



Confidential Document

# DATA IMAGE CORPORATION

## TFT Module Specification

PRELIMINARY

ITEM NO.: FG040370DSSWMG01

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### 3. Application

Digital equipments which need color display, such as P.O.S, medical equipments and industrial equipments.

### 4. GENERAL Specifications

Parameter	Specifications	Unit
Display resolution	480X R.G.B x 272	dot
Active area	95.04(W) x 53.856(H)	mm
Screen size	4.3(Diagonal)	inch
Dot pitch	0.066 (W) x 0.198(H)	mm
Color configuration	R.G.B. Stripe	
Overall dimension	105.5 (W) x 67.2(H) x 3.1(D)	mm
Weight	TBD	g
Surface treatment	Antiglare	
View Angle direction	6 o'clock	
Our components and processes are compliant to RoHS standard.		

### 5. Electrical Characteristics

 $T_a=25^{\circ}\text{C}$ 

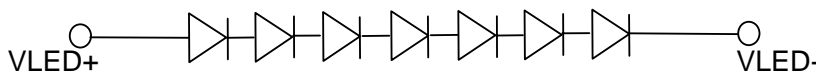
Parameter	Symbol	MIN.	Typ.	MAX.	Unit	Remark
Power Supply voltage	$V_{DD}$	3.0	3.3	3.6	V	Note1
Power Supply Current	$I_{DD}$		12		mA	$V_{DD}=3.3\text{V}$
Ripple Voltage	$V_{RFVDD}$			100	mVp-p	
	$V_{RFVDD}$			100	mVp-p	
"H" level logical input voltage	$V_{IH}$	0.7VDD	--	VDD	V	
"L" level logical input voltage	$V_{IL}$	0	--	0.3VDD	V	
Operating temperature	Topa	-20	--	70	$^{\circ}\text{C}$	Ambient temperature
Storage temperature	Tstg	-30	--	80	$^{\circ}\text{C}$	Ambient temperature

Note1:VDDAbsolute Maximum Ratings -0.3V~+4.5V

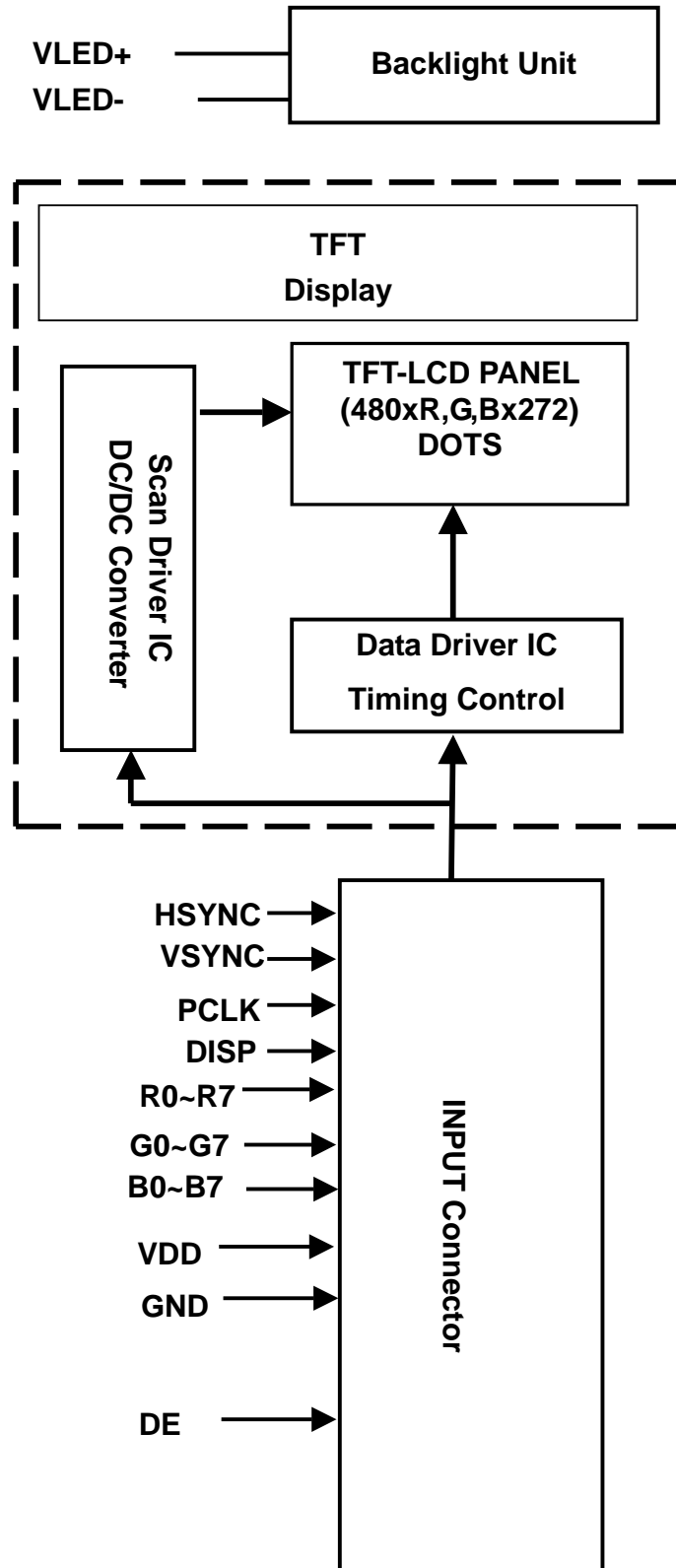
#### 5.1 Backlight driving for power conditions

