INNOLUX DISPLAY CORPORATION

BT101IW03 V.1 LCD MODULE SPECIFICATION

( ) Preliminary Specification
(●) Final Specification

Customer	Checked & Approved by

Approved by	Checked by	Prepared by
MKT	PD	PM
		Annie Lu

Date: 2009/12/04

Innolux Display Corporation

No.160 Kesyue Rd., Chu-Nan Site, Hsinchu Science Park,

Chu-Nan 350, Miao-Li County, Taiwan

Tel: 886-37-586000 Fax: 886-37-586060

Record of Revision

Version	Revise Date	Page	Content
0.0	2009/08/06	All	First Edition issued
0.1	2009/08/21	1	Add LED usage information: 27EA
		13	Add LED circuit block information
0.2	2009/12/04	23	Change EDID Freq. to 54.2MHz

1. General Specifications

NO.	Item	Specification	Unit
1	Display resolution (pixel)	1024(H) X 600(V), SD resolution	
2	Active area	222.72(H) X 125.28(V)	mm
3	Screen size	10.1 inches diagonal	Inches
4	Pixel pitch	217.5x208.8	um
5	Color configuration	R, G, B vertical stripe	
6	Overall dimension	235 (W) X 143(H) X 5.2(D) (max)	mm
7	Weight	190Max.	Grams
8	Surface treatment	Anti-glare	
9	Input color signal	6 bit LVDS	
10	Display colors	262K (6 bit)	
11	Optimum viewing direction	6 o'clock	
12	Backlight	W-LED	
13	RoHS	RoHS compliance	

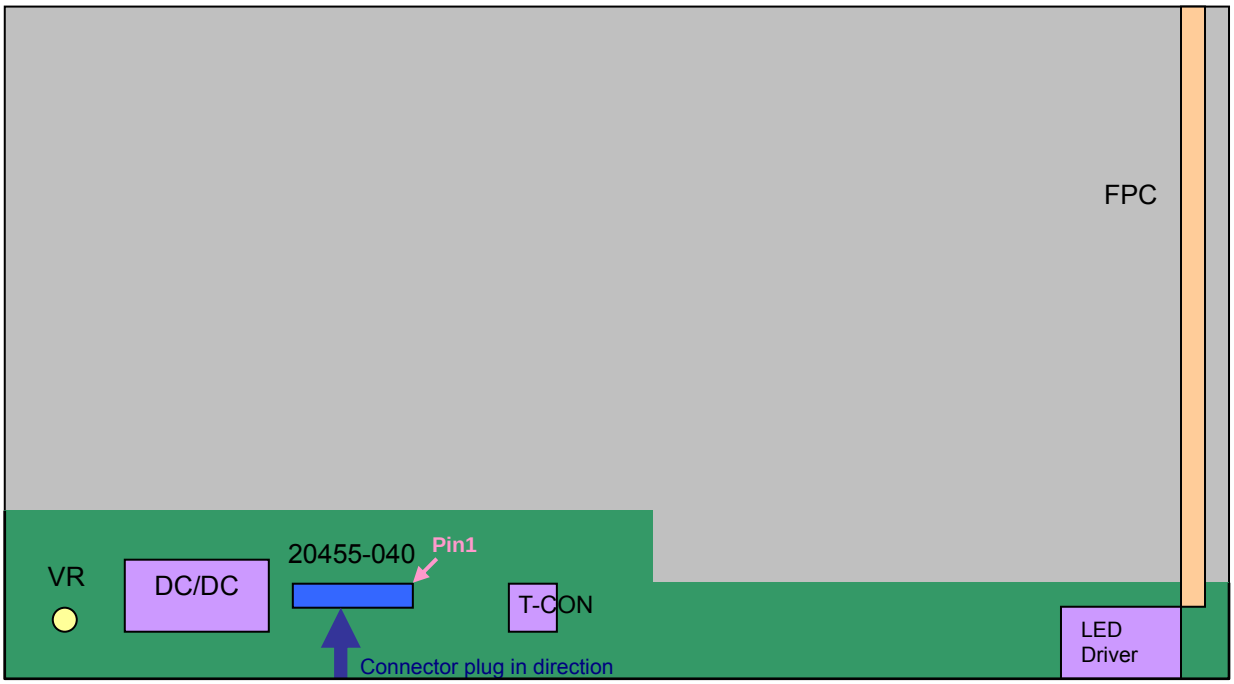
2. Electrical Specifications

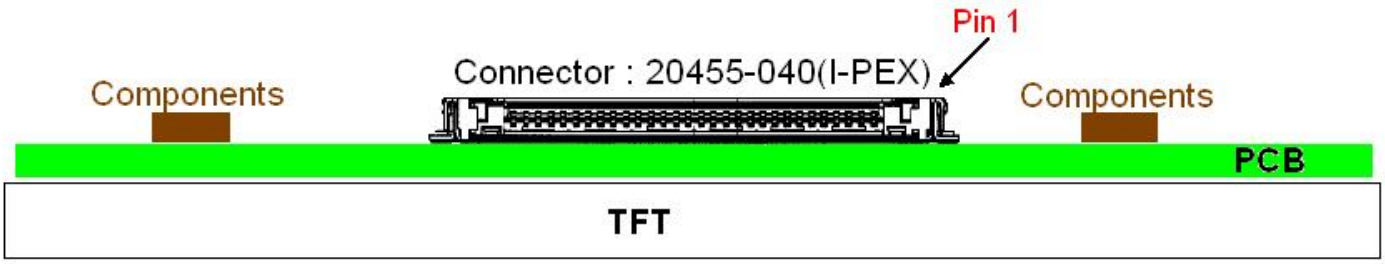
2-1 Pin Assignment

a. Panel connector
Connector Part No.: I-PEX 20455-040E or equivalent
User's connector Part No: I-PEX 20453-040T-11 or equivalent

PIN NO	Symbol	Description	Remark
1	DIAG_LOOP	Plug detection pin	
2	V_{CC}	Power Supply (+3.3V)	
3	V_{CC}	Power Supply (+3.3V)	
4	V_{EDID}	DDC Power +3.3V	
5	BIST	BIST function enable (+3.3V)	
6	Clk_{EDID}	DDC Clock	
7	$DATA_{EDID}$	DDC Data	
8	Rxin0-	Differential Data Input	R0~R5,G0
9	Rxin0+	Differential Data Input	
10	GND	Ground	
11	Rxin1-	Differential Data Input	G1~G5,B0,B1
12	Rxin1+	Differential Data Input	
13	GND	Ground	
14	Rxin2-	Differential Data Input	B2~B5,DE,Hsync,Vsync
15	Rxin2+	Differential Data Input	
16	GND	Ground	
17	CLK-	Differential Clock Input	
18	CLK+	Differential Clock Input	
19	NC	No connection (Reserve)	
20	NC	No connection (Reserve)	
21	NC	No connection (Reserve)	
22	NC	No connection (Reserve)	
23	NC	No connection (Reserve)	
24	NC	No connection (Reserve)	
25	NC	No connection (Reserve)	
26	NC	No connection (Reserve)	
27	NC	No connection (Reserve)	
28	NC	No connection (Reserve)	
29	NC	No connection (Reserve)	
30	NC	No connection (Reserve)	
31	LED_GND	LED Ground	
32	LED_GND	LED Ground	
33	LED_GND	LED Ground	
34	DIAG_LOOP	Plug detection pin	
35	LED_PWM	PWM dimming signal input	
36	LED_EN	LED enable pin (3.3V)	
37	NC	No connection (Reserve)	
38	V_LED	LED power supply 6.0V~20V	
39	V_LED	LED power supply 6.0V~20V	
40	V_LED	LED power supply 6.0V~20V	

