TFT LCD Preliminary Specification

MODEL NO.: M150X3 -S07

Customer : _____

Approved by : _____

Note :

Liquid Crystal Display Division		
QRA Dept.	RD Dept.	PD Dept.
Approval	Approval	Approval
陳 90.9.12 永一	李 90.9.11 忠光	張 90.9.11 源仁

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REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 1.0	Jily.18'2001	All	All	Preliminary Specification was first issued.
Ver 1.1	Sep.10'2001	17		Update Timing Relation Corresponds to DE

1. GENERAL DESCRIPTION

1.1 OVERVIEW

M150X3-S07 is a 15.0" TFT Liquid Crystal Display module with 4 CCFL Backlight units. This module supports 1024 x 768 XGA mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

1.2 FEATURES

- Wide viewing angle
- XGA (1024 x 768 pixels) resolution
-High contrast 400:1 Min

1.3 APPLICATION

- Desktop monitors

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	304.1(H) x 228.1(V) (15.0" diagonal)	mm	(1)
Bezel Opening Area	308.2(H) x 232.1(V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1024 x R.G.B. x 768	pixel	-
Pixel Pitch	0.297(H) x 0.297(W)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	-	331.6	-	mm	(1)
	Vertical(V)	-	254.76	-	mm	
	Depth(D)	-	13.0		mm	(1)(2)
Weight		-	-	1,350	g	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) The depth is without connector and boss.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

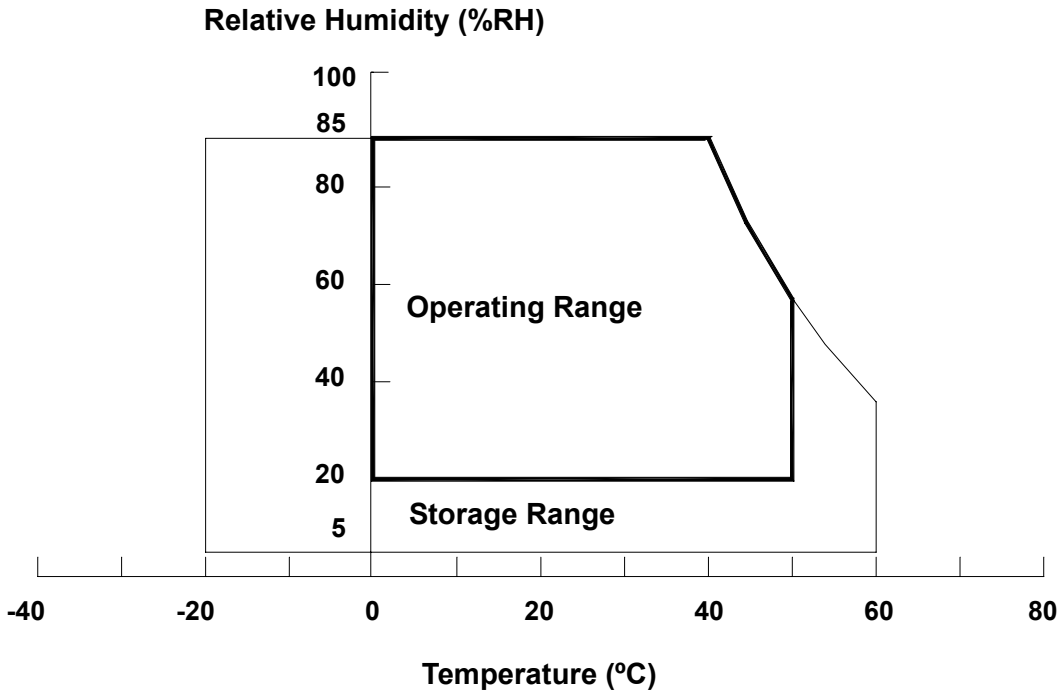
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)
Storage Humidity	H_{ST}	5	85	%	-
Operation Humidity	H_{OP}	20	85	%	-
Shock (Non-Operating)	S_{NOP}	-	50	G	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	2	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 85 %RH Max. (Ta ≤ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation of water.



Note (2) The temperature of panel surface should be 0 ºC Min. and 60 ºC Max.

Note (3) 6ms, 1 time each ±X,±Y and ±Z directions

Note (4) 10 ~ 500 Hz, 1 cycle/20min. 1.5mm max, 1 hour each X, Y and Z directions

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V_{DD}	-0.3	4.0	V	(1)

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_L	603	737	V_{RMS}	(1), (2), I_L = 5.5mA
Lamp Current	I_L	2.0	6.5	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	30	80	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to Section 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE POWER CONSUMPTION

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{DD}	3.0	3.3	3.6	V	-
Rush Current		I_{RUSH}	-	-	1.5	A	(2)
Power Supply Current	White	Icc	-	350	-	mA	(3)a
	Black		-	530	-	mA	(3)b
	Vertical Stripe		-	450	-	mA	(3)c
Input voltage	"H" Level	V_{IH}	2.4	-	3.6	V	-
	"L" Level	V_{IL}	0	-	0.9	V	-

Note (1) The module should be always operated within above ranges.

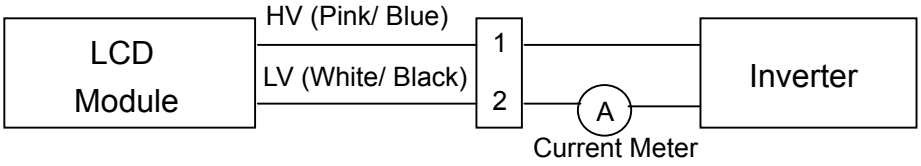
Note (2) Measurement Conditions:

3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	603	670	737	V_{RMS}	I_L = 5.5 mA
Lamp Current	I_L	2.0	5.5	6.5	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	-	-	1,350 (25 °C)	V_{RMS}	(2)
		-	-	1,510 (0 °C)	V_{RMS}	(2)
Operating Frequency	F_L	30	45	80	KHz	(3)
Lamp Life Time	L_{BL}	40,000	50,000	-	Hrs	(5)
Power Consumption	P_L	-	14,740	-	mW	(4), I_L = 5.5 mA

Note (1) Lamp current is measured by utilizing a high frequency current meter as shown below:



Note (2) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may generate interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) $P_L = I_L \times V_L$

Note (5) The lifetime of lamp is defined as the time when it continues to operate under the conditions at Ta = 25 ± 2 °C and I_L =7.0mA_{RMS} until one of the following events occurs:

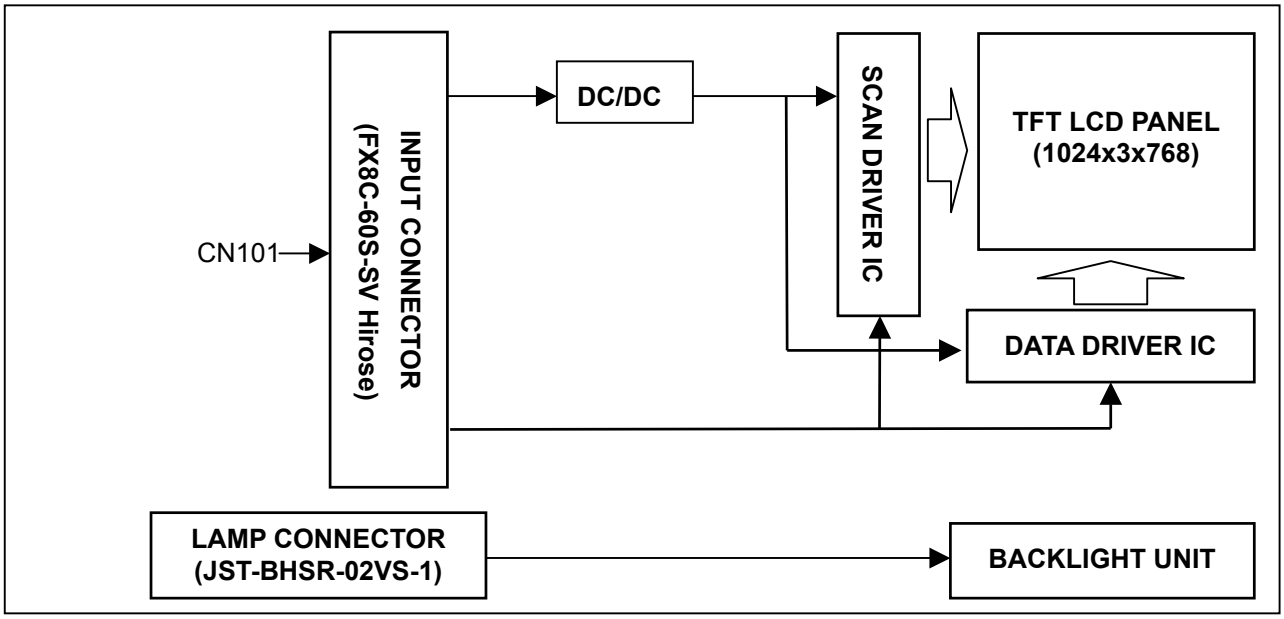
(a) When the brightness becomes ≤ 50% of its original value.

(b) When the effective ignition length becomes ≤ 80% of its original value. (Effective ignition length is defined as an area that the brightness is less than 70% compared to the center point.)

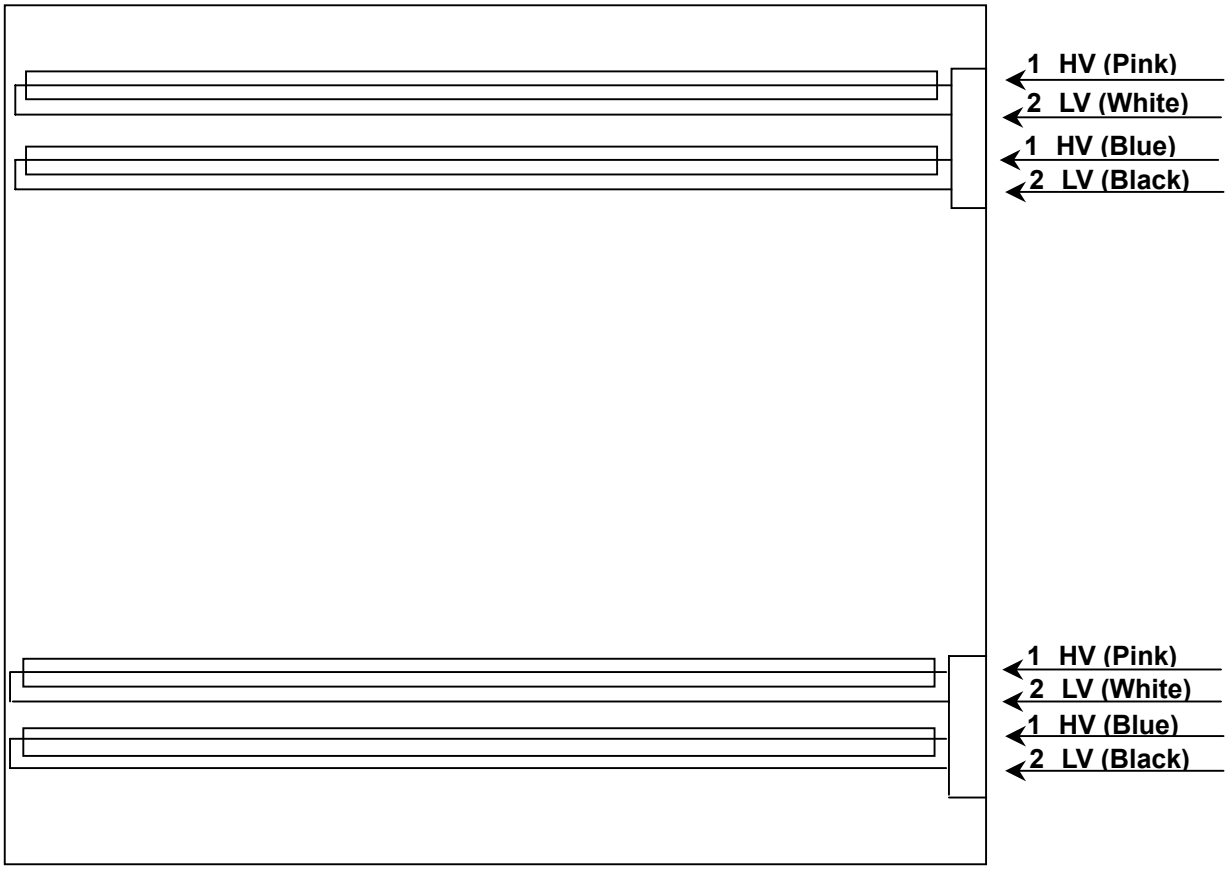
Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid generating too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

CN101			
Pin	Symbol	I/O	Function
1	GND	-	GND
2	D55	I	*
3	D53	I	*
4	D51	I	*
5	D45	I	*
6	D43	I	*
7	D41	I	*
8	D35	I	*
9	D33	I	*
10	D31	I	*
11	CKH	I	For transfer the Shift Register Data Clock input. Write the data register at the rising edge. CKH should be input continuously.
12	POL	I	POL="L" : The reference voltages for Odd number outputs are GMA1~GMA5 Even number outputs are GMA6~GMA10 POL="H" : The reference voltages for Odd number outputs are GMA6~GMA10 Even number outputs are GMA1~GMA5
13	REV1	I	Select the input data invert or not REV1: For port 1 inverting control REV2: For port 2 inverting control REV1,2="H": Data are inverted REV1,2="L": Data are not inverted
14	D24	I	*
15	D22	I	*
16	D20	I	*
17	D14	I	*
18	D12	I	*
19	D10	I	*
20	D04	I	*
21	D02	I	*
22	D00	I	*
23	GVOFF	I	3 scan control signal
24	STV	I	Vertical shift data control signal
25	SELPOL	I	H: dot inversion. L: 2-line inversion
26	GND	-	GND
27	GND	-	GND
28	VDD	I	For supply digital power to the device
29	VDD	I	
30	VDD	I	
31	VDD	I	
32	VDD	I	
33	GND	-	GND
34	GND	-	GND
35	IDREV	O	TN, MVA Panel Set. IDREV=H, MVA panel, IDREV=L, TN panel
36	CKV	I	Vertical shift clock. This is the shift clock for the shift registers. Data is shifted though the shift registers synchronously with the rising edge of CKV
37	OE	I	Output enable pins. This signals control the data appearing at the LCD panel drive pins. The VGH/L voltage is output when OE are high; normal shift data is output when OE are low.

