Confidential Document

DATA IMAGE CORPORATION

TFT Module Specification
PRELIMINARY
ITEM NO.: FG040310DSSWBG01

Table of Contents

Customer Companies	R&D Dept.	Q.C. Dept.	Eng. Dept.	Prod. Dept.
	ALEX	ERIC	PAUL	HELEN
Approved by	Version:	Issued Date:	Sheet Code:	Total Pages:
	1	2006/06/8		17

2. RECORD OF REVISION

Rev	Date	Item	Page	Comment
1	5/MAY/06			Initial preliminary

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 3.95(D)	mm
Weight	TBD	g
Surface treatment	Clear hard coat	
View Angle direction	6 o'clock	
Our components and processes are compliant to RoHS standard		

5. Electrical Characteristics

Ta=25°C

Parameter	Symbol	MIN.	Typ.	MAX.	Unit	Remark
Power Supply voltage	V_{CC}	2.5	2.5	3.3	V	Note1
	AV_{DD}	4.8	5	5.2	V	Note2
Power Supply Current	I_{CC}		TBD	TBD	mA	V_{CC} =2.5V
	I_{AVDD}		TBD	TBD	mA	AVDD=5V
Ripple Voltage	V_{RFVCC}			100	mVp-p	
	V_{RFVDD}			100	mVp-p	
"H" level logical input voltage	V_{IH}	0.7Vcc	--	--	V	
"L" level logical input voltage	V_{IL}	--	--	0.3Vcc	V	
Input Current (Low)	I_{OL}			TBD	μA	
Input Current (high)	I_{OH}			TBD	μA	
Operating temperature	Topa	-20	--	70	°C	Ambient temperature
Storage temperature	Tstg	-30	--	80	°C	Ambient temperature

Note1:VCC Absolute Maximum Ratings -0.3V~+6V
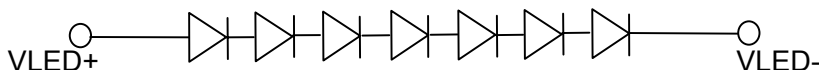Note2:AVDD Absolute Maximum Ratings -0.3V~+6V

5.1 Backlight driving for power conditions

Ta= 25 °C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current	I_L	--	20	--	mA	
VLED voltage	V_L	--	TBD	--	V	$I_{L=20 mA}$
LED Life Time decay to 50%		--	TBD	--	hr	

