

**RoHS
Compliant**

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**3.45” TFT LCD MODULE
WITH TOUCH PANEL
SPECIFICATION**

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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
- ✓ One chip solution with COG mounting
- ✓ DC2DC power supplies (VGH/VGL/VCOM voltage supply)
- ✓ Support 18-bit digital (RGB) or CCIR_601/656 input timing
- ✓ 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)	3.5 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 4.4	mm
8	Back-light	LED Back-light / White	-
9	Weight	T.B.D.	g

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



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1.3 Touch Panel

- Type : Resistance , Analog, 4-Wires Type Touch Panel
- Input Method : Finger or Pen
- Activation Force : 5gf ~ 80gf
- Hardness of Surface : 3H

1.4 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.

- ◆ Cadmium (Cd) < 100 ppm
- ◆ Mercury (Hg) < 1000 ppm
- ◆ Hexavalent-Chromium (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 respect to VSS=0V.
- (2) Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

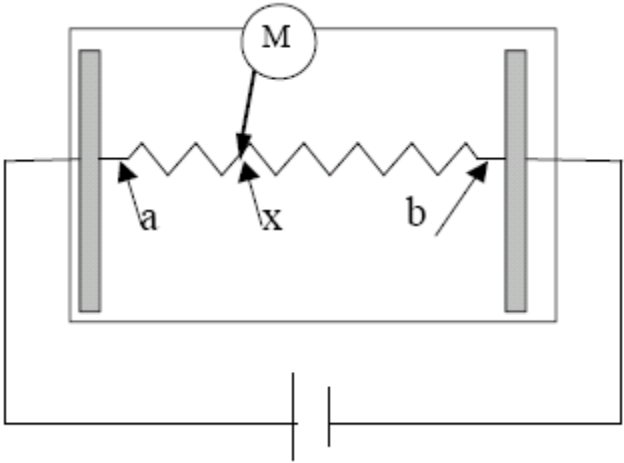
2.2 Electrical characteristics of touch panel

Description		Specification	Remark
Operating Voltage		DC 5V	
Circuit Resistance	X-axis	200Ω ~ 900Ω	At connector
	y-axis	200Ω ~ 900Ω	At connector
Insulation Resistance		≥ 20MΩ	At DC 25V,60sec
Chattering Time		≤ 10ms	Test Condition: Voltage:3V, Frequency: 5Hz
Linearity		≤ 1.5%	Material of Pen: Poly-acetal resin End shape:R0.8mm Pitch: 10mm Test Forece:150gf (1)

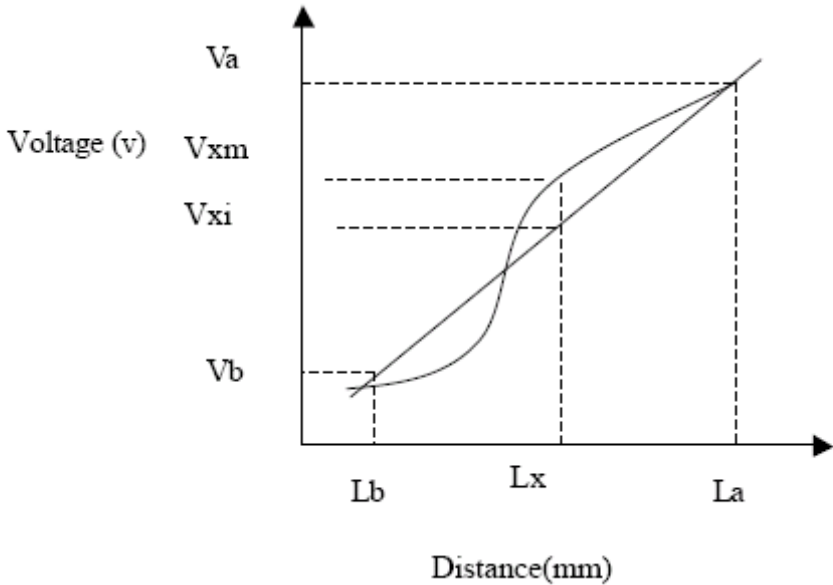
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Note:
(1) Measurement condition of Linearity

