3.45” TFT LCD MODULE

SPECIFICATION

MODEL NAME: LTF0345CA6A5

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Record of Revision

Ver.	Revise Date	Page	Content	Modified By
A.0	2007/02/14	-	New specification was first issued	Archer Chi
A.1	2007/05/21	12	Update outline dimension	Important

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1 GENERAL DESCRIPTION

1.1 Description

- ✓ Screen size: 3.5 inch diagonal
- ✓ Number of dots displayed: 76,800 dots
- ✓ Display Colors: 16.7 M colors
- ✓ Display mode: Normally white / Transmissive
- ✓ Two chips solution with COG mounting
- ✓ DC2DC power supplies (VGH/VGL/VCOM voltage supply)
- ✓ Support 24-bit digital (RGB)
- ✓ Incorporated white LED back light unit (serial type)

1.2 Physical specification

No.	Item	Specification	UNIT
1	Number of Dots	320 x RGB x 240	dot
2	Display Size (Diagonal)	3.45 inch	Inch
3	Pixel Size	219 x 219	μm
4	Active Area	70.08 x 52.56	mm
5	Viewing Angle	6 O'clock with SWV polarizer	-
6	Color arrangement	RGB stripe	-
7	Dimension (W x H x D) *1	76.9 x 63.9 x 3.3	mm
8	Back-light	LED Back-light / White	-
9	Weight	T.B.D.	g

*1 The protrusions (FPC, parts) are excluded.

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1.3 Environmental impact substances controlled for containing in products

The environmental impact substances we control are classified into 2 types as described below.

a. Prohibited substances:

LOI, in principle, does not produce any products containing or contaminated by substances of this type.

- Cadmiun (Cd) < 100 ppm
- Mercury (Hg) < 1000 ppm
- Hexavalent-Chromiun (Cr^{+6}) < 1000 ppm
- Polybrominated biphenylethers (PBDE) < 1000 ppm
- Polybrominated biphenyls (PBB) < 1000 ppm

b. Prohibited substances:

Desired not to be contained in or contaminate our products as far as possible and abolished by a targeted date. LOI moderately produces products containing substances of this type.

- Lead (Pb) < 1000 ppm

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2 ABSOLUTE MAXIMUM RATINGS

2.1 Absolute maximum ratings

Item	Symbol	Value	Unit	Note
Power Supply Voltage	VDD	-0.3 to +7.0	V	AVSS=0 GND=0
	VCC	-0.3 to +7.0	V	
	VGH	-0.3 to +32.0	V	
	VGL	-22.0 to +0.3	V	
	VGH-VGL	-0.3 to +45.0	V	
Input Voltage	Vi	-0.3 to VDD(VCC)+0.3	V	

Note:

(1) All of the voltages listed above are with respective to VSS=0V.

(2) Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

2.2 Environmental absolute maximum ratings

Item	Symbol	Min.	Max.	unit	Note
Storage Temperature	Tstg	(-30)	(80)	℃	(1)
Operating Temperature (Ambient Temperature)	Topr	(-20)	(60)	℃	(1),(2)

Note:

(1) 95 % RH Max. (40℃ ≧Ta)

(2) In Case of below 0℃, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one.

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3 Electrical characteristics

3.1 Typical operating conditions (GND=AVss =0V)

Item		Symbo	Min.	Typ.	Max.	Unit	Remark
Digital Power supply		VCC	3	3.3	3.6	V	
Analog Power supply		VDD	3.8	5	5.5	V	
Gate On Power		VGH	14	16	18	V	
Gate Off Power		VGL	-11	-10	-8	V	
Frame frequency		fFrame		(60)		HZ	
Dot Data Clock		DCLK		6.4		MHZ	
VCOM Signal Voltage	H Level	VcomH	-	3.5	-	V	
	L Level	VcomL	-	-1.5	-	V	

3.2 Backlight driving conditions (LED)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current	I_L		20	30	mA/LED	Note 1
LED voltage	V_L	3.0	3.4	3.8	V/LED	

Note 1: 6×LEDs are in serial type.

