() Preliminary Specification

(V) Final Specification

Module	19" SXGA TFT-LCD Module
Model Name	G190ETN02.0

Customer	Date	Checked & Approved by	Date
		Vito Huang	3/11/2013
Approved by		**Prepared by**	**Date**
		Vivian Huang	3/11/2013
Note: This Specification is subject to change without notice.		Audio-Video Display Business Unit / AU Optronics corporation	

2. General Description

G190ETN02.0 is a Color Active Matrix Liquid Crystal Display composed of a TFT-LCD panel, a driver circuit, and a backlight system. The screen format is intended to support the SXGA (1280(H) x 1024(V)) screen and 16.7M colors (RGB 6-bits + HiFRC data). All input signals are dual channel LVDS interface.

2.1 Display Characteristics

The following items are characteristics summary on the table under 25 ℃ condition:

| Items	Unit	Specifications
Screen Diagonal	[mm]	482.6 (19.0")
Active Area	[mm]	376.32 (H) x 301.06 (V)
Pixels H x V		1280(x3) x 1024
Pixel Pitch	[mm]	0.294 (per one triad) x 0.294
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		Normally White
White Luminance	[cd/m^2]	1000 (center, Typ)
Contrast Ratio		800 (Typ)
Optical ResponseTime	[msec]	25 (Typ, on/off)
Nominal Input Voltage VDD	[Volt]	+5.0 V
Power Consumption	[Watt]	37.1 W (Typ) (PDD= 4.7 W, PLED=32.4 W)
Weight	[Grams]	1990 (Typ)
Physical Size (H x V x D)	[mm]	396 (H) x 324 (V) x 17.2(D) (Typ)
Electrical Interface		Dual channel LVDS
Surface Treatment		Hard-coating (3H), Glare treatment
Support Color		16.7M colors (RGB 6-bit + Hi_FRC)

Temperature Range
    Operating
    Storage (Non-Operating)
	[^{o}C]
	[^{o}C]
		0 to +60 (Tgs)
		-20 to +60 (Ta)

RoHS Compliance		RoHS Compliance

2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25℃ (Room Temperature).

Item	Unit	Conditions		Min.	Typ.	Max.	Note
Viewing Angle	[degree]	Horizontal (Right) CR = 5 (Left)		70 70	80 80	-	1
		Vertical (Up) CR = 5 (Down)		70 70	80 80	-	
Contrast Ratio		Normal Direction		400	800	-	3
Optical Response Time	[msec]	Raising Time (TrR)		-	22	27	2
		Falling Time (TrF)		-	3	8	
		Rising + Falling		-	25	35	
Color / Chromaticity Coordinates (CIE)		Red x		0.594	0.644	0.694	3
		Red y		0.293	0.343	0.393	
		Green x		0.269	0.319	0.369	
		Green y		0.573	0.623	0.673	
		Blue x		0.099	0.149	0.199	
		Blue y		0.015	0.065	0.115	
		White x		0.250	0.300	0.350	
		White y		0.280	0.330	0.380	
Central Luminance	[cd/m^2]			800	1000	-	3
Luminance Uniformity	[%]	13 Points		75	80	-	4,5
NTSC	%			-	72	-	

Optical Equipment: BM-5A, BM-7, PR880, or equivalent

Note 1: Definition of viewing angle

Viewing angle is the measurement of contrast ratio$\geq$ 10 or $\geq$ 5, at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as follows; 90° (θ) horizontal left and right and 90° (Φ) vertical, high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated about its center to develop the desired measurement viewing angle.
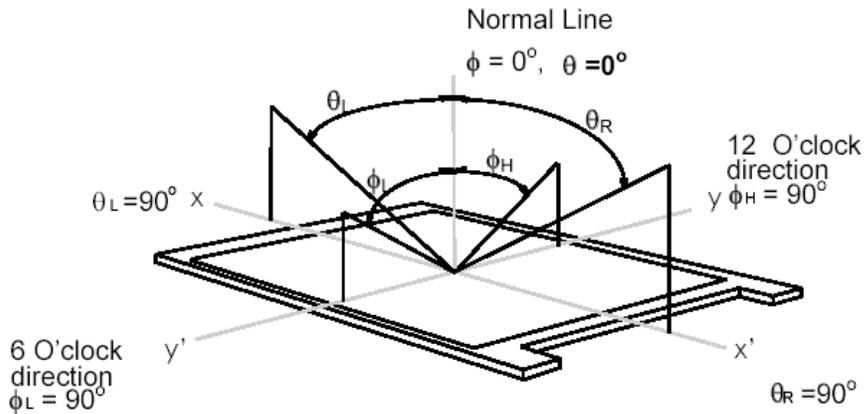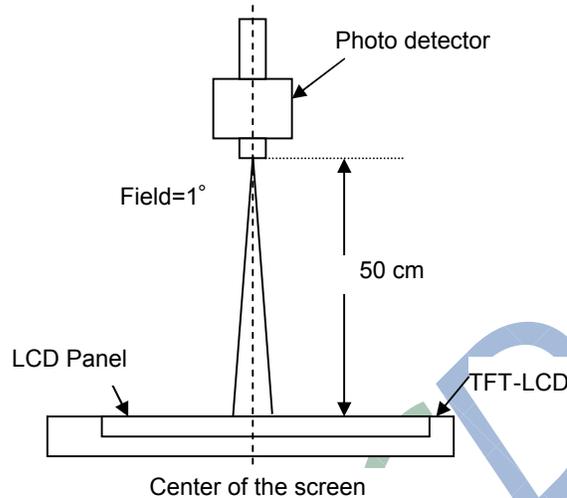