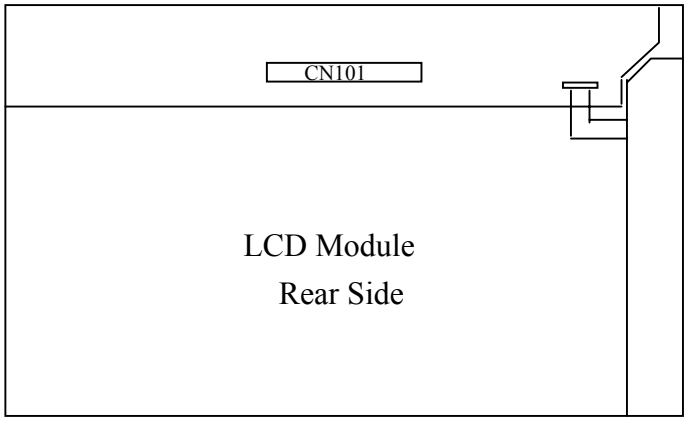
38	GVON	I	3 scan control signal
39	STH	I	For Start Pulse I/O of internal Shift Register
40	D01	I	*
41	D03	I	*
42	D05	I	*
43	D11	I	*
44	D13	I	*
45	D15	I	*
46	D21	I	*
47	D23	I	*
48	D25	I	*
49	REV2	I	Select the input data invert or not REV1: For port 1 inverting control REV2: For port 2 inverting control REV1,2="H": Data are inverted REV1,2="L": Data are not inverted
50	STB	I	Latch the contents of the data register and transfer to D/A converter at the rising edge and output gray scale voltage at falling edge.
51	D30	I	*
52	D32	I	*
53	D34	I	*
54	D40	I	*
55	D42	I	*
56	D44	I	*
57	D50	I	*
58	D52	I	*
59	D54	I	*
60	GND	-	GND

Note(1)* For Data input

Input gray scale data (6 bit) multiple 2 pixels (6 dot) 36 bit length image data Dn0: LSB, Dn7: MSB

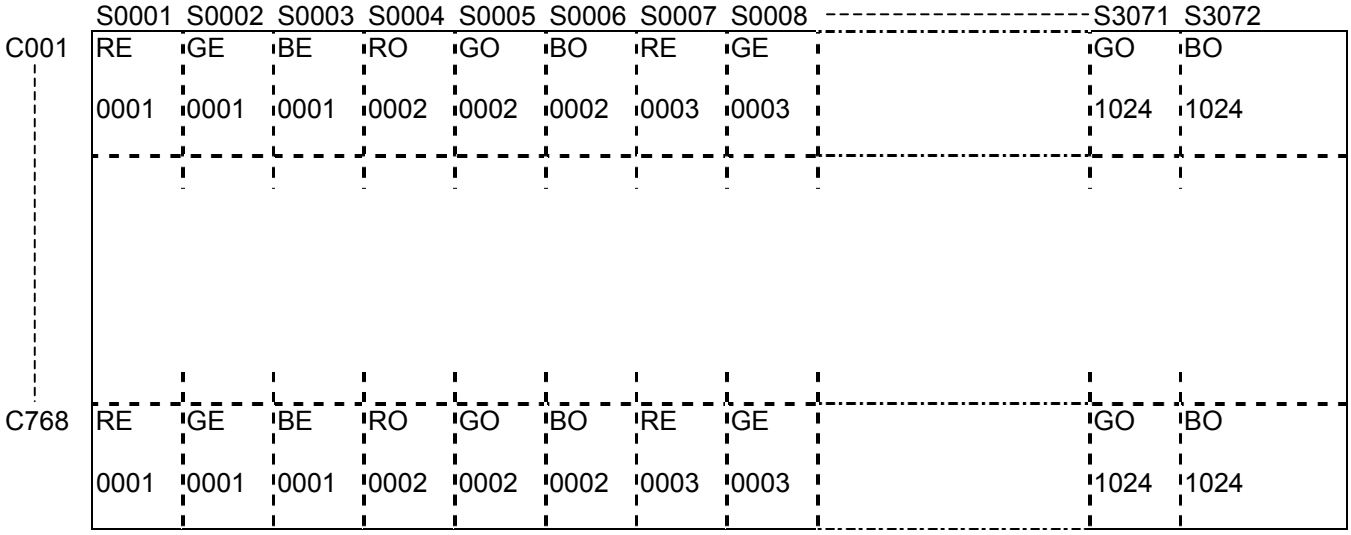
Note (2) Matching Connector Part No.: FX8C-60P-SV2 or equivalent

Upper Side



Lower Side

Correspondence between Data and Display Position



5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Color
1	HV1	High Voltage	Pink/ Blue
2	LV	Ground	White/ Black

Note (1) Connector Part No.: BHSR-02VS-1 (JST) or equivalent

Note (2) Matching Connector Part No.: SM02B-BHS-1-TB (JST) or equivalent

5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
Gray Scale Of Red	Red(0) / Dark	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	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	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	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	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	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

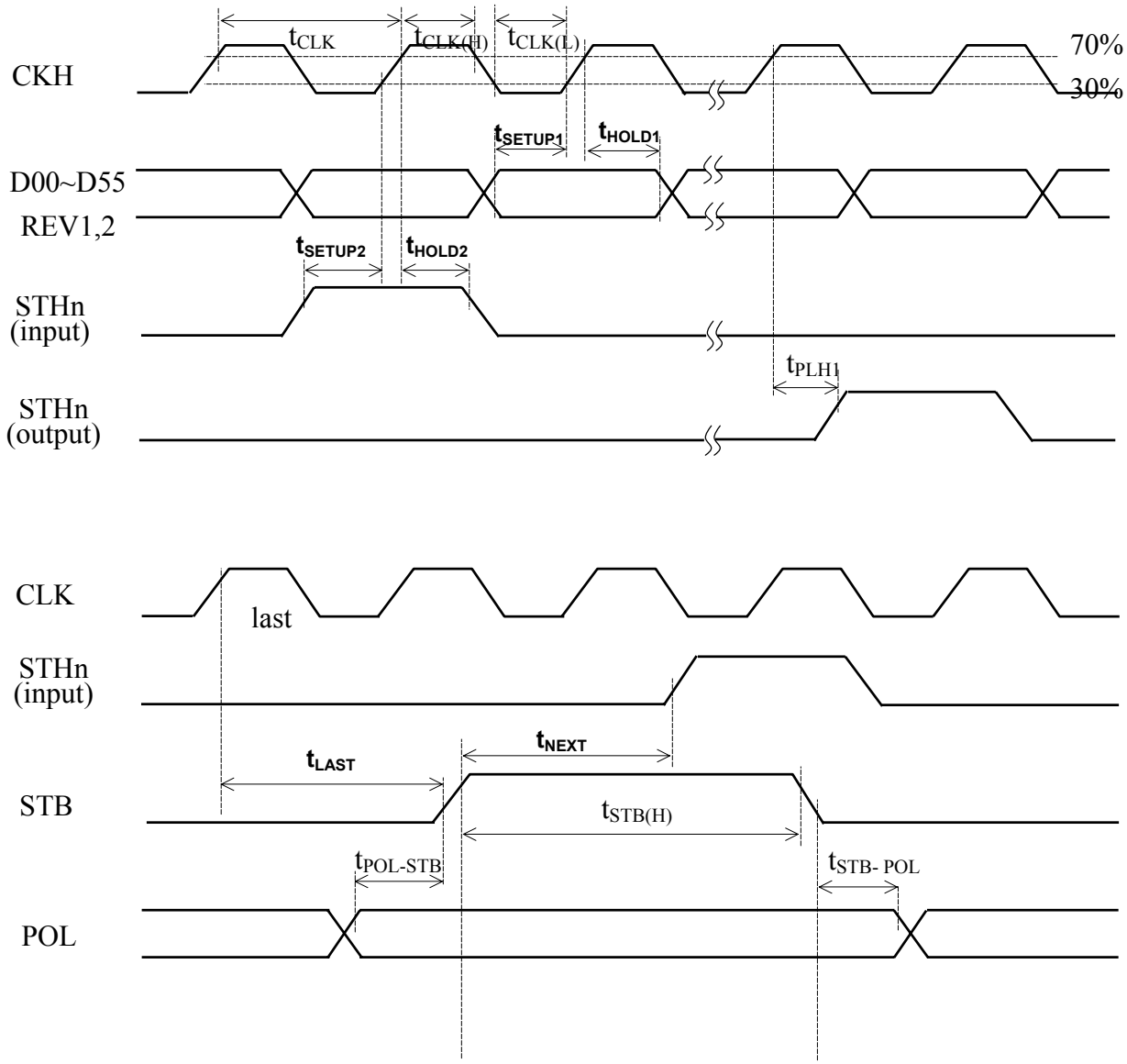
6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