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4 AC CHARACTERISTICS

4.1 Timing conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
DCLK Frequency	Dclk	-	6.4	-	MHZ
DCLK High Time	Tch	-	78	-	ns
DCLK Low Time	Tcl	-	78	-	ns
Data Setup Time	Tds	12	-	-	ns
Data Hold Time	Tdh	12	-	-	ns
Hsync Period	TH	-	408	-	DCLK
Hsync Pulse Width	Thp	-	30	-	DCLK
Hsync Back-Porch	Thb	-	38	-	DCLK
Hsync Display Period	Thd	-	320	-	DCLK
Hsync Front-Porch	Thf	-	20	-	DCLK
Vsync period NTSC	Tv	-	262.5	-	TH
Vsync period PAL	Tv	-	312.5	-	TH
Vsync Pulse Width	Tvp	1	3	5	TH
Vsync Back-Porch NTSC	Tvb	-	15	-	TH
Vsync Back-Porch PAL	Tvb	-	23	-	TH
Vsync Display Period	Tvd	-	240		TH
Vsync Front-Porch NTSC	Tvf	-	4.5	-	TH
Vsync Front-Porch PAL	Tvf		46.5		TH

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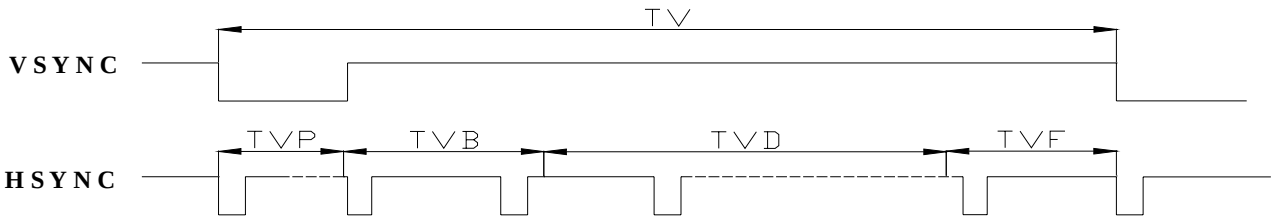
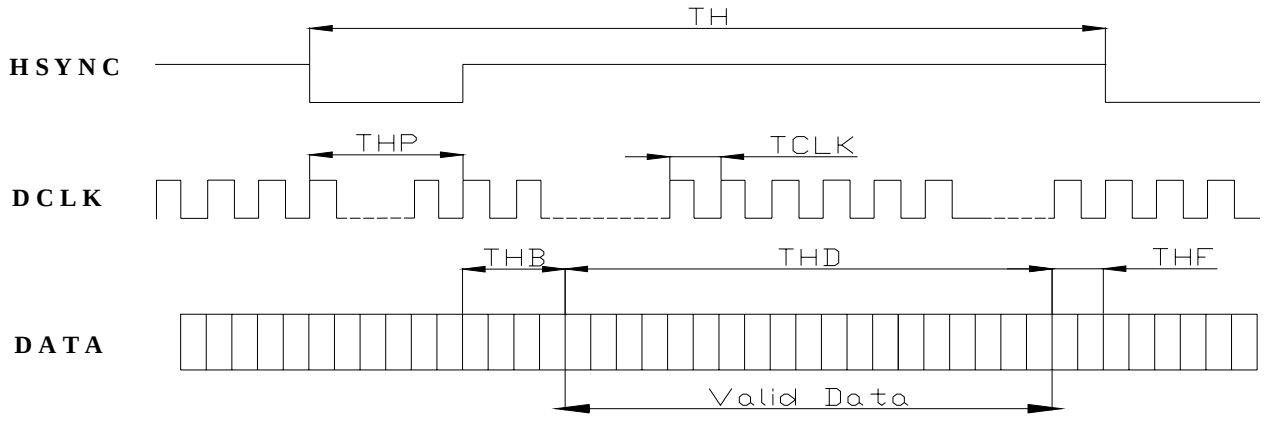
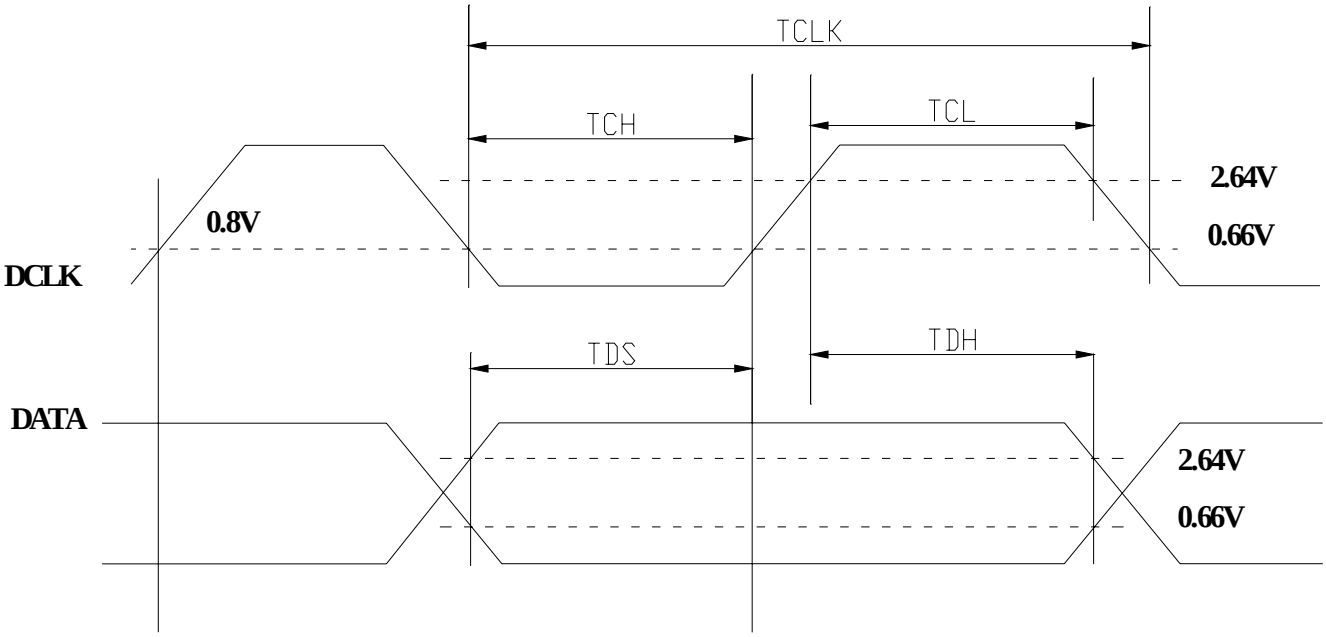
4.2 AC Timing diagrams







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5 OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in note (1).

Measuring equipment: BM-5A, BM-7

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time Rise Fall	Tr+Tf	25 ℃	25	35	50	ms	Note 4
Contrast ratio	CR	At optimized viewing angle	250	300	-		Note 5,6
Viewing angle Top Bottom Left Right		CR≧10	- - - -	50 55 60 60	- - - -	deg.	Note 7
Brightness	B	θ =0°	280	320	-	nit	Note 8
White chromaticity	x	θ =0°	-	(0.29)	-		
	y	θ =0°	-	(0.30)	-		
Degree of Saturation (NTSC)			-	50	-	%	

Note 1: Ambient temperature =25℃,And LED current IL=20mA.

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-5A, after 10 minutes operation.

Note 4: Definition of response time: The output signals of photo-detector are measured when the input signals are changed from “black” to “white”(falling time) and from “white” to “black” (rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as shown below.