Note 2: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "Full Black" to "Full White" (rising time), and from "Full White" to "Full Black" (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as below.
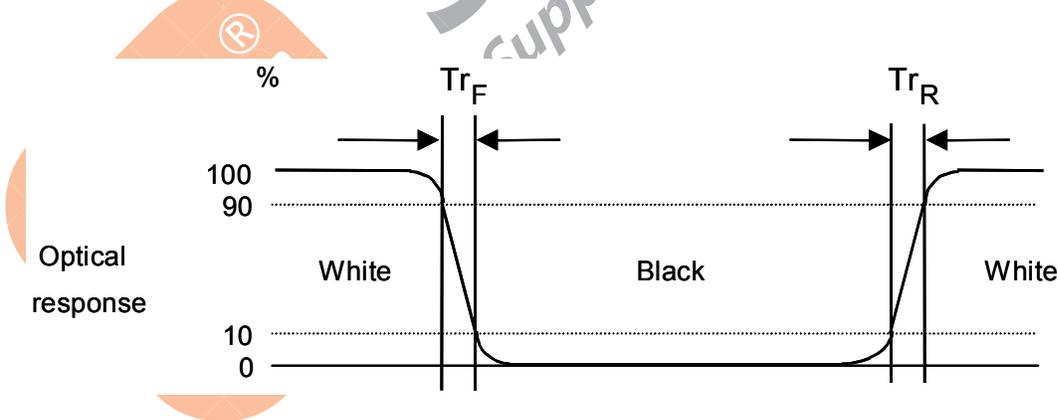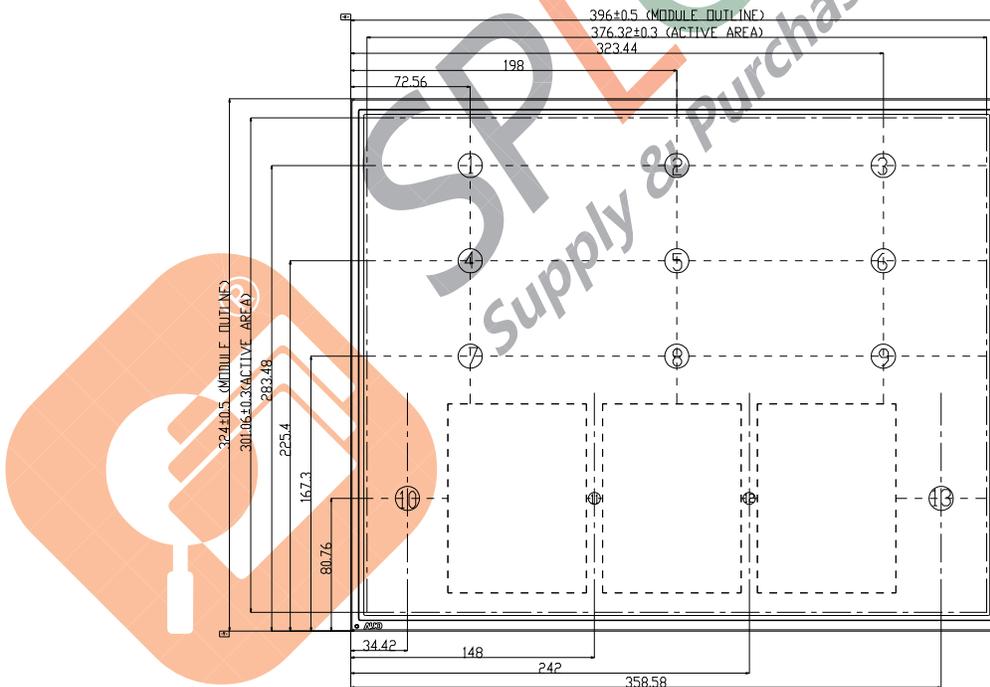
Note 3: Measurement method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room.

Photo detector

Field=1°

50 cm

LCD Panel

TFT-LCD

Center of the screen

Note 4: 13 points position

396±0.5 (MODULE OUTLINE)
376.32±0.3 (ACTIVE AREA)
323.44
198
72.56

324±0.5 (MODULE OUTLINE)
301.06±0.3(ACTIVE AREA)
283.48
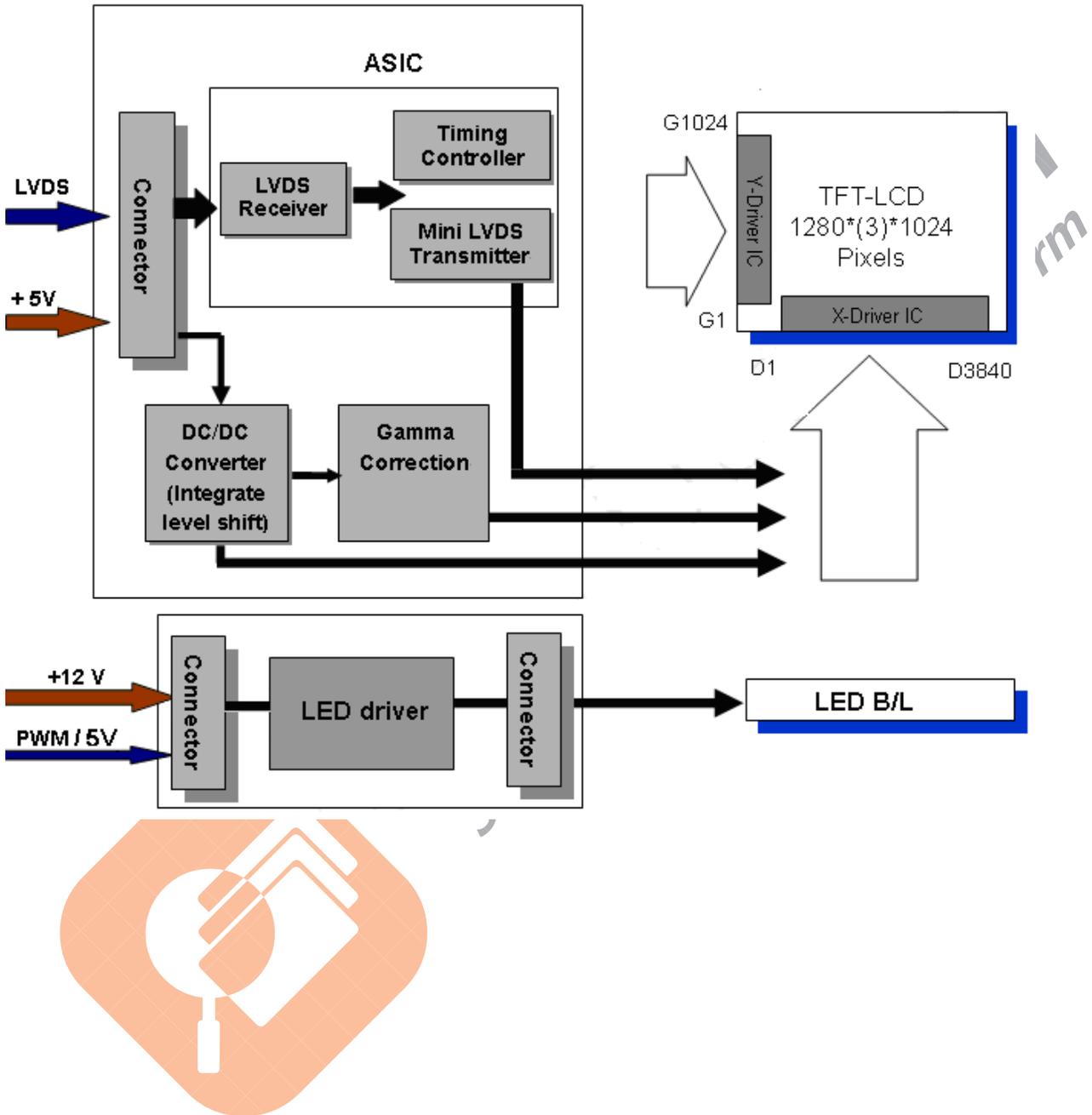225.4
167.3
80.76

34.42
148
242
358.58

Note 5:

$$\delta_{W13} = \frac{\text{Minimum Luminance of 13 points}}{\text{Maximum Luminance of 13 points}}$$

3. Functional Block Diagram

The following diagram shows the functional block of the 19.0 inches wide Color TFT-LCD Module:

4. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

4.1 TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	VDD	-0.3	+5.5	[Volt]	**Note 1,2**

4.2 Absolute Ratings of Environment

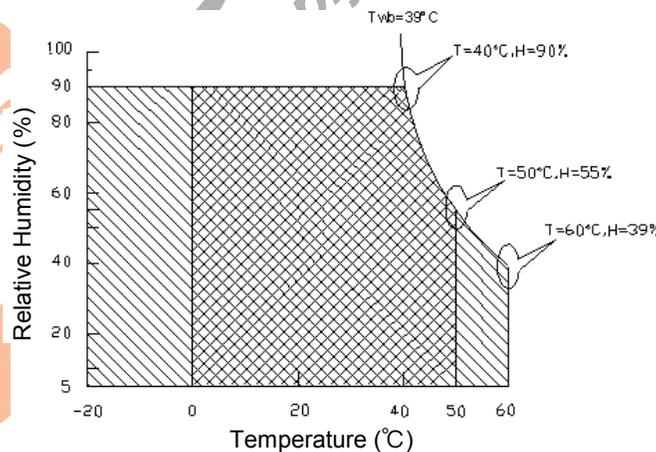| Item	Symbol	Min.	Max.	Unit	Conditions
Glass Surface Temperature (operation)	Tgs	0	+60	[^{o}C]	**Note 3, Note 4**
Operation Humidity	HOP	5	90	[%RH]	**Note 3**
Storage Temperature	TST	-20	+60	[^{o}C]	
Storage Humidity	HST	5	90	[%RH]	

Note 1: With in Ta (25℃)
Note 2: Permanent damage to the device may occur if exceeding maximum values
Note 3: Temperature and relative humidity range are shown as the below figure.

    1. 90% RH Max (Ta ≦ 39℃)
    2. Max wet-bulb temperature at 39℃ or less (Ta ≦ 39℃)
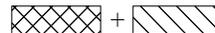   3. No condensation
Note 4: Function Judged only

Operating Range   ⊠   Storage Range   ⊠ + ▨

5. Electrical characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Input power specifications are as follows:

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	[Volt]	+/-10%
IDD	Input Current	-	0.94	1.1	[A]	VDD= 5.0V, All Black Pattern At 60Hz,
PDD	VDD Power	-	4.7	5.5	[Watt]	VDD= 5.0V, All Black Pattern At 60Hz
IRush	Inrush Current	-	-	3.0	[A]	**Note 1**
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	[mV] p-p	VDD= 5.0V, All Black Pattern At 75Hz

Note 1: Measurement conditions:

The duration of rising time of power input is 470us.
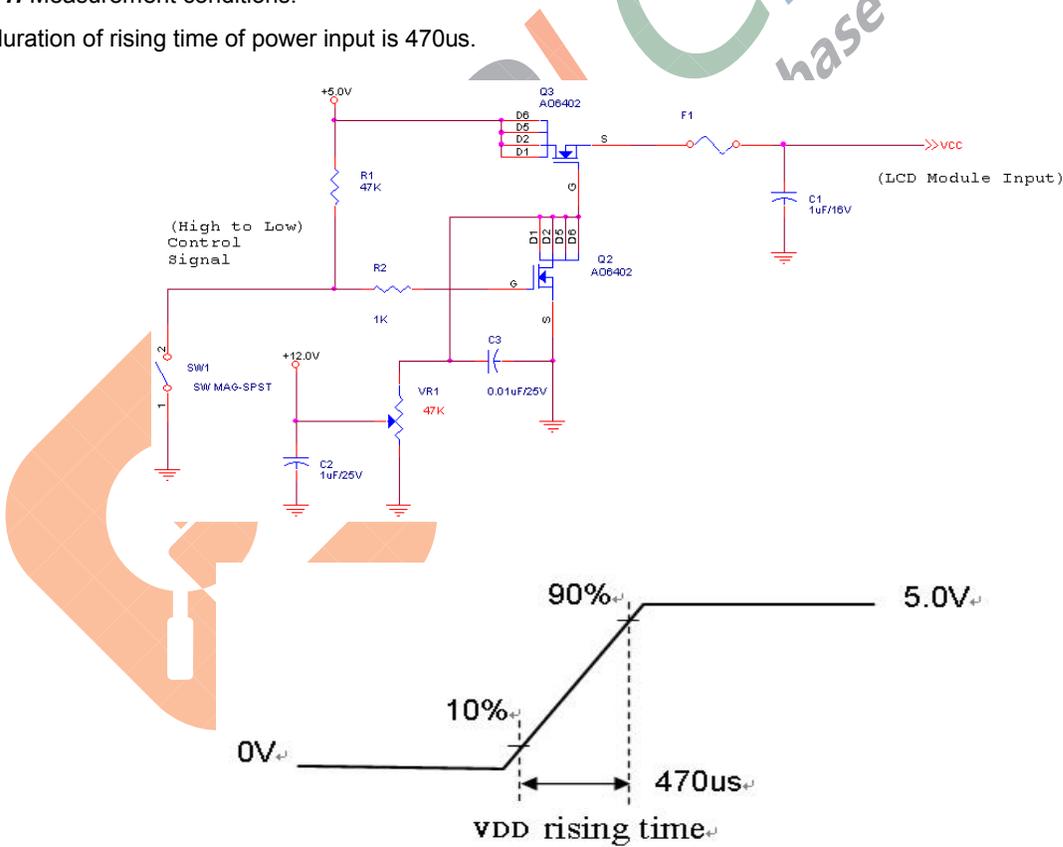
5.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDD is off. Please refer to specifications of SN75LVDS82DGG (Texas Instruments) in detail.

Each signal characteristics are as follows;

Symbol	Parameter	Min	Typ	Max	Units	Condition
V_{TH}	Differential Input High Threshold	-	-	+100	[mV]	V_{CM} = 1.2V **Note 1**
V_{TL}	Differential Input Low Threshold	-100	-	-	[mV]	V_{CM} = 1.2V **Note 1**
$|V_{ID}|$	Input Differential Voltage	100	400	600	[mV]	**Note 1**
V_{CM}	Differential Input Common Mode Voltage	+1.0	+1.2	+1.5	[V]	V_{TH}-V_{TL} = 200mV (max) **Note 1**