 $T_a= 25^{\circ}\text{C}$ 

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current	$I_L$	--	20	--	mA	
VLED voltage	$V_L$	--	23.1	--	V	$I_L=20\text{mA}$



## 6. Block Diagram



## 7. PIN CONNECTIONS

### 7.1 Input Pins Connection

Pin No	Symbol	Function	Remark
1	VLED-	LED Power Source input terminal (Cathode side)	
2	VLED+	LED Power Source input terminal (Anode side)	
3	GND	Ground	
4	VDD	Power Supply : +3.3V	
5	R0	Red pixel data(LSB)	
6	R1	Red pixel data	
7	R2	Red pixel data	
8	R3	Red pixel data	
9	R4	Red pixel data	
10	R5	Red pixel data	
11	R6	Red pixel data	
12	R7	Red pixel data(MSB)	
13	G0	Green pixel data(LSB)	
14	G1	Green pixel data	
15	G2	Green pixel data	
16	G3	Green pixel data	
17	G4	Green pixel data	
18	G5	Green pixel data	
19	G6	Green pixel data	
20	G7	Green pixel data(MSB)	
21	B0	Blue pixel data(LSB)	
22	B1	Blue pixel data	
23	B2	Blue pixel data	
24	B3	Blue pixel data	
25	B4	Blue pixel data	
26	B5	Blue pixel data	
27	B6	Blue pixel data	
28	B7	Blue pixel data(MSB)	
29	GND	Ground	
30	PCLK	clock signal to sample each data	
31	DISP	Display ON/OFF Signal ON=H, OFF=L	
32	HSYNC (HS)	Horizontal synchronous signal	
33	VSYNC (VS)	Vertical synchronous signal	
34	DE	Data Enable Control	
35	NC	No Connection	
36	GND	Ground	
37	NC	No Connection	
38	NC	No Connection	
39	NC	No Connection	
40	NC	No Connection	