Linearity Definition



- Va: maximum voltage in the active area of touch panel
- Vb: minimum voltage in the active area of touch panel
- X: random measuring point
- Vxm: Actual voltage of Lx point
- Vxi: Theoretical voltage of Lx point



Linearity: $[(Vxi - Vxm) / (Va - Vb)] * 100\%$

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2.3 Environmental absolute maximum ratings

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

Note:

(1) 95 % RH Max. ($40^{\circ}\text{C} \geq T_a$)

(2) In Case of below 0°C , 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	-	4	-	V	
	L Level	VcomL	-	-1	-	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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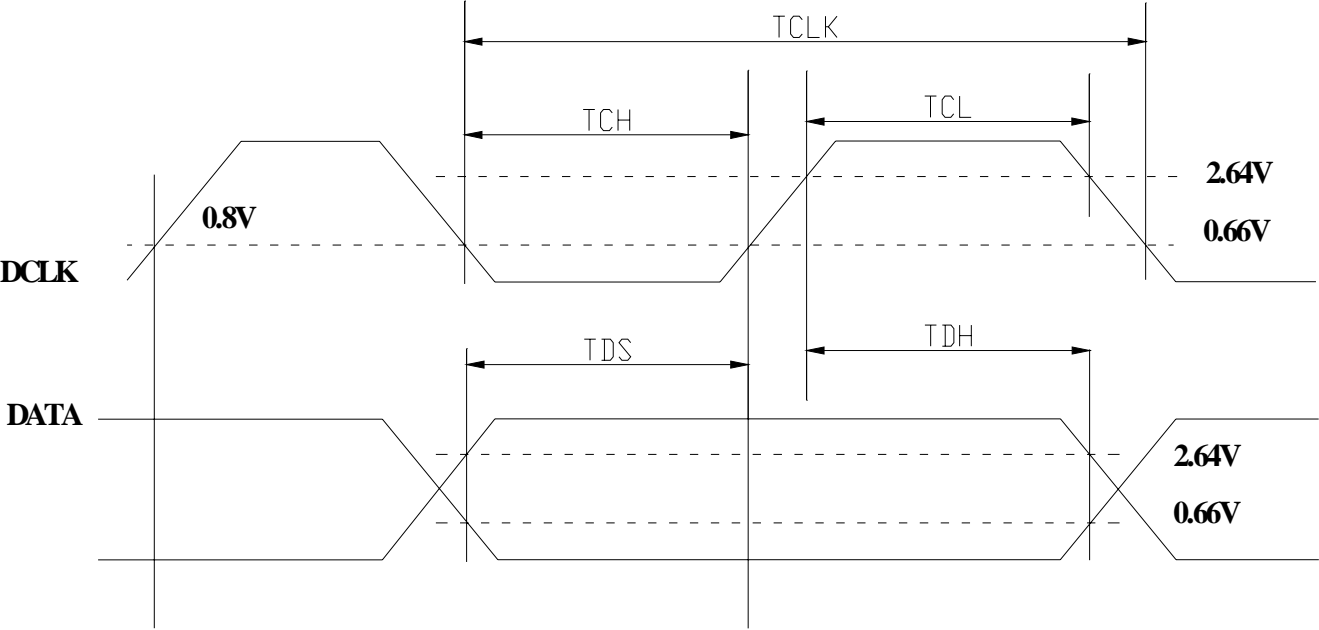
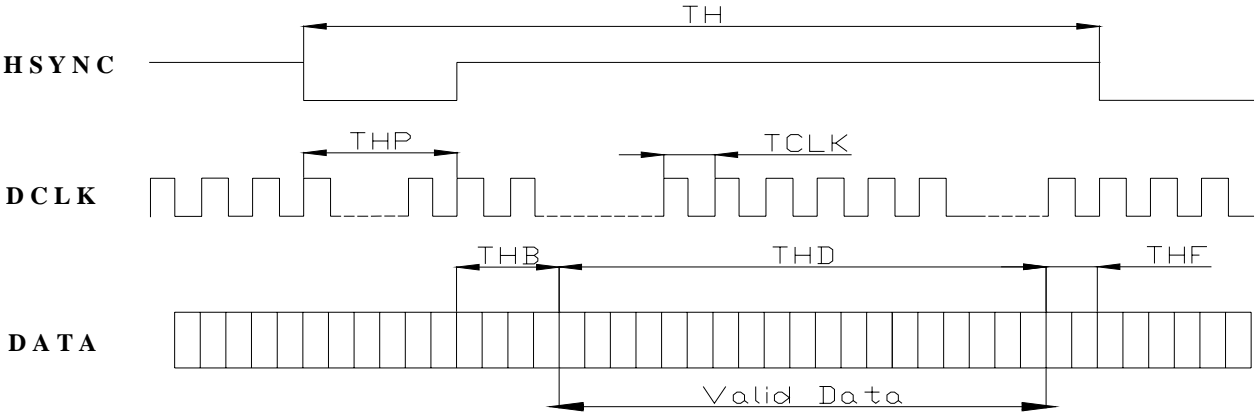
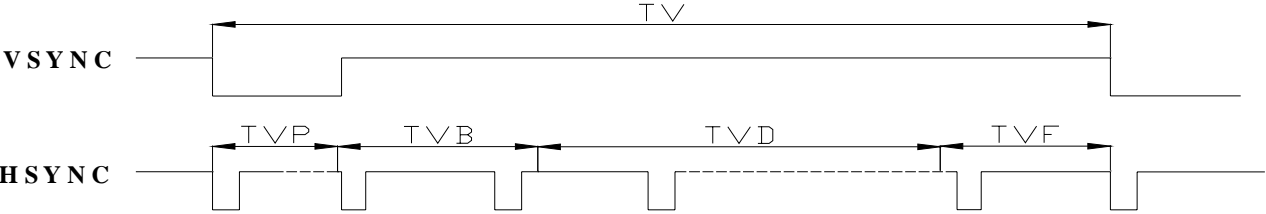
4 AC CHARACTERISTICS