Note1: LVDS Signal Waveform

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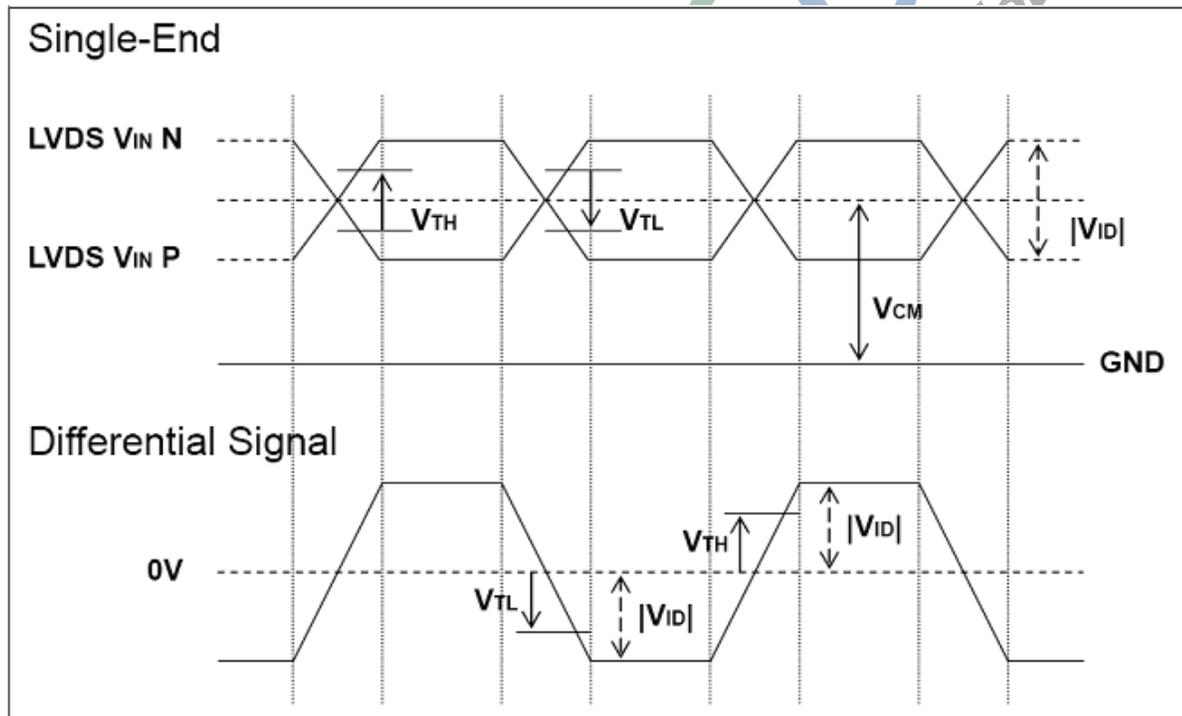
5.1.3 Backlight unit

Following characteristics are measured under a stable condition using a inverter at 25℃. (Room Temperature):

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
VCC	Input Voltage	10.8	12	13.2	[Volt]	
I_{VCC}	Input Current	-	2.7	-	[A]	100% PWM Duty
P_{VCC}	Power Consumption	-	32.4	35.64	[Watt]	100% PWM Duty
IRush	Inrush Current	-	-	3.0	[A]	**Note 7**
F_{PWM}	Dimming Frequency	200	-	20K	[Hz]	
	Swing Voltage	3	3.3	5	[Volt]	
	Dimming duty cycle	5	-	100	%	
I_F	LED Forward Current	-	100	-	[mA]	Ta = 25℃
V_F	LED Forward Voltage	-	(29.7)	(33.3)	[Volt]	I_F = 100mA, Ta = 0℃
		-	28.8	32.4	[Volt]	I_F = 100mA, Ta = 25℃
		-	(27.9)	(31.5)	[Volt]	I_F = 100mA, Ta = 70℃
P_{LED}	LED Power Consumption	-	(14.4)	16.2	[Watt]	I_F = 100mA, Ta = 25℃
LED Life Time		50,000	-	-	Hrs	I_F = 100mA, Ta= 25℃

Note 1: Ta means ambient temperature of TFT-LCD module.

Note 2: VCC, I_{VCC}, P_{VCC} are defined for LED backlight.(100% duty of PWM dimming)

Note 3: I_F, V_F are defined for one channel LED. There are five LED channels in one light bar. P_{LED} is defined for one light bar. There are two light bars in back light unit.

Note 4: If G190ETN02.0 module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

Note 5: Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.

Note 6: LED lifetime is definition: brightness is decreased to 50% of the initial value. LED lifetime is restricted under normal condition, ambient temperature = 25℃ and LED operating I_F = 100mA.

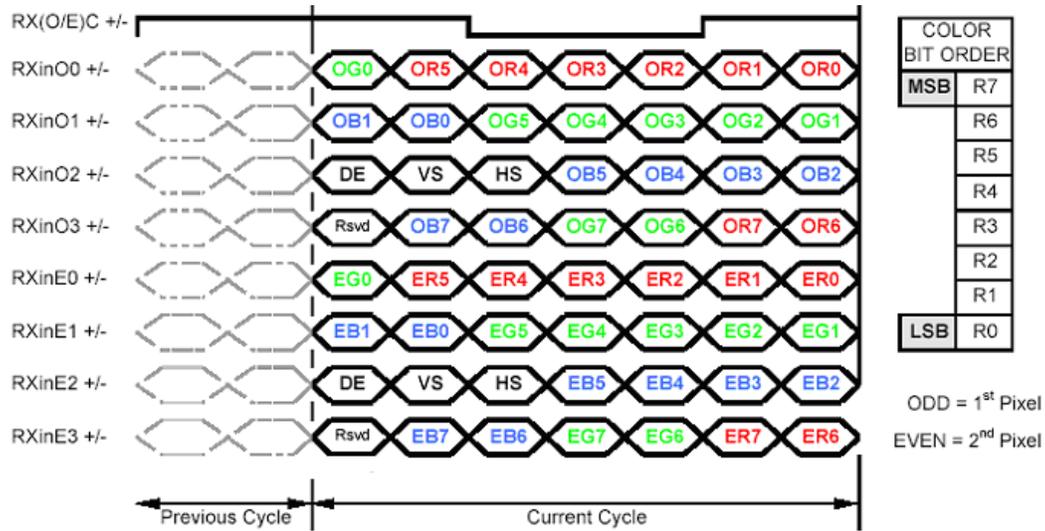Note 7: Measurement conditions: The duration of rising time of power input is 470us.

6. Signal Characteristic

6.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.
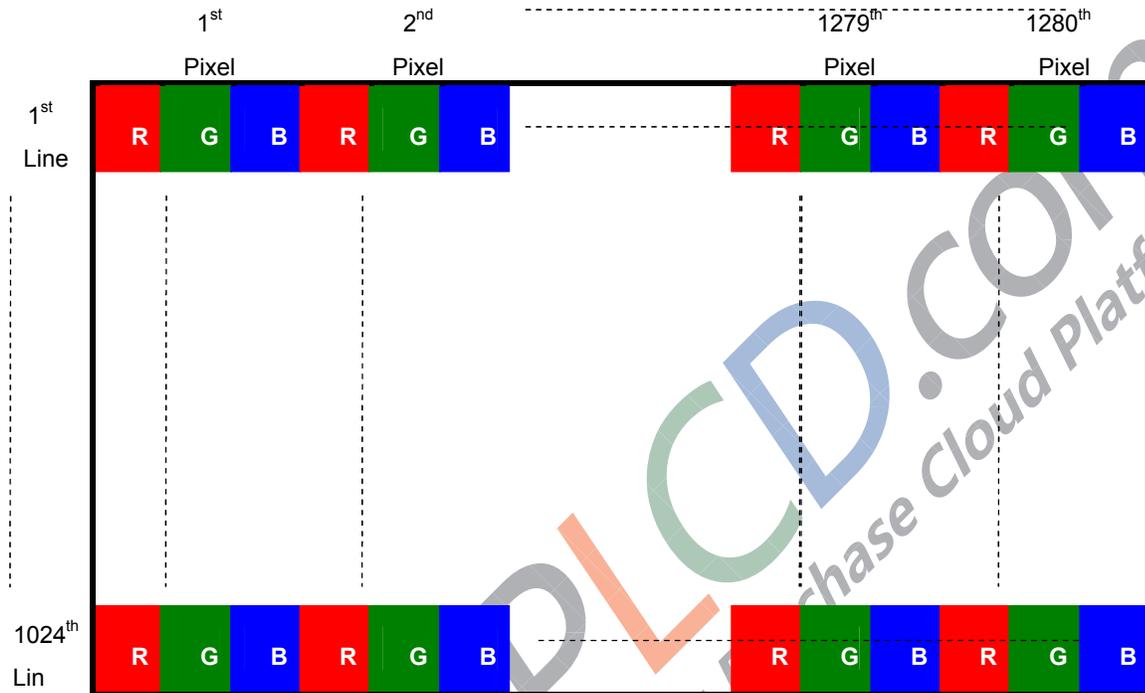
6.2 The Input Data Format

