



DATA IMAGE CORPORATION

TFT Module Specification

preliminary

ITEM NO.: FG04032ADSSWBGL1

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Customer Companies	R&D Dept.	Q.C. Dept.	Eng. Dept.	Prod. Dept.
	ALEX	JOE	GARY	KEN
Approved by	Version:	Issued Date:	Sheet Code:	Total Pages:
	1	4/ NOV/13'		21



2. RECORD OF REVISION

Rev	Date	Item	Page	Comment
1	4/ NOV/13'			Initial preliminary

3. FEATURE

- 64 gray level with 2 bit dithering function to realize 16M colors

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	45	g
Surface treatment	Antiglare	
View Angle direction(Gray inversion)	6 o'clock	
Our components and processes are compliant to RoHS & REACH standard		

5. ELECTRICAL CHARACTERISTICS

GND=0V, Ta=25°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}	--	17	20	mA	V _{DD} =3.3V
Ripple Voltage	V _{RPVDD}	--	--	100	mVp-p	
"H" level logical input voltage	V _{IH}	0.8VDD	--	VDD	V	
"L" level logical input voltage	V _{IL}	0	--	0.2VDD	V	
Operating temperature	Topa	-20	--	70	°C	Ambient temperature
Storage temperature	Tstg	-30	--	80	°C	Ambient temperature

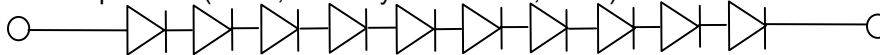
Note1:VDD Absolute Maximum Ratings -0.3V~+6V

5.1 Backlight driving for power conditions

Ta= 25 °C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current	I _{LED}	--	15	--	mA	
VLED voltage	V _{LED}	--	33	--	V	I _L =20 mA
LED life time		--	TBD	--	Hours	Note 1

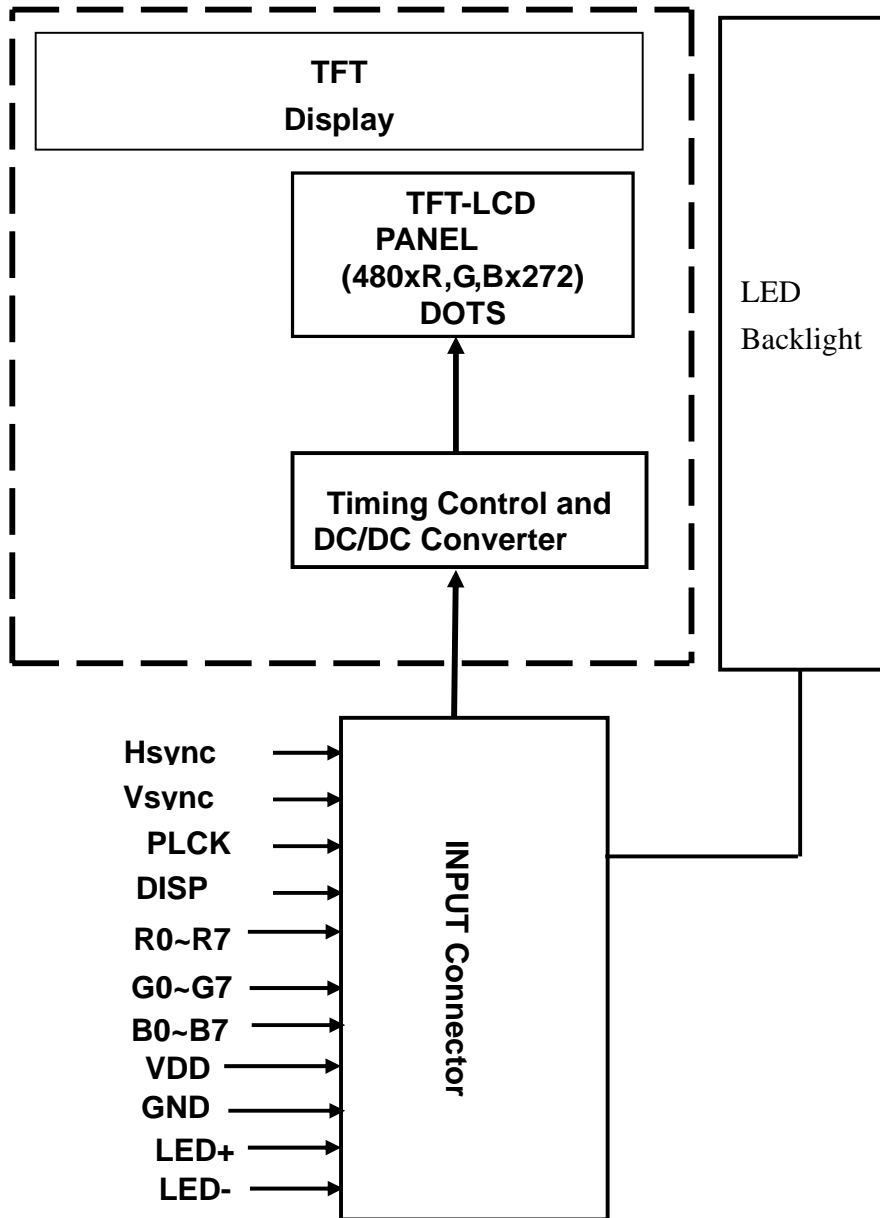
Note 1 under room temperature (25 °C, Humidity 30-60% RH, 15mA) and I_{LED}=15mA.



Voltage : V_{LED}=33V(Typ.)

Current : 15mA

6. BLOCK DIAGRAM



7. PIN CONNECTIONS

7.1 Input Pins Connection

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

8. AC CHARACTERISTICS

8.1 Input Timing Requirement

(480RGBx272, Ta =25°C, VDD=3.3V GND= 0V)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Clock cycle	$f_{CLK(1)}$	-	9	15	MHz
Hsync cycle	1/th	-	17.14	-	KHz
Vsync cycle	1/tv	-	59.94	-	Hz
Horizontal Signal					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	thp ⁽²⁾	2	41	41	CLK
Horizontal back porch	thb ⁽²⁾	2	2	41	CLK
Vertical Signal					
Vertical cycle	tv	285	286	511	H ⁽¹⁾
Vertical display period	tvd	272	272	272	H ⁽¹⁾
Vertical front porch	tvf	1	2	227	H ⁽¹⁾
Vertical pulse width	tvp ⁽²⁾	1	10	11	H ⁽¹⁾
Vertical back porch	tvb ⁽²⁾	1	2	11	H ⁽¹⁾

Note: (1) Unit: CLK=1/ f_{CLK} , H=th,

(2)It is necessary to keep $tvp+tvb=12$ and $thp+thb=43$ in sync mode.