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 °C	25	35	50	ms	Note 4
Contrast ratio	CR	At optimized viewing angle	150	200	-		Note 5,6
Viewing angle Top Bottom Left Right		CR ≥ 10	-	50 55 60 60	-	deg.	Note 7
Brightness	B	$\theta = 0^\circ$		200	-	nit	Note 8
White chromaticity	x	$\theta = 0^\circ$	-	(0.29)	-		
	y	$\theta = 0^\circ$	-	(0.30)	-		
Degree of Saturation (NTSC)			-	63	-	%	

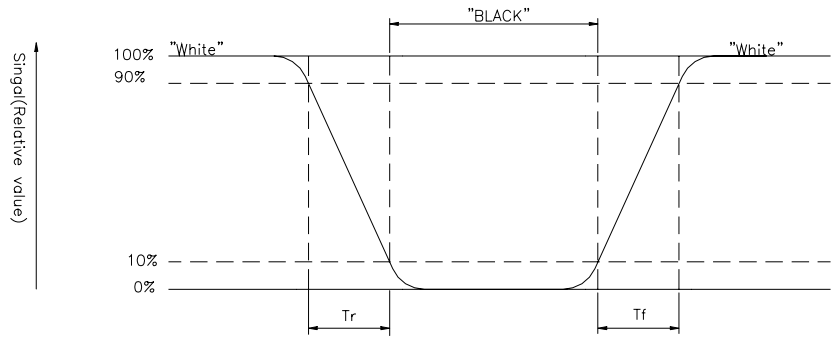
Note 1: Ambient temperature =25°C, And LED current IL=20mA.