b. General Block Diagram



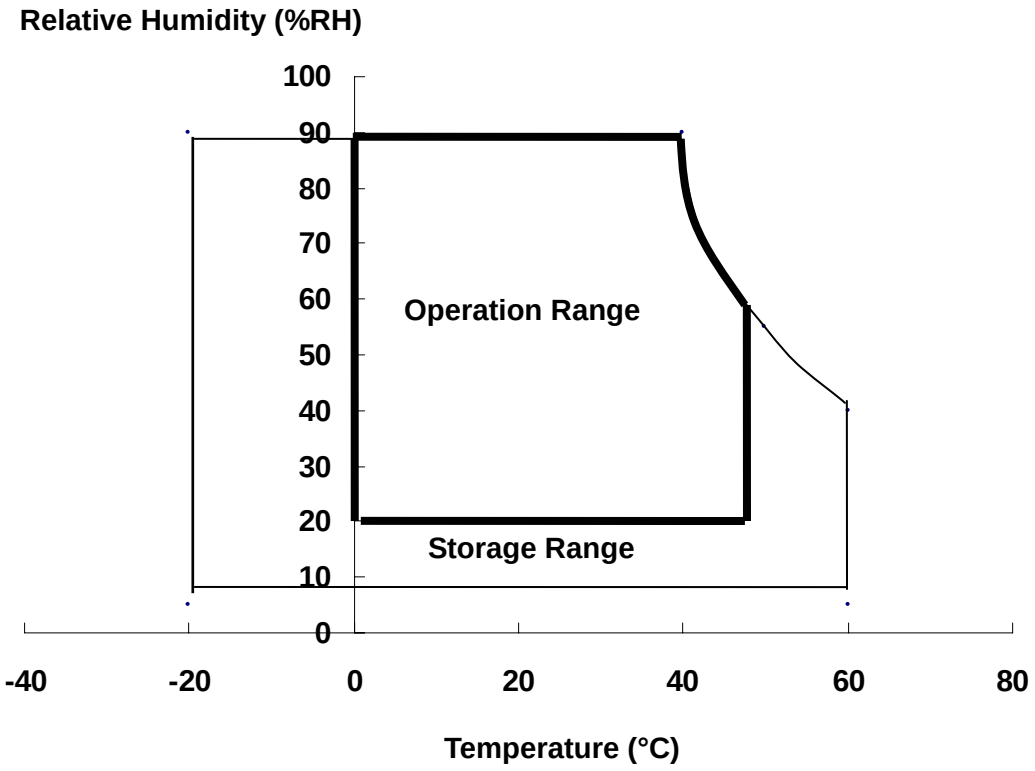


2-2. Absolute Maximum Ratings

Parameter	Symbol	Values		Unit	Remark
		Min.	Max.		
Power input voltage	V_{CC}	- 0.3	4.0	V	At 25°C
Input signal voltage	V_{IN}	- 0.3	4.0	V	At 25°C
LED input voltage	V_{LED}	- 0.3	30	V	At 25℃
Operating temperature	Top	0	50	°C	Note 1
Storage temperature	T_{ST}	- 20	60	°C	Note 2
Re-screw		-	5	Times	
Assured torque at side mount		-	2	kgf.cm	

Note 1: The relative humidity must not exceed 90%, non-condensing at temperatures of 40°C or less. At temperatures greater than 40°C, the wet bulb temperature must not exceed 39°C.

Note 2: The unit should not be exposed to corrosive chemicals.



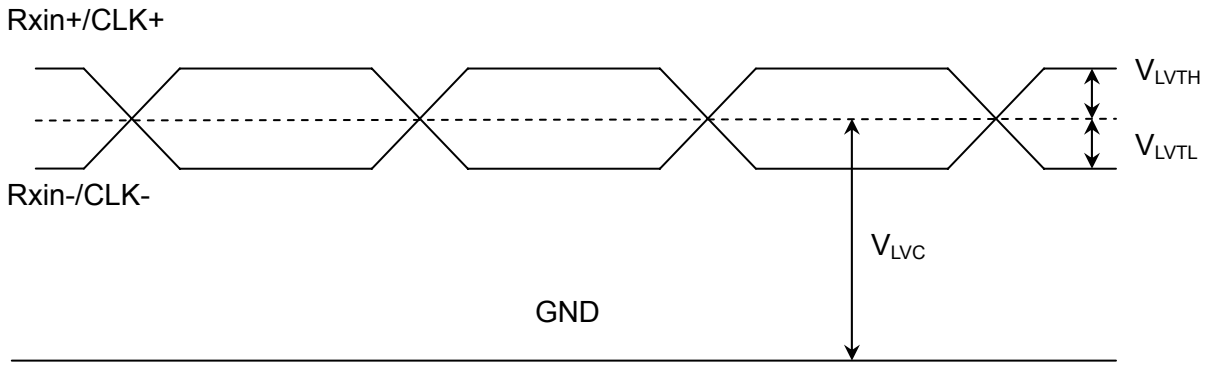
2-3. Electrical Characteristics

a. Typical operating conditions

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power input voltage		V_{CC}	3	3.3	3.6	V	
Permissive power input ripple		V_{RF}	-	-	0.1	V	
Power input current		I_{CC}	-	220	400	mA	Note 1
Power consumption		P_c	-	2.75	(3.15)	Watts	Note 1
LVDS interface	Differential input high threshold voltage	V_{LVTH}	-	-	+100	mV	V_{LVC}=1.2V, Note 2
	Differential input low threshold voltage	V_{LVTL}	-100	-	-	mV	V_{LVC}=1.2V, Note 2
	Common input voltage	V_{LVC}	1.0	1.2	1.4	V	Note 2
	Terminating resistor	R_T	90	100	110	ohm	
Rush current		I_{Rush}	-	-	1	A	Note 3
LED rush current		$I_{LED-Rush}$	-	-	2.0	A	Note 4

Note 1: The specified input current and power consumption are under the V_{cc} =3.3 V, 25°C, f_V=60Hz (frame frequency) condition whereas black pattern is displayed.