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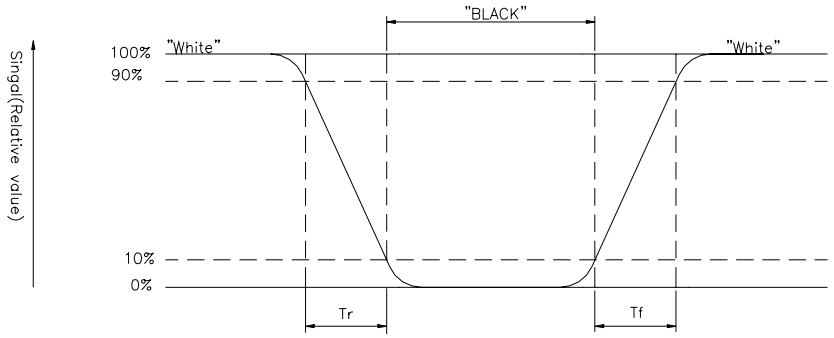


Note 5: Contrast ratio is calculated with the following formula.

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

Note 6: White Vi =Vi50 + 1.5V

Black Vi =Vi50 ± 2.0V

“±” means that the analog input signal swings in phase with VCOM signal.

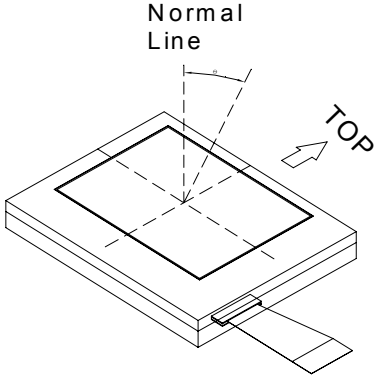
“∓” means that the analog input signal swings out of phase with VCOM signal.

“Vi50” : 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.

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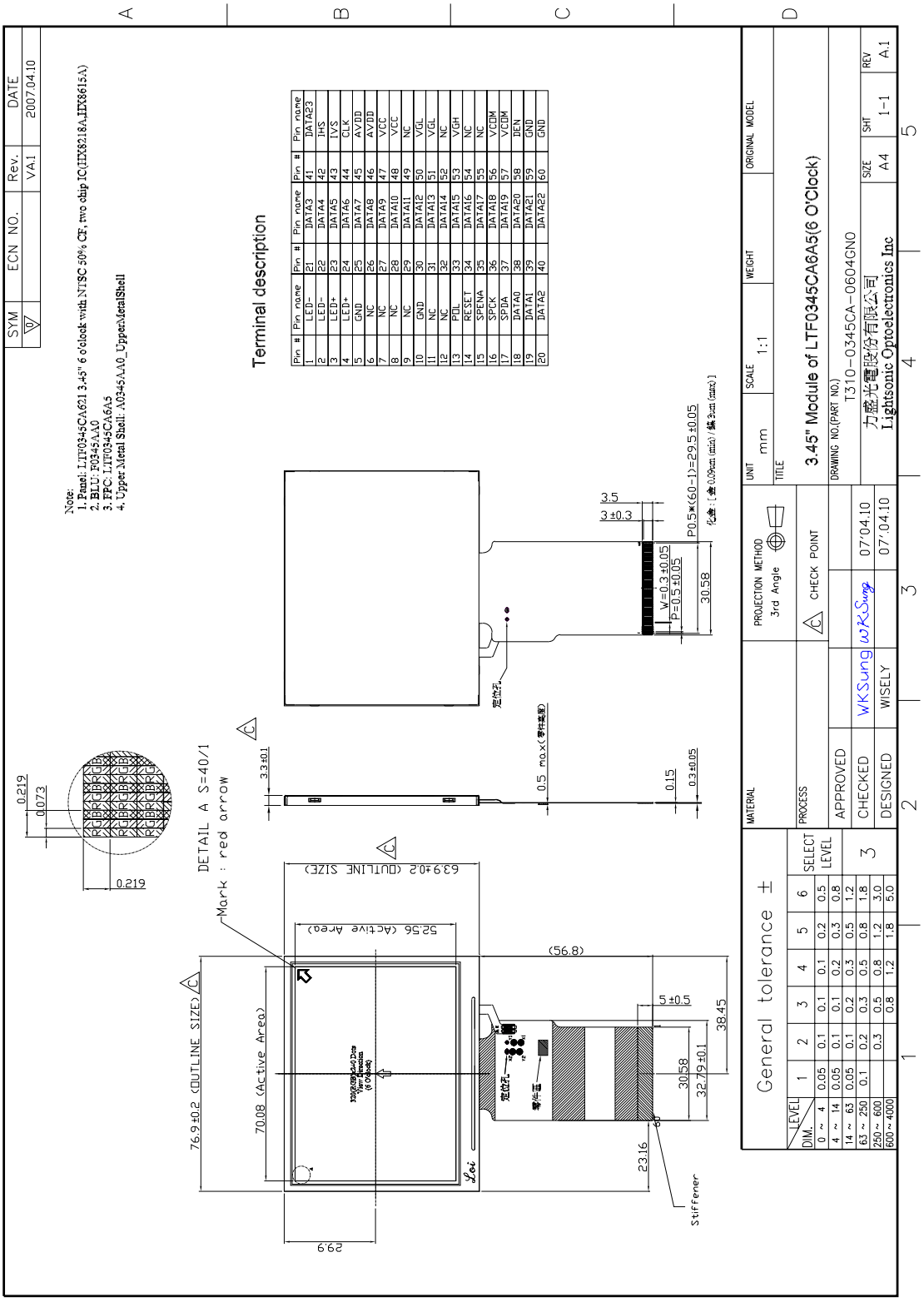
6 OUTLINE DIMENSION