## 8. INTERFACE SPECIFICATIONS

### 8.1 INPUT SIGNAL TIMING SPECIFICATIONS

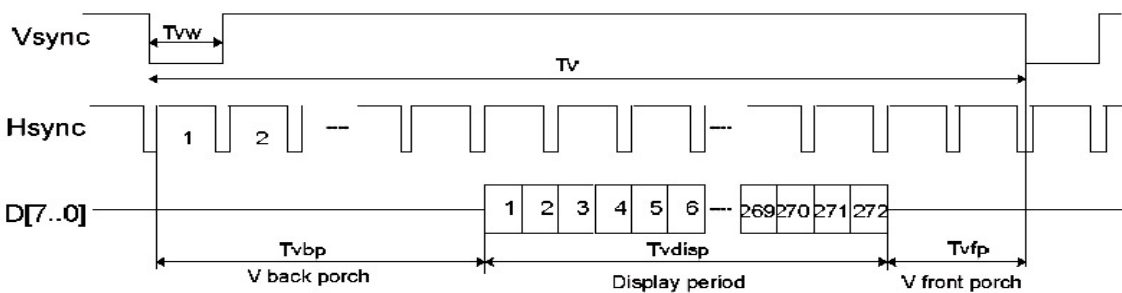
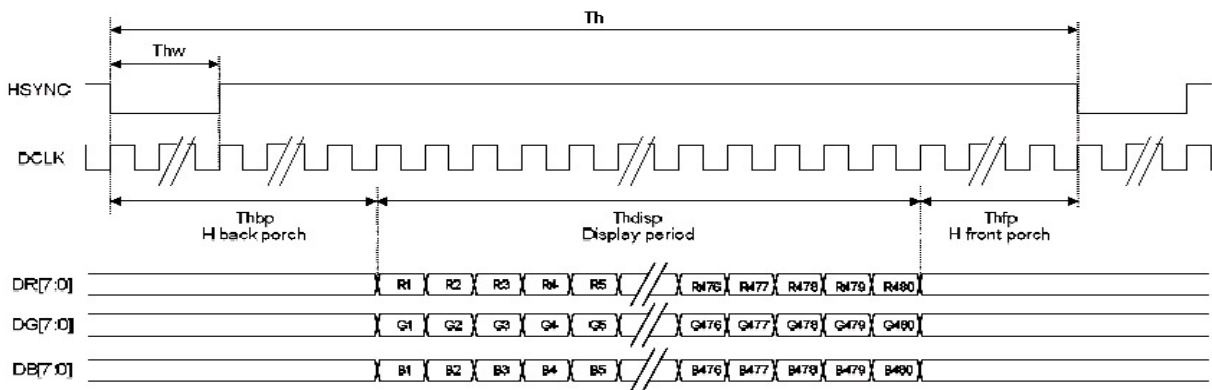
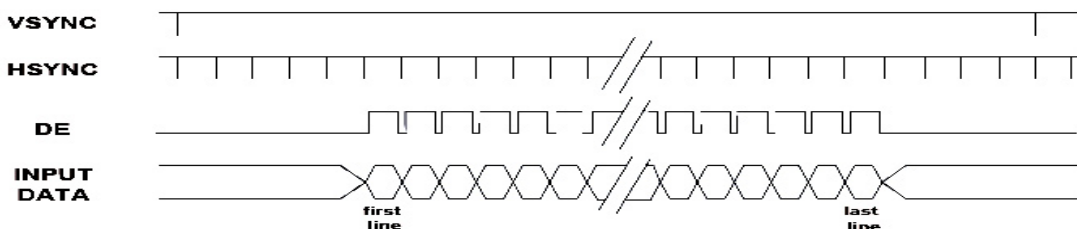
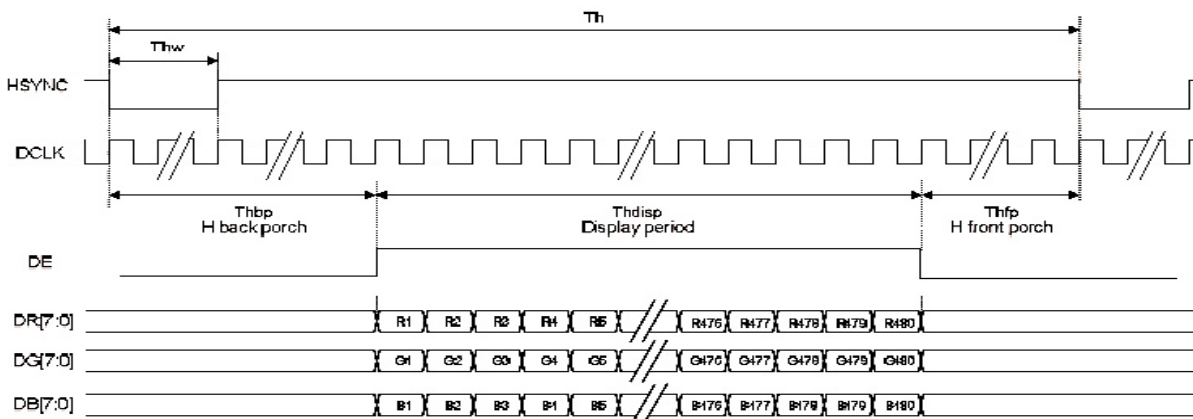
The specification of input signals timing is as the following table and timing diagram.