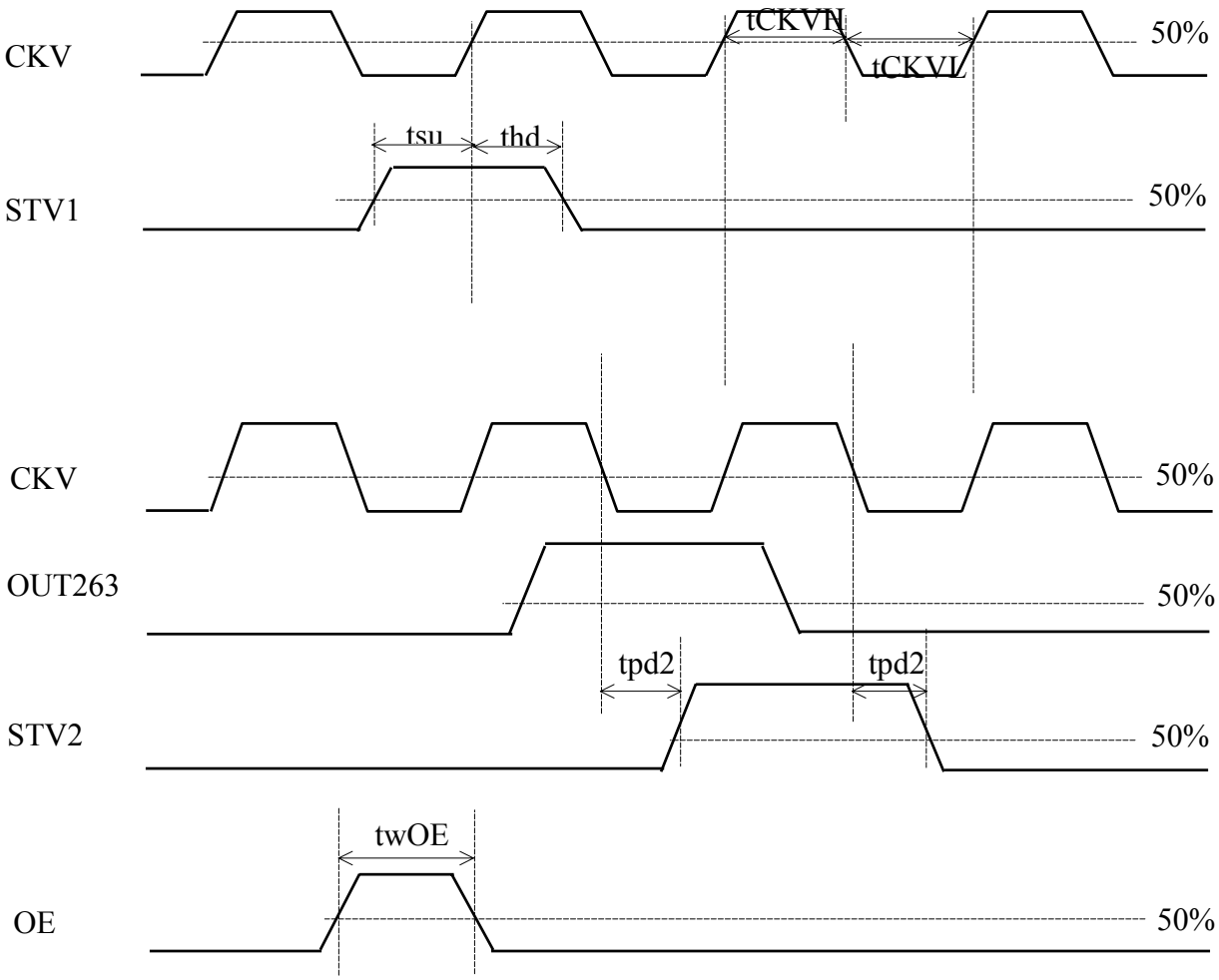
The input signal timing specifications are shown as the following table and timing diagram.

Parameter	Symbol	Condition	Spec			Unit
			Min.	Typ.	Max.	
Clock pulse width	t_{CKH}		22			ns
Clock pulse low period	$t_{CKH(L)}$		6			ns
Clock pulse high period	$t_{CKH(H)}$		6			ns
Data & INV setup time	t_{SETUP1}		6			ns
Data & INV hold time	t_{HOLD1}		6			ns
Start pulse setup time	t_{SETUP2}		6			ns
Start pulse hold time	t_{HOLD2}		6			ns
Start pulse delay time	t_{PLH1}	CL=25pF		10	15	ns
STB high period	$t_{STB(H)}$		200			ns
Last data CLK to STB high	t_{LAST}		1			CLK
STB high to STHn high	t_{NEXT}		2			CLK
POL to STB setup time	$t_{POL-STB}$	POL toggle to STB rising	-5			
STB to POL hold time	$t_{STB-POL}$	STB falling to POL toggle	6			
Output delay time 1	t_{PD1}	Note 1, LPC is open			5	μs
Output delay time 2	t_{PD2}	Note 1, LPC is open			12	μs

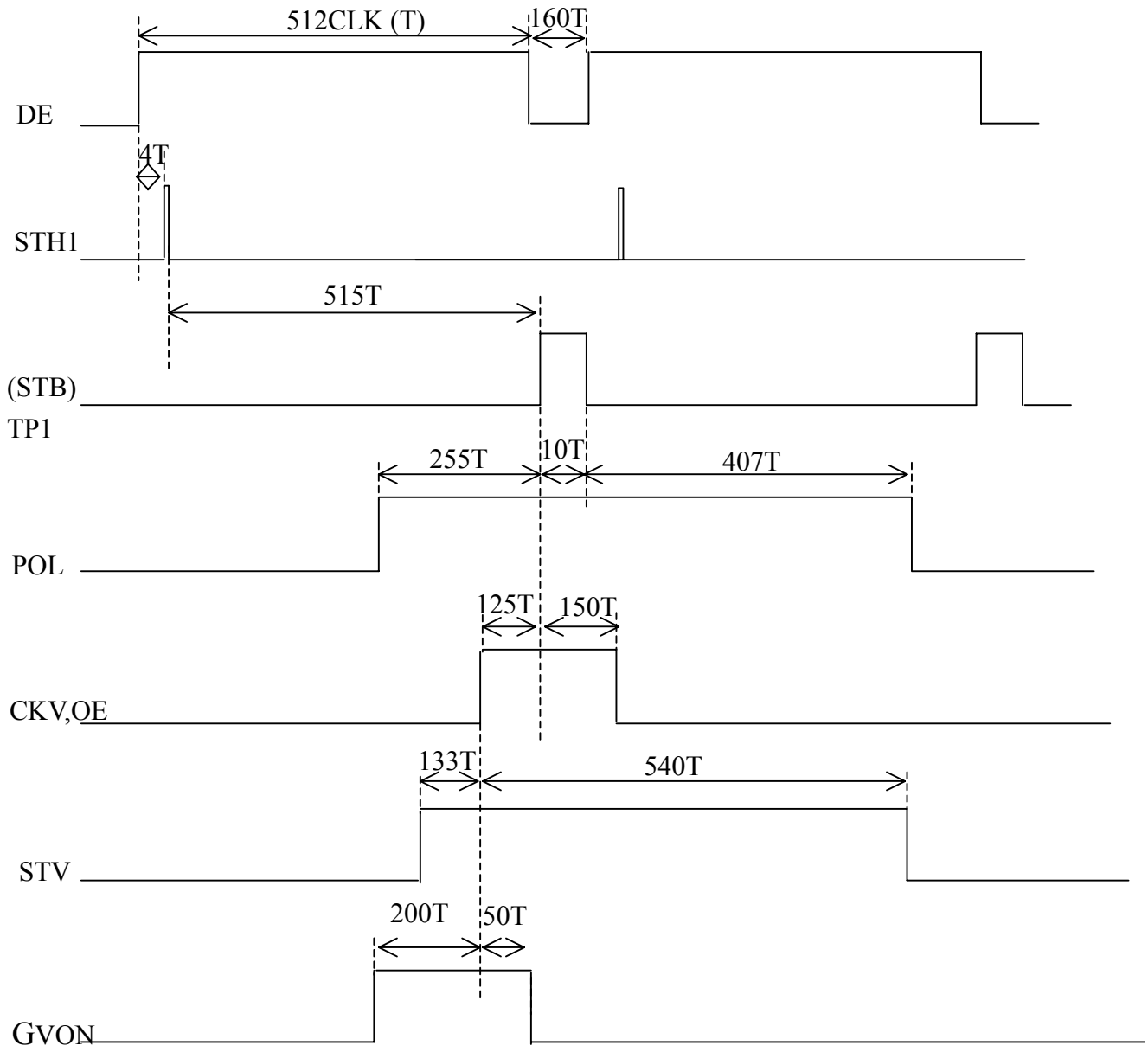
Parameter	Symbol	Condition	Spec		Unit
			Min.	Max.	
Operation frequency	tCKV		5		μs
CKV pulse width	tCKVH, tCKVL	50% duty cycle	2.5		
OE pulse width	twOE		1		
Data setup time	tsu		700		ns
Data hold time	thd		700		
Output delay time (1)	tpd1	CL=300pF		1000	
Output delay time (2)	tpd2	CL=30pF		800	
Output delay time (3)	tpd3	CL=300pF		800	
Output delay time (3)	tpd4	CL=300pF		3000	