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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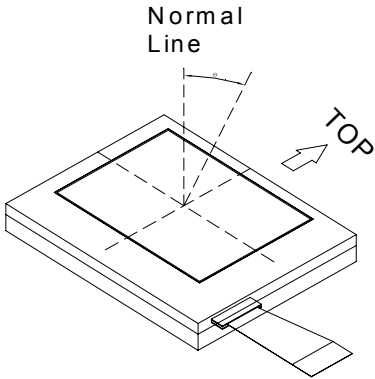
Note 5: Contrast ratio is calculated with the following formula.
 Photo-detector output when LCD is at "White" state

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

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

"±" 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.

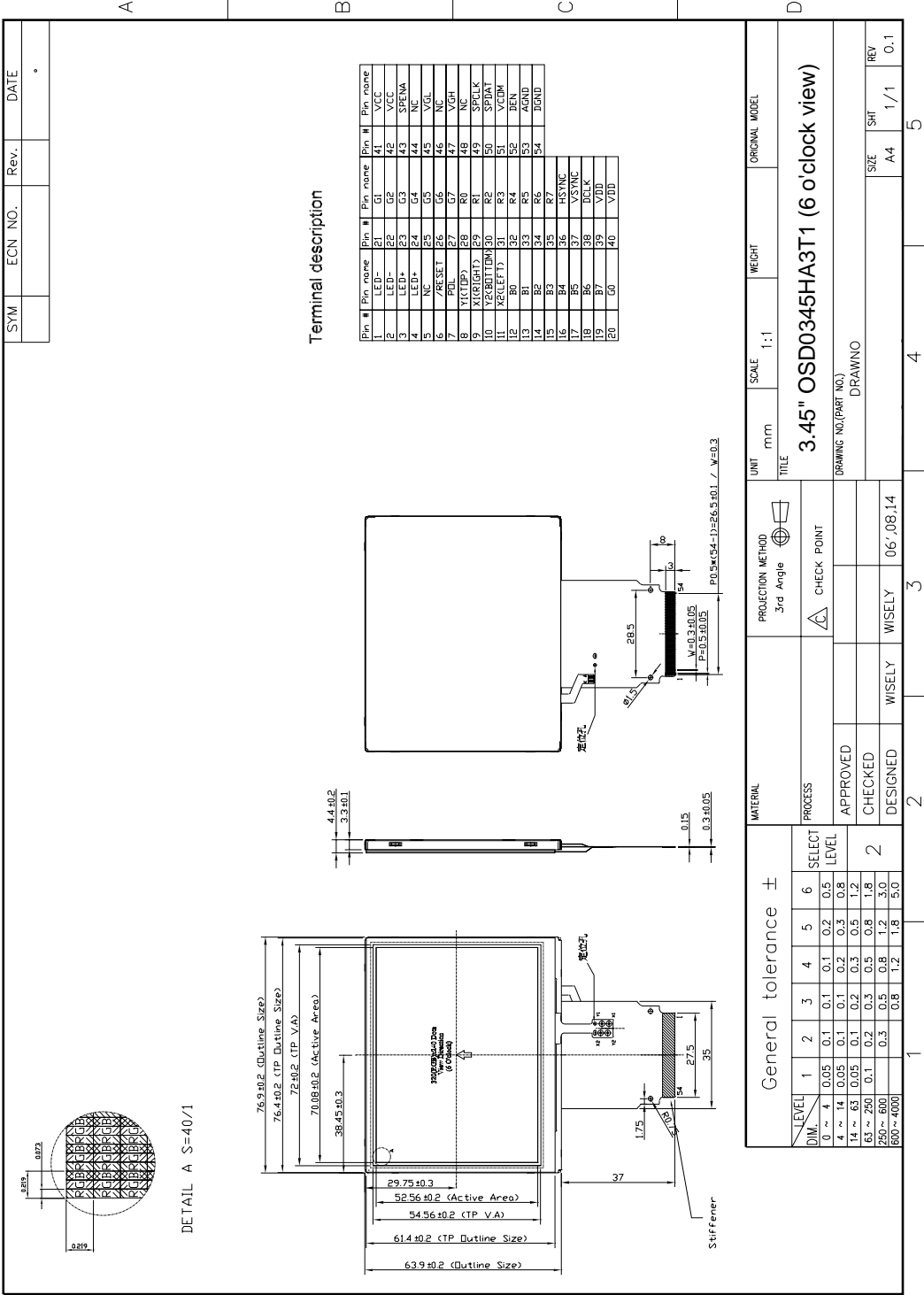
Note 7: Definition of viewing angle:
 Refer to figure as below.