VLED+ ▷|▷|▷|▷|▷|▷|▷| VLED-

DATA IMAGE

6. Block Diagram

VLED+
VLED-

Backlight Unit

TFT Display

Scan Driver IC
DC/DC Conveter

TFT-LCD PANEL (480xR,G,Bx272) DOTS

Data Driver IC Timing Control

INPUT Connector

HS
VS
CK
DISP
R0~R7
G0~G7
B0~B7
VCC
GND
AVDD
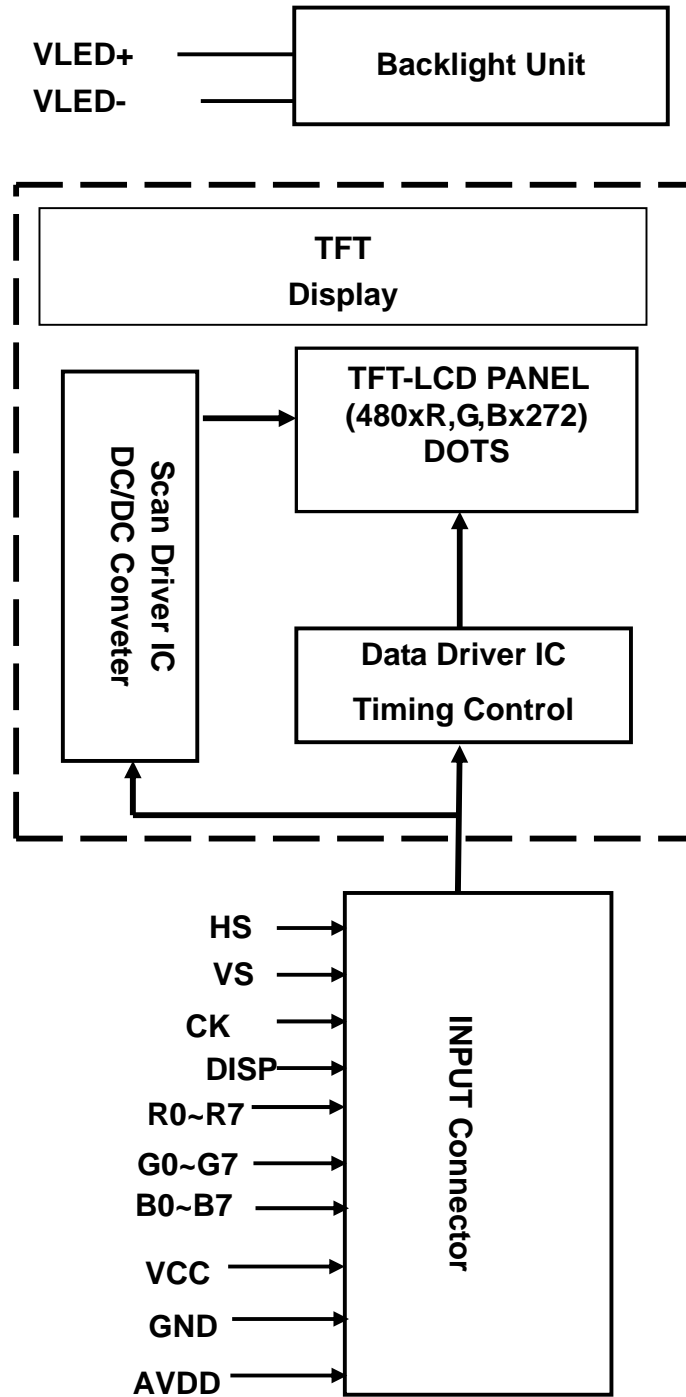
7. PIN CONNECTIONS
7.1 Input Pins Connection

Pin No	Symbol	Function	Remark
1	GND	Ground	
2	GND	Ground	
3	Vcc	Power Supply : +2.5V	
4	Vcc	Power Supply : +2.5V	
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	CK	clock signal to sample each data	
31	DISP	Display ON/OFF Signal ON=H, OFF=L	
32	HS (HSYNC)	Horizontal synchronous signal	
33	VS (VSYNC)	Vertical synchronous signal	
34	NC	No Connection	
35	AVDD	+5V Analog power source	
36	AVDD	+5V Analog power source	
37	NC	No Connection	
38	NC	No Connection	
39	NC	No Connection	
40	NC	No Connection	