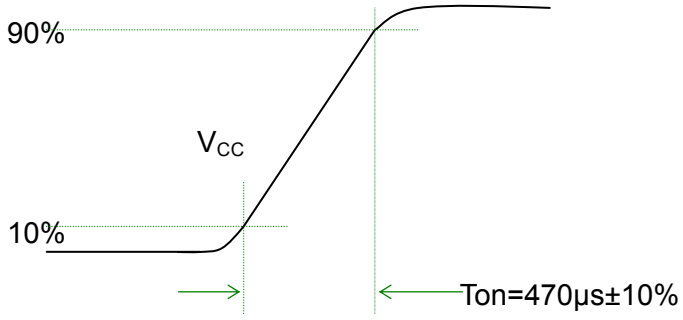
Note 2: LVDS waveform diagram



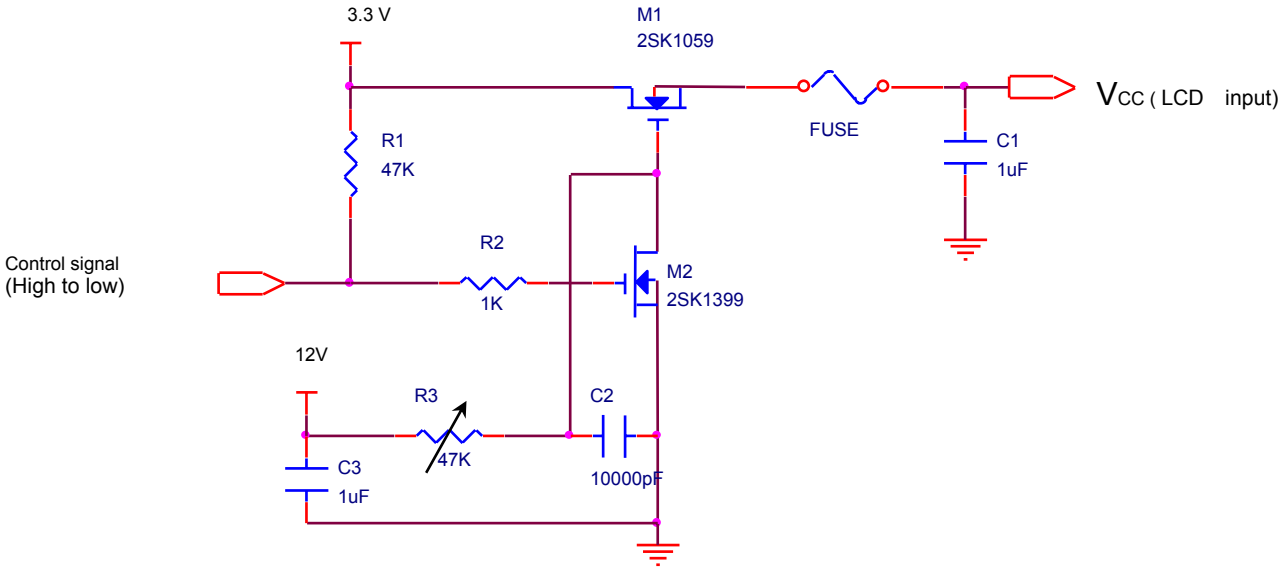
Note 3: Test condition

(1) Pattern: Black pattern

(2) V_{CC} = 3.3 V, V_{CC} rising time = 470 μs ± 10%



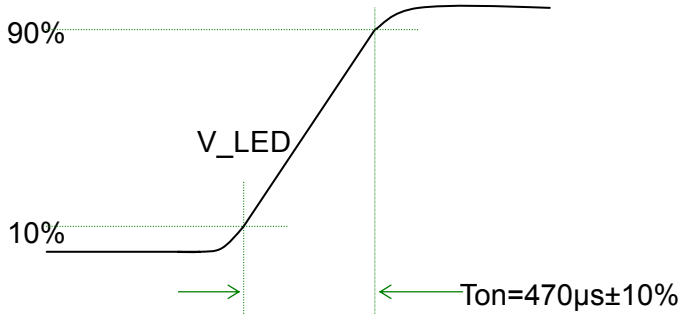
(3) Test circuit



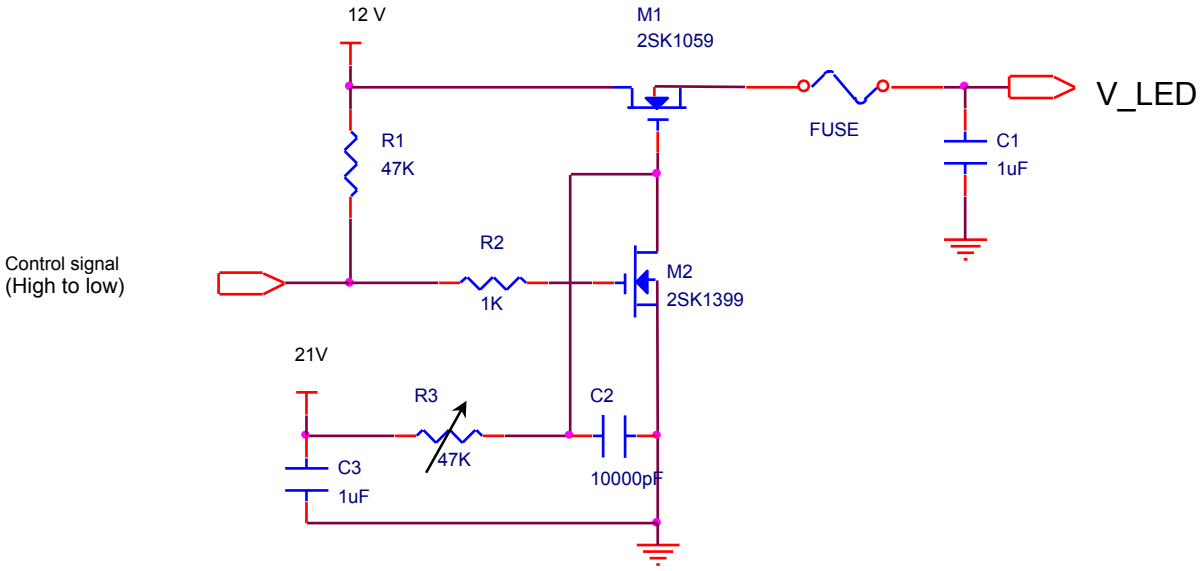
Note 4: Test condition

(1) LED duty 100%

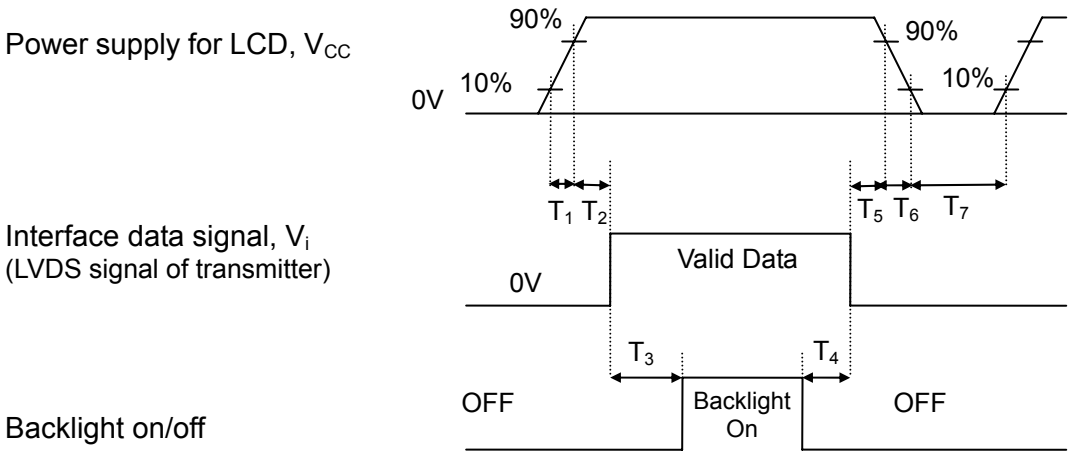
(2) V_LED = 12.0V, V_LED rising time = 470 μs ± 10%



(3) Test circuit



b. Power sequence

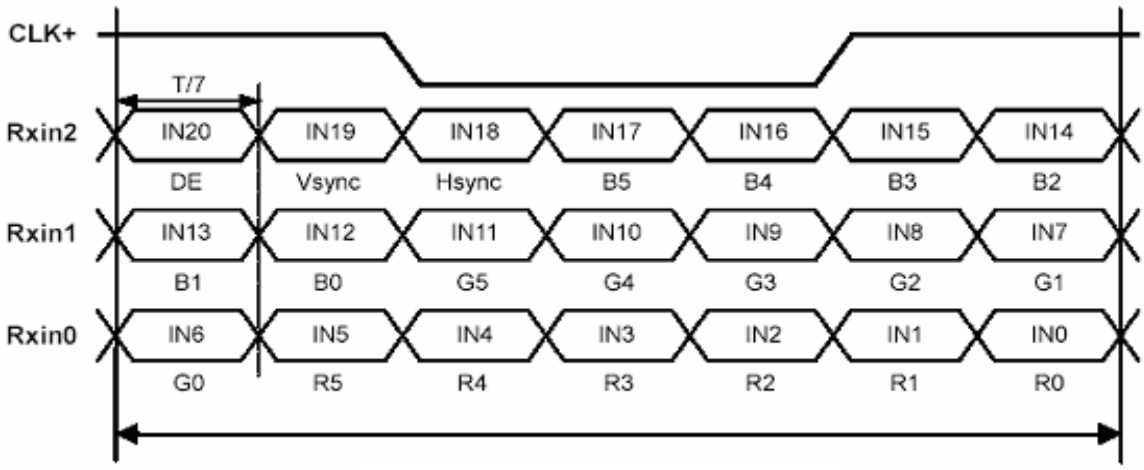


Power sequence timing table

Parameter	Value			Units
	Min.	Typ.	Max.	
T_1	0.5	-	10	ms
T_2	0	-	50	ms
T_3	200	-	-	ms
T_4	200	-	-	ms
T_5	0	-	50	ms
T_6	0	-	10	ms
T_7	400	-	-	ms

c. Display color vs. input data signals

Signal Name	Description	Remark
R5	Red Data 5 (MSB)	Red-pixel data. Each red pixel's brightness data consists of these 6 bits pixel data.
R4	Red Data 4	
R3	Red Data 3	
R2	Red Data 2	
R1	Red Data 1	
R0	Red Data 0 (LSB)	
	Red-pixel Data	
G5	Green Data 5 (MSB)	Green-pixel data. Each green pixel's brightness data consists of these 6 bits pixel data.
G4	Green Data 4	
G3	Green Data 3	
G2	Green Data 2	
G1	Green Data 1	
G0	Green Data 0 (LSB)	
	Green-pixel Data	
B5	Blue Data 5 (MSB)	Blue-pixel data. Each blue pixel's brightness data consists of these 6 bits pixel data.
B4	Blue Data 4	
B3	Blue Data 3	
B2	Blue Data 2	
B1	Blue Data 1	
B0	Blue Data 0 (LSB)	
	Blue-pixel Data	

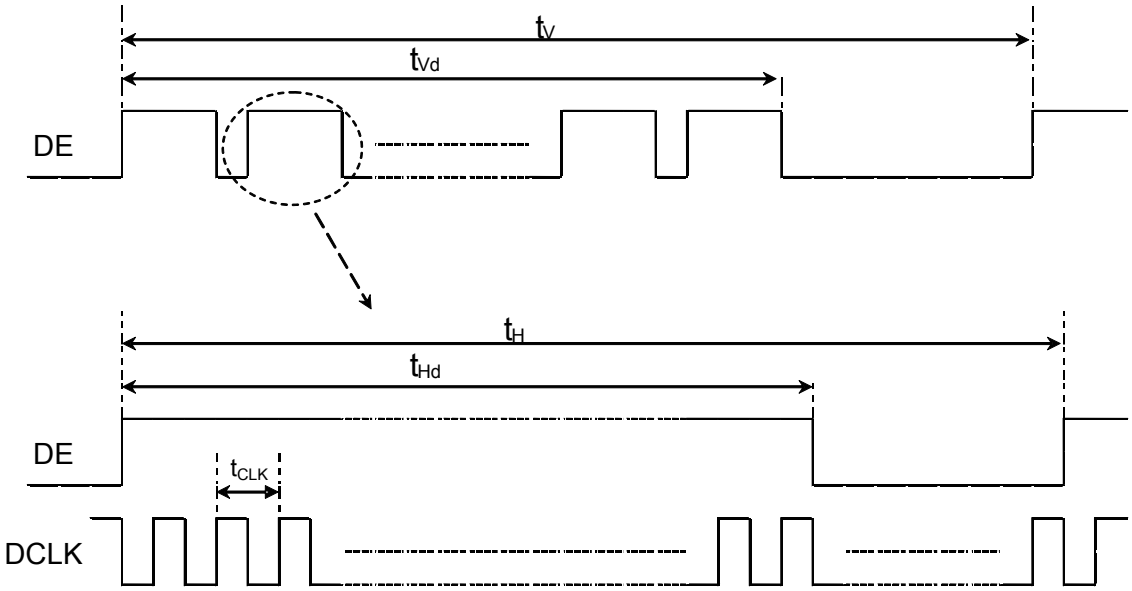


Signal for 1 DCLK cycle (t_{CLK})

d. Input signal timing

Timing table

Description	Symbol	Min	Typ	Max	Unit
Frame rate	--	---	60	---	Hz
Clock freq.	$1/t_{CLK}$	(40)	54.2	(60)	MHz
Line cycle time	t_H	(1054)	1440	(1600)	t_{CLK}
Line width-active	t_{Hd}	---	1024	---	t_{CLK}
Frame cycle time	t_V	(610)	628	(680)	t_H
V width-active	t_{Vd}	---	600	---	t_H



e. Display position

D(1, 1)	D(2, 1)	……	D(673, 1)	……	D(1023, 1)	D(1024, 1)
D(1, 2)	D(2, 2)	……	D(673, 2)	……	D(1023, 2)	D(1024, 2)
⋮		……	⋮	……	⋮	⋮
D(1, 384)	D(2, 300)	……	D(673, 384)	……	D(1023, 300)	D(1024, 300)
⋮		……	⋮	……	⋮	⋮
D(1, 767)	D(2, 599)	……	D(673, 599)	……	D(1023, 599)	D(1024, 599)
D(1, 768)	D(2, 600)	……	D(673, 600)	……	D(1023, 600)	D(1024, 600)