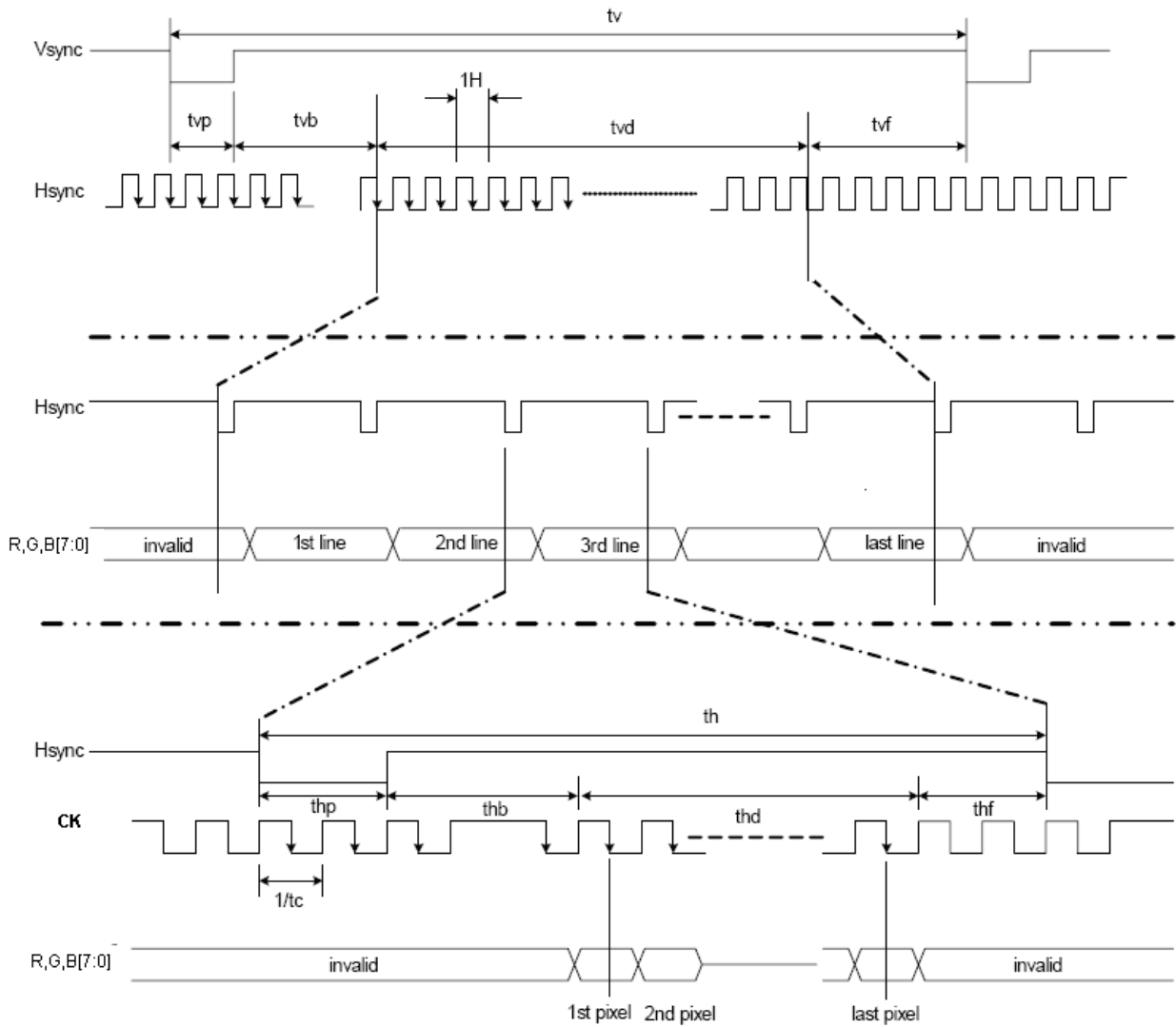


Fig 1. Parallel RGB input timing

8.2 Input Setup Timing Requirement

(Ta =25°C, VDD=3.3V ,GND= 0V, tr (1)=tf (1)=2ns)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
DISP setup time	t _{diss}	10	-	-	ns
DISP hold time	t _{dish}	10	-	-	ns
Clock period	PW _{CLK(2)}	66.7	-	-	ns
Clock pulse high period	PWH ₍₂₎	26.7	-	-	ns
Clock pulse low period	PWL ₍₂₎	26.7	-	-	ns
Hsync setup time	t _{hs}	10	-	-	ns
Hsync hold time	t _{hh}	10	-	-	ns
Data setup time	t _{ds}	10	-	-	ns
Data hold time	t _{dh}	10	-	-	ns
Vsync setup time	t _{vhs}	10	-	-	ns
Vsync hold time	t _{vhh}	10	-	-	ns

Note: (1) tr, tf is defined 10% to 90% of signal amplitude.

(2) For parallel interface, maximum clock frequency is 15MHz.