Note: The measurement point for all of above signals is at 50% of input/output amplitude.

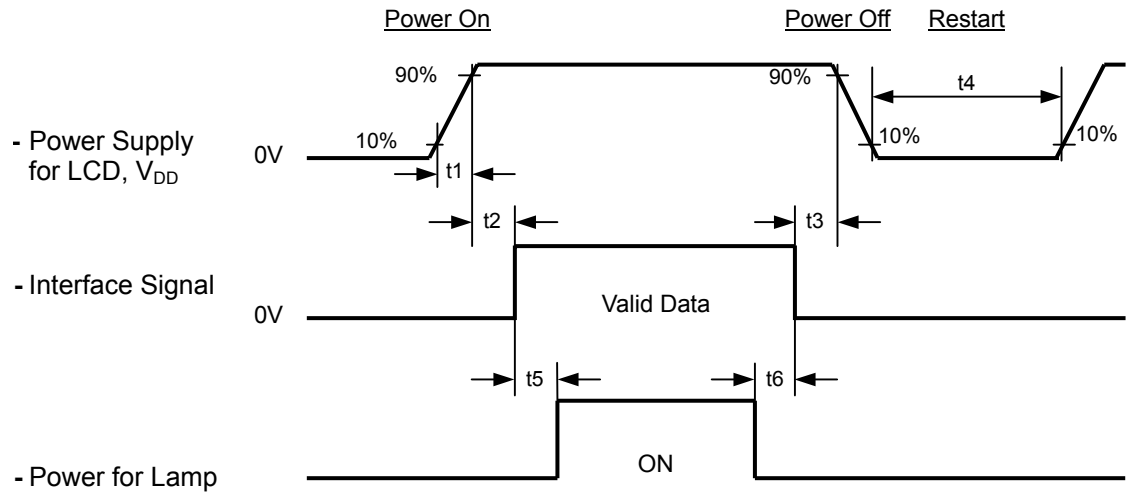


Timing Relation Corresponds to DE



GVOFF=~ GVON

6.2 POWER ON/OFF SEQUENCE



Timing Specifications:

0 < t1 ≤ 10 msec

0 < t2 ≤ 50 msec

0 < t3 ≤ 50 msec

t4 ≥ 1 sec

t5 ≥ 100 msec

t6 ≥ 100 msec

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD V_{DD} to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

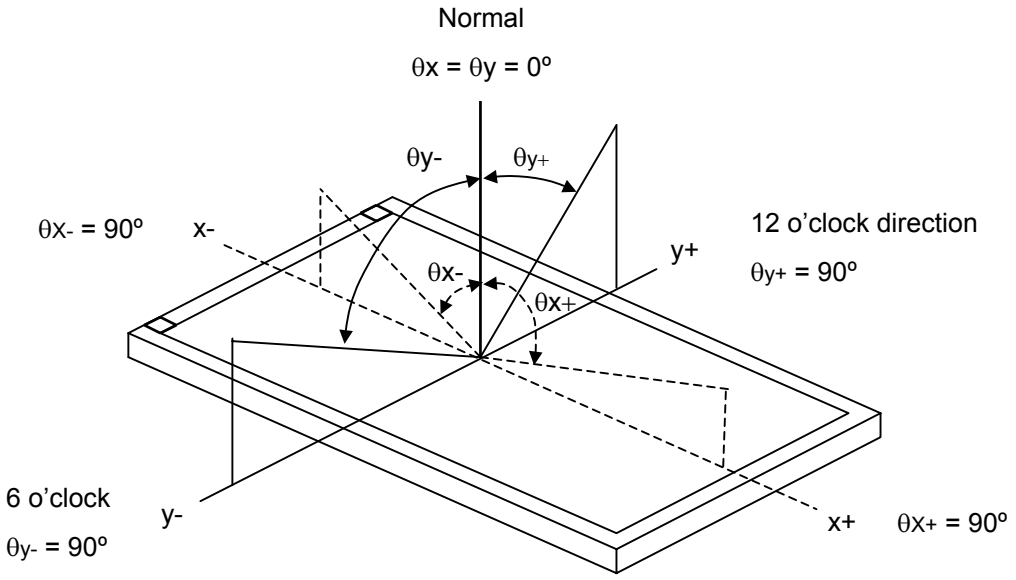
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{DD}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	5.5	mA

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in Note (4).

7.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_x=0°, θ_Y =0° Viewing Normal Angle	250	300	-	-	(2), (4)
Response Time		T_R		-	7	22	ms	(3)
		T_F		-	23	38	ms	
Center Luminance of White		L		200	250	-	cd/m^2	(4)
Color Chromaticity	Red	Rx		0.607	0.637	0.667	-	(1), (4)
		Ry		0.323	0.353	0.383	-	
	Green	Gx		0.272	0.302	0.332	-	
		Gy		0.558	0.588	0.618	-	
	Blue	Bx		0.111	0.141	0.171	-	
		By		0.064	0.094	0.124	-	
	White	Wx		0.280	0.310	0.340	-	
		Wy		0.300	0.330	0.360	-	
Viewing Angle	Horizontal	θ_x+		50	60	-	Deg.	
		θ_x-		50	60	-		
	Vertical	θ_Y+		30	40	-		
		θ_Y-		50	60	-		

Note (1) Definition of Viewing Angle (θx, θy):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