f. Backlight driving conditions

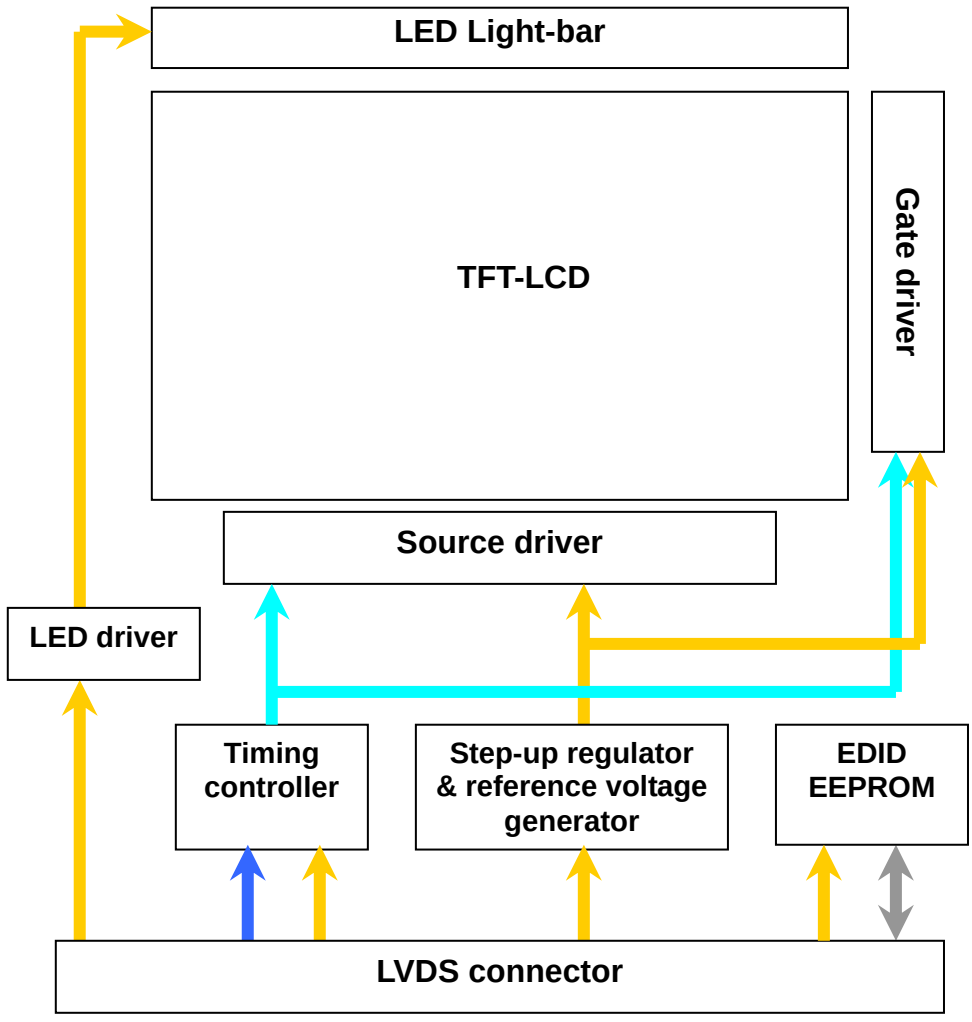
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED Forward Voltage	V_F	3	3.2	3.4	V_{rms}	T = 25°C, Note 1, 2
LED Forward Current	I_F		20		mA_{rms}	T = 25°C, Note 1, 2
LED Power consumption	P_{LED}		2.1	(2.3)	W	T = 25°C, Note 1, 2
Output PWM frequency	F_{PWM}	200	1000	2000	Hz	T = 25°C, Note 1, 2
Duty ratio	-	5		100	%	Note 1, 2
LED Life Time (LED only)	-	15,000			Hr	T = 25°C , Note 3

Note 1: The BL power consumption @100 nits with full white pattern under the V_{cc} =3.3 V, 25 ° C, f_V=60Hz (frame frequency) condition

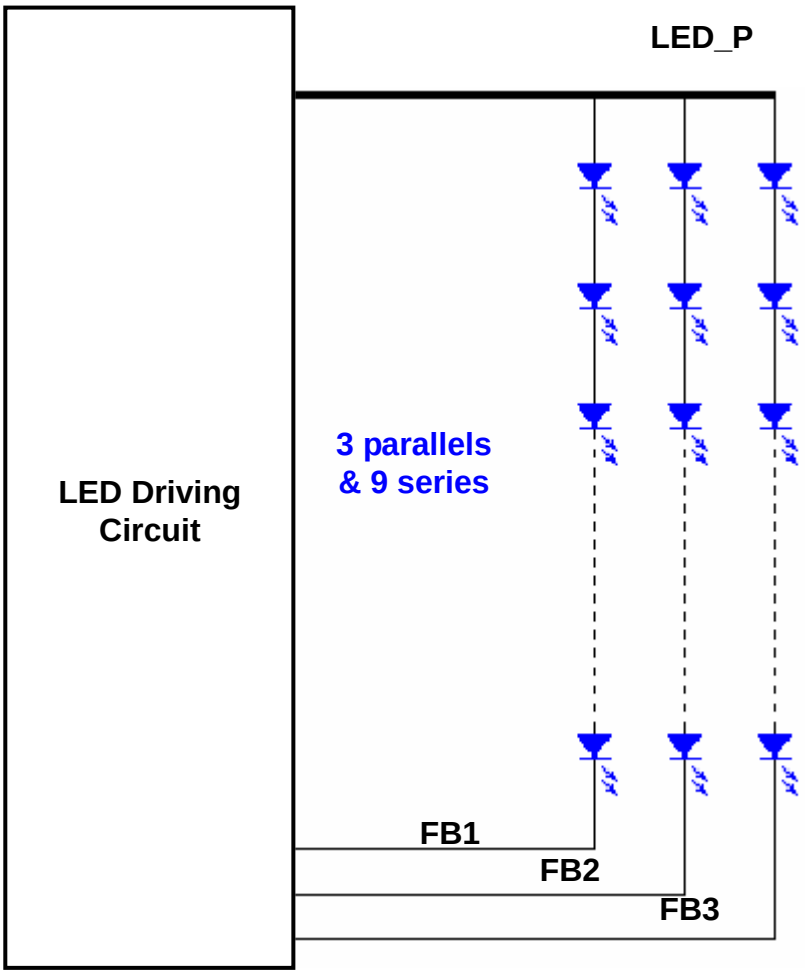
Note 2: PWM duty cycle linearity guarantees 20~100%.

Note 3: LED life time definition is brightness decrease to 50% of initial or abnormal lighting.

g. Module function block



h. LED circuit block



3. Optical specifications

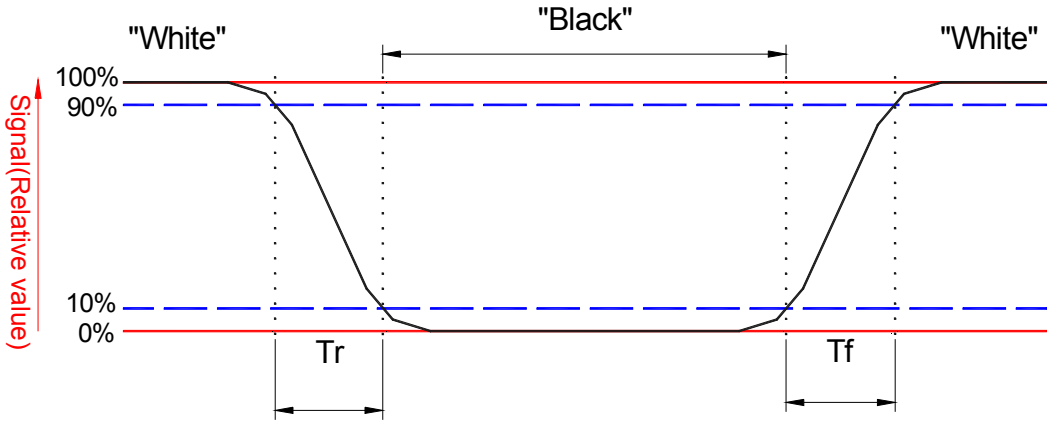
Item	Symbol	Condition	Specification			Unit	Remark
			Min.	Typ.	Max.		
Response time	Tr+Tf	θ= 0°		8	16	ms	Note 3
Contrast ratio	CR	θ= 0°	400	500			Note 2,4
Viewing angle	Top	CR≧10	15			deg	Note 2,4,6
	Bottom		30				
	Left		40				
	Right		40				
Brightness (5 points average)	Y_L		170	200		nit	Note 2,5
Color chromaticity (CIE)	W_x	θ= 0°	-0.03	0.313	+0.03		Note 2
	W_y			0.329			
	R_x			0.575			
	R_y			0.348			
	G_x			0.336			
	G_y			0.574			
	B_x			0.154			
	B_y			0.105			
Color Gamut	NTSC	CIE1931	40	45		%	-
White uniformity	$\delta_{W(13)}$				(1.55)		Note 2,7
Cross talk	Ct				2%		Note 8

Note 1: To be measured in dark room.