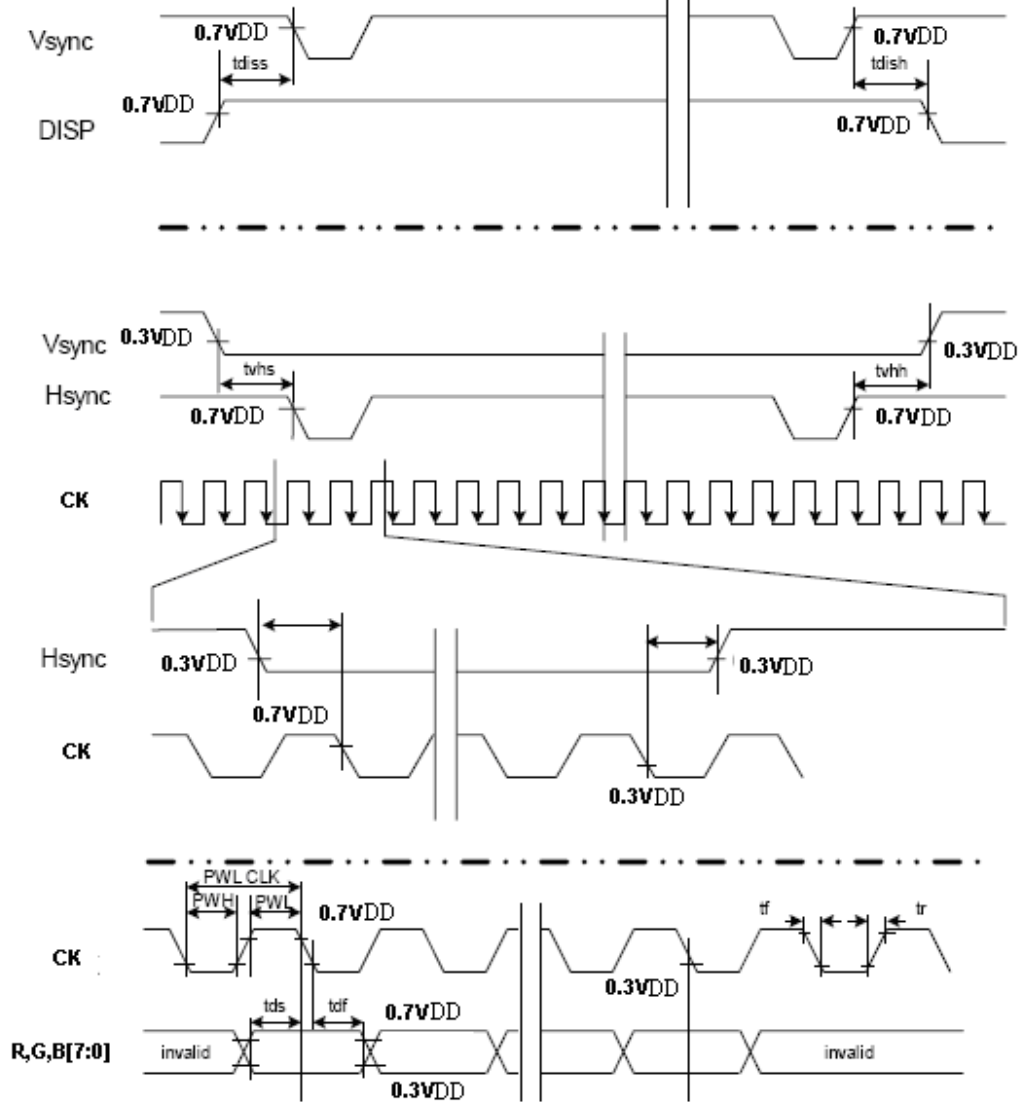


Fig 2. Input setup timing requirement

8.3 TCON Power ON/OFF Control

The TCON IC has a power ON/OFF sequence control function. 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, too.