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



UNIT: mm		SCALE: 1:1	WEIGHT:	ORIGINAL MODEL:
PROJECTION METHOD: 3rd Angle		TITLE: 3.45" OSD0345HA3T1 (6 o'clock view)		
PROCESS: APPROVED		DRAWING NO.(PART NO.):		
CHECKED: DESIGNED		DRAWING:		
MATERIAL:		APPROVED: WISELY	CHECKED: WISELY	DESIGNED: WISELY
SELECT LEVEL: 2		DATE: 06.08.14		
DIM. TOLERANCE ±		REV: 1/1		
0 ~ 4	0.05	1	2	3
4 ~ 14	0.05	1	2	3
14 ~ 63	0.05	1	2	3
63 ~ 250	0.1	1	2	3
250 ~ 600	0.3	1	2	3
600 ~ 4000	0.8	1	2	3
	1.2	1	2	3
	1.8	1	2	3
	5.0	1	2	3

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7 INTERFACE PIN CONNECTION

7.1 TFT LCD module interface

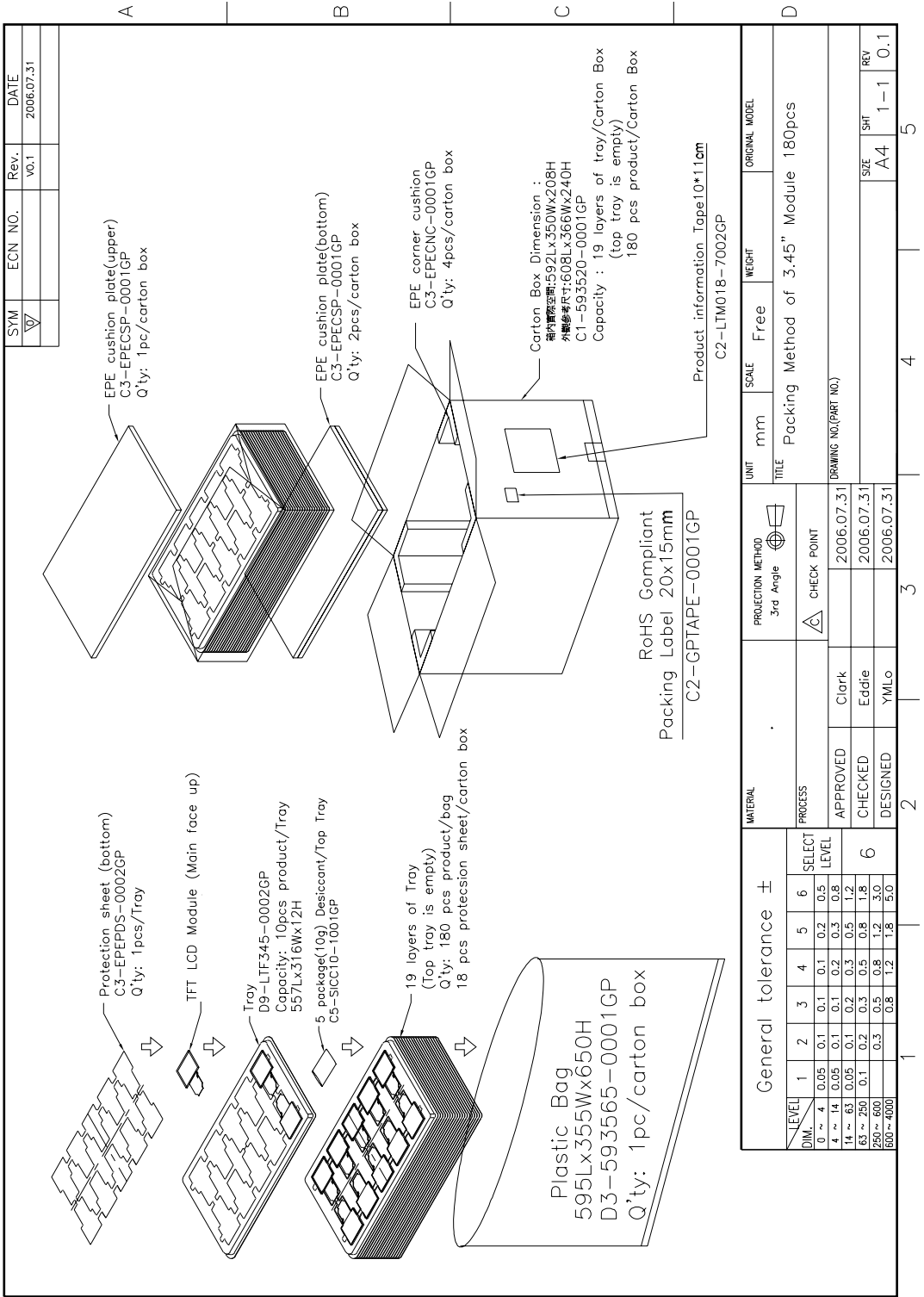
Pin No.	Symbol	Pin No.	Symbol	Pin No.	Symbol
1	LED-	19	B7	37	VSYNC
2	LED-	20	G0	38	DCLK
3	LED+	21	G1	39	VDD
4	LED+	22	G2	40	VDD
5	NC	23	G3	41	VCC
6	/RESET	24	G4	42	VCC
7	POL	25	G5	43	SPENA
8	Y1 (TOP)	26	G6	44	NC
9	X1 (RIGHT)	27	G7	45	VGL
10	Y2 (BOTTOM)	28	R0	46	NC
11	X2 (LEFT)	29	R1	47	VGH
12	B0	30	R2	48	NC
13	B1	31	R3	49	SPCLK
14	B2	32	R4	50	SPDAT
15	B3	33	R5	51	VCOM
16	B4	34	R6	52	DEN
17	B5	35	R7	53	AGND
18	B6	36	HSYNC	54	DGND

