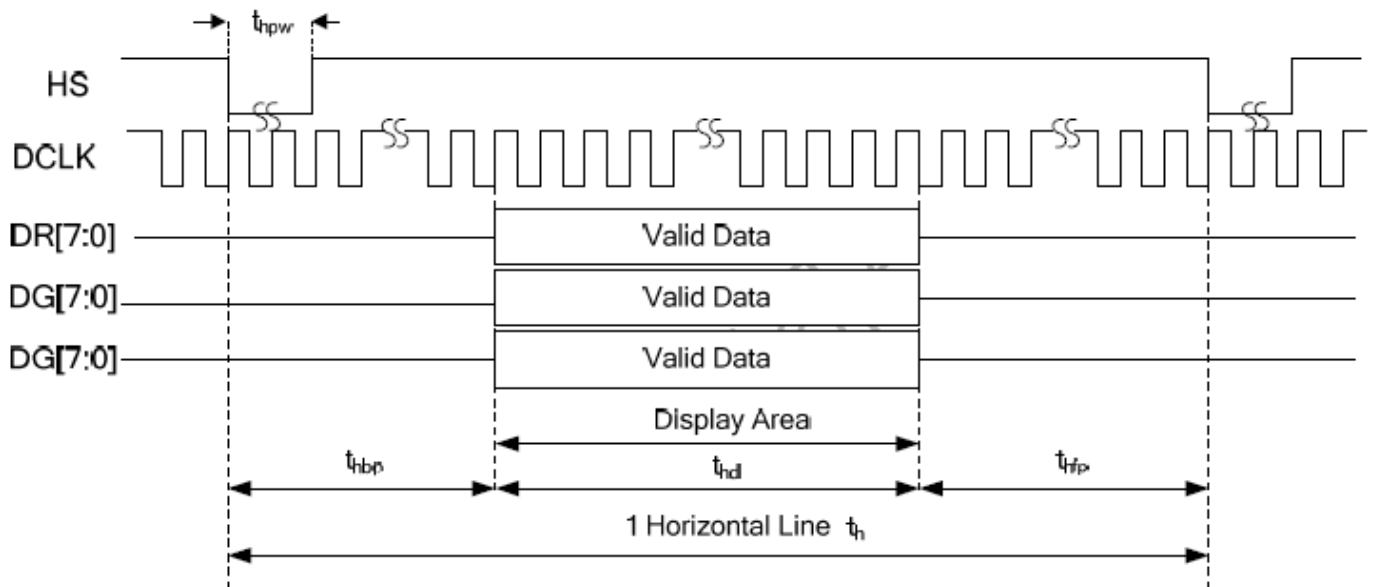
- Vertical

Timings for RGB I/F

Item	Symbol	Min.	Typ.	Max.	Unit
DCLK frequency	FDCLK		38		MHz
Horizontal valid data	thd	720	720	720	DCLK
Hsync pulse width	thpw	1	2	88	DCLK
Hsync back porch	thbp	5	16	89	DCLK
Hsync front porch	thfp	19	64	103	DCLK
1 horizontal line	th	776	780	828	DCLK
Vertical valid data	tvd	720	720	720	H
Vsync pulse width	tvpw	1	2	38	H
Vsync back porch	tvbp	5	5	139	H
Vsync front porch	tvfp	5	67	139	H
1 vertical field	tv	730	792	864	H