7.2 Backlight Pins Connection

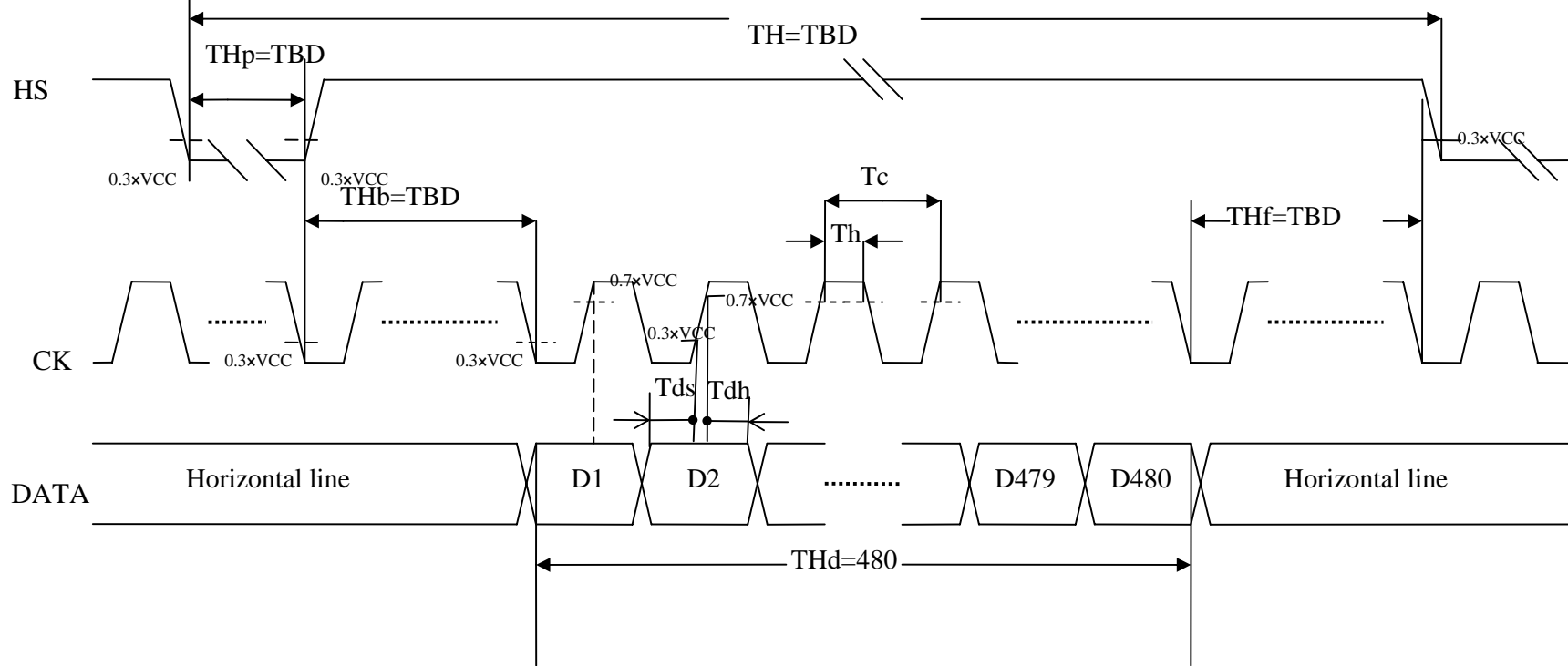| No.	Signal	Function
1	VLED-	LED Power Source input terminal (Cathode side)
2	NC	No Connection
3	NC	No Connection
4	VLED+	LED Power Source input terminal (Anode side)