( $T_A=25^{\circ}\text{C}$ ,  $V_{DD}=2.25\text{V}\sim 3.6\text{V}$ ,  $GND=0\text{V}$ )

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Remarks
Clock cycle	fCLK	5	9	12	MHz	
Hsync cycle	1/th	-	16.95	-	KHZ	
Vsync cycle	1/tv	-	31.25	-	HZ	
Horizontal Signal						
Horizontal cycle	Th	490	531	605	CLK	
Horizontal display period	Thdisp	-	480	-	CLK	
Horizontal front porch	Thfp	2	8	-	CLK	
Horizontal pulse width	Thw	1	-	-	CLK	
Horizontal back porch	Thbp	8	43	-	CLK	
Vertical Signal						
Vertical cycle	Tv	275	288	335	H <sup>(1)</sup>	
Vertical display period	Tvdisp	-	272	-	H <sup>(1)</sup>	
Vertical front porch	Tvfp	1	4	-	H <sup>(1)</sup>	
Vertical pulse width	Tvw	1	10	-	H <sup>(1)</sup>	
Vertical back porch	Tvbp	2	12	-	H <sup>(1)</sup>	

Note:

- ◇ In case of using the slow frequency, the deterioration of display flicker etc may occur.
- ◇ The timing characteristics are basically fixed as above.


**Figure 8-1 Sync mode Input timing**

**Figure 8- 2 Sync-DE mode Input setup timing**

**8.3 Color DATA INPUT ASSIGNMENT**

COLOR	INPUT DATA	R DATA								G DATA								B DATA							
		R7	R6	R5	R4	R3	R2	R1	R0	R7	R6	R5	R4	R3	R2	R1	R0	R7	R6	R5	R4	R3	R2	R1	R0
		MSB							LSB	MSB							LSB	MSB							LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	GREEN(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

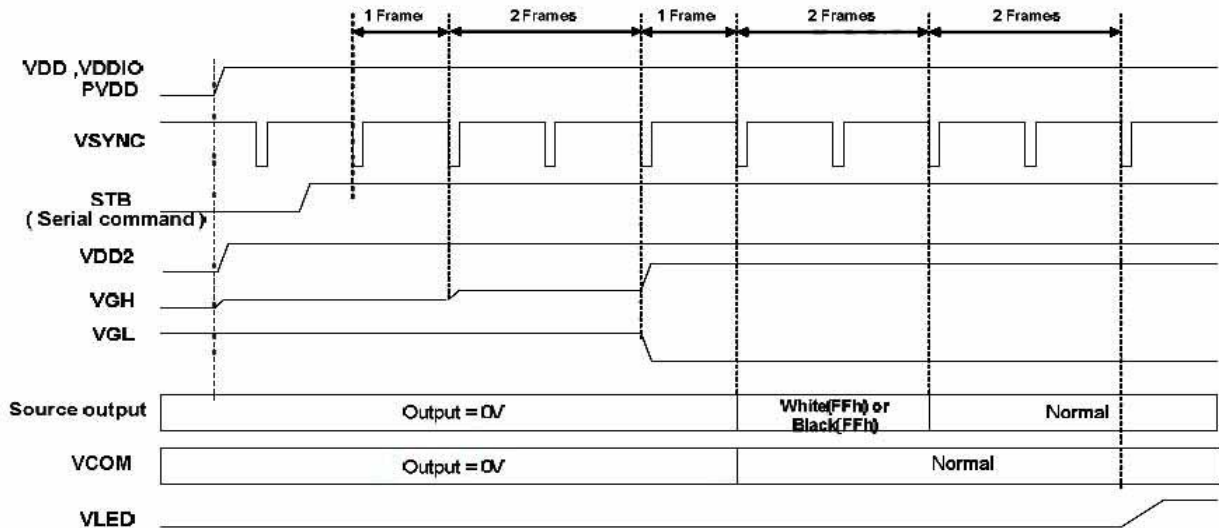
**[NOTE] :**

- 1) Definition of Gray level : Color(n) : n to show the Gray level · n is the more high and the light more bright.
- 2) Data:1-High, 0-Low.