6.3 RGB interface General Timing
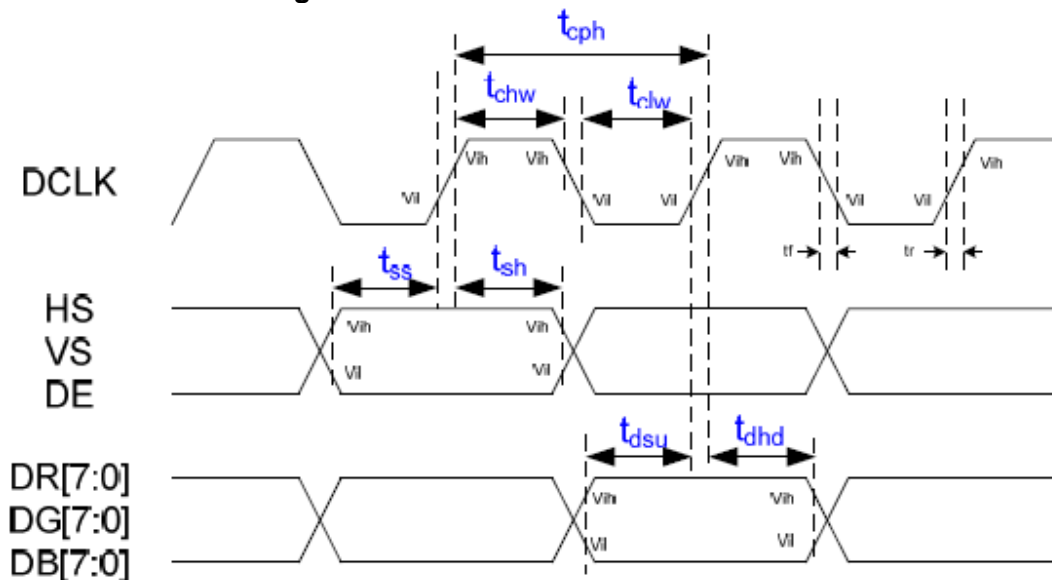
Figure 5.2.3.1 General Timings for RGB I/F

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK period	T_{cph}	16.8	-	-	ns
DCLK clock high width	T_{chw}	6	-	-	ns
DCLK clock low width	T_{clw}	6	-	-	ns
VS setup time	T_{ss}	5	-	-	ns
VS hold time	T_{sh}	5	-	-	ns
HS setup time	T_{ss}	5	-	-	ns
HS hold time	T_{sh}	5	-	-	ns
DE setup time	T_{ss}	5	-	-	ns
DE hold time	T_{sh}	5	-	-	ns
Data setup time	T_{dsu}	5			ns
Data hold time	T_{dhd}	5			ns
Input signal rising time	Tr	-	-	10	ns
Input signal falling time	Tf	-	-	10	ns

6.4 Reset Input Timing
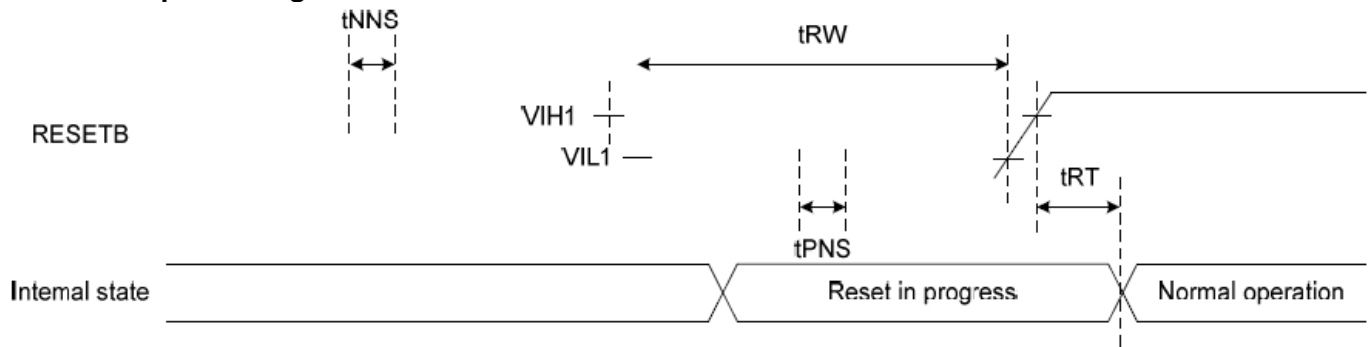
Signal	Paramete	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
RESETB	Reset pulse width	tRW	10	-	-	µs
	Reset complete time	tRT	-	-	5	µs
	Positive spike noise width	tPNS	-	-	100	ns
	Negative spike noise width	tNNS	-	-	100	ns