Note 2: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

Note 3: Definition of response time:

The output signals of BM-7 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 interval is between 10% and 90% of amplitudes. Refer to figure as below.



Note 4: Definition of contrast ratio:

Contrast ratio is calculated with the following formula:

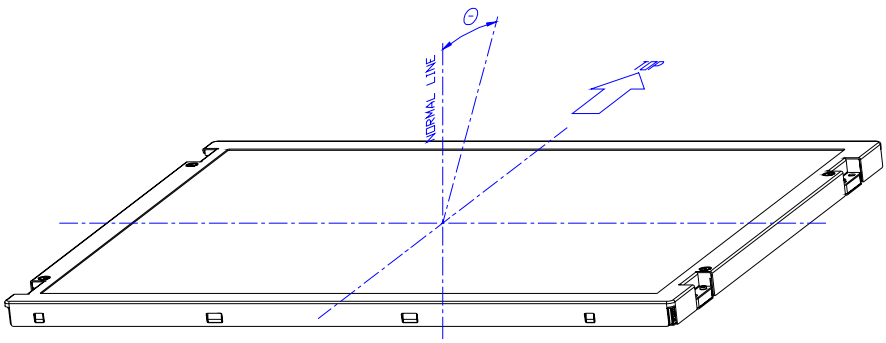
$$\text{Contrast ratio (Avg of 5pts)} = \frac{L_{\text{white (Avg of 5pts.)}}}{L_{\text{Black (Avg of 5pts.)}}}$$

Note 5: Driving current for LED should be 20 mA.

Luminance are measured at the following thirteen points (1~13):

$Y_L = (Y5+Y10+Y11+Y12+Y13) / 5$

Note 6: Definition of viewing angle



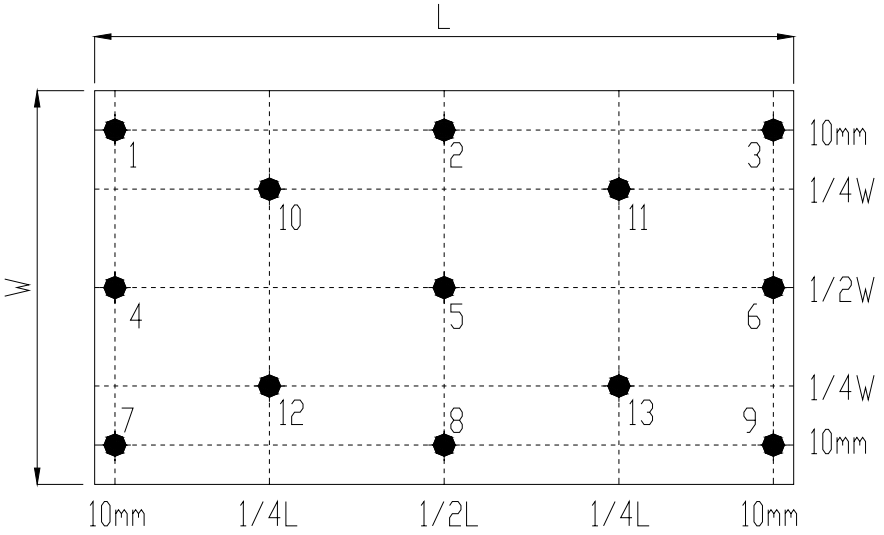
Note 7: Definition white uniformity:

Luminance is measured at the following thirteen points (1~13):

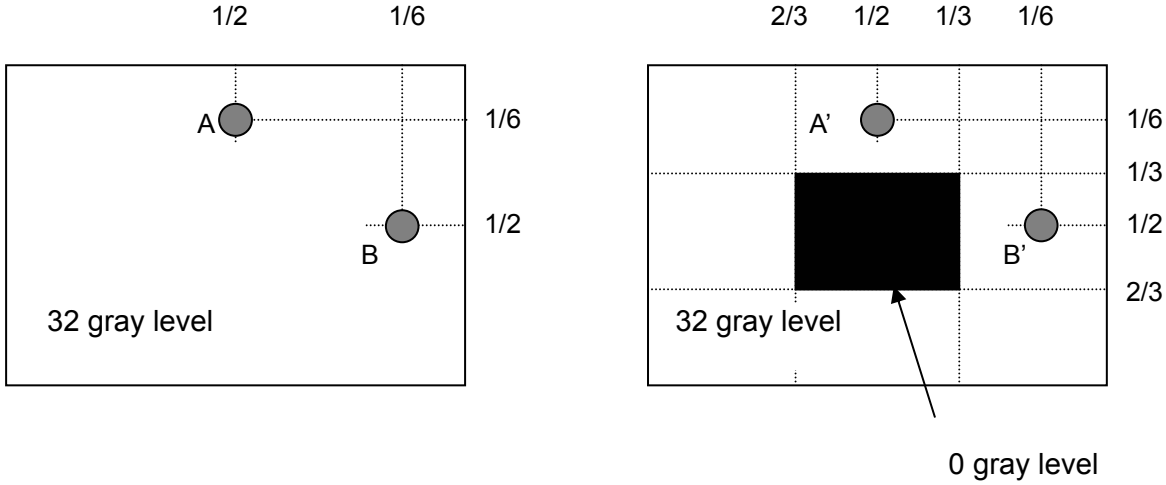
$$\delta_{W(13)} = \frac{\text{Maximum Brightness of thirteen points}}{\text{Minimum Brightness of thirteen points}}$$

$$\delta_{W(5)} = \frac{\text{Maximum Brightness of five points}}{\text{Minimum Brightness of five points}}$$

13 point measuring locations refer to the point 1,~13.
5 point measuring locations refer to the point 5,10~13.
L and W are active area dimensions. Active area center refer to attached drawing



Note 8:



Unit: percentage of dimension of display area

I L_A-$L_{A'}$ I / L_A x 100%= 2% max., L_A and $L_{A'}$ are brightness at location A and A'

I L_B-$L_{B'}$ I / L_B x 100%= 2% max., $L_{B'}$ and $L_{B'}$ are brightness at location B and B'

4. Reliability test items

Test Item	Test Condition	Judgment	Remark
High temperature storage	60°C, 240 hours	Note 1	Note 2
Low temperature storage	-20°C, 240 hours	Note 1	Note 2
High temperature & high humidity operation	40°C, 90% RH, 240 hours (No condensation)	Note 1	Note 2
High temperature operation	50°C, 240 hours	Note 1	Note 2
Low temperature operation	0°C, 240 hours	Note 1	Note 2
Thermal Shock (Non-operation)	-25°C / 30 mins ~ 65°C / 30 mins 100 cycles	Note 1	Note 2
Electrostatic discharge (ESD)	150 pF, 330Ω, Contact: ±8kV, Air: ±15kV	Note 1	
Vibration (Non-operation)	1.5Grms, (PSD: 0.0046^G/Hz) 10 to 500 Hz random; 0.5hr for each perpendicular axes (X, Y, Z).	Note 1	Note 2
Mechanical shock (Non-operation)	220G/2ms, Half sine wave, ±X, ±Y, ±Z one time for each direction	Note 1	Note 2

Note 1: Pass: Normal display image with no obvious non-uniformity and no line defect.
Fail: No display image, obvious non-uniformity, or line defects.
Partial transformation of the module parts should be ignored.

Note 2: Evaluation should be tested after storage at room temperature more than one hour.

5. Safety

5-1. Sharp edge requirements

There will be no sharp edges or corners on the display assembly that could cause injury.

5-2. Materials

a. Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible InnoLux Toxicologist.

b. Flammability

All components including electrical components that do not meet the flammability grade UL94-V0 in the module will complete the flammability rating exception approval process. The printed circuit board will be made from material rated 94-V0 or better. The actual UL flammability rating will be printed on the printed circuit board.

c. Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

6. Display quality

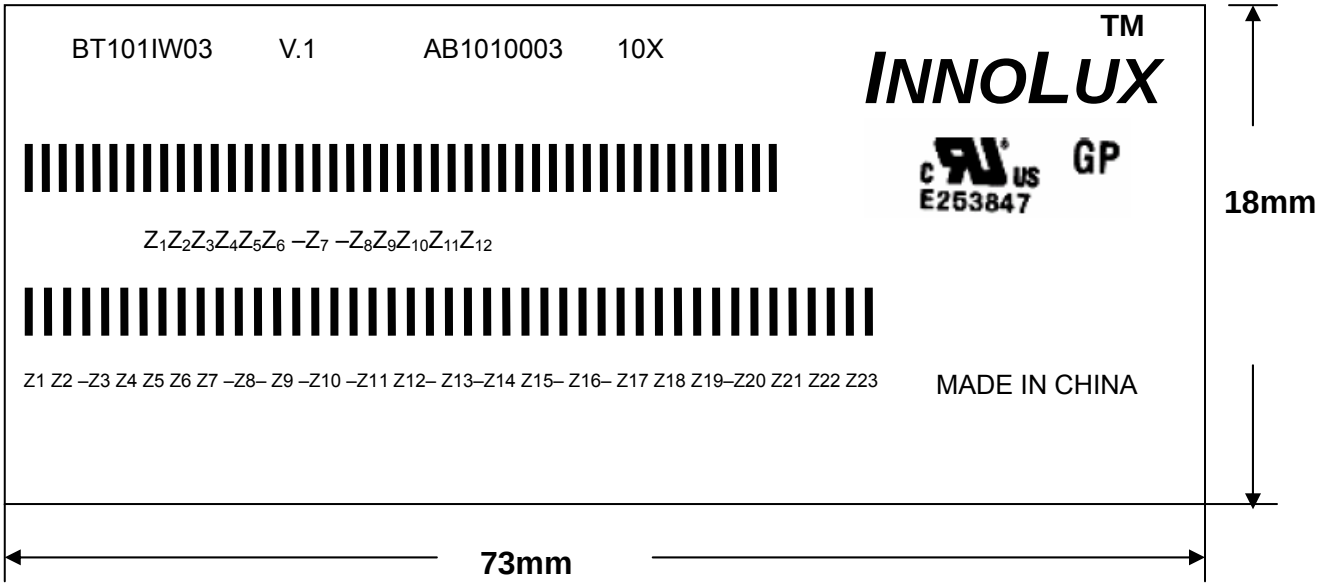
The display quality of the color TFT-LCD module should be in compliance with the InnoLux incoming inspection standard.