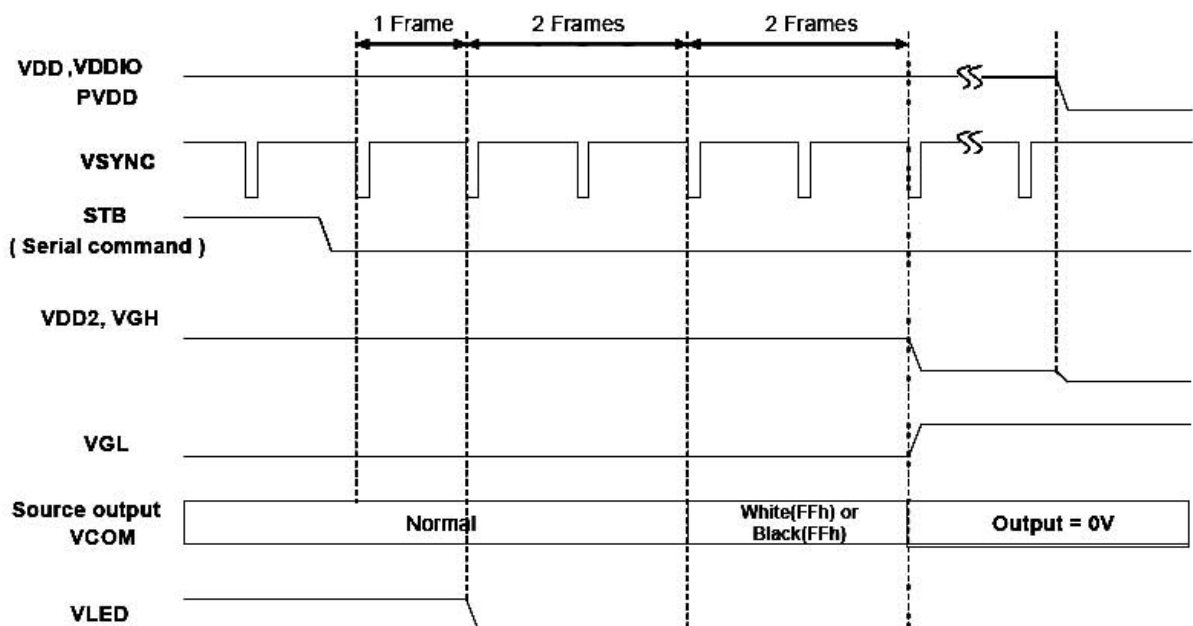


## 8.4 Sequences of supply voltage and signals

### 8.4.1 Power on Sequence



### 8.4.2 Power off Sequence



**Note:**

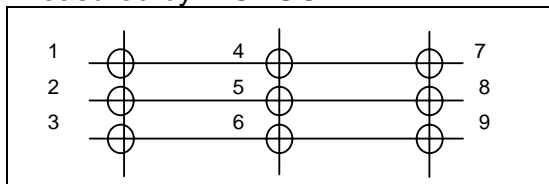
- When normally-black LC is used, please send black pattern to discharge the panel.
- When normally-white LC is applied, please send white pattern to discharge the panel.

## 9. Optical Characteristics

### 9.1 Specification:

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise+ Fall	Tr+ Tf	$\theta=0^\circ$	-	25	-	ms	Note 4,6
Contrast ratio		CR	At optimized viewing angle		300			Note 5,6
Viewing angle	Top		$CR \geq 10$		80	-	Deg.	Note 6,7
	Bottom				80	-		
	Left				80	-		
	Right				80	-		
Luminance of white			$\theta=0^\circ$	--	400	--	cd/m <sup>2</sup>	
Uniformity				70	--		%	
White chromaticity	X		$\theta=0^\circ$	0.27	0.32	0.37		Note 8
	y			0.28	0.33	0.38		

Measured by :TOPCON BM-7



$$\text{Brightness} = \frac{1+2+3+4+5+6+7+8+9}{9}$$

Note 5: See next page.

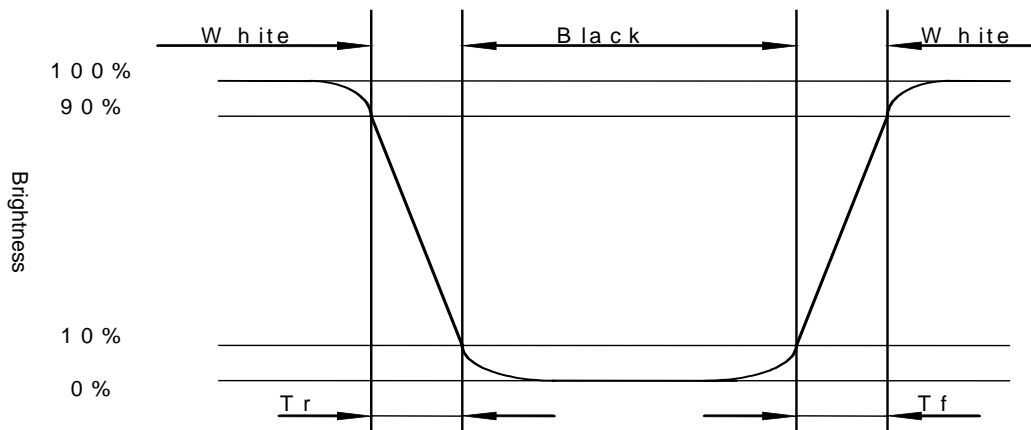
Note 1: Ambient temperature =25°C. LED current = 20 mA.