Note1: Normally, DE, VS, HS on EVEN channel are not used.
Note2: Please follow PSWG.
Note3: 8-bit in

6.3 Signal Description

The module using a pair of LVDS receiver SN75LVDS82(Texas Instruments) or compatible. LVDS is a differential signal technology for LCD interface and high speed data transfer device. Transmitter shall be SN75LVDS83(negative edge sampling) or compatible. The first LVDS port(RxOxxx) transmits odd pixels while the second LVDS port(RxExxx) transmits even pixels.

PIN #	SIGNAL NAME	DESCRIPTION
1	RxOIN0-	Negative LVDS differential data input (Odd data)
2	RxOIN0+	Positive LVDS differential data input (Odd data)
3	RxOIN1-	Negative LVDS differential data input (Odd data)
4	RxOIN1+	Positive LVDS differential data input (Odd data)
5	RxOIN2-	Negative LVDS differential data input (Odd data, H-Sync,V-Sync,DSPTMG)
6	RxOIN2+	Positive LVDS differential data input (Odd data, H-Sync,V-Sync,DSPTMG)
7	VSS	Power Ground
8	RxOCLKIN-	Negative LVDS differential clock input (Odd clock)
9	RxOCLKIN+	Positive LVDS differential clock input (Odd clock)
10	RxOIN3-	Negative LVDS differential data input (Odd data)
11	RxOIN3+	Positive LVDS differential data input (Odd data)
12	RxEIN0-	Negative LVDS differential data input (Even data)
13	RxEIN0+	Positive LVDS differential data input (Even data)
14	VSS	Power Ground
15	RxEIN1-	Negative LVDS differential data input (Even data)
16	RxEIN1+	Positive LVDS differential data input (Even data)
17	VSS	Power Ground
18	RxEIN2-	Negative LVDS differential data input (Even data)
19	RxEIN2+	Positive LVDS differential data input (Even data)
20	RxECLKIN-	Negative LVDS differential clock input (Even clock)
21	RxECLKIN+	Positive LVDS differential clock input (Even clock)
22	RxEIN3-	Negative LVDS differential data input (Even data)
23	RxEIN3+	Positive LVDS differential data input (Even data)
24	VSS	Power Ground
25	VSS	Power Ground
26	VSS	Power Ground
27	VSS	Power Ground
28	VDD	+5.0V Power Supply
29	VDD	+5.0V Power Supply
30	VDD	+5.0V Power Supply

Note1: Start from left side

Connector
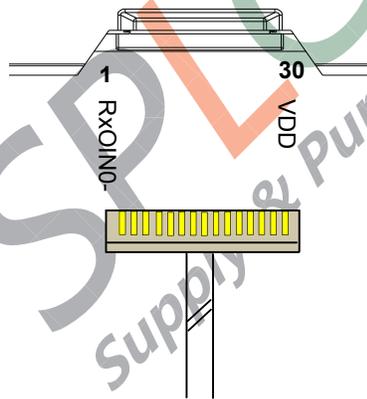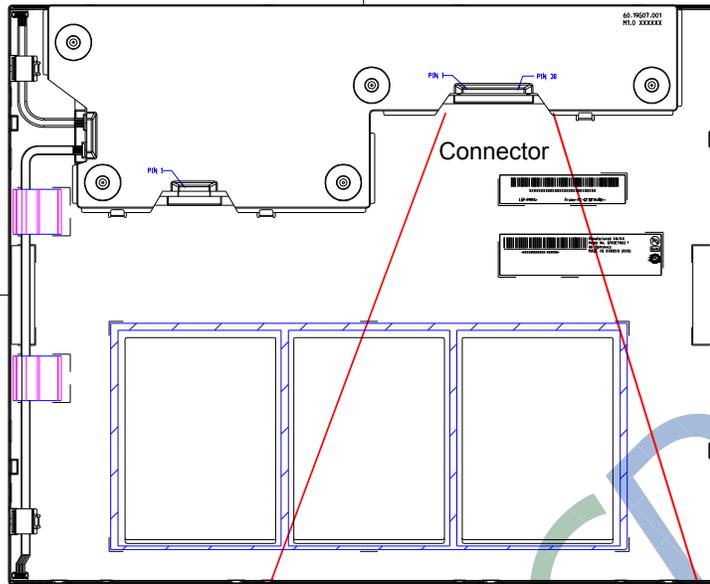
Note2: Input signals of odd and even clock shall be the same timing.
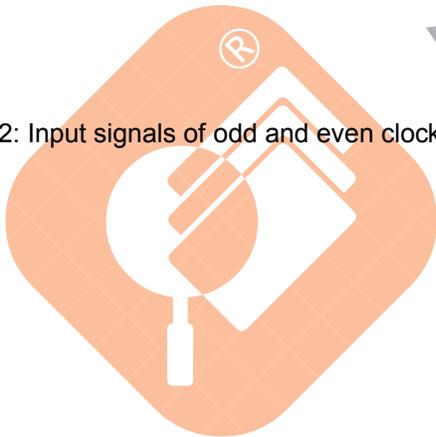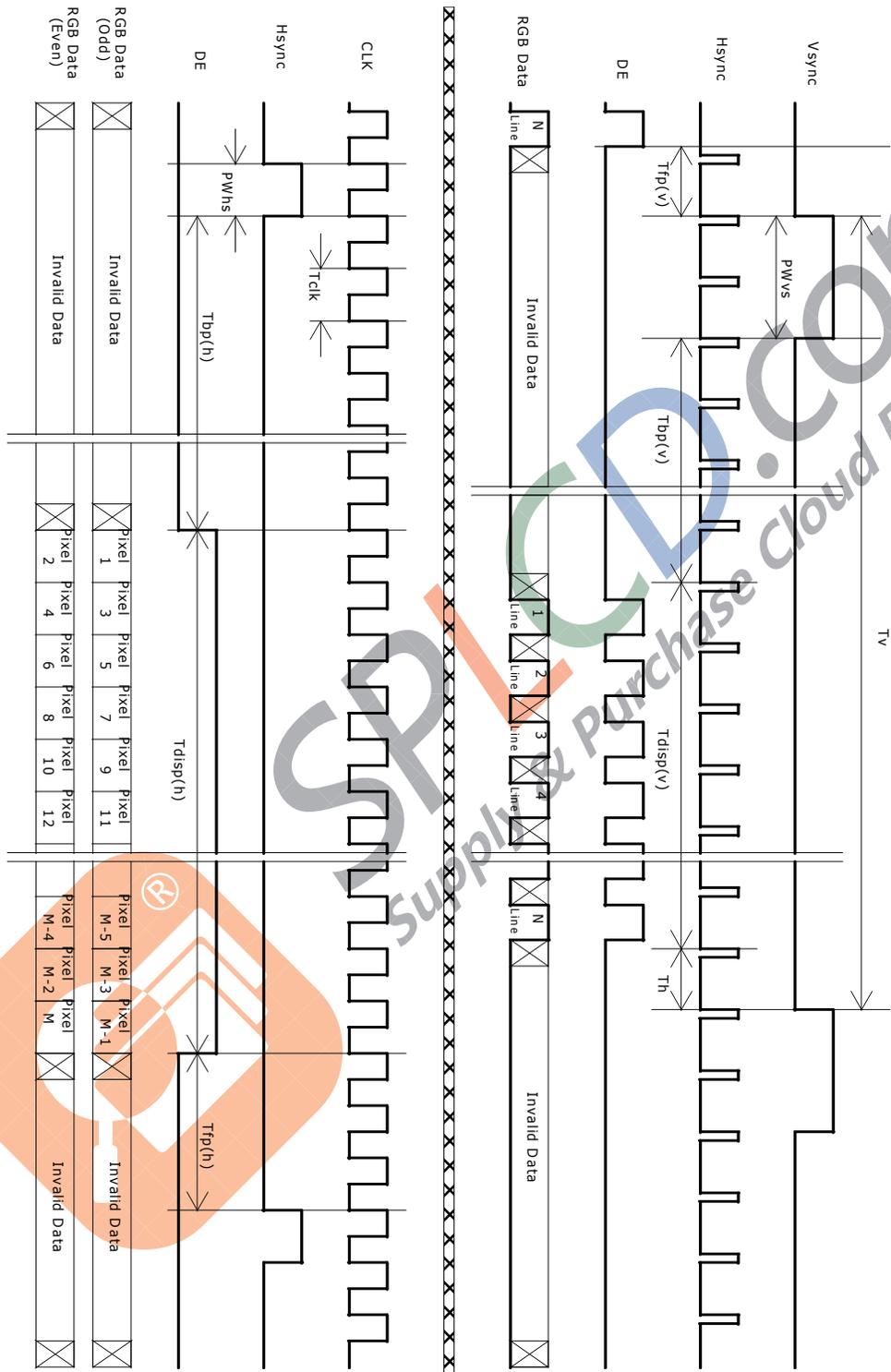
6.4 Interface Timing