7. OPTICAL CHARACTERISTIC

Ta= 25°C

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Viewing Angle		θL	Center CR≥10	70	80	-	deg	Note 1,2
		θR		70	80	-		
		θT		70	80	-		
		θB		70	80	-		
Contrast Ratio		CR	at optimized viewing angle	600	800	-		Note 1,4
Response time		Tr+Tf	Center θx=θy =0°	-	25	-	ms	Note 1,6
Uniformity		B-uni	θx=θy =0°	70	-	-	%	Note 1,5
Brightness		L	θx=θy =0°	800	1000	-	cd/㎡	Note 1,3
Chromaticity	W	x_W	Center θx=θy =0°	Typ. -0.05	0.301	Typ. +0.05		Note 1,7
		y_W			0.338			
	R	x_R			0.561			
		y_R			0.316			
	G	x_G			0.303			
		y_G			0.527			
	B	x_B			0.143			
		y_B			0.169			

The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance ≤1 lux, and at room temperature). The operation temperature is 25°C±2°C and LED Backlight Current IF=130mA. The measurement method is shown in Note1.

Note 1: The method of optical measurement:
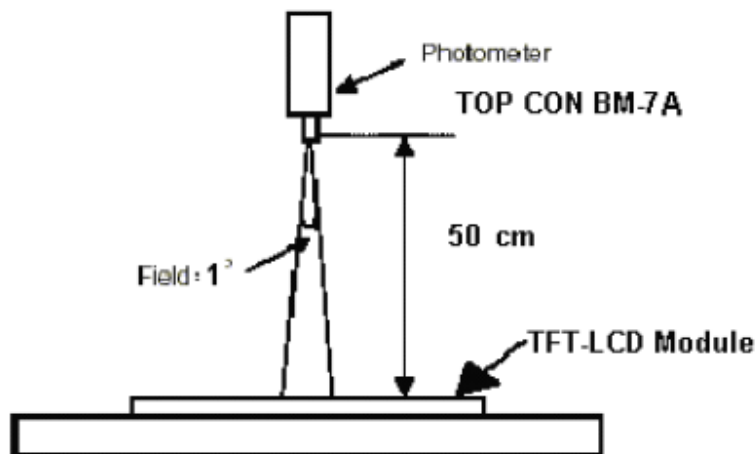
Note 2: Definition of viewing angle range
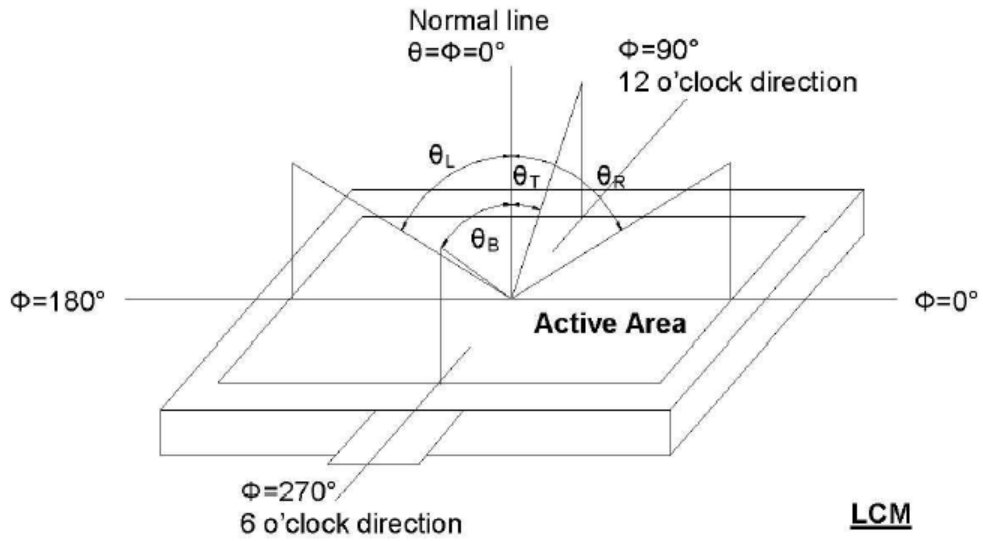
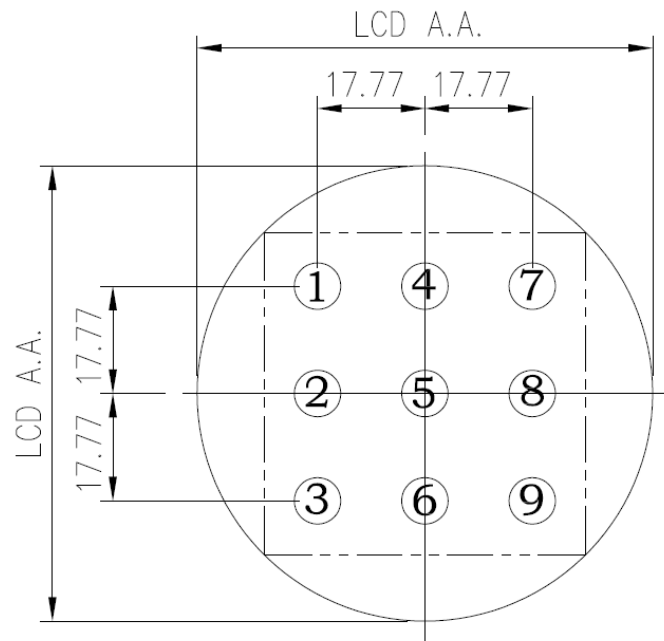Note 3: Measured at the center area of the panel and at the viewing angle of the θx=θy =0°