Note 2: To be measured in the dark room.

Note 3: To be measured on the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-7, after 2 minutes operation.

Note 4: Definition of response time:

The output signals of photo-detector are measured when the input signals are changed from "white" to "black"(rising time) and from "black" to "white"(falling time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as shown below.


**Note5: Definition of contrast ratio:**

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo-detector output when LCD is at "White" state}}{\text{Photo-detector output when LCD is at "Black" state}}$$

Note 6. White  $V_i = V_{i50} \pm 1.5V$  Black  $V_i = V_{i50} \pm 2.0V$

" $\pm$ " means that the analog input signal swings in phase with COM signal.

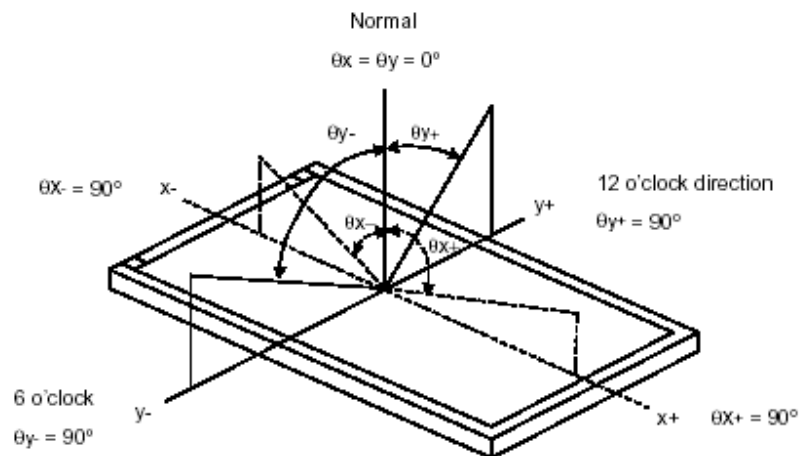
" $\mp$ " means that the analog input signal swings out of phase with COM signal.

$V_{i50}$  : The analog input voltage when transmission is 50%

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 7. Definition of viewing angle:

Refer to figure as below.



Note 8. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

## 10. QUALITY ASSURANCE

### 10.1 Test Condition

#### 10.1.1 Temperature and Humidity(Ambient Temperature)

Temperature :  $25 \pm 5^{\circ}\text{C}$

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.