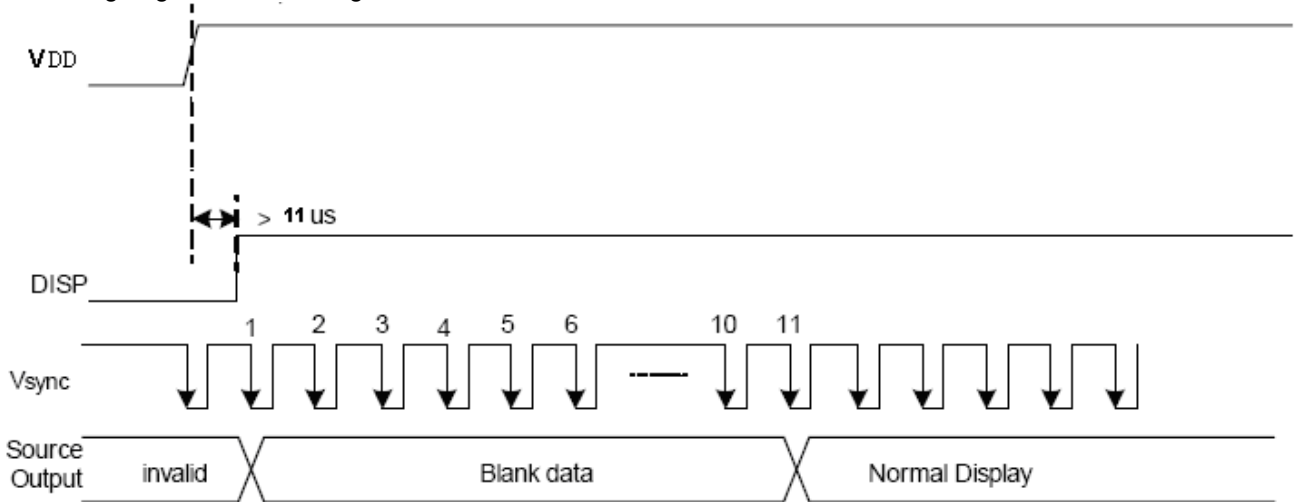


Fig 3. Power On Sequence

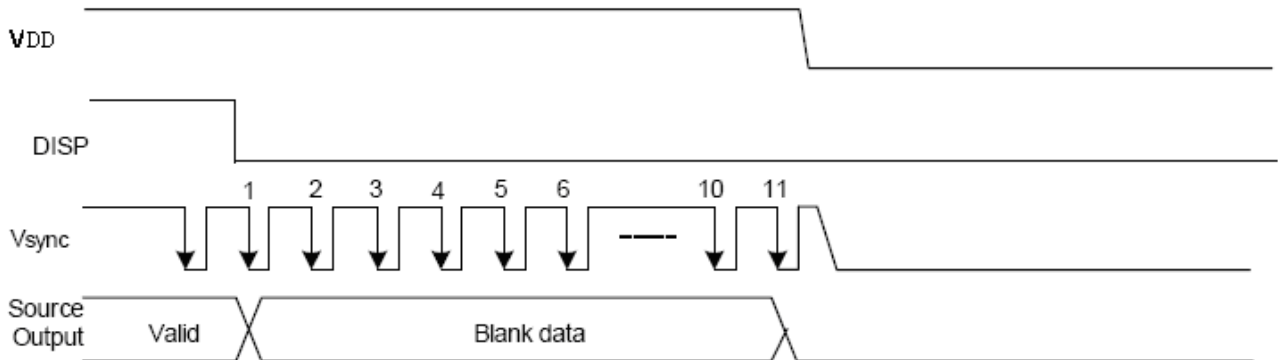


Fig 4. Power Off Sequence

9. Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise	Tr	$\theta=0^\circ$	--	5	8	ms	Note 4
	Fall	Tf		--	15	20	ms	
Contrast ratio		CR	At optimized viewing angle	500	600	--		Note 5
Viewing angle	Top		$CR \geq 10$	40	50	--	Deg.	Note 6
	Bottom			60	70	--		
	Left			60	70	--		
	Right			60	70	-		
Luminance		B-uni	$\theta=0^\circ$	250	350	--	cd/m ²	Note 7
Uniformity				70	--		%	Note 8
White chromaticity	X		$\theta=0^\circ$	0.27	0.30	0.32		Note 7
	y			0.27	0.30	0.33		

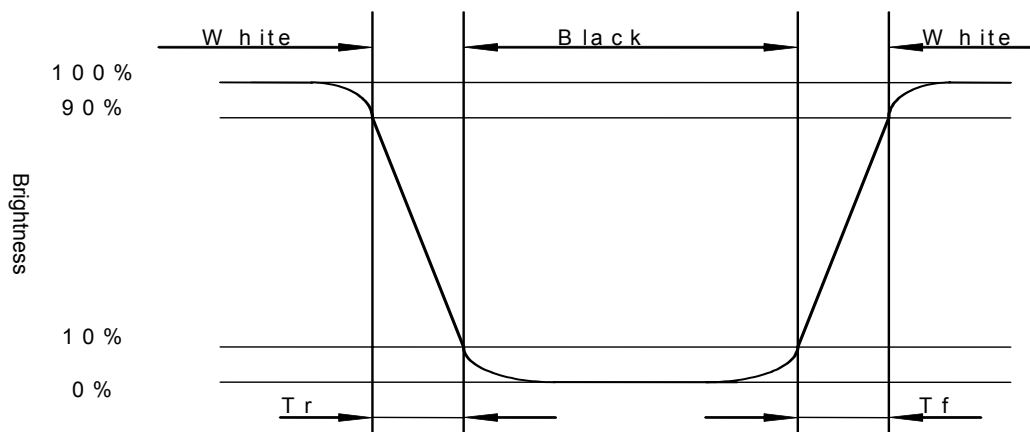
Note 1: Ambient temperature =25°C. LED current $I_L= 20$ mA.

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-7A, 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.



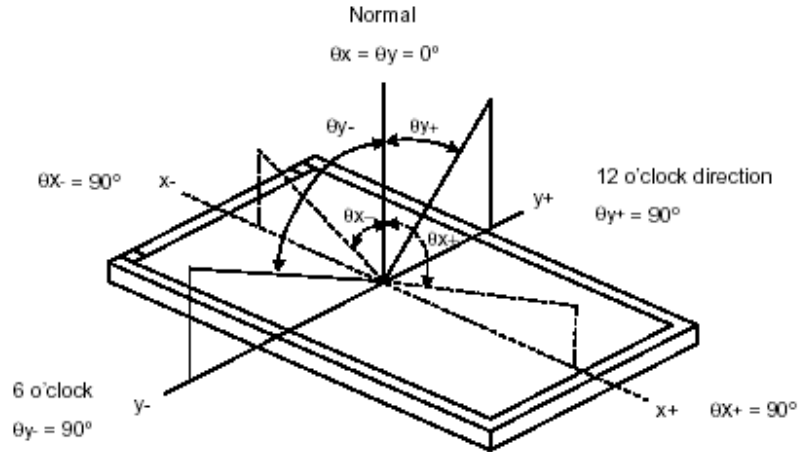
Note5: Definition of contrast ratio:

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. Definition of viewing angle:

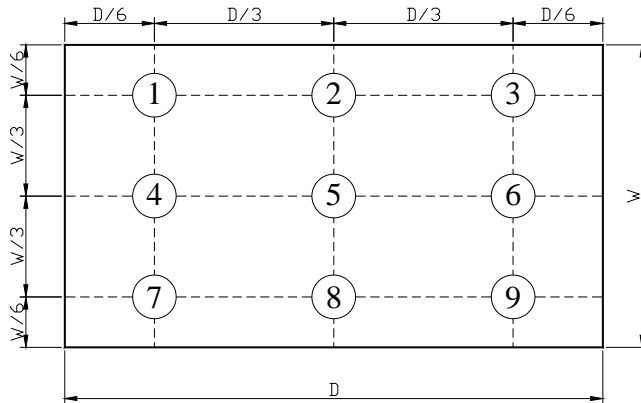
Refer to figure as below.



Note 7. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

Note 8: Definition of Brightness Uniformity (B-uni):

Luminance Measuring Points



$$B\text{-uni} = \frac{\text{Minimum luminance of 9 points}}{\text{Maximum luminance of 9points}}$$