8. INTERFACE SPECIFICATIONS
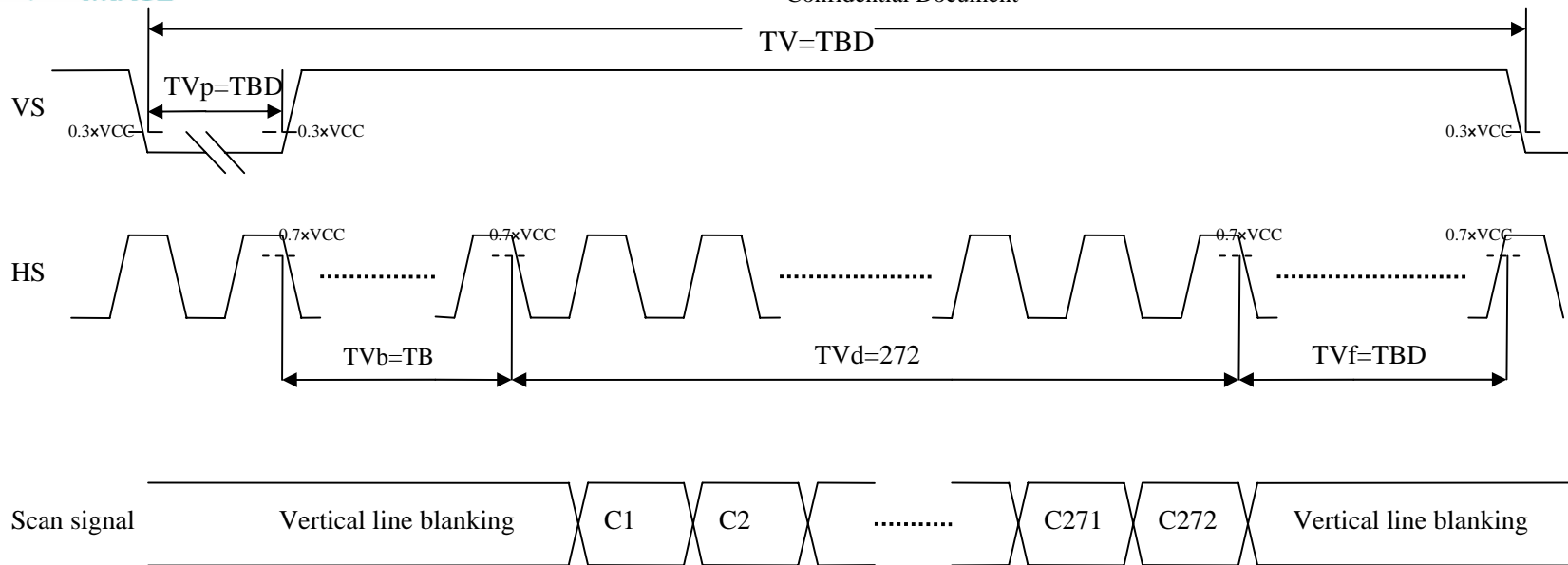### 8.1 INPUT SIGNAL TIMING SPECIFICATIONS
The specification of input signals timing is as the following table and timing diagram.

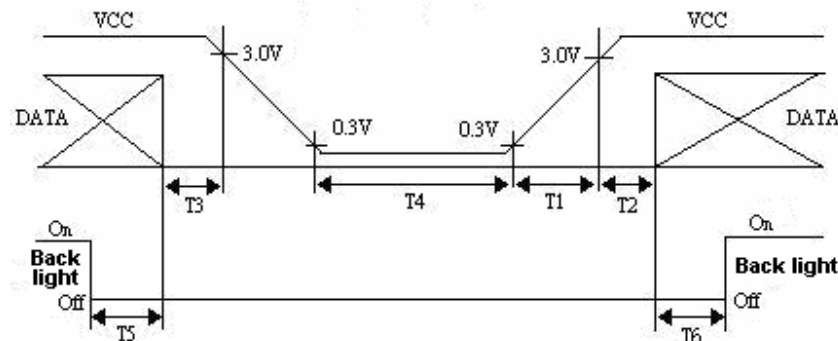| Parameter		Symbol	MIN.	TYP.	MAX.	Unit	Remarks
CLK	Frequency	1/Tc		TBD		MHz	
	Duty ratio	Th/Tc		TBD		%	
DATA	Setup time	Tds		TBD		ns	
	Hold time	Tdh		TBD		ns	
Horizontal synchronizing	Period	TH	--	TBD	--	Clock	
	Pulse width	THp	--	TBD	--	Clock	
	Horizontal period	THd	--	480	--	Clock	
	Blank porch	THb	--	TBD	--	Clock	
	Front porch	THf	--	TBD	--	Clock	
Vertical synchronizing	Period	TV	--	TBD	--	Line	
	Pulse width	TVp	--	TBD	--	Line	
	Vertical period	TVd	--	272	--	Line	
	Blank porch	TVb	--	TBD	--	Line	
	Front porch	TVf	--	TBD	--	Line	

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

THp=TBD

TH=TBD

HS

0.3×VCC

0.3×VCC

0.3×VCC

THb=TBD

Tc

Th

THf=TBD

0.7×VCC

0.7×VCC

0.3×VCC

CK

0.3×VCC

0.3×VCC

Tds Tdh

DATA Horizontal line | D1 | D2 | .... | D479 | D480 | Horizontal line

THd=480

TV=TBD

TVp=TBD

VS

0.3×VCC   0.3×VCC   0.3×VCC

0.7×VCC   0.7×VCC   0.7×VCC   0.7×VCC

HS

TVb=TB   TVd=272   TVf=TBD

Scan signal   Vertical line blanking   C1   C2   ....   C271   C272   Vertical line blanking