Note 4: Definition of Contrast Ratio (CR):

$$CR = \frac{\text{Luminance with all pixels in white state}}{\text{Luminance with all pixels in Black state}}$$
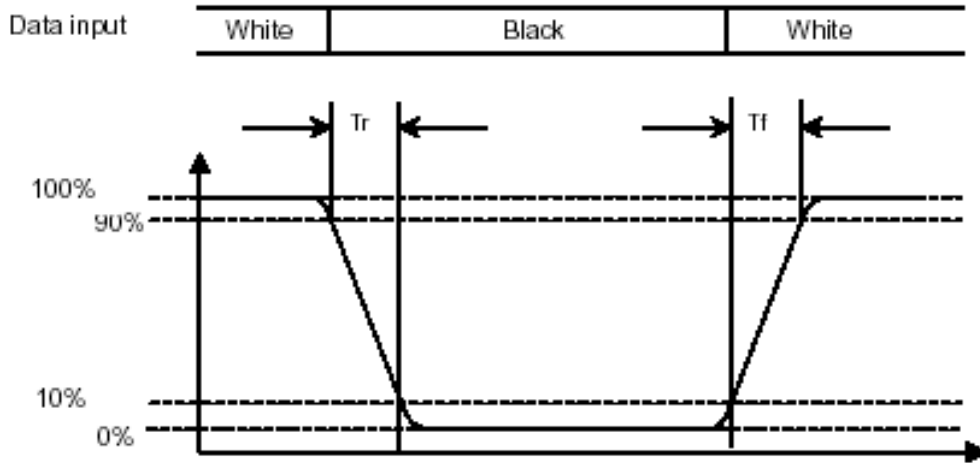
Note 5: Definition of Brightness Uniformity (B-uni):

$$B\text{-uni} = \frac{\text{Minimum luminance of 9 points}}{\text{Maximum luminance of 9points}} \quad \text{(Note 5).}$$

Note 6: Definition of Response Time:

The Response Time is set initially by defining the "Rising Time (Tr)" and the "Falling Time (Tf)" respectively. Tr and Tf are defined as following figure.


Note 7: The color coordinates $(x_w, y_w), (x_R, y_R), (x_G, y_G),$ and (x_B, y_B) are obtained with all pixels in the viewing field at white, red, green, and blue states, respectively.

8. PIN CONNECTIONS

Pin No	Symbol	Description	Remark
1	NC	No Connection	
2	VDD	Power supply for analog system	
3	VDD		
4	GND	Ground	
5	/RESX	This signal will reset the device and must be applied to properly initialize the chip. Signal is active low.	
6	SDA	Serial data input signal.	
7	NC	No Connection	
8	SCL	Serial data clock signal.	
9	CSX	Chip select input pin ("Low" enable).	
10	DCLK	Pixel clock signal.	
11	DE	Data enable signal.	
12	VSYNC	Vertical sync.	
13	HSYNC	Horizontal sync.	
14	GND	Ground	
15	DB0	RGB data bus.	
16	DB1		
17	DB2		
18	DB3		
19	DB4		
20	DB5		
21	DB6		
22	DB7		
23	GND	Ground	
24	DB8	RGB data bus.	
25	DB9		
26	DB10		
27	DB11		
28	DB12		
29	DB13		
30	DB14		
31	DB15		
32	GND	Ground	
33	DB16	RGB data bus.	
34	DB17		
35	DB18		
36	DB19		
37	DB20		
38	DB21	RGB data bus.	