10. QUALITY ASSURANCE

10.1 RA 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

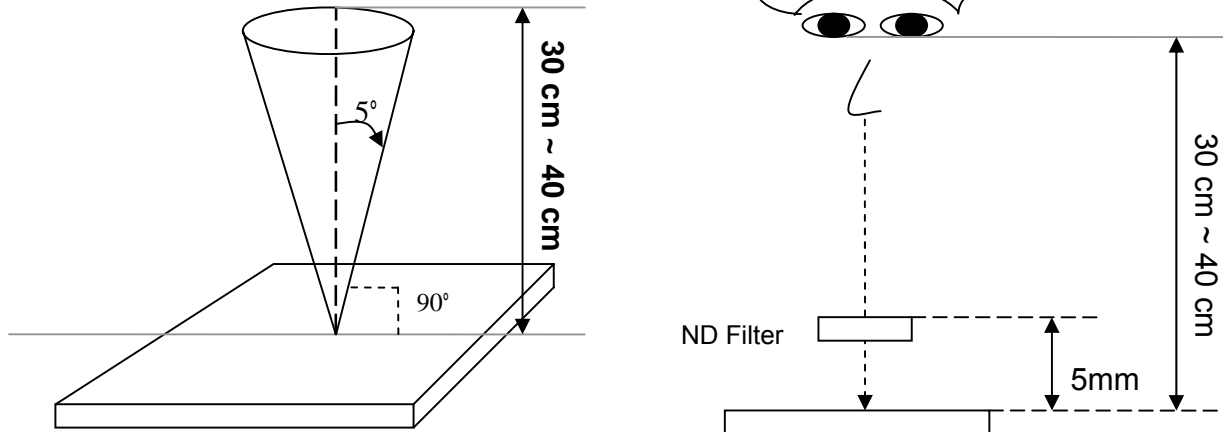
No.	Reliability Test Item & Level	Test Level	Remark
1	High Temperature Storage Test	T=80°C,240hrs	IEC68-2-2
2	Low Temperature Storage Test	T=-30°C,240hrs	IEC68-2-1
3	High Temperature Operation Test	T=70°C,240hrs	IEC68-2-2
4	Low Temperature Operation Test	T=-20°C,240hrs	IEC68-2-1
5	High Temperature and High Humidity Operation Test	T=60°C,90% RH,240hrs	IEC68-2-3
6	Thermal Cycling Test (No operation)	-30°C → +25°C → +80°C,200 Cycles 30 min 5min 30 min	IEC68-2-14
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	IEC68-2-6
8	Electrostatic Discharge Test (No operation)	150pF,330Ω Air:± 15KV;Contact: ± 8KV 10 times/point;4 points/panel face	IEC-61000-4-2

10.2 Inspection Judgment standard

10.2.1 Inspection conditions

10.2.1.1 Inspection Distance : 35 ± 5 cm

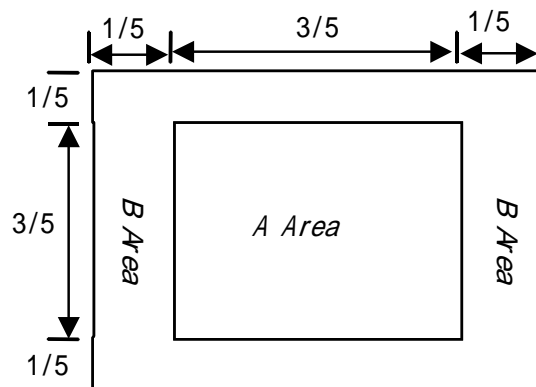
10.2.1.2 View Angle : Inspection under test condition : $\pm 5^\circ$



10.2.1.3 Environment conditions :

Ambient Temperature :		25 ± 5
Ambient Humidity :		$65 \pm 5\%$
Ambient Illumination	Cosmetic Inspection	More than 600lux
	Functional Inspection	300 ~ 800lux

10.2.1.4 Definition of applicable Zones



10.3 Inspection Condition

No.	Parameter	Criteria																
1	Operating	Display function: No Display malfunction (Major)																
		Contrast ratio (Black, White): Does not meet specified range in the spec. (Major) (Note:3)																
		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 ≤ 5 dots (Minor)(Note:1)																
		<table border="1"> <thead> <tr> <th>Item</th> <th>Acceptable number</th> <th>Total</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td>Bright</td> <td>3</td> <td rowspan="4">5</td> <td rowspan="4">Minor</td> <td rowspan="4">1.5</td> </tr> <tr> <td>Dark</td> <td>5</td> </tr> <tr> <td>Adjacent Bright</td> <td>1</td> </tr> <tr> <td>Adjacent Dark</td> <td>1</td> </tr> </tbody> </table>	Item	Acceptable number	Total	Class Of Defects	AQL Level	Bright	3	5	Minor	1.5	Dark	5	Adjacent Bright	1	Adjacent Dark	1
		Item	Acceptable number	Total	Class Of Defects	AQL Level												
		Bright	3	5	Minor	1.5												
		Dark	5															
		Adjacent Bright	1															
		Adjacent Dark	1															
Non-uniformity: Visible through 6%ND filter white, R, G, B and gray 50%pattern. (Minor)																		
Foreign material in Black or White spots shape ($W > 1/4L$)																		
<table border="1"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td>$D \leq 0.25$</td> <td>*</td> <td rowspan="3">Minor</td> <td rowspan="3">1.5</td> </tr> <tr> <td>$0.25 < D \leq 0.5$</td> <td>4</td> </tr> <tr> <td>$D > 0.5$</td> <td>0</td> </tr> </tbody> </table>	Dimension	Acceptable number	Class Of Defects	AQL Level	$D \leq 0.25$	*	Minor	1.5	$0.25 < D \leq 0.5$	4	$D > 0.5$	0						
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$D \leq 0.25$	*	Minor	1.5															
$0.25 < D \leq 0.5$	4																	
$D > 0.5$	0																	
D = (Long + Short) / 2 * : Disregard																		
Foreign Material in Line or spiral shape ($W \leq 1/4L$) (Note: 4)																		
<table border="1"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td>$W > 0.1\text{mm}, L > 5\text{mm}$</td> <td>0</td> <td rowspan="3">Minor</td> <td rowspan="3">1.5</td> </tr> <tr> <td>L 5mm, $0.05\text{mm} < W < 0.1\text{mm}$</td> <td>4</td> </tr> <tr> <td>L 5mm, $W < 0.05\text{mm}$</td> <td>*</td> </tr> </tbody> </table>	Dimension	Acceptable number	Class Of Defects	AQL Level	$W > 0.1\text{mm}, L > 5\text{mm}$	0	Minor	1.5	L 5mm, $0.05\text{mm} < W < 0.1\text{mm}$	4	L 5mm, $W < 0.05\text{mm}$	*						
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L 5mm, $0.05\text{mm} < W < 0.1\text{mm}$	4																	
L 5mm, $W < 0.05\text{mm}$	*																	
L : Length W : Width * : Disregard																		
2	External Inspection (non-operating)	Dimension: Outline (Major)																
		Bezel appearance: uneven (Minor)																
		Scratch on the polarizer: (Note:2)																
		<table border="1"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Class Of Defects</th> <th>AQL Level</th> </tr> </thead> <tbody> <tr> <td>$W > 0.1\text{mm}, L > 5\text{mm}$</td> <td>0</td> <td rowspan="3">Minor</td> <td rowspan="3">1.5</td> </tr> <tr> <td>L 5mm, $0.05\text{mm} < W < 0.1\text{mm}$</td> <td>4</td> </tr> <tr> <td>L 5mm, $W < 0.05\text{mm}$</td> <td>*</td> </tr> </tbody> </table>	Dimension	Acceptable number	Class Of Defects	AQL Level	$W > 0.1\text{mm}, L > 5\text{mm}$	0	Minor	1.5	L 5mm, $0.05\text{mm} < W < 0.1\text{mm}$	4	L 5mm, $W < 0.05\text{mm}$	*				
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		L 5mm, $W < 0.05\text{mm}$	*															
		L : Length W : Width * : Disregard																
		Dent and spots shape on the polarize (Note:2):																
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$D > 0.5$	0																	
D = (Long + Short) / 2 * : Disregard																		