8.2 Power Off/On Sequence Timing

VCC   3.0V   3.0V   VCC

DATA   0.3V   0.3V   DATA

T3   T4   T1   T2

On   On

Back light   Back light

Off   Off

T5   T6

Timing Specifications:
$0 < T1 \leq 15mS$
$T2 > 0.5S$
$0 < T3 \leq 0.1S$
$T4 > 1S$
$T5 > 0.1S$
$T6 > 0.1S$

8.3 Color DATA INPUT ASSIGNMENT

Colors & Gray Scale	Gray Scale	R0 LSB	R1	R2	R3	R4	R5	R6	R7 MSB	G0 LSB	G1	G2	G3	G4	G5	G6	G7 MSB	B0 LSB	B1	B2	B3	B4	B5	B6	B7 MSB
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
Blue	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Green	—	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
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
Red	—	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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
Gray Scale of Red Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	↓				↓								↓								↓				
⇩	↓				↓								↓								↓				
Brighter	GS253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇩	GS254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red	GS255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	↓				↓								↓								↓				
⇩	↓				↓								↓								↓				
Brighter	GS253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
⇩	GS254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Green	GS255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Blue Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
⇧	↓				↓								↓								↓				
⇩	↓				↓								↓								↓				
Brighter	GS253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
⇩	GS254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Blue	GS255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

0 : Low level voltage   1 : High level voltage

Each basic color can be displayed in 256 gray scales from 8 bit data signals. According to the combination of 24 bit data signals, the 16-million-color display can be achieved on the screen.

8.4 Sequences of supply voltage and signals
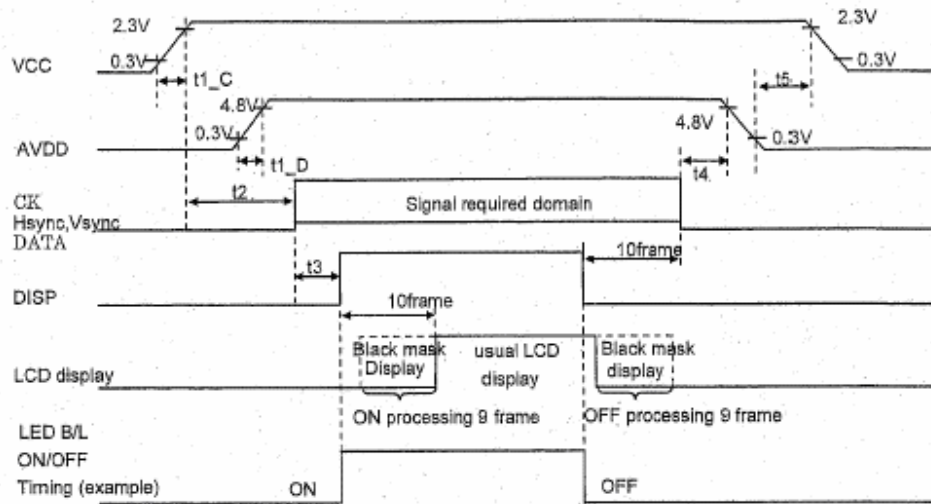
When DISP pin is pulled "H" blank data is outputted for 10 frames first, from the falling edge of the following VSYNC signal. Similarly, when DISP is pulled "L", 10-frames of blank data will be outputted from the falling edge of the following VSYNC.