Pin #	Pin name	Pin #	Pin name	Pin #	Pin name
1	LED-	21	DATA3	41	DATA23
2	LED-	22	DATA4	42	IHS
3	LED+	23	DATA5	43	IVS
4	LED+	24	DATA6	44	CLK
5	GND	25	DATA7	45	AVDD
6	NC	26	DATA8	46	AVDD
7	NC	27	DATA9	47	VCC
8	NC	28	DATA10	48	VCC
9	NC	29	DATA11	49	NC
10	GND	30	DATA12	50	VGL
11	NC	31	DATA13	51	VGL
12	NC	32	DATA14	52	NC
13	PDL	33	DATA15	53	VGH
14	RESET	34	DATA16	54	NC
15	SPENA	35	DATA17	55	NC
16	SPCK	36	DATA18	56	VCOM
17	SPDA	37	DATA19	57	VCOM
18	DATA0	38	DATA20	58	DEN
19	DATA1	39	DATA21	59	GND
20	DATA2	40	DATA22	60	GND

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7 INTERFACE PIN CONNECTION

7.1 TFT LCD module interface

Pin No.	Symbol	Pin No.	Symbol	Pin No.	Symbol
1	LED-	21	DATA3	41	DATA23
2	LED-	22	DATA4	42	IHS
3	LED+	23	DATA5	43	IVS
4	LED+	24	DATA6	44	CLK
5	GND	25	DATA7	45	AVDD
6	NC	26	DATA8	46	AVDD
7	NC	27	DATA9	47	VCC
8	NC	28	DATA10	48	VCC
9	NC	29	DATA11	49	NC
10	GND	30	DATA12	50	VGL
11	NC	31	DATA13	51	VGL
12	NC	32	DATA14	52	NC
13	POL	33	DATA15	53	VGH
14	RESET	34	DATA16	54	NC
15	SPENA	35	DATA17	55	NC
16	SPCK	36	DATA18	56	VCOM
17	SPDK	37	DATA19	57	VCOM
18	DATA0	38	DATA20	58	DEN
19	DATA1	39	DATA21	59	GND
20	DATA2	40	DATA22	60	GND