7. Handling precaution

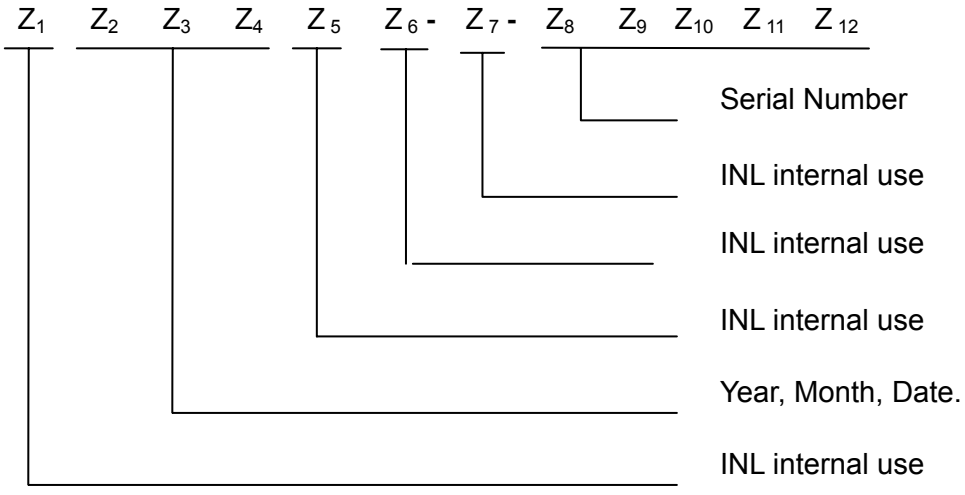
(1) Do not apply rough force such as bending or twisting to the module during assembly.
(2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
(3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.
(4) Always follow the correct power sequence when LCD module is connecting and operating.
(5) Do not pull the I/F connector in or out while the module is operating.
(6) Do not disassemble the module.
(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
(8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
(9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

8. Label Definition

8-1. Module label



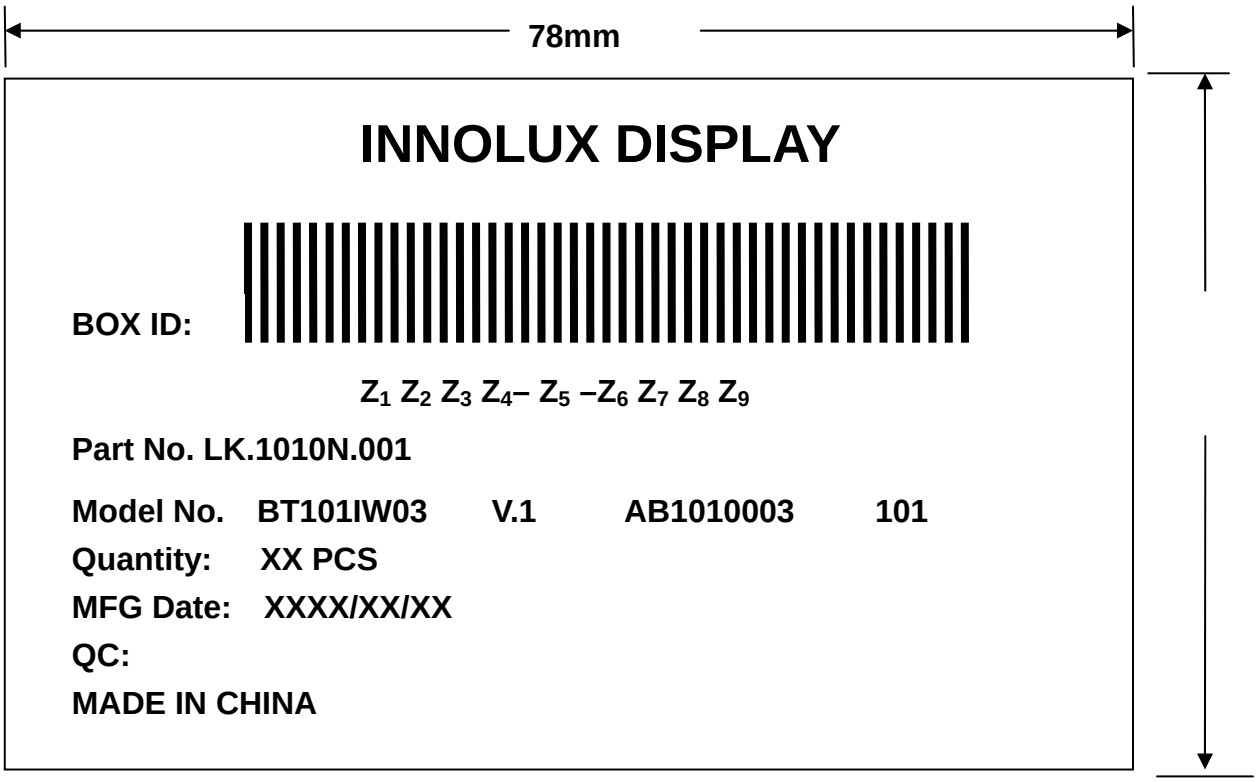
(a) Model Number : BT101IW03
(b) Product Number : AB101000310X
(c) Serial ID I (INL Internal Use):



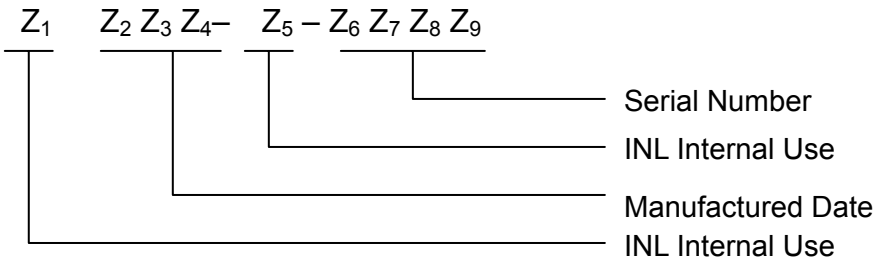
Serial ID includes the information as below:
Manufactured Date: Year: 0~9, for 2000~2009
Month: 1~9 & A~C for Jan.~Dec.
Date: 1~9 & A~Z (exclude I, O, Q, U) for 1th~31th
Serial No.: Module manufactures sequential number.

(d) Serial ID II (INL Internal Use):
Z1 Z2 –Z3 Z4 Z5 Z6 Z7 –Z8– Z9 –Z10 –Z11 Z12– Z13–Z14 Z15– Z16– Z17 Z18 Z19–Z20 Z21 Z22 Z23