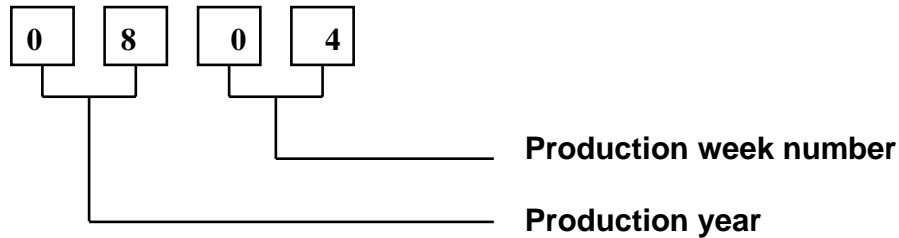
#### 10.1.4 Test Frequency

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

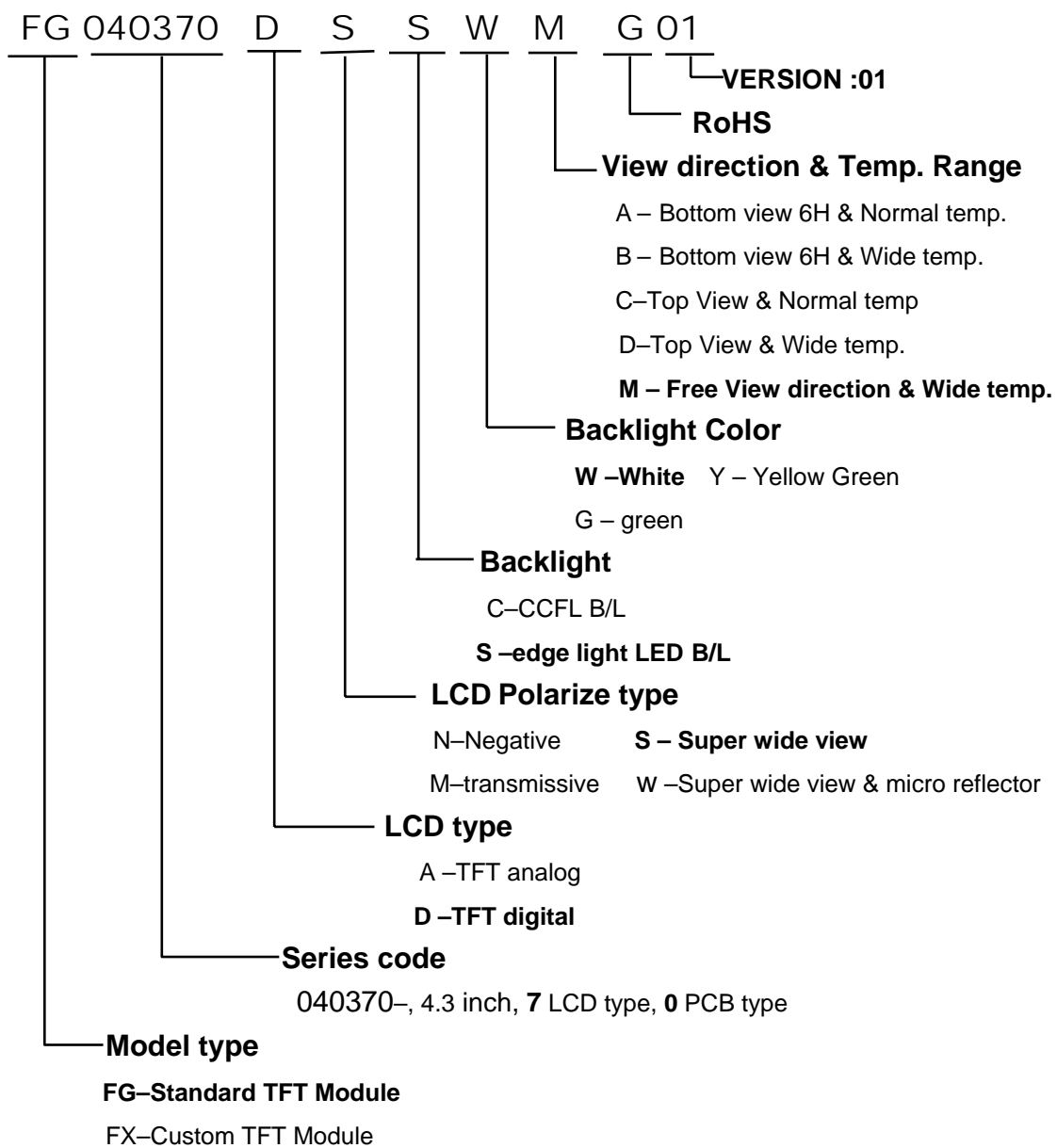
#### 10.1.5 Test Method

No.	Reliability Test Item & Level	Test Level
1	High Temperature Storage Test	T=80°C,240hrs
2	Low Temperature Storage Test	T=-30°C,240hrs
3	High Temperature Operation Test	T=70°C,240hrs
4	Low Temperature Operation Test	T=-20°C,240hrs
5	High Temperature and High Humidity Operation Test	T=60°C,90% RH,240hrs
6	Temperature Cycle Test (No operation)	-30°C → +25°C → +80°C,200 Cycles 30 min 5min 30 min
7	Vibration Test (No operation)	Frequency:0 ~ 55 Hz Amplitude:1.5 mm Sweep Time:11min Test Period:6 Cycles for each Direction of X,Y,Z
8	Electrostatic Discharge Test (No operation)	± 2KV

### 11. LOT NUMBERING SYSTEM



### 12. LCM NUMBERING SYSTEM



## 13. PRECAUTIONS IN USE LCM

### 1. LIQUID CRYSTAL DISPLAY (LCD)

LCD is made up of glass, organic sealant, organic fluid, and polymer based polarizers. The following precautions should be taken when handling,

- (1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel off or bubble.
- (2). Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzin.
- (3). Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.
- (4). Glass can be easily chipped or cracked from rough handling, especially at corners and edges.
- (5). Do not drive LCD with DC voltage.

### 2. Liquid Crystal Display Modules

#### 2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.

- (1). Do not tamper in any way with the tabs on the metal frame.
- (2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.
- (3). Do not touch the elastomer connector, especially insert an backlight panel (for example, EL).
- (4). When mounting a LCM make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
- (5). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

#### 2.2. Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

- (1). The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, 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.