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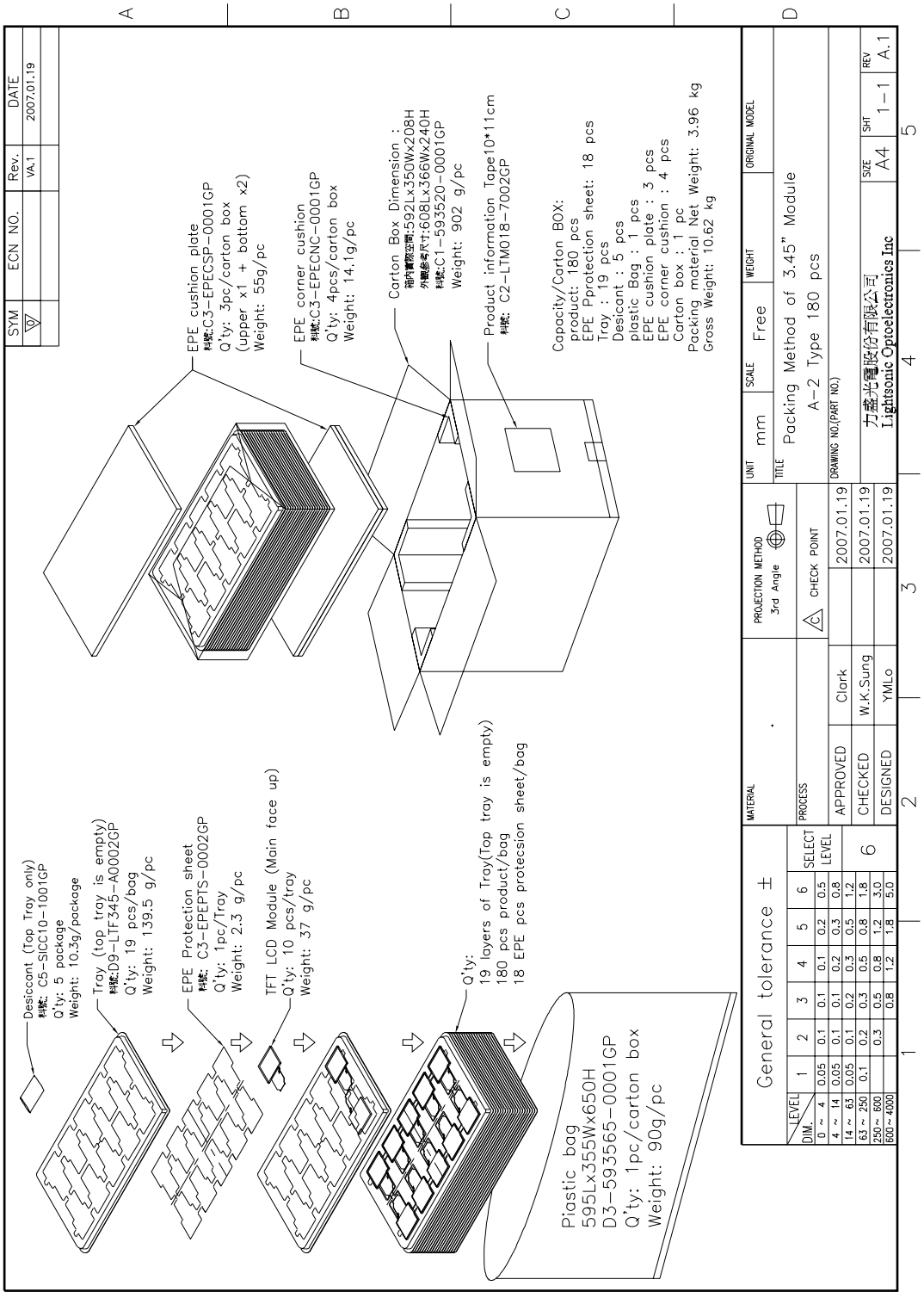
8 PACKING FORM