Class of defects			Definition
	Major	AQL 0.65%	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 $>1/2$ pixel respectively

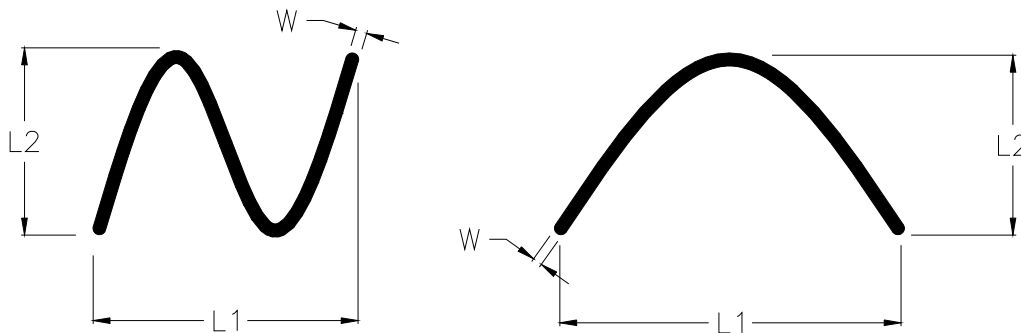
(b)Dark point defect is defined as visible in full white pattern.

(c)The point defect must under 2% ND Filter visible .

Note:2 The external inspection should be conducted at the distance 30 ± 5 cm between the eyes of inspector and the panel .

Note:3 Luminance measurement for contrast ratio is at the distance 50 ± 5 cm 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.



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.

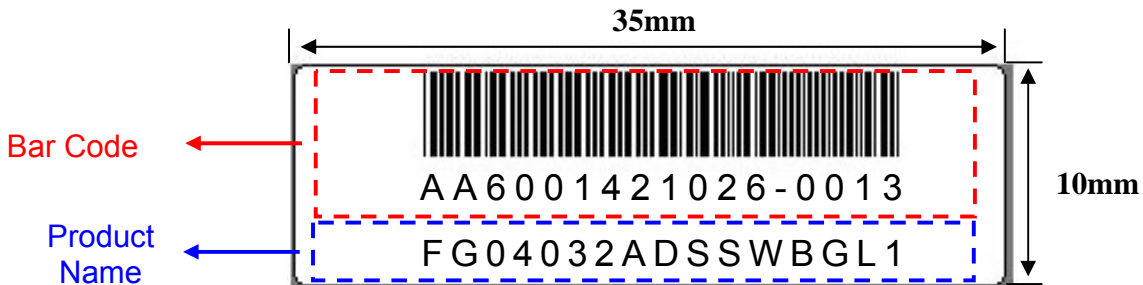
Sampling type: normal inspection, single sampling