#### 2.3 Soldering

- (1). Solder only to the I/O terminals.
- (2). Use only soldering irons with proper grounding and no leakage.
- (3). Soldering temperature :  $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
- (4). Soldering time: 3 to 4 sec.
- (5). Use eutectic solder with resin flux fill.
- (6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed after wards.

#### 2.4 Operation

- (1). The viewing angle can be adjusted by varying the LCD driving voltage  $V_0$ .
- (2). Driving voltage should be kept within specified range; excess voltage shortens display life.
- (3). Response time increases with decrease in temperature.
- (4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
- (5). Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured".

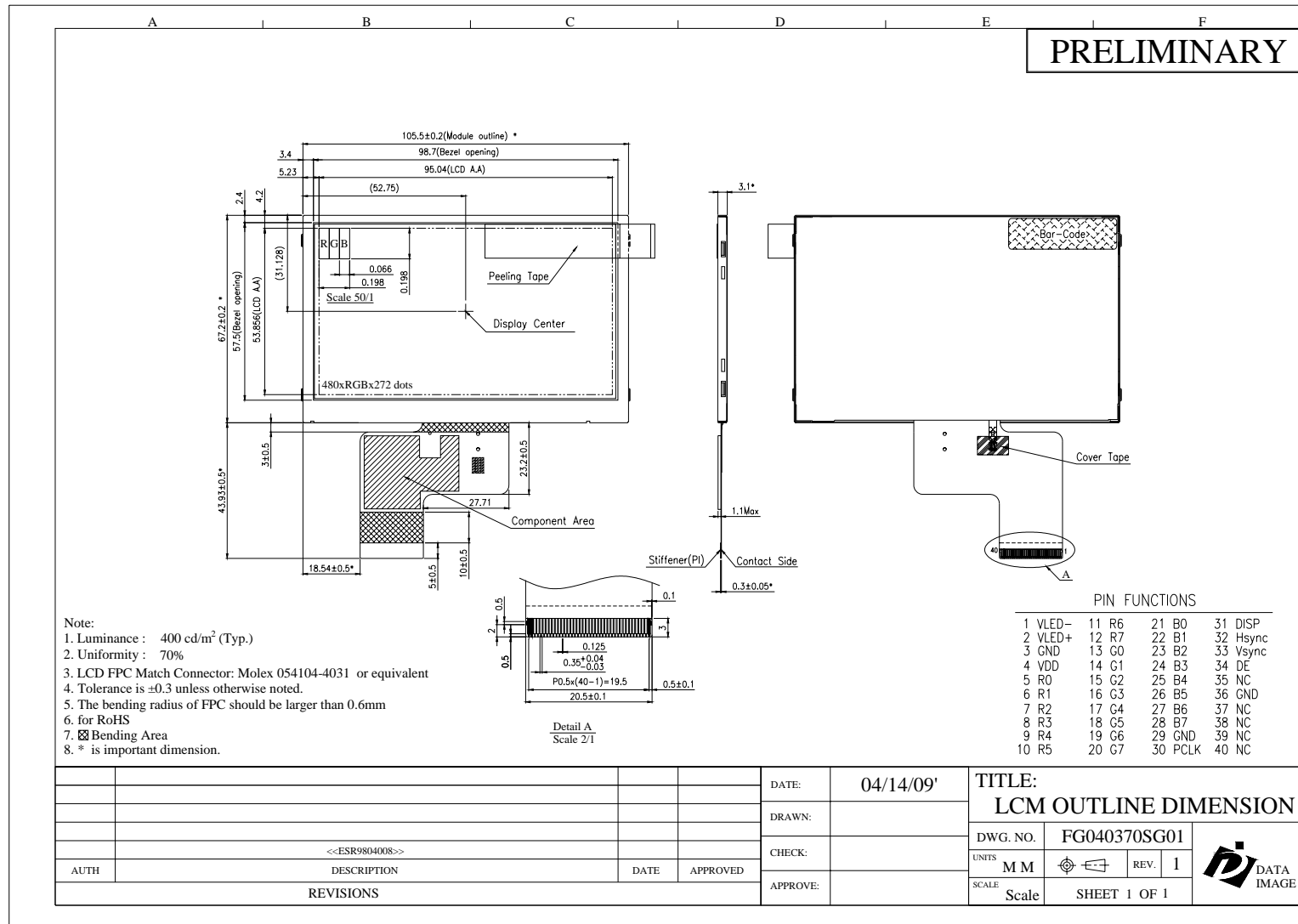
#### 2.5 Storage

If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

#### 2.6 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.

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**14. OUTLINE DRAWING**



**15. PACKAGE INFORMATION**