7.2 Touch panel interface

Pin No.	Symbol	Pin No.	Symbol
1	YU	3	YD
2	XL	4	XR

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8 PACKING FORM



General tolerance ±		1	2	3	4	5	6	SELECT LEVEL
DIM.	0.05	0.1	0.1	0.1	0.2	0.2	0.5	LEVEL
1 ~ 14	0.05	0.1	0.1	0.2	0.2	0.3	0.5	1.2
14 ~ 83	0.05	0.1	0.2	0.3	0.5	0.8	1.2	1.8
83 ~ 230	0.1	0.2	0.3	0.5	0.8	1.2	3.0	5.0
230 ~ 400	0.3	0.5	0.8	1.2	1.8	3.0	5.0	10.0
400 ~ 600	0.5	0.8	1.2	1.8	3.0	5.0	10.0	20.0

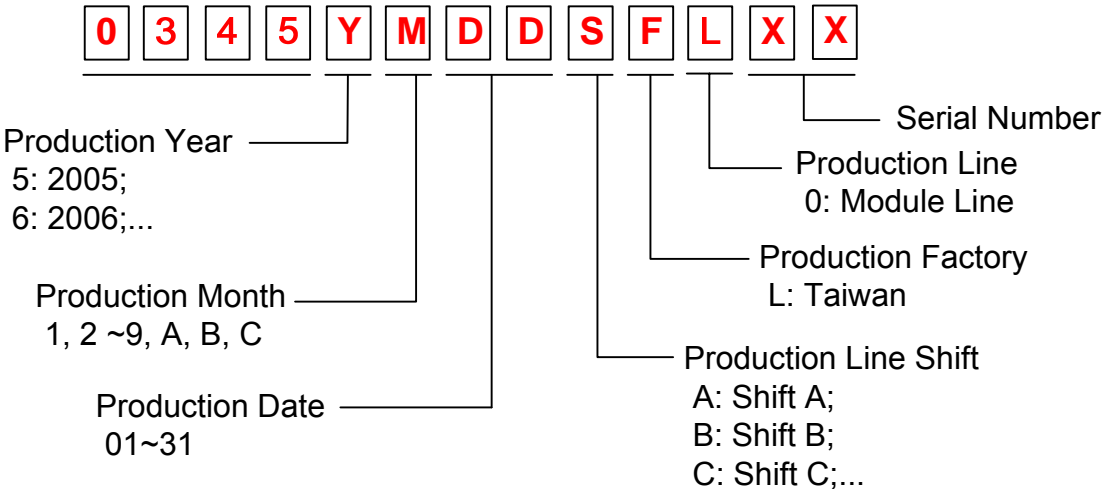
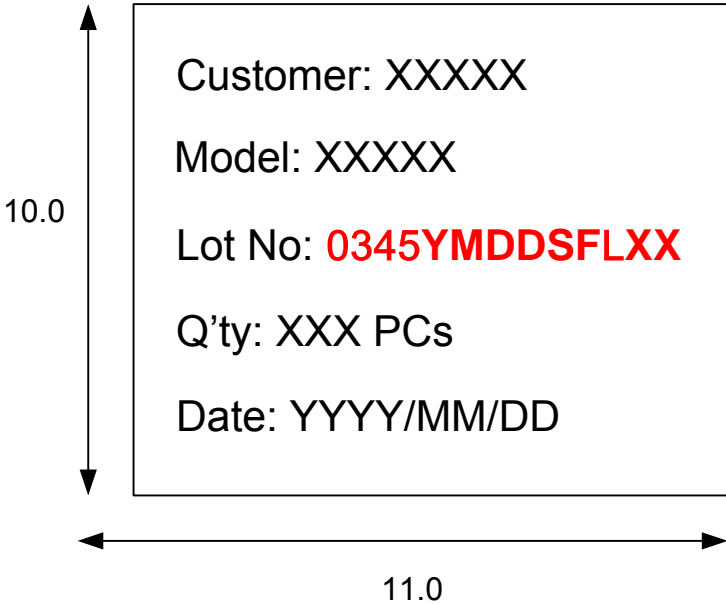
MATERIAL	PROCESS	APPROVED	CHECKED	DESIGNED
		Clark	Eddie	YML0
PROJECTION METHOD 3rd Angle		CHECK POINT		
		2006.07.31		
UNIT		DRAWING NO.(PART NO.)		
mm	Free	Packing Method of 3.45" Module 180pcs		
SCALE		ORIGINAL MODEL		
		C2-LTM018-7002GP		
TITLE		Product information Tape10*11mm		
		C2-GPTAPE-0001GP		
PROJECTION METHOD		SIZE		
3rd Angle		A4		
CHECK POINT		REV		
2006.07.31		1-1		
APPROVED		SHT		
Clark		5		
CHECKED		REV		
Eddie		0.1		
DESIGNED		REV		
YML0		0.1		