Sampling table: MIL-STD-105E

Inspection level: Level II

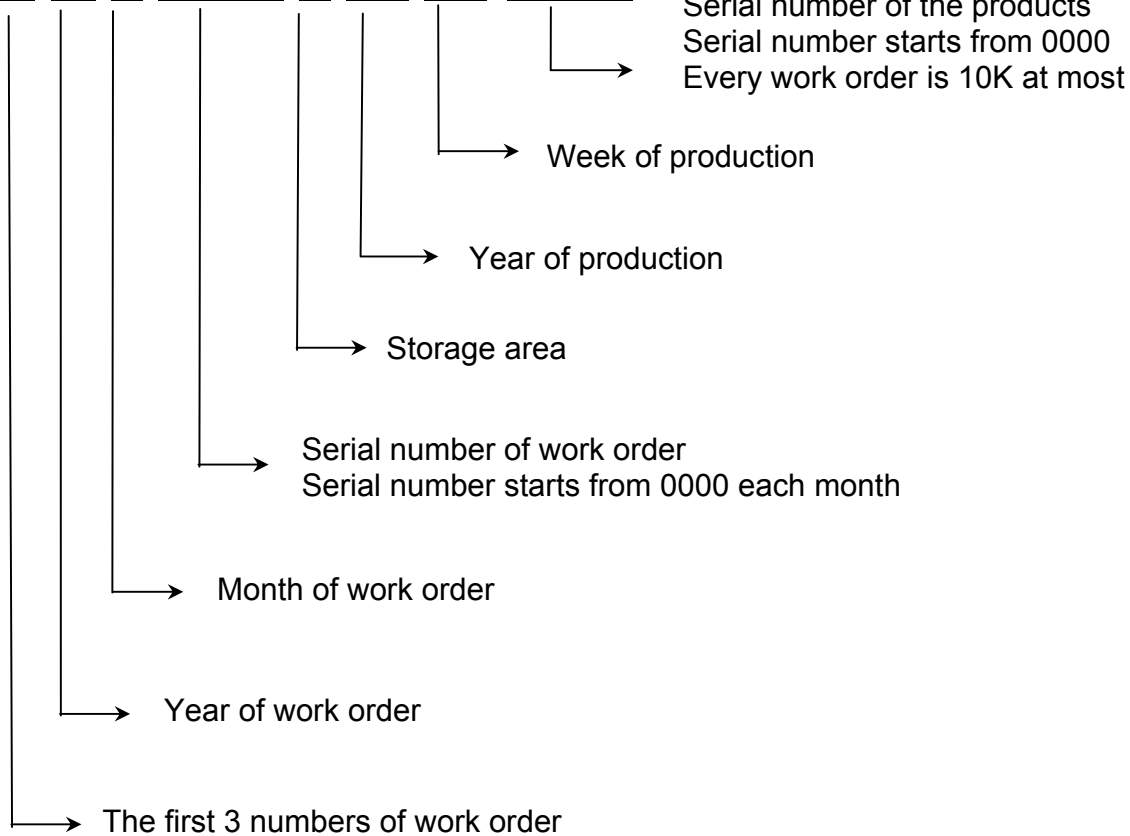
11. LCM PRODUCT LABEL DEFINE

Product Label style:

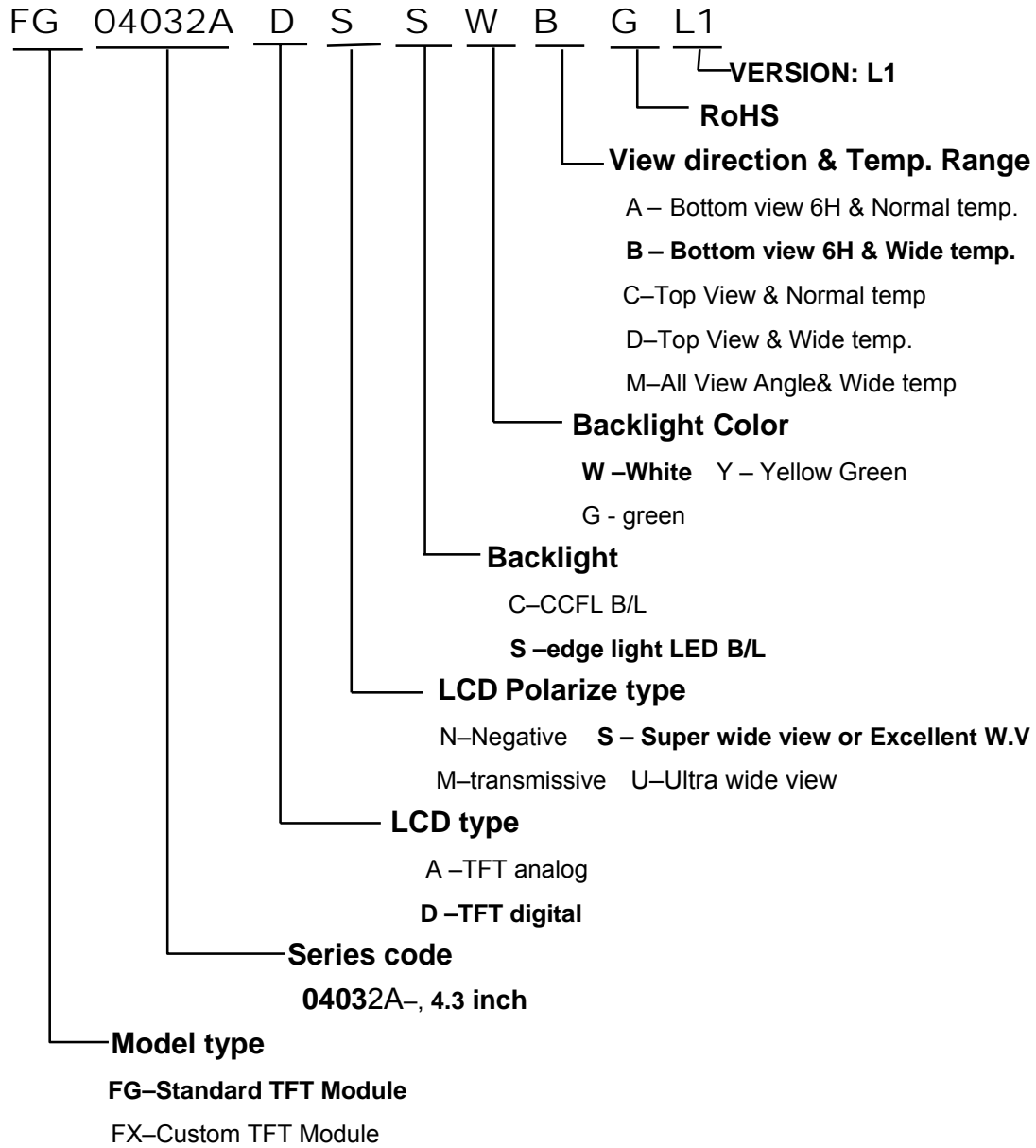


BarCode Define:

A A 6 0014 2 10 26-0013



Product Name Define:



12. PRECAUTION FOR USING 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

- (1) 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.