6.4.1 Timing Characteristics

Signal	Item	Symbol	Min	Typ	Max	Unit
Vertical Section	Period	Tv	1032	1066	1150	Th
	Active	Tdisp(v)	1024	1024	1024	Th
	Blanking	Tbp(v)+Tfp(v)+PWvs	8	42	126	Th
Horizontal Section	Period	Th	780	844	2047	Tclk
	Active	Tdisp(h)	640	640	640	Tclk
	Blanking	Tbp(h)+Tfp(h)+PWhs	140	204	-	Tclk
Clock	Period	Tclk	22.2	18.52	14.81	ns
	Frequency	Freq.	45	54	67.5	MHz
Frame Rate	Frequency	1/Tv	50	60	75	Hz

Note: DE mode only

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6.4.2 Timing Diagram

6.5 Power ON/OFF Sequence

VDD power and lamp on/off sequence are as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.
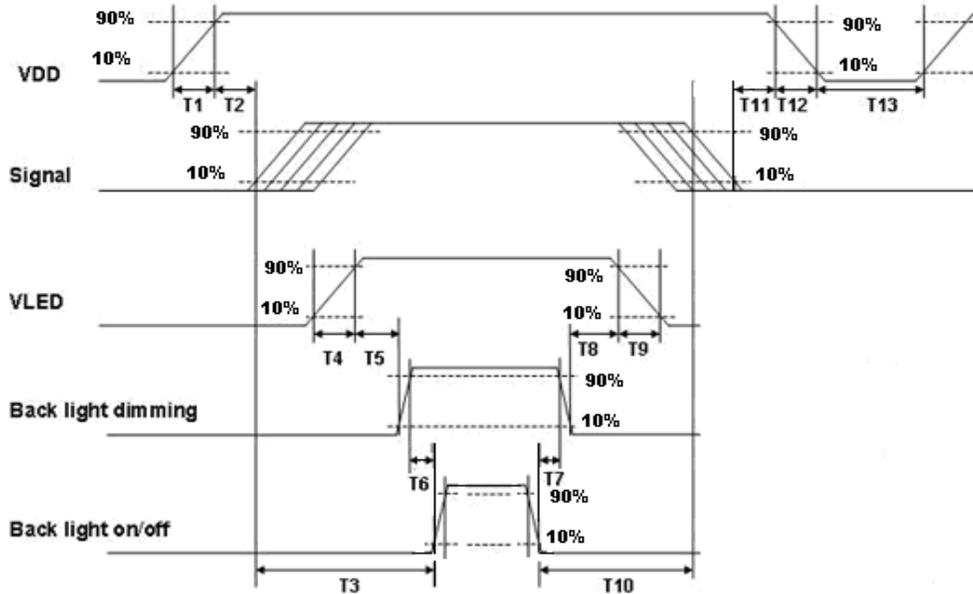
Power Sequence Timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	
T2	30	40	50	
T3	200	-	-	
T4	0.5	-	10	
T5	10	-	-	
T6	10	-	-	
T7	0	-	-	ms
T8	10	-	-	
T9	-	-	10	
T10	110	-	-	
T11	0	16	50	
T12	-	-	10	
T13	1000	-	-	

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7. Connector & Pin Assignment

Physical interface is described as for the connector on module.These connectors are capable of accommodating the following signals and will be following components.