39	DB22		
40	DB23		
41	GND	Ground	
42	LEDA	Power Supply for LED+	
43	LEDA		
44	LEDK	Power Supply for LED-	
45	LEDK		

Pixel mapping
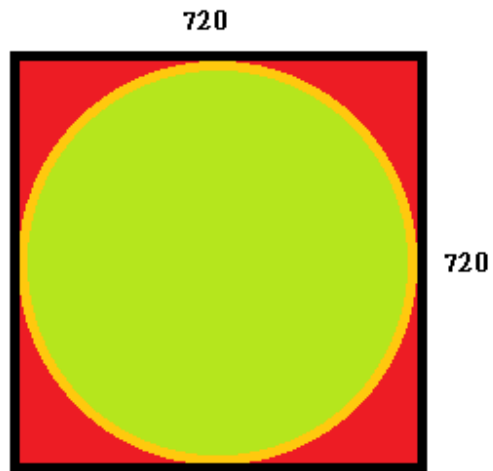
Green : Active

Red : Non-Active

9. INIT CODE

```
SPIW 00 00 //page 0
SPIW 03 F1 //RES 720x720
SPIW 04 40 //Gate right
SPIW 26 51 // Gate pass
SPIW 27 68 // Gate pass
SPIW 18 75 //DRVP TonToff
SPIW 19 75 //DRVN TonToff

SPIW 20 7F //VCOM


SPIW 00 01 //page 1 Gamma

SPIW 01 00
SPIW 02 00
SPIW 03 07
SPIW 04 04
SPIW 05 1b //
SPIW 06 07
SPIW 07 0d
SPIW 08 14
SPIW 09 17
SPIW 0a 18
SPIW 0b 1d
SPIW 0c 1e
SPIW 0d 1f
SPIW 0e 19
SPIW 0f 0f
SPIW 10 1c //
SPIW 11 00
SPIW 12 00
SPIW 13 0c

SPIW 14 00
SPIW 15 00
SPIW 16 07
SPIW 17 04
SPIW 18 1b //
SPIW 19 07
SPIW 1a 0d
SPIW 1b 14
SPIW 1c 17
SPIW 1d 18
SPIW 1e 1d
SPIW 1f 1e
SPIW 20 1f
SPIW 21 19
SPIW 22 0f
SPIW 23 1c //
SPIW 24 00
SPIW 25 00
SPIW 26 0c
```

10. QUALITY ASSURANCE

10.1 Test Condition

10.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : $25 \pm 5°C$
Humidity : $65 \pm 5\%$

10.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

10.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

10.1.4 Test Frequency

In case of related to deterioration such as shock test.   It will be conducted only once.

10.1.5 Test Method

| No.	Reliability Test Item & Level		Remark
	Test Item	Test Level	
1	High Temperature Storage Test	Ta=85°C,240hrs	IEC0068-2-2
2	Low Temperature Storage Test	Ta=-30°C,240hrs	IEC0068-2-1
3	High Temperature Operation Test	Ta=85°C,240hrs	IEC0068-2-2
4	Low Temperature Operation Test	Ta=-30°C,240hrs	IEC0068-2-1
5	High Temperature and High Humidity (No operation)	T=60°C,90%RH,240hrs	IEC0068-2-3
6	Thermal Cycling Test (No operation)	-30°C → +25°C → +85°C ,100 Cycles 30 min 5 min 30 min	IEC0068-2-14
7	Vibration test (Package)	Frequency:10~55HZ Amplitude:1.5mm Sweep time:11min Test period:6Cycles for each direction of X,Y,Z	IEC0068-2-6
8	Drop test (Package)	Height :60cm 1 conner,3edges,6surfaces	IEC0068-2-32
9	Electrostatic Discharge Test	Location: LCM/TP surface Condition:150pf 330Ω Contact +/- 6kV Air +/-8kV Criteria: Class C	IEC61000-4-2