8-2. Carton label

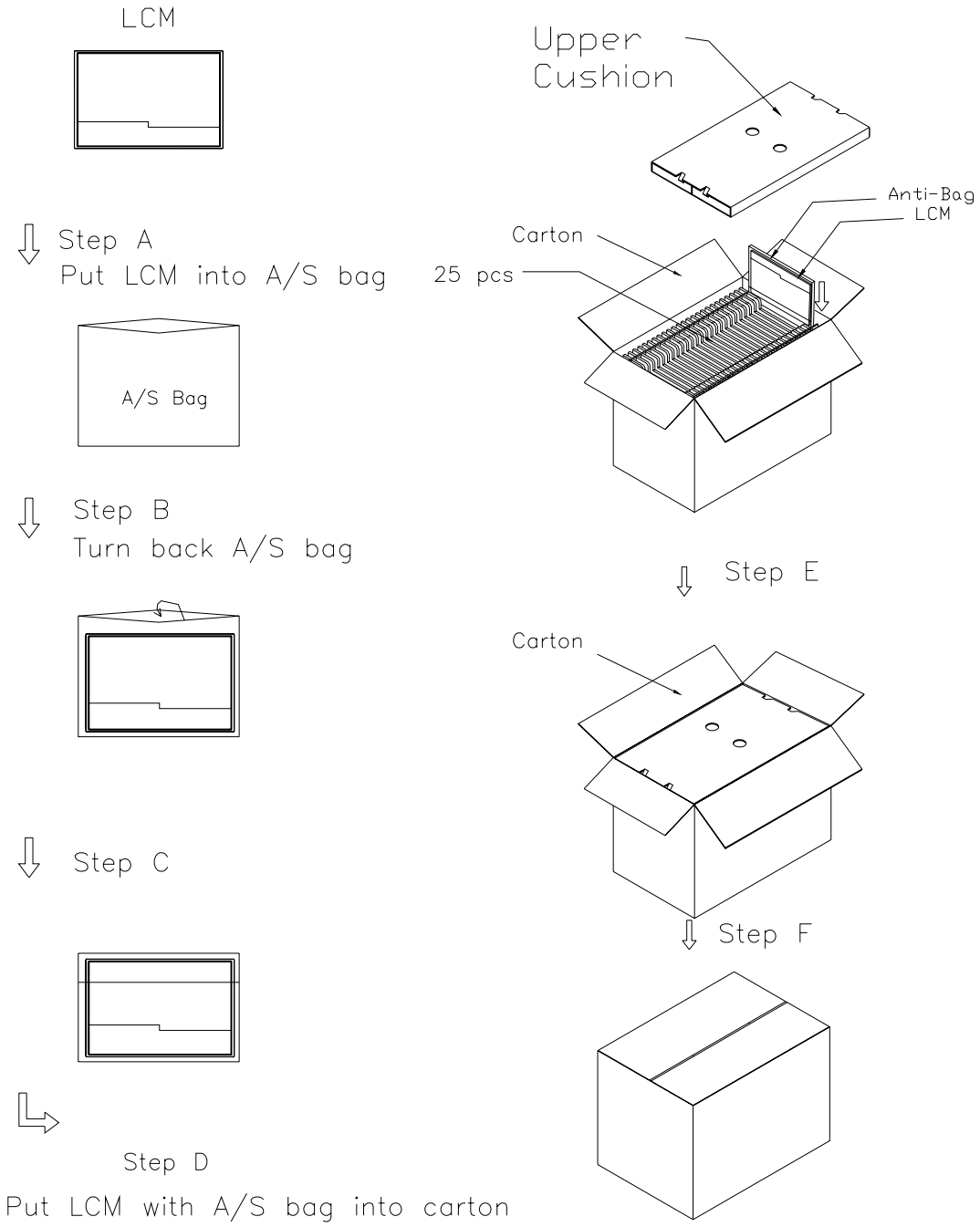


(a) Model No. : BT101IW03 V.1
(b) Package Quantity: XX PCS
(c) Serial ID :



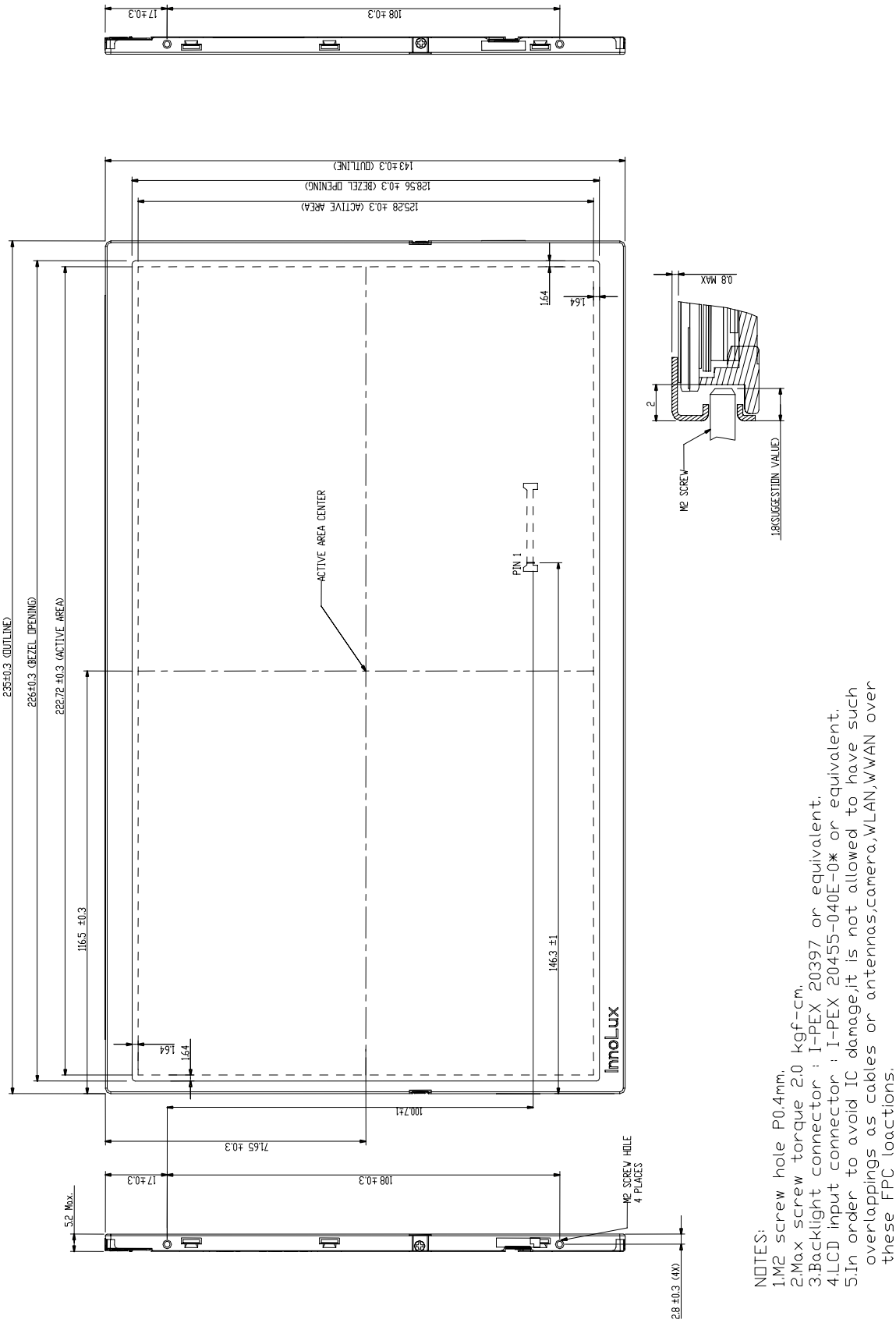
Serial ID includes the information as below:
→Manufactured Date:
Year: 0~9, for 2000~2009;
Month: 1~9 & A~C for Jan. ~Dec.;
Date: 1~9 & A~V (exclude I, O, Q, U) for 1st~31st.
→Serial Number: Module packing sequence number

9. Packing Form



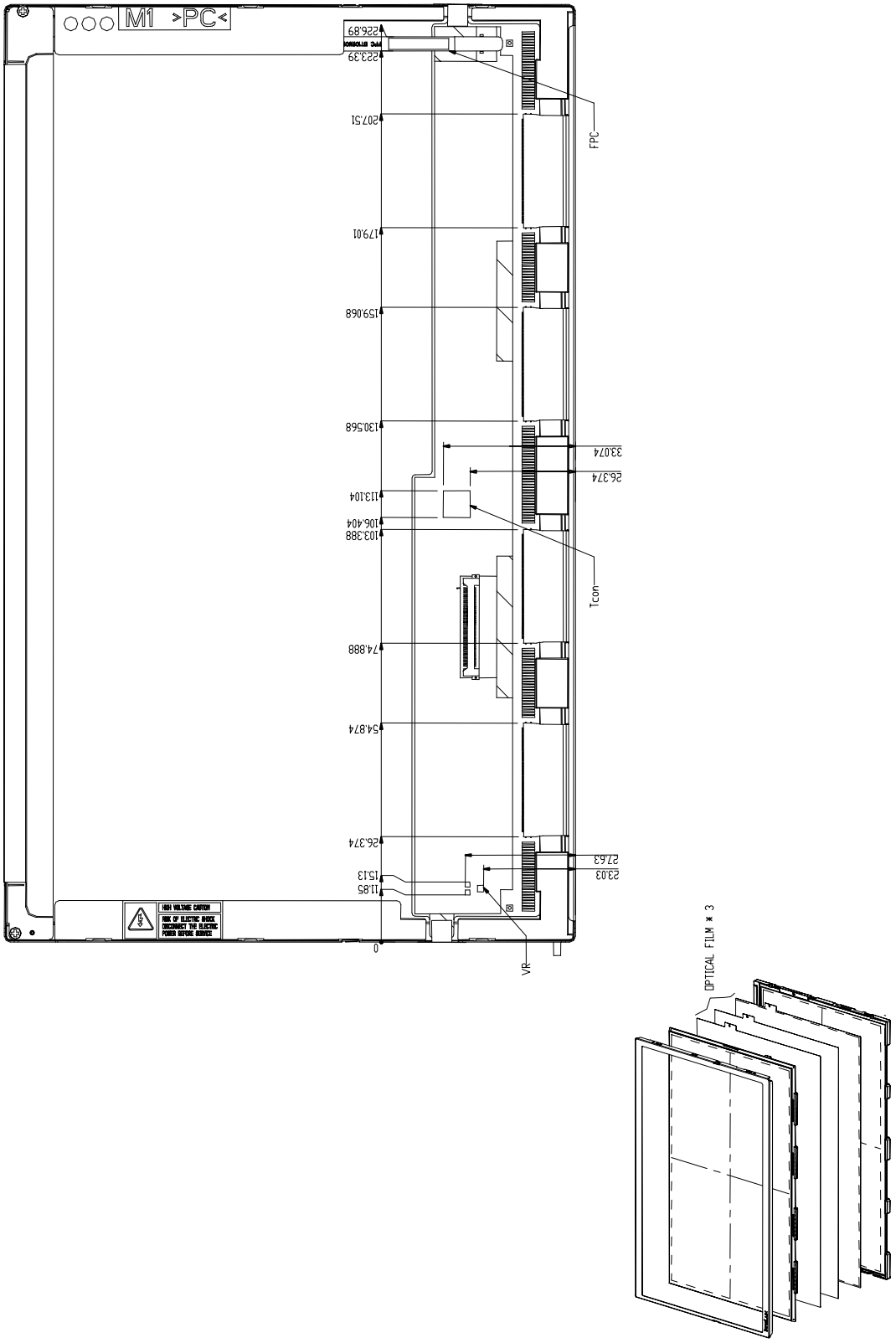
10. Mechanical drawings

10-1. Front Side



NOTES:
1.M2 screw hole P0.4mm.
2.Max screw torque 2.0 kgf-cm.
3.Backlight connector : I-PEX 20397 or equivalent.
4.LCD input connector : I-PEX 20455-040E-0* or equivalent.
5.In order to avoid IC damage,it is not allowed to have such overlappings as cables or antennas,camera,WLAN,WWAN over these FPC loactions.