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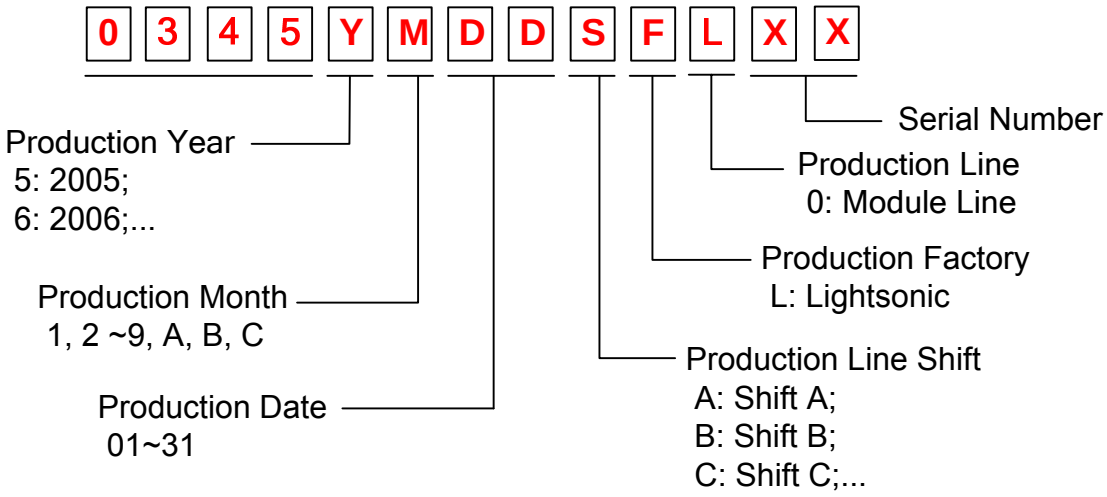
9 DESIGNATION OF LOT MARK

9.1 Lot Mark on Packing Label

Lot Number on Outer Carton Box



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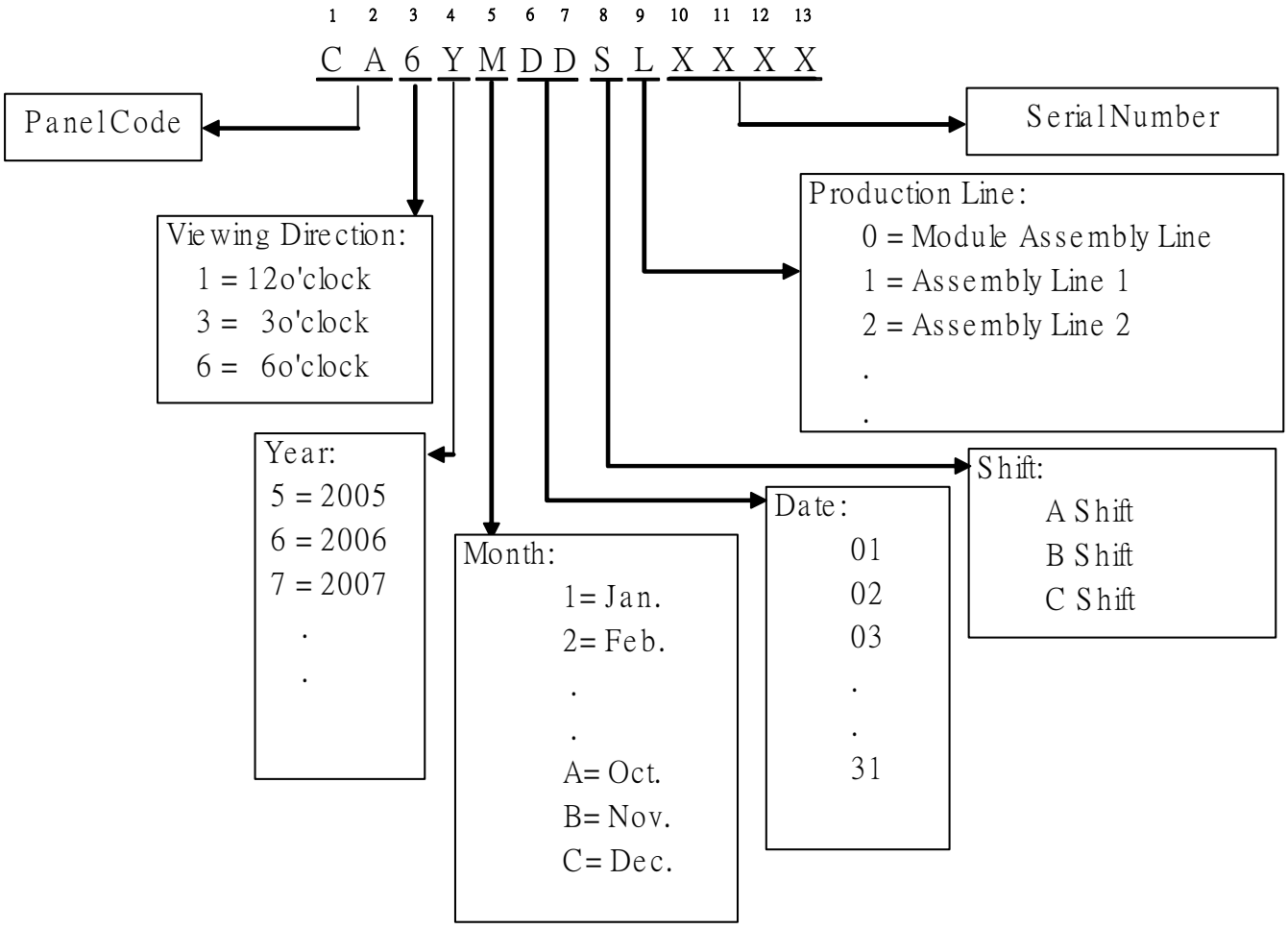
9.2 Production Lot Mark of LCD Module