10.2 Inspection condition
 10.2.1 Inspection conditions
   10.2.1.1 Inspection Distance : 35 ± 5 cm
   10.2.1.2 View Angle : Inspection under test condition : ±5°
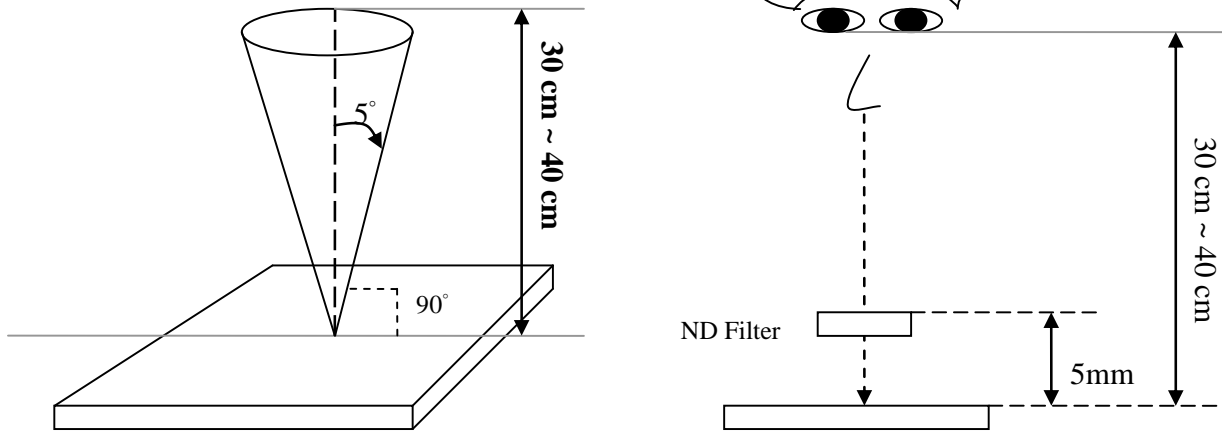
10.2.2 Environment conditions :

Ambient Temperature :		25±5°C
Ambient Humidity :		65±5%
Ambient Illumination	Cosmetic Inspection	600 ~ 800lux
	Functional Inspection	300 ~ 500lux

10.2.3 Definition of applicable Zones

10.3 Inspection Parameters

No.	Parameter	Criteria
1	Operating	Display function: No Display malfunction (Major)
		Line Defect: No obvious Vertical and Horizontal line defect in bright, dark and colored. (Major) (Note:1)
		Point Defect (Red, green, blue, dark): Active area ≤4dots (Minor)(Note:1)

Point Defect table:

Item	Acceptable number	Total	Class Of Defects	AQL Level
Bright	2	4	Minor	1.5
Dark	3			
Adjacent Bright	1	1		
Adjacent Dark	1	1		

Non-uniformity:
Visible through 2%ND filter white, R, G, B and gray 50%pattern. (Minor)

Foreign material in Black or White spots shape (W>1/4L) (Note: 5)

Dimension	Acceptable number	Class Of Defects	AQL Level
D ≤ 0.3	*	Minor	1.5
0.3 < D ≤0.5	3		
D> 0.5	0		

D = (Long + Short) / 2   ∗ : Disregard

Foreign Material in Line or spiral shape (W≤1/4L) (Note: 4)

Dimension	Acceptable number	Class Of Defects	AQL Level
W>0.1mm,L>5mm	0	Minor	1.5
L≦5mm,0.05mm<W≦0.1mm	3		
L≦5mm,W<0.05mm	*		

L : Length   W : Width   ∗ : Disregard

No.	Parameter	Criteria
2	External Inspection (non-operating)	Dimension: Outline (Major)
		Bezel appearance: uneven (Minor)
		Polarizer flaw or leak out resin : Defect is defined as the active area.