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9 DESIGNATION OF LOT MARK

9.1 Lot Mark on Packing Label

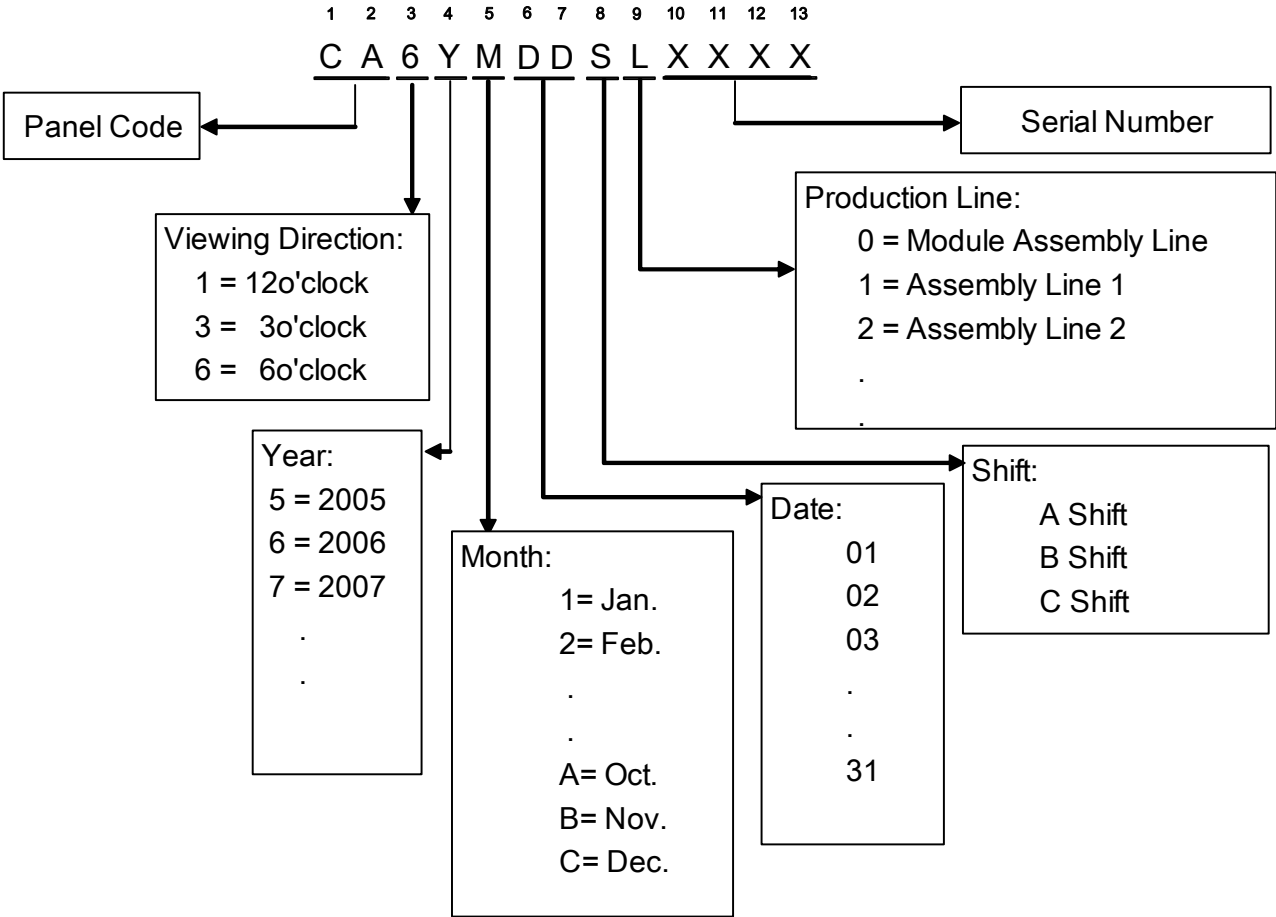
Lot Number on Outer
Carton Box



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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°C 240Hrs	
2	Low temperature storage	Ta=-25°C 240Hrs	
3	High temperature operation	Ta=60°C 240Hrs	
4	Low temperature operation	Ta=0°C 240Hrs	
5	High temperature and high humidity	Ta=60°C , 90%RH 240Hrs	Operation
6	Thermal shock	-25°C ~ 80°C/50 cycle 2Hrs/cycle	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 Precautions in use of touch panel

- (1) Do not give excessive strain to the product.
 - (2) To prevent giving distortion to the film of the product and peeling off of the film from the product, do not fix the film and a set case or a shock absorbing material adhered to a set case by adhesion.
 - (3) Operate it with a polyacetal pen (tip R0.8 or over) or a belly of a finger without applying excessive load. Never use any mechanical pencils, ball point pens and hard fingertips whose tip is hard for input, otherwise malfunctions may result.
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- (4) The input position may be fluctuated a little through long-time use. It is desirable to provide a zero-adjustment function by using a circuit and software.
- (5) Operation at the out of Active Area is out of our guarantee. It causes a serious damage of a transparent electrode. Do not operate at the out of Active Area.

11.5 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.
 - (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.
-