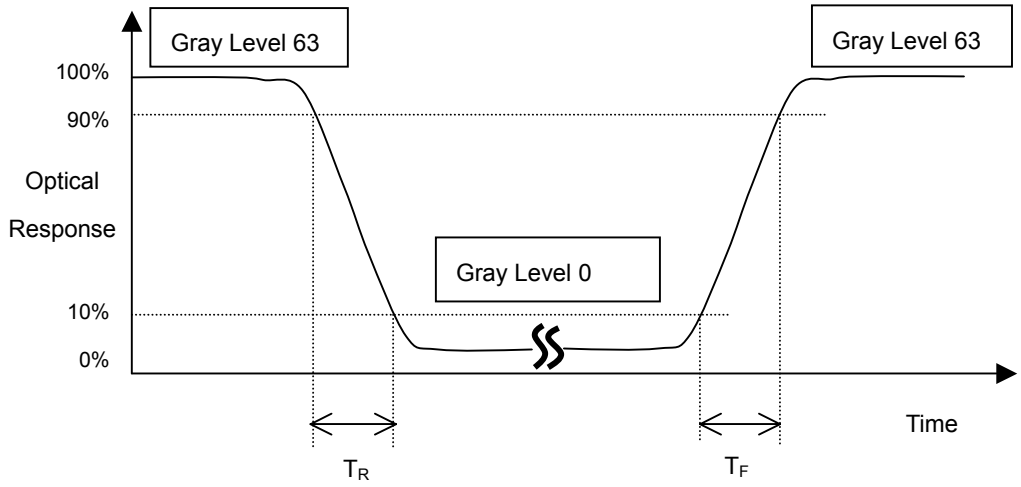
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (5)

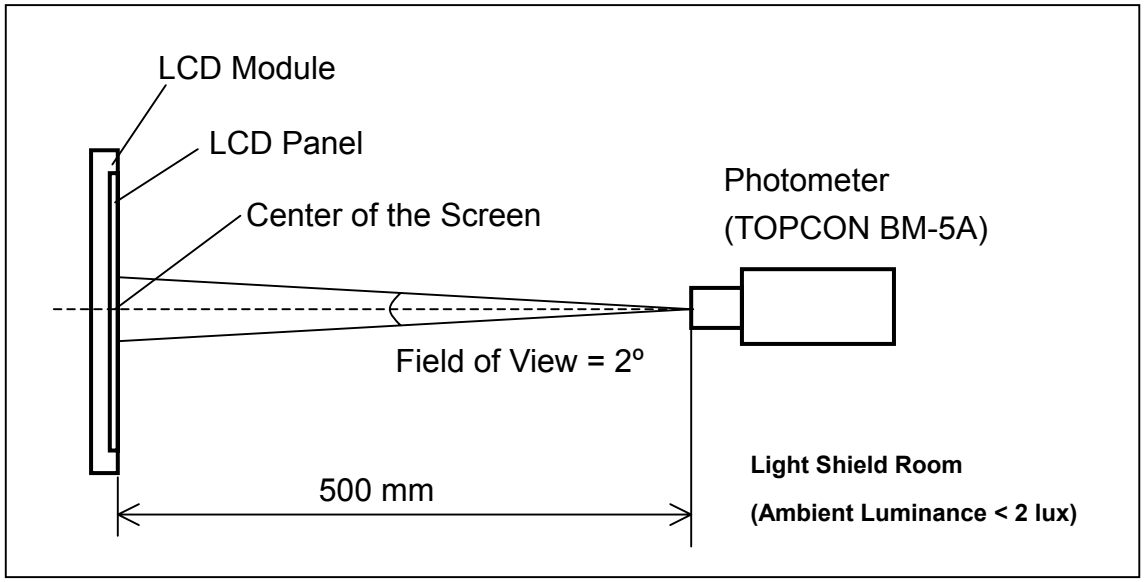
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

Note (3) Definition of Response Time (T_R, T_F):

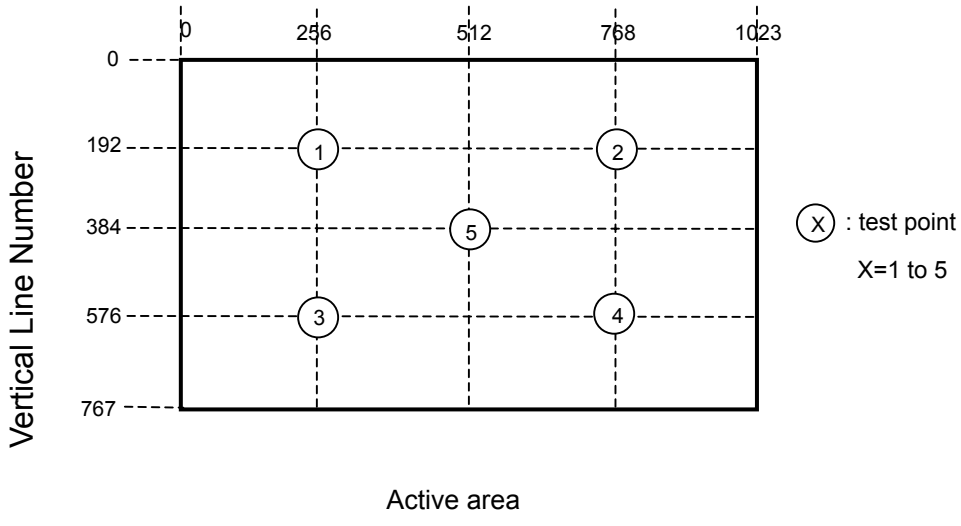


Note (4) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (5) Definition of luminance uniformity measured points:



8. PRECAUTIONS

8.1 HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.

(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.

(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

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

(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(9) Do not disassemble the module.

(10) Do not pull or fold the lamp wire.

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

8.2 STORAGE PRECAUTIONS

(1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.

(3) It may reduce the display quality if the ambient temperature is lower than 10 ºC. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

8.3 OPERATION PRECAUTIONS

(1) Do not pull the I/F connector in or out while the module is operating.

(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while

assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

9. PACKAGING

9.1 PACKING SPECIFICATIONS

(1) 5 LCD modules / 1 Box

(2) Box dimensions : 353(L) X 268(W) X 462(H) mm

(3) Weight : approximately 8.5Kg (5 modules per box)

9.2 PACKING Method

Figures 9-1and 9-2 are the packing method.