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

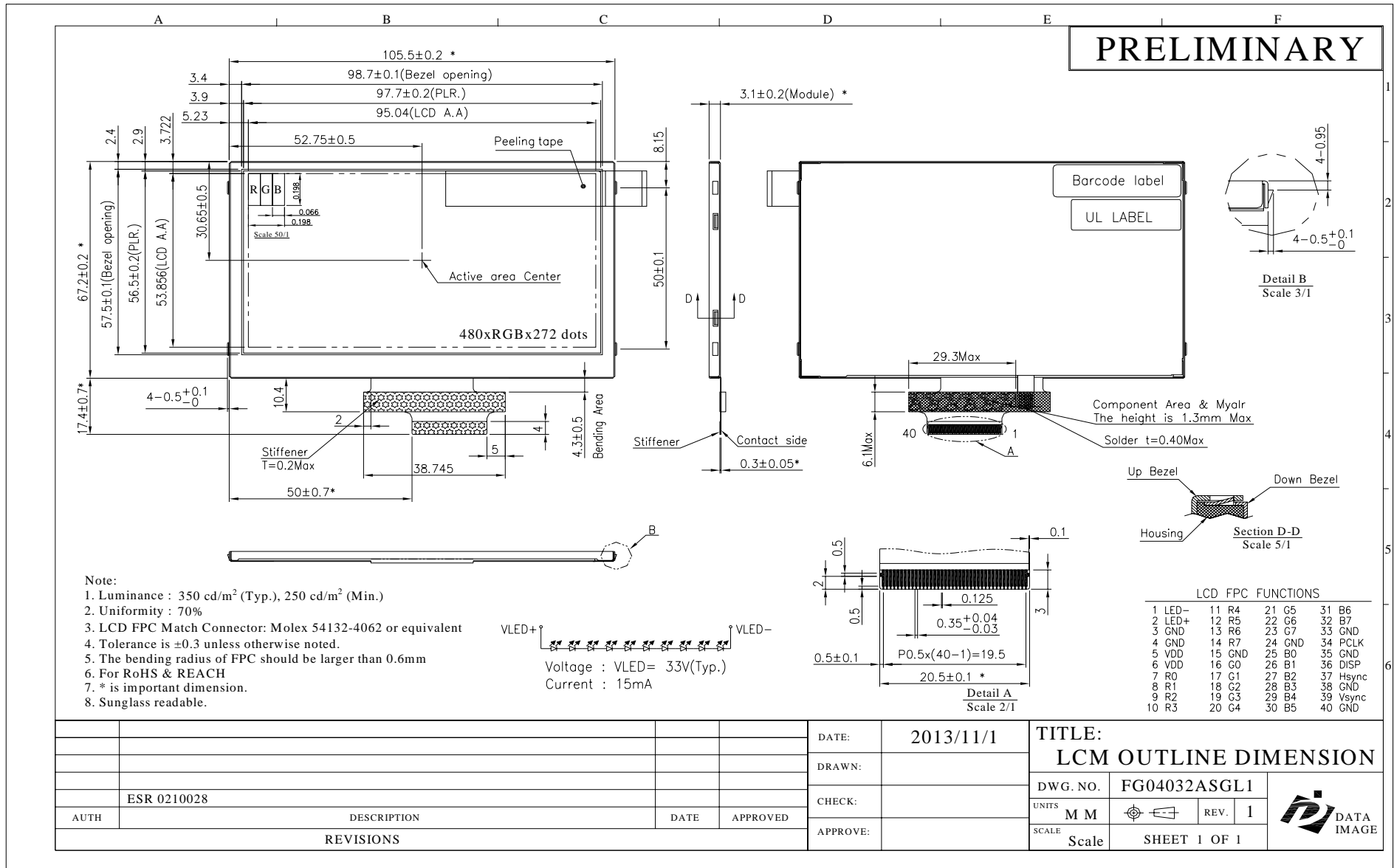
5. OTHERS

- (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 and 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:
- (4) Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.
- (5) Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
- (6) 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.)

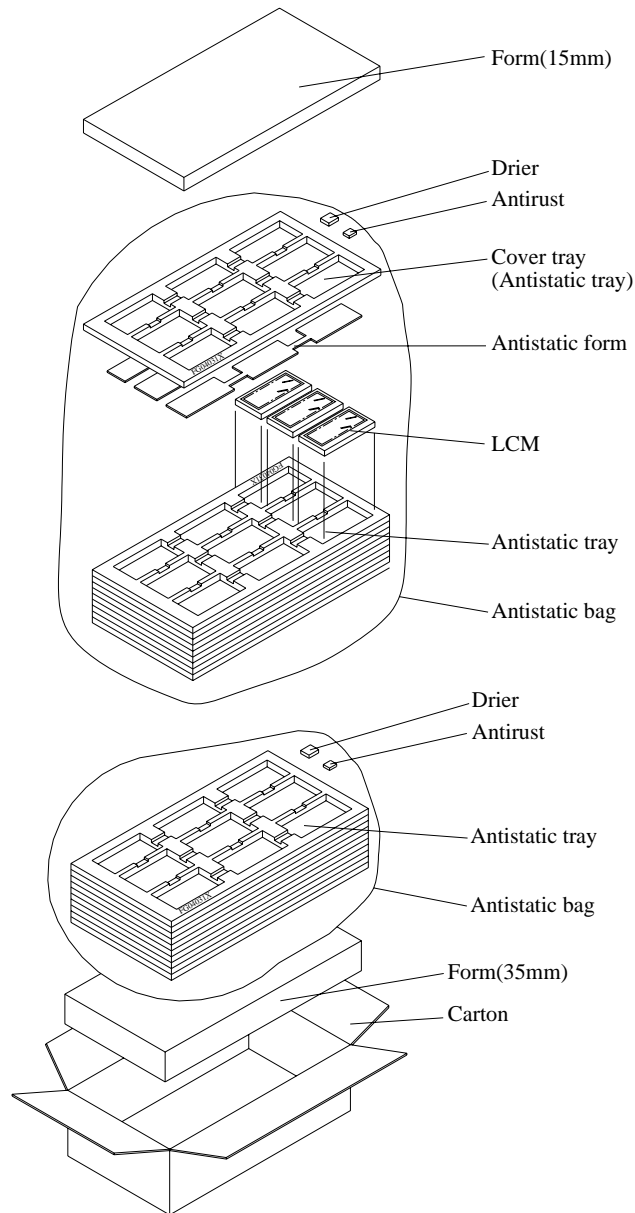
6. LIMITED WARRANTY

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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13. OUTLINE DRAWING



14. PACKAGE INFORMATION



Material

1 Carton + 1 Form (15mm) + 2 Anti-static bag + 20 Anti-static tray
+ 2 Drier + 2 Antirust + 1 Form (35mm)

Total pcs

1 Antistatic tray = 9 pcs (modules)

1 Anti-static bag = 9 Anti-static tray + cover tray = $9 \times 9 + 1 \times 0 = 81$ pcs

1 Carton = 2 Anti-static bag = $2 \times 81 = 162$ pcs

1 Carton = 162 pcs

Carton size : 465L x 380W x 395H (mm)

Total Weight \div 11.6 kgw