Parameter	MIN.	TYP.	MAX.	Unit
t1_C		TBD		ms
t1_D		TBD		ms
t2		TBD		ms
t3		TBD		ms
t4		TBD		ms
t5		TBD		ms

9. Optical Characteristics
9-1. Specification:

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise	Tr	$\theta=0°$	-	15	30	ms	Note 4,6
	Fall	Tf		-	35	50	ms	
Contrast ratio		CR	At optimized viewing angle	100	400			Note 5,6
Viewing angle	Top		CR≥10	70	80	-	Deg.	Note 6,7
	Bottom			70	80	-		
	Left			70	80	-		
	Right			70	80	-		
Luminance of white			$\theta=0°$	--	165	--		
Uniformity				70	--		%	
White chromaticity	X		$\theta=0°$		TBD			Note 8
	y				TBD			

Measured by :TOPCON BM-7
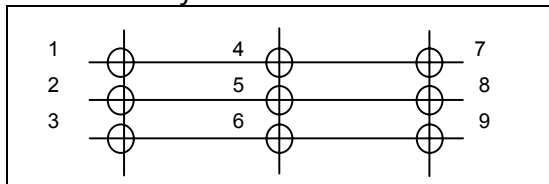
$$\text{Brightness} = \frac{1+2+3+4+5+6+7+8+9}{9}$$

Note 1~5: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.
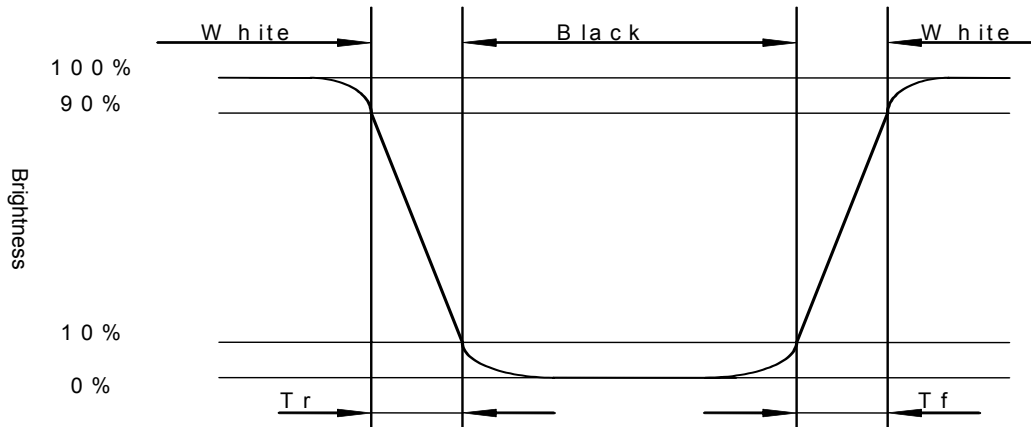
Note5: Definition of contrast ratio:

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 $Vi = V_{i50} -/+ 1.5V$ Black $Vi = V_{i50} +/- 2.0V$

"+/-" means that the analog input signal swings in phase with COM signal.
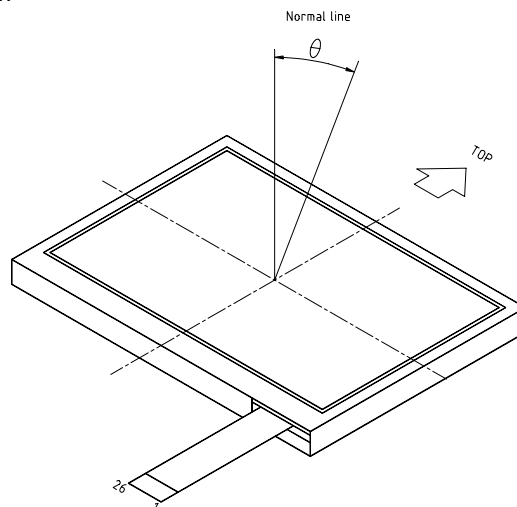
" -/+ " means that the analog input signal swings out of phase with COM signal.