7.1 TFT LCD Module

7.1.1 Connector

Connector Name / Designation	Interface Connector / Interface card
Manufacturer	Hirose
Type Part Number	MDF76TW-30S-1H
Mating Type Part Number	MDF76-30P-1C

7.1.2 Pin Assignment

Pin#	Signal Name	Pin#	Signal Name
1	RxOIN0-	2	RxOIN0+
3	RxOIN1-	4	RxOIN1+
5	RxOIN2-	6	RxOIN2+
7	VSS	8	RxOCLKIN-
9	RxOCLKIN+	10	RxOIN3-
11	RxOIN3+	12	RxEIN0-
13	RxEIN0+	14	VSS
15	RxEIN1-	16	RxEIN1+
17	VSS	18	RxEIN2-
19	RxEIN2+	20	RxECLKIN-
21	RxECLKIN+	22	RxEIN3-
23	RxEIN3+	24	VSS
25	VSS	26	VSS
27	VSS	28	VDD
29	VDD	30	VDD

7.2 Backlight Unit

Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

7.2.1 Connector

Connector Name / Designation	Lamp Connector / Backlight lamp
Manufacturer	Hirose
Type Part Number	DF14-10P- 1.25H
Mating Type Part Number	DF14-10D-1.25C

7.2.2 Pin Assignment

Pin No.	Symbol	Description
Pin1	GND	GND
Pin2	GND	GND
Pin3	12V	12V
Pin4	12V	12V
Pin5	On/OFF	3.3-5V:ON, 0V:OFF
Pin6	PWM	PWM dimming (for brightness adjustment) G190ETN02.0

G190ETN02.0

Duty	Current (mA / 1 ch)
10%	8.662
20%	20.132
30%	30.110
40%	40.100
50%	50.110
60%	60.116
70%	70.086
80%	80.054
90%	90.036
100%	99.960

Pin No.	Symbol	Description
Pin7	12V	12V
Pin8	12V	12V
Pin9	GND	GND
Pin10	GND	GND

8. Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃, 80%RH, 240hours	
High Temperature Operation (HTO)	Tgs= 60℃, 240hours	3
Low Temperature Operation (LTO)	Ta= 0℃, 240hours	
High Temperature Storage (HTS)	Ta= 60℃, 240hours	
Low Temperature Storage (LTS)	Ta= -20℃, 240hours	
Vibration Test (Non-operation)	Acceleration: 1.5 G Wave: Random Frequency: 10 - 200 - 10 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 20 ms Direction: ±X, ±Y, ±Z (one time for each Axis)	
Drop Test	Height: 60 cm, package test	
Thermal Shock Test (TST)	-20℃/30min, 50℃/30min, 50 cycles	
ESD (ElectroStatic Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point. Air Discharge: ± 15KV, 150pF(330Ω) 1sec 8 points, 25 times/ point.	1

Note1: According to EN61000-4-2, ESD class B: Some performance degradation allowed. No data lost

Self-recoverable. No hardware failures.

Note2:

- Water condensation is not allowed for each test items.

- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.

- The reliability test is performed only to examine the TFT-LCD module capability.

- To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24 hours at least in advance.

- No function failure occurs.

Note3: Tgs is defined as the panel surface temperature.

9. Labels

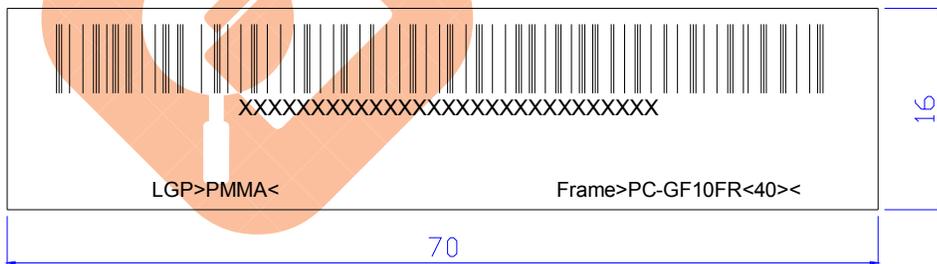## 9.1 Shipping Label
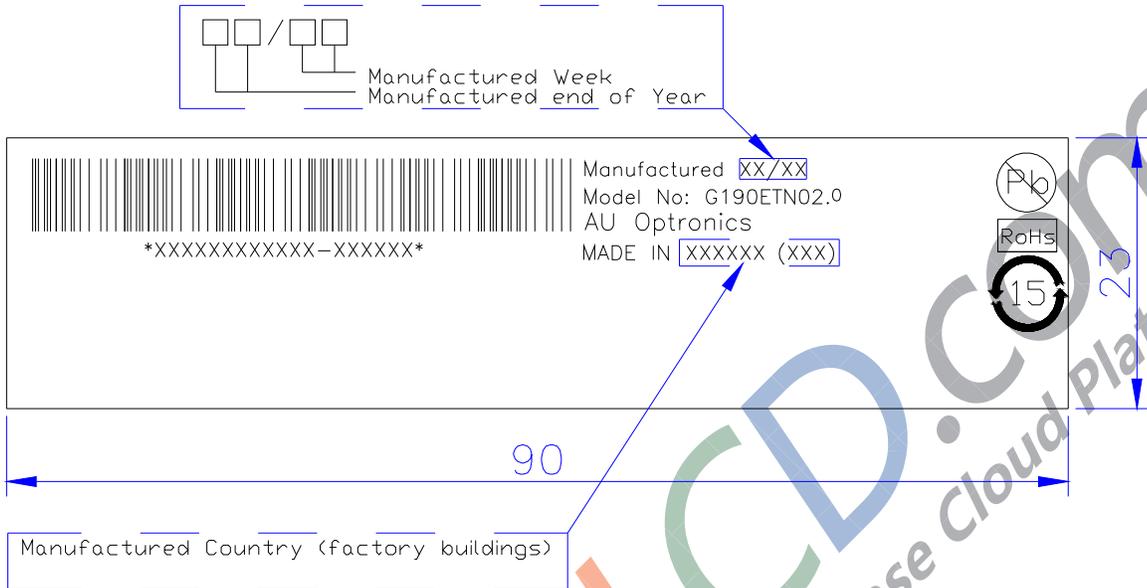
Unit: mm