The production lot of module is specified on the back of FPC follows. The lot mark is consisted of 13-digit number.



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10 RELIABILITY DATA

No	Test items	Conditions	Remark
1	High temperature storage	Ta=80℃ 240Hrs	
2	Low temperature storage	Ta=-30℃ 240Hrs	
3	High temperature operation	Ta=70℃ 240Hrs	
4	Low temperature operation	Ta=-20℃ 240Hrs	
5	High temperature and high humidity	Ta=60℃ , 90%RH 240Hrs	Operation
6	Thermal shock	-30℃ (0.5H) ~ 80℃ (0.5H) / 50 cycles	Non-operation
7	Electrostatic discharge	±200V, 200pF(0Ω), once for each terminal	Non-operation
8	Vibration (with carton)	Random vibration: $0.015G^2$/Hz from 5～200Hz -6dB/Octave from 200～500Hz	IEC 68-34
9	Drop (with carton)	Height: 60cm 1 corner, 3 edges ,6 surfaces	

Note: Ta: Ambient temperature.

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11 PRECAUTIONS

11.1 Handling

(1) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.

(2) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(3) Note that the polarizer is very fragile and could be easily damaged. Do not press or scratch the surface harder than a B pencil lead.

(4) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Don't use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static; it may cause damage to the CMOS Gate Array IC.

(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

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(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(12) Pins of I/F connector shall not be touched directly with bare hands.

11.2 Storage

(1) Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35oC and relative humidity of less than 70%.

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

11.3 Operation

(1) Do not connect; disconnect the module in the “Power on” condition.

(2) Power supply should always be turned on/off by the chapter 8 TFT-LCD Driver IC Operation Algorithms.

11.4 Others

(1) The Liquid crystal is deteriorated by ultra violet, do not leave it in direct sunlight and strong ultraviolet ray for many hours.

(2) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(3) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation in part contents and environmental temperature and so on). Otherwise the panel may be damaged.

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(4) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image" Sticks" to the screen.

(5) His panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

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