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

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

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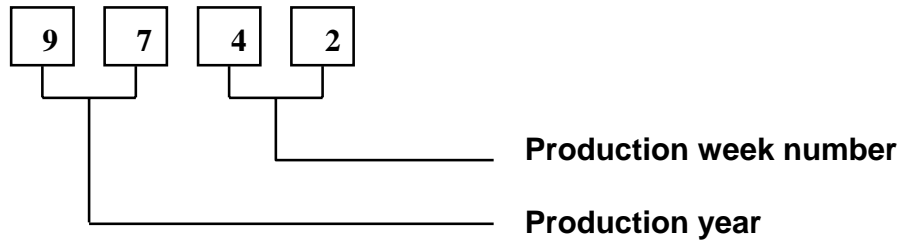Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

10.1.4 Test Frequency

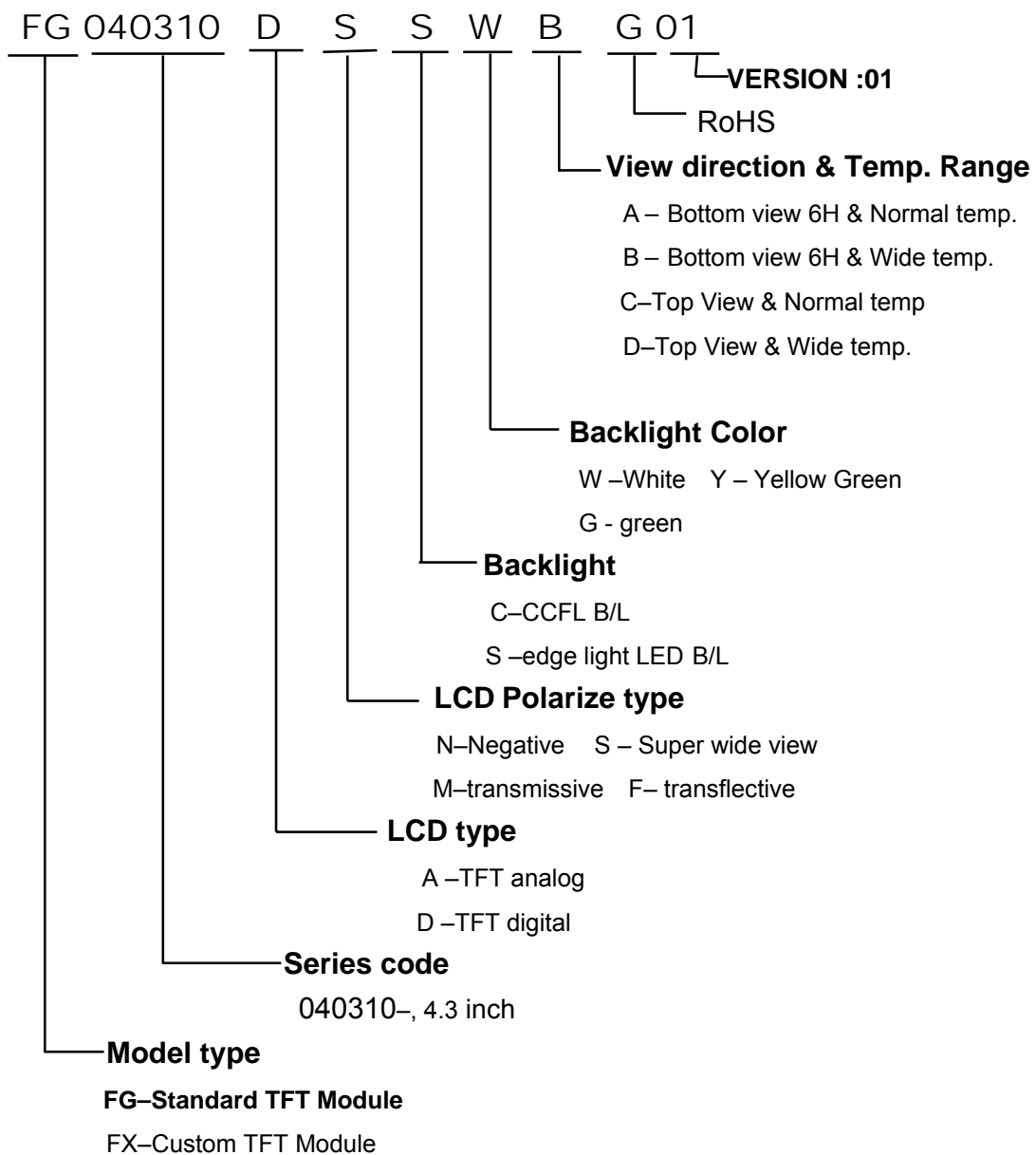In case of related to deterioration such as shock test.   It will be conducted only once.