Scratch on the polarize:: (Note:2)

Dimension	Acceptable number	Class Of Defects	AQL Level
W>0.1mm,L>5mm	0	Minor	1.5
L≦5mm,0.05mm<W≦0.1mm	3		
L≦5mm,W<0.05mm	*		

L : Length   W : Width   ∗ : Disregard

Dent and spots shape on the polarize :(Note:2): (Note: 5)

Dimension	Acceptable number	Class Of Defects	AQL Level
D ≤ 0.3	*	Minor	1.5
0.3 < D ≤0.5	3		
D> 0.5	0		

D = (Long + Short) / 2   ∗ : Disregard

| Class of defects | **Major** | AQL 0.65 | **Definition** It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function. |
| | **Minor** | AQL 1.5 | It is a defect that will not result in functioning problem with deviation classified. |

Note:1.(a)Bright point defect is defined as point defect of R,G,B with area >1/2 dot respectively

      (b)Dark point defect is defined as visible in full white pattern.

      (c)Definition of distribution of point defect is as follows:

        -minumum separation between dark point defects should be larger than 5mm.

        -minumum separation between bright point defects should be larger than 5mm.

      (d)Definition of joined bright point defect and joined dark point defect are as follows:

        -Three or more joined bright point defects must be nil.

        -Three joined dark point defects must be nil.

        -Coupling of one dark and one bright point in junction is counted as one dark and bright spot with 1 pair maxmum.

Note:2 The external inspection should be conducted at the distance 35± 5cm between the eyes of inspctor and the panel .

Note:3 Luminance measurement for contrast ratio is at the distance 50± 5cm between the detective head and the panel with ambient illuminance less than 1 lux. Contrast ratio is obtained at optimum view angle.

Note:4 W-Width in mm , L-length of Max.(L1,L2) in mm.
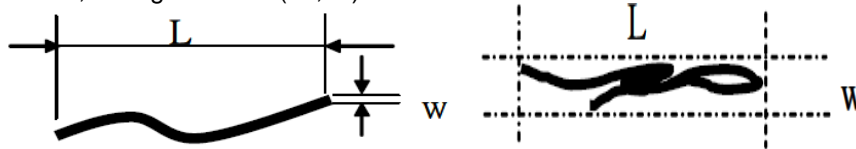
Note:5 Spot Foreign Material (W ≧ L/4)

$$D = \frac{(L+W)}{2}$$
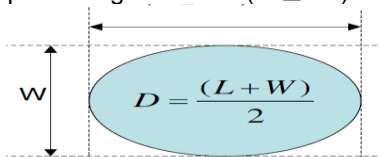
10.4 Sampling Condition

    Unless otherwise agree in written, the sampling inspection shall be   applied to the incoming inspection of customer.

    Lot size: Quantity of shipment lot per model.

    Sampling type: normal inspection, single sampling

    Sampling table: ISO 2859

    Inspection level: Level II

11. LCM PRODUCT LABEL DEFINE

Product Label style:

BarCode Define:

Serial number of the products
Serial number starts from 0000
Every work order is 10K at most

Week of production

Year of production

Storage area

Serial number of work order
Serial number starts from 0000 each month

Month of work order

Year of work order

The first 3 numbers of work order

Product Name Define:

FG 040210 D S S W M G 01

VERSION : 01

RoHS

View direction & Temp. Range

A – Bottom view 6H & Normal temp.

B – Bottom view 6H & Wide temp.

C–Top View & Normal temp

D–Top View & Wide temp.

M –All View Angle& Wide temp

Backlight Color

W –White   Y – Yellow Green

G - Green

Backlight

C–CCFL B/L

S –Edge light LED B/L

LCD Polarize type

N–Negative   **S –Super wide view or Excellent W.V**

M–Transmissive   F– Transflective

LCD type

A –TFT analog

D –TFT digital

Series code

040210–, **4.2 inch**

Model type

FG–Standard TFT Module

FX–Custom TFT Module

12. PRECAUTIONS IN USE LCM

1. ASSEMBLY PRECAUTIONS
   (1) You must mount a module using holes arranged in four corners or four sides.
   (2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
   (3) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
   (4) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
   (5) Do not open the case because inside circuits do not have sufficient strength.
   (6) Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
   (7) Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.
   (8) Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.

2. OPERATING PRECAUTIONS
   (1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
   (2) Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification
   (3) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
   (4) When fixed patterns are displayed for a long time, remnant image is likely to occur.
   (5) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
   (6) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.

3. ELECTROSTATIC DISCHARGE CONTROL
   The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such the copper leads on the PCB and the interface terminals with any parts of the human body.