10-2. Rear Side



Appendix: EDID Code

	Byte (hex)	Field Name and Comments	Value (hex)	Value (binary)
Header	0	Header	00	00000000
	1	Header	FF	11111111
	2	Header	FF	11111111
	3	Header	FF	11111111
	4	Header	FF	11111111
	5	Header	FF	11111111
	6	Header	FF	11111111
	7	Header	00	00000000
Vendor / Product EDID Version	8	EISA manufacture code (3 Character ID) " INL"	25	00100101
	9	EISA manufacture code (Compressed ASCⅡ)	CC	11001100
	0A	Panel Supplier Reserved - Product Code "11"	0D	00010001
	0B	(Hex. LSB first)	00	00000000
	0C	LCD Module Serial No - Preferred but Optional ("0" If not used)	00	00000000
	0D	LCD Module Serial No - Preferred but Optional ("0" If not used)	00	00000000
	0E	LCD Module Serial No - Preferred but Optional ("0" If not used)	00	00000000
	0F	LCD Module Serial No - Preferred but Optional ("0" If not used)	00	00000000
	10	Week of Manufacture 00 weeks	00	00000000
	11	Year of Manufacture 2009 years	13	00010011
	12	EDID structure version # = 1	01	00000001
	13	EDID revision # = 3	03	00000011
Display Parameters	14	Video input Definition = Digital signal	80	10000000
	15	Max H image size (Rounded cm) = 22 cm	16	00010110
	16	Max V image size (Rounded cm) = 12 cm	0C	00001100
	17	Display gamma “2.2”	78	01111000
	18	Feature Support (no_DPMS, no_Active Off/Very Low Power, RGB color display, Timing BLK 1,no_ GTF)	0A	00001010
Panel Color Coordinates	19	Red/Green Low Bits (RxRy/GxGy)	40	01000000
	1A	Blue/White Low Bits (BxBy/WxWy)	85	10000101
	1B	Red X Rx = 0.575	93	10010011
	1C	Red Y Ry = 0.348	59	01011001
	1D	Green X Gx = 0.336	56	01010110
	1E	Green Y Gy = 0.574	93	10010011
	1F	Blue X Bx = 0.154	27	00100111
	20	Blue Y By = 0.105	1B	00011011
	21	White X Wx = 0.313	50	01010000
	22	White Y Wy = 0.329	54	01010100
Established Timings	23	Established timing 1 (00h if not used)	00	00000000
	24	Established timing 2 (00h if not used)	00	00000000

	25	Manufacturer's timings (00h if not used)	00	00000000
Standard Timing ID	26	Standard timing ID1 (01h if not used)	01	00000001
	27	Standard timing ID1 (01h if not used)	01	00000001
	28	Standard timing ID2 (01h if not used)	01	00000001
	29	Standard timing ID2 (01h if not used)	01	00000001
	2A	Standard timing ID3 (01h if not used)	01	00000001
	2B	Standard timing ID3 (01h if not used)	01	00000001
	2C	Standard timing ID4 (01h if not used)	01	00000001
	2D	Standard timing ID4 (01h if not used)	01	00000001
	2E	Standard timing ID5 (01h if not used)	01	00000001
	2F	Standard timing ID5 (01h if not used)	01	00000001
	30	Standard timing ID6 (01h if not used)	01	00000001
	31	Standard timing ID6 (01h if not used)	01	00000001
	32	Standard timing ID7 (01h if not used)	01	00000001
	33	Standard timing ID7 (01h if not used)	01	00000001
	34	Standard timing ID8 (01h if not used)	01	00000001
	35	Standard timing ID8 (01h if not used)	01	00000001
Timing Descripter #1	36	Pixel Clock/10,000 (LSB) 54.2 MHz @ 60Hz	2C	00101100
	37	Pixel Clock/10,000 (MSB)	15	00010101
	38	Horizontal Active (lower 8 bits) 1024 Pixels	00	00000000
	39	Horizontal Blanking(Thp-HA) (lower 8 bits) 378 Pixels	7A	01111010
	3A	Horizontal Active / Horizontal Blanking(Thp-HA) (upper 4:4bits)	41	01000001
	3B	Vertical Avtive 600 Lines	58	01011000
	3C	Vertical Blanking (Tvp-HA) (DE Blanking typ.for DE only panels) 44 Lines	2C	00101100
	3D	Vertical Active : Vertical Blanking (Tvp-HA) (upper 4:4bits)	20	00100000
	3E	Horizontal Sync. Offset (Thfp) 48 Pixels	30	00110000
	3F	Horizontal Sync Pulse Width (HSPW) 32 Pixels	20	00100000
	40	Vertical Sync Offset(Tvfp) : Sync Width (VSPW) 3 Lines : 6 Lines	36	00110110
	41	Horizontal Vertical Sync Offset/Width (upper 2bits)	00	00000000
	42	Horizontal Image Size (mm) 222 mm	DE	11011110
	43	Vertical Image Size (mm) 125 mm	7D	01111101
	44	Horizontal Image Size / Vertical Image Size	00	00000000
	45	Horizontal Border = 0 (Zero for Notebook LCD)	00	00000000
	46	Vertical Border = 0 (Zero for Notebook LCD)	00	00000000
	47	Non-Interlace, Normal display, no stereo, Digital Separate (Vsync_NEG, Hsync_NEG), DE only note : LSB is set to '1' if panel is DE-timing only. H/V can be ignored.	18	00011000
Timing Descriptor #2 (sDRRS 40Hz)	48	Flag	00	00000000
	49	Flag	00	00000000
	4A	Flag	00	00000000
	4B	Data Type Tag (Descriptor Defined by manufacturer)	00	00000000

	4C	Flag	00	00000000
	4D	Descriptor Defined by manufacturer	00	00000000
	4E	Descriptor Defined by manufacturer	00	00000000
	4F	Descriptor Defined by manufacturer	00	00000000
	50	Descriptor Defined by manufacturer	00	00000000
	51	Descriptor Defined by manufacturer	00	00000000
	52	Descriptor Defined by manufacturer	00	00000000
	53	Descriptor Defined by manufacturer	00	00000000
	54	Descriptor Defined by manufacturer	00	00000000
	55	Descriptor Defined by manufacturer	00	00000000
	56	Descriptor Defined by manufacturer	00	00000000
	57	Descriptor Defined by manufacturer	00	00000000
	58	Descriptor Defined by manufacturer	00	00000000
	59	Descriptor Defined by manufacturer	00	00000000
Timing Descriptor #3 (Dynamic DCLK)	5A	Flag	00	00000000
	5B	Flag	00	00000000
	5C	Flag	00	00000000
	5D	Data Type Tag (ASCII String)	FE	11111110
	5E	Flag	00	00000000
	5F	ASCII String "I"	49	01001001
	60	ASCII String "N"	4E	01001110
	61	ASCII String "L"	4C	01001100
	62		0A	01000100
	63		20	01101001
	64		20	01110011
	65		20	01110000
	66		20	01101100
	67		20	01100001
	68		20	01111001
	69		20	00001010
	6A		20	00100000
	6B		20	00100000
Timing Descriptor #4 (Brightness Table)	6C	Detailed timing/monitor	00	00000000
	6D	descriptor #4	00	00000000
	6E	Flag	00	00000000
	6F	Data Type Tag	FC	11111100
	70	Flag	00	00000000
	71	Manufacture P/N "B"	42	01000010
	72	Manufacture P/N "T"	54	01010100
	73	Manufacture P/N "1"	31	00110001
	74	Manufacture P/N "0"	30	00110000
	75	Manufacture P/N "1"	31	00110001

	76	Manufacture P/N "I"	49	01001001
	77	Manufacture P/N "W"	57	01010111
	78	Manufacture P/N "0"	30	00110000
	79	Manufacture P/N "3"	33	00110011
	7A	Manufacture P/N "V"	56	01010110
	7B	Manufacture P/N "1"	31	00110001
	7C		0A	00001010
	7D		20	00100000
Checksum	7E	Extension flag (# of optional 128 panel ID extension block to follow, Typ = 0)	00	00000000
	7F	Check Sum (The 1-byte sum of all 128 bytes in this panel ID block shall = 0)	C1	11000001