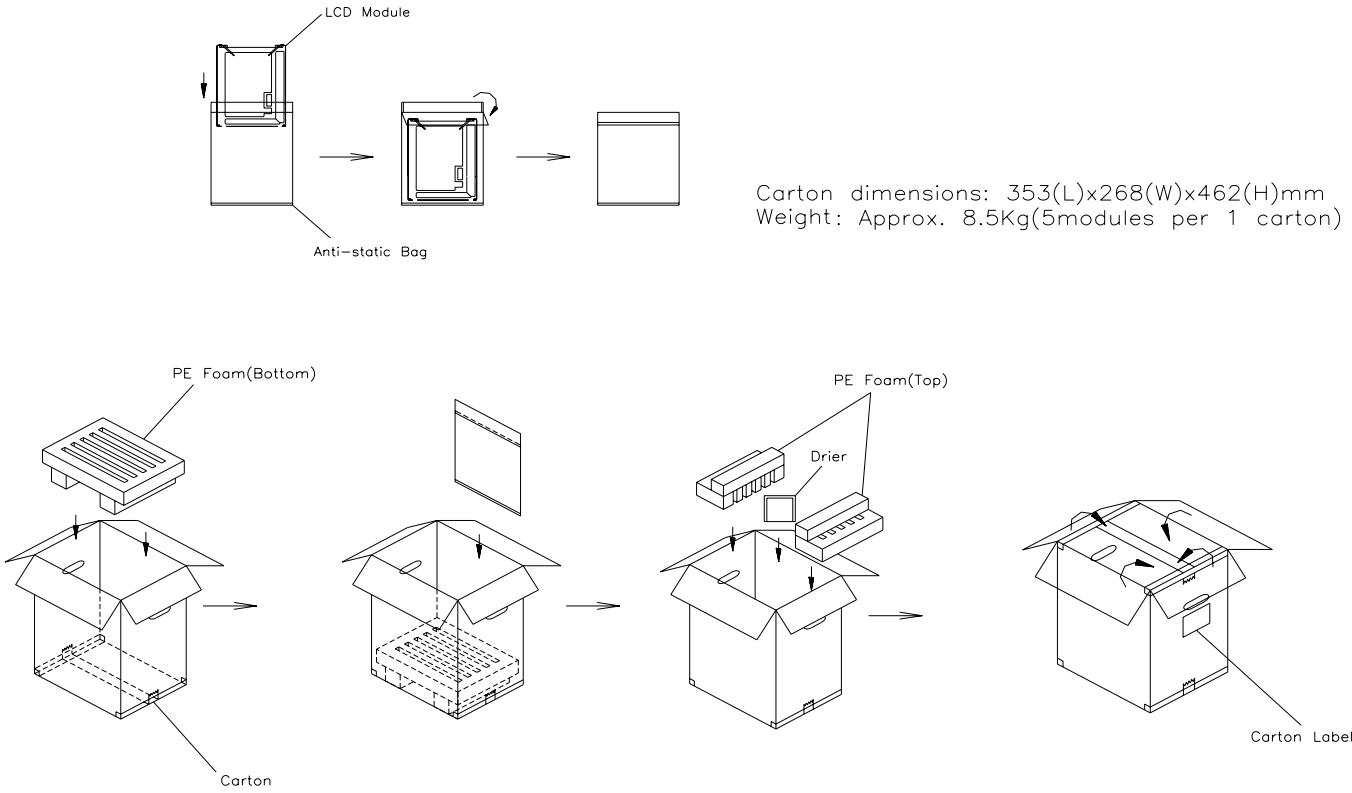


Figure. 9-1 Packing method

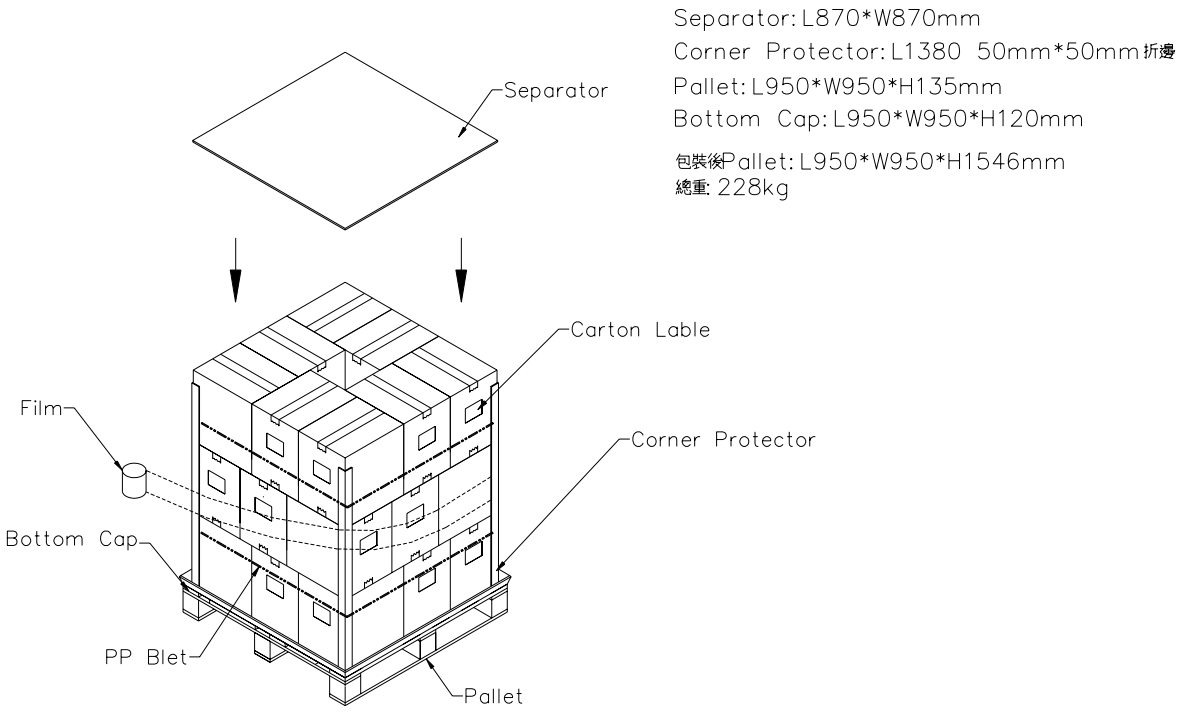


Figure. 9-2 Packing method

10. INCOMING INSPECTION DAY

The Supplier should be acquainted the inspection results (acceptance or rejection) by Customer, and the results are in accordance with the incoming inspection standard within 30 days after the date of the bills of lading. Should Customer fail to so notify the Supplier within the said 30 days period. The Customer's right to reject the LCMS shall then lapse, and the said LCMS shall be deemed to have been accepted by the customer.

11. DEFINITION OF LABELS

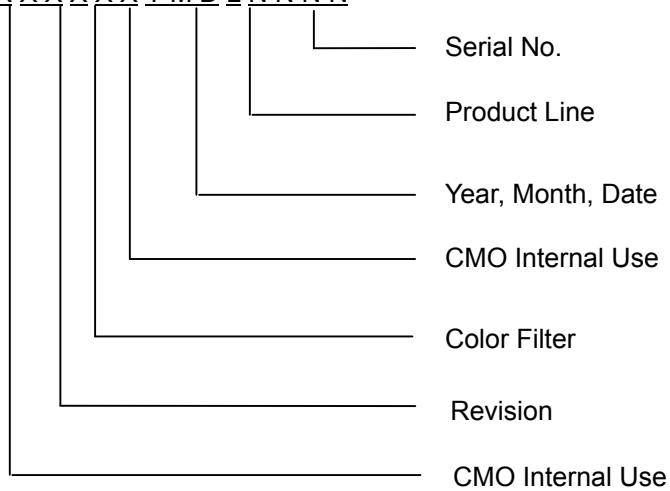
11.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

(a) Model Name: M150X3 –S07

(b) Revision: Rev. XX, for example: C1, C2 …etc.

(c) Serial ID: X X X X X X X Y M D L N N N N



Serial ID includes the information as below:

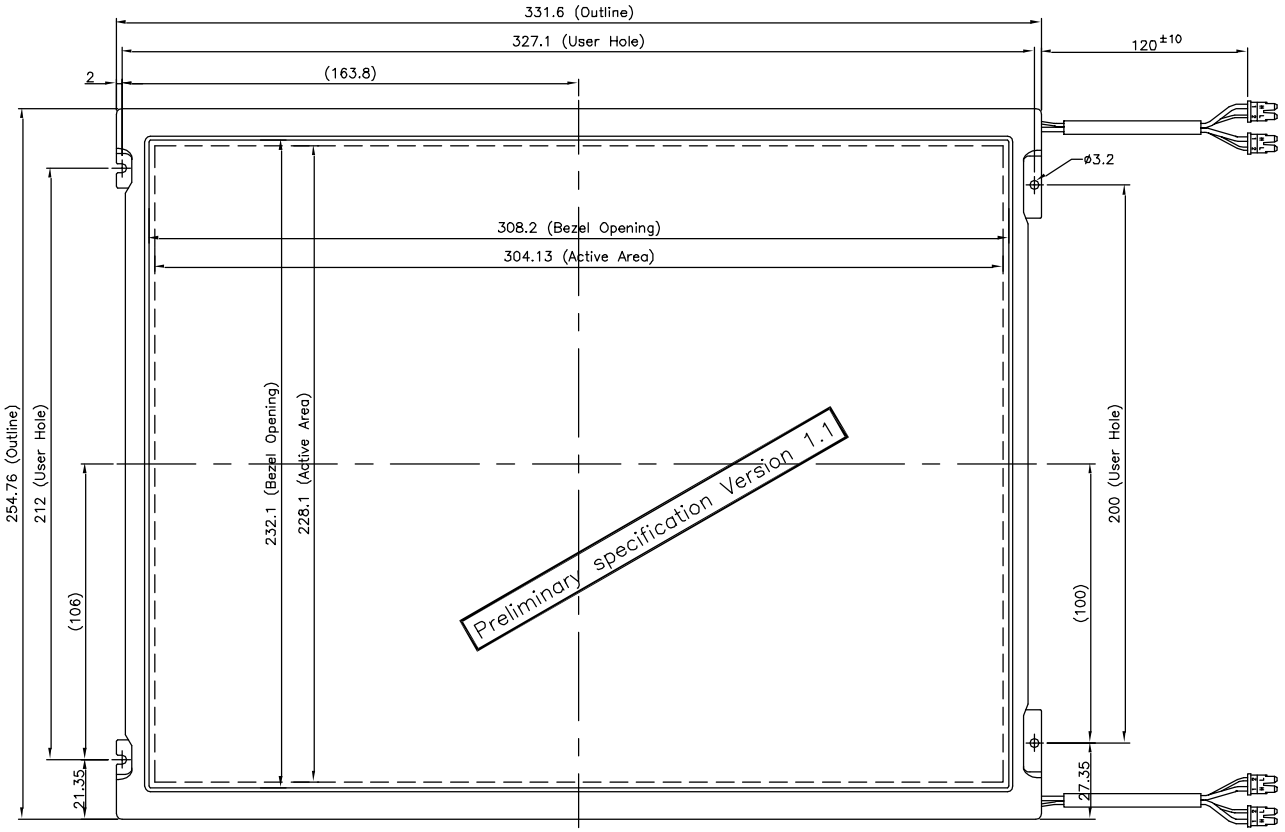
(a) Manufactured Date: Year: 1~9, for 2000~2009
Month: 1~9, A~C, for Jan. ~ Dec.
Day: 1~9, A~Y, for 1st to 31st, exclude I and O

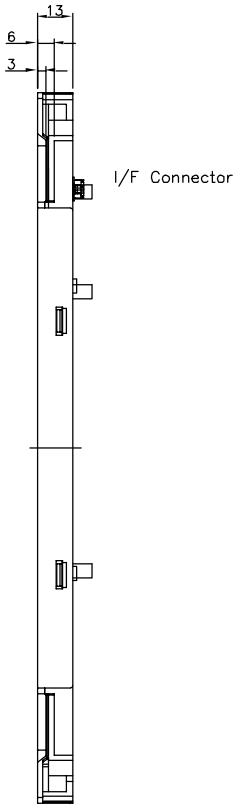
(b) Revision Code: cover all the change

(c) Color Filter: 0 ->CMO, 2 -> Toppan

(d) Serial No.: Manufacturing sequence of product

(e) Product Line: 1 -> Line1, 2 -> Line 2, …etc.

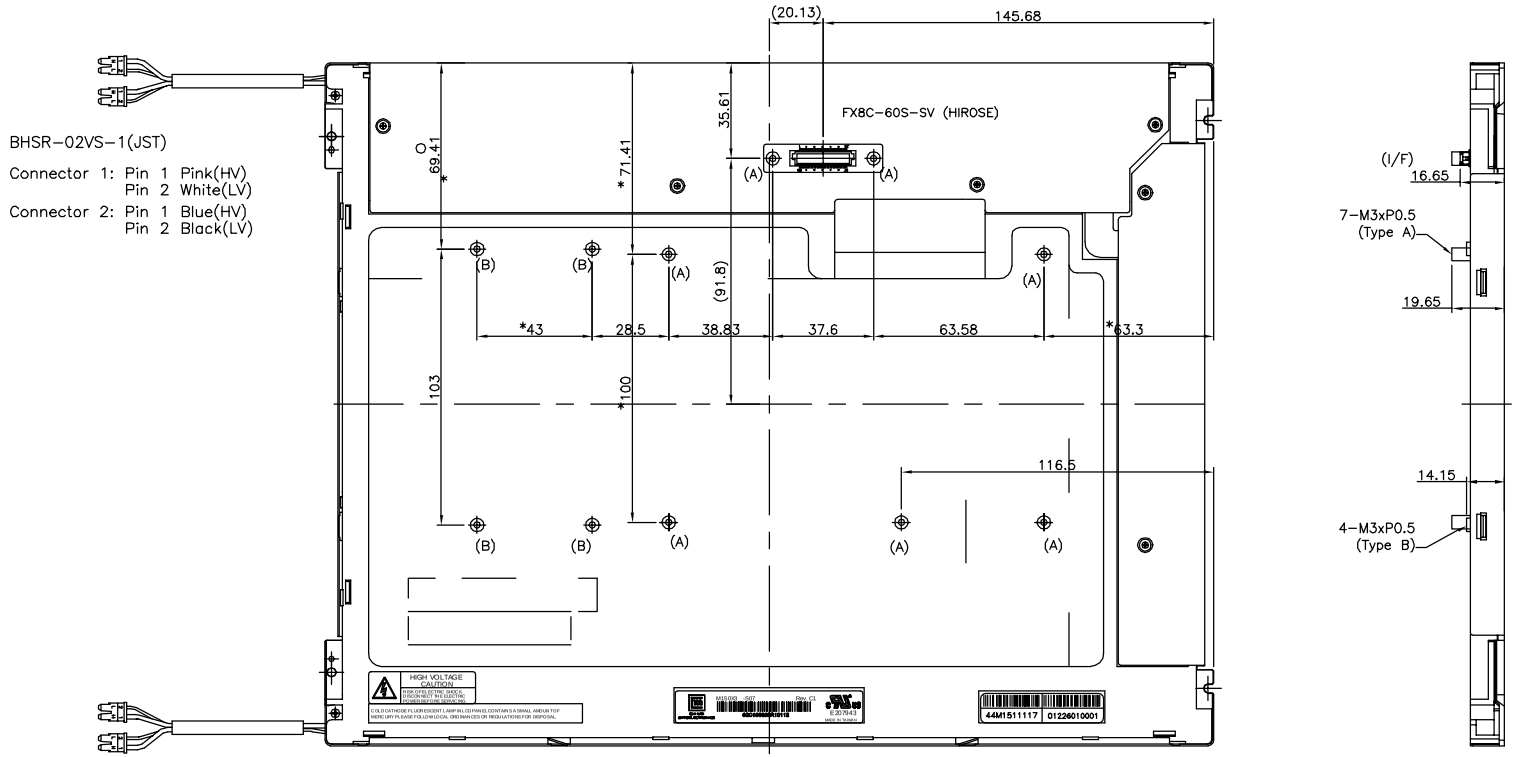




NOTES:
1. GENERAL TOLERANCE: ±0.5

CHI MEI
OPTOELECTRONICS CORP.

APPROVED: JACK FAN	DWG NO.: M150141133				
CHECKED: DAVID LIN	DATE: 09/07/2001				
DESIGNER: DAVIS WANG	PART NO.:				
DRAWER: DAVIS WANG	REV.: 3	UNIT:	SCALE:	SHEET:	
TITLE: Outline M150X3-S07		MM	1:2	1/2	



NOTES:
1. GENERAL TOLERANCE: ±0.5
2. INSERT BOSS TORQUE 2.0~2.5kgf-cm

CHI MEI
OPTOELECTRONICS CORP.

APPROVED: JACK FAN	DWG NO.: M150141133				
CHECKED: DAVID LIN	DATE: 09/07/2001				
DESIGNER: DAVIS WANG	PART NO.:				
DRAWER: DAVIS WANG	REV.: 3	UNIT:	SCALE:	SHEET:	
TITLE: Outline M150X3-S07		MM	1:2	2/2	