   (2) The modules should be kept in antistatic bags or other containers resistant to static for storage.
   (3) Only properly grounded soldering irons should be used.
   (4) If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.
   (5) The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended
   (6) Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

4. STORAGE PRECAUTIONS
   (1) When you store LCDs for a long time, it is recommended to keep the temperature between 0°C-40°C without the exposure of sunlight and to keep the humidity less than 90%RH.
   (2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60°C 90%RH
   (3) Please do not leave the LCDs in the environment of low temperature; below -20°C.

5. OTHERS
   (1) A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight Land strong UV rays
   (2) Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.
   (3) For the packaging box, please pay attention to the followings:
   a. Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.
   b. Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
   c. Packing box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)
   (4) Waste
   Liquid crystal module products shall not be arbitrarily discarded; the water and soil have a negative impact on the environment, the need to be handled by a qualified unit.

6. LIMITED WARRANTY
   Unless otherwise agreed between DATA IMAGE and customer, DATA IMAGE will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with DATA IMAGE acceptance standards, for a period on one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of DATA IMAGE is limited to repair and/or replacement on the terms set forth above. DATA IMAGE will not responsible for any subsequent or consequential events.

FG040210DSSWMG01   REV: 1

PRELIMINARY

Note:
1. Luminance : 1000cd/m²(Typ.) 800cd/m²(Min.)
2. LCM FPC Match Connector: MOLEX 54132-4562 or equivalent.
3. Tolerance is ±0.2 unless otherwise noted.
4. The bending radius of FPC should be larger than 1.0mm.
5. For RoHS.
6. Important dimension: ①~⑦
7. Uniformity: 70%(Min.)

① 128.50(LCM □.D)
113.36(PLR)
105.84(LCM A.A)

7.32±0.3
11.33±0.3

③ 107.67±1
② 128.50(LCM □.D)
6.68±0.3   114.50(PLR)
11.33±0.3   105.84(LCM A.A)

④ 52.75±1

67.30±1
(Bending Area)

8.37±1
(Bending Area)

6.00±0.5
(Stiffener)

RGB
0.049
0.147
0.147
SCALE 100:1

4.21" RESOLUTION:720xRGBx720
View direction(Free)

Peeling Tape

Component & Mylar
H=2mm Max.

Stiffener   Contact side

0.30±0.03
⑥

Stiffener(PI)

LCM Label
UL Label

45
"A"

7.24
6.30±0.2 ⑤

3.80±0.3
0.50±0.1
0.20±0.2

Detail A
Scale 2:1

W=0.30±0.03
P0.5*(45-1)=22.00±0.05
23.00±0.07
⑦

Pin Define

No.	Pin name	No.	Pin name	No.	Pin name
1	NC	24	DB8		
2	VDD	25	DB9		
3	VDD	26	DB10		
4	GND	27	DB11		
5	/RESX	28	DB12		
6	SDA	29	DB13		
7	NC	30	DB14		
8	SCL	31	DB15		
9	CSX	32	GND		
10	DCLK	33	DB16		
11	DE	34	DB17		
12	VSYNC	35	DB18		
13	HSYNC	36	DB19		
14	GND	37	DB20		
15	DB0	38	DB21		
16	DB1	39	DB22		
17	DB2	40	DB23		
18	DB3	41	GND		
19	DB4	42	LEDA		
20	DB5	43	LEDA		
21	DB6	44	LEDK		
22	DB7	45	LEDK		
23	GND				

REVISIONS

AUTH	DESCRIPTION	DATE	APPROVED
△₃	Modify dimensions from 10.37mm to 8.37mm、74.3mm to 67.3mm. Modify mylar area. (ESR-0607015)	2017/12/27	
△₂	Modify 1、6、7 pin define. Modify B/L,FPC location bore and pad design. Modify TFT FPC design.(ESR-0607015) 2017/12/27		
△₁	(ESR-0607015)		

DATE: **2017/09/29**
DRAWN:
CHECK:
APPROVE:

TITLE: **LCM OUTLINE DIMENSION**

UNITS **MM**
DWG. NO. **FG040210SG01**
SCALE **Scale**
REV. **2**
SHEET **1 OF 1**

DATA IMAGE

14. PACKAGE INFORMATION

TBD