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	Thermal Cycling Test (No operation)	-30°C $\rightarrow$ +25°C $\rightarrow$ +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)	150pF,330Ω Air:$\pm$ 15KV;Contact: $\pm$ 8KV 10 times/point;4 points/panel face

11. LOT NUMBERING SYSTEM

| 9 | 7 | 4 | 2 |

Production week number

Production year

12. LCM NUMBERING SYSTEM

FG 040310 D S S W B 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.

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

M–transmissive   F– transflective

LCD type

A –TFT analog

D –TFT digital

Series code

040310–, 4.3 inch

Model type

FG–Standard TFT Module

FX–Custom TFT Module

13. PRECAUTION FOR USING 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 handing,
(1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degredation, 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 : $280°C \pm 10°C$
(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 V0.
(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.

14. OUTLINE DRAWING

PRELIMINARY

105.5±0.2
98.7±0.1(Bezel opening)
97.1±0.2(PLR.)
95.04(A.A)

(3.95)

Peeling Tape

2.3±0.1

67.2±0.2
57.5±0.1(Bezel opening)
55.9±0.2(PLR.)
53.856(A.A)
36.05

27±0.1

480xRGBx270 dots

82.9±0.8
82±0.6

Component Area

A

1 40
1 4

2.5±0.05
40.75±0.8
48.3±0.6

Detail A
Scale 2/1

0.5
0.1
1 40
2
0.5
0.125
0.35 +0.04 −0.03
P0.5x(40−1)=19.5
20.5±0.1
0.5±0.1
3

0.3±0.05
(Include stiffener)
0.2±0.05
(Include stiffener)

Note:
1. Luminance of white : 165 cd/m² (Typ.)
2. Uniformity : 70%
3. Connector: Molex 54132-4092 or equivalent
4. for RoHS
5. Tolerance is ±0.3 unless otherwise noted.
6. The bending radius of FPC should be larger than 0.6mm

PIN FUNCTIONS
1 VLED−
2 NC
3 NC
4 VLED+

FPC PIN FUNCTIONS

1 GND	11 R6	21 B0	31 DISP
2 GND	12 R7	22 B1	32 Hsync
3 VCC	13 G0	23 B2	33 Vsync
4 VCC	14 G1	24 B3	34 NC
5 R0	15 G2	25 B4	35 AVDD
6 R1	16 G3	26 B5	36 AVDD
7 R2	17 G4	27 B6	37 NC
8 R3	18 G5	28 B7	38 NC
9 R4	19 G6	29 GND	39 NC
10 R5	20 G7	30 CK	40 NC

DATE:	05/08/06'	TITLE:
		LCM OUTLINE DIMENSION

DRAWN:	
Add Display resolution 480xRGBx272 dots	06/09/06'	DWG. NO. FG040310S-01
Change FPC PIN FUNCTIONS 38, 39, 40 from TEST 1, TEST 2, TEST 3 to NC	06/09/06'	CHECK:
AUTH	DESCRIPTION	DATE	APPROVED	UNITS M M	REV. 2	DATA IMAGE
REVISIONS		APPROVE:	SCALE Scale	SHEET 1 OF 1

15.PACKAGE INFORMATION

Carton

Form (35 mm)

Drier

Antirust

Form (15mm)

Antistatic bag

Antistatic tray

LCM

Antistatic form

Drier

Cover tray (Antistatic tray)

Antirust

Form (15 mm)