Shipping No. has 18 digits：

XXXXXXXXXXXX-XXXXXX   => Lot number

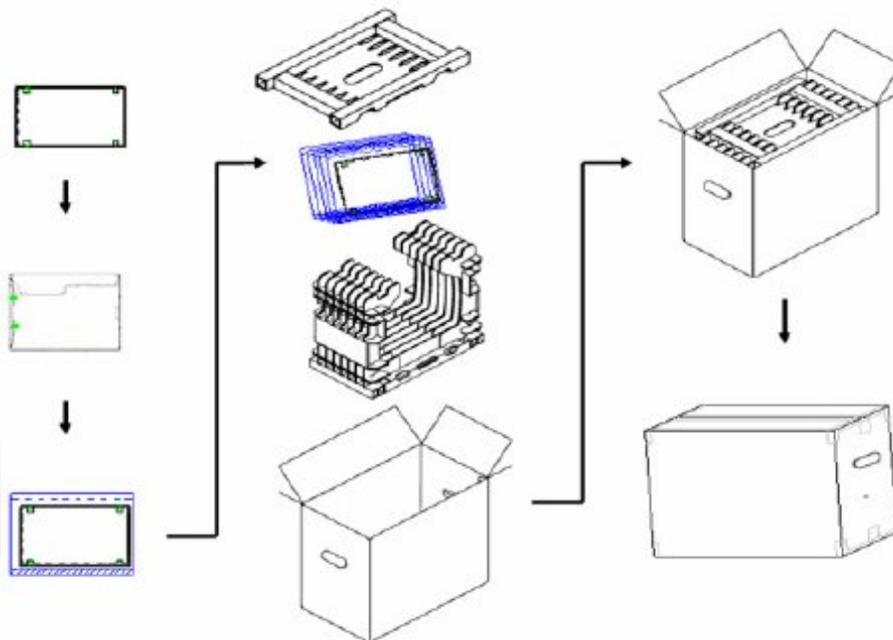XXXXXXXXXXXX-XXXXXX   => Factory number

9.2 BLU Label

XXXXXXXXXXXXXXXXXXXXXXXXXXXXX

LGP>PMMA<   Frame>PC-GF10FR<40><

Unit: mm

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10. Packing Form

10.1 Packaging material

FILM PROTECT
BAG ANTI-STATIC
TAPE
TAPE CREPED PAPER
PACKING CARTON
LABEL SPEC
LABEL CARTON.
CUSHION PACKING

10.2 Packing instruction

Max capacity：6 TFT-LCD module per carton

Max weight: 14.5 kg per carton

Outside dimension of carton: 476mm*274mm*413mm

Pallet size： 1140 mm * 980 mm * 132 mm

Box stacked

Module by air：(2 *4) *3 layers，one pallet put 24 boxes，total 144pcs module

Module by sea：(2*4) *4 layers，one pallet put 36 boxes，total 192pcs module

Palletizing

	SHIPPING BY AIR	SHIPPING BY SEA
MODULE/CARTON	6	6
CARTON/LAYER	8	8
LAYER/PALLET	3	4
MODULE/PALLET	144	192
CARTON SIZE(MM)	476(L)*274(W)*413(H)	476(L)*274(W)*413(H)
PALLET SIZE(MM)	1140(L)*980(W)*135(H)	1140(L)*980(W)*135(H)
TOTAL PALLET HEIGHT(MM)	1374	1787
TOTAL PALLET WEIGHT(KG)	361	477

ONE PALLET SHIPMENT EXAMPLE
SHIPPING BY AIR USED

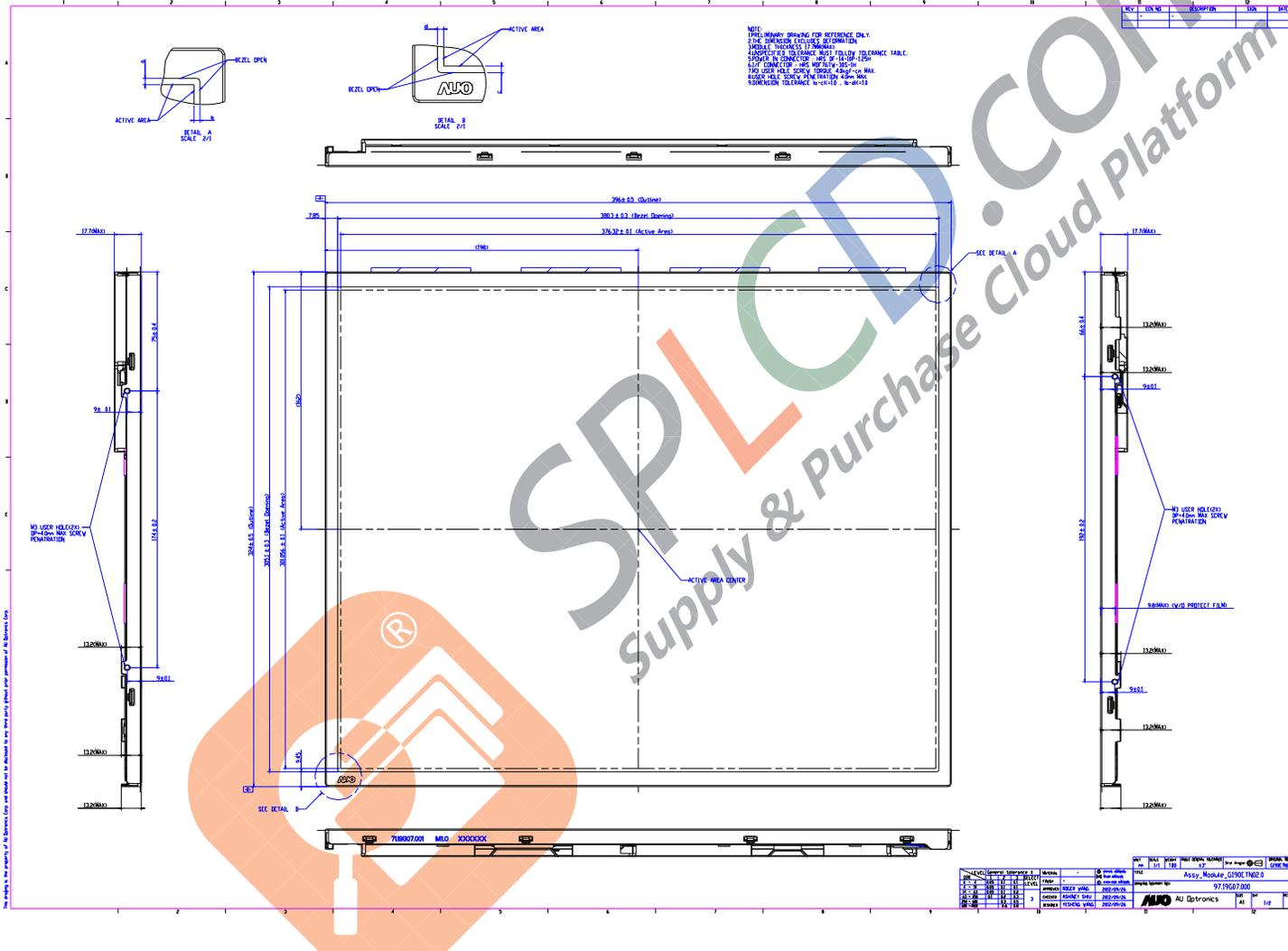ONE PALLET SHIPMENT EXAMPLE
SHIPPING BY SEA USED

11. Outline Drawing

Record of Revision

Version & Date	Page	Old Description	New Description	Remark
0.0 2012/08/17	All	Frist Draft		
0.1 2012/12/20	4	Contrast Ratio 1000: 1 (Typ.)	Contrast Ratio TBD (Typ.)	
	4	Power consumption: 40.7 W (Typ)	Power consumption: 37.1 W (Typ)	
	4	Opertion[^{o}C]: 0 to +50 Storage(Non-Operating) [^{o}C]:-20 to +60	Opertion[^{o}C]: 0 to +60 (Tgs) Storage (Non-Operating) [^{o}C]: -20 to +60 (Ta)	
	5	Viewing Angle: Min 70; Typ. 80	Viewing Angle: Min TBD; Typ. TBD	
	5	Contrast Ratio: Min 600; typ. 1000	Contrast Ratio: Min TBD; typ. TBD	
	5		Add Color / Chromaticity Coordinates (CIE) spec	
	8		Update 3.0 Functional Block Diagram	
	9		Update 4.2 Absolute Ratings of Environment	
	12		Update VCC& IVCC & PVCC; Add IRush and Note7.	
	22	High Temperature Operation (HTO): Ta= 60℃, 240hours	High Temperature Operation (HTO): Ta= 60℃, 240hours And add Note 3.	
	23	Shipping Label: TBD	Add shipping label and BLU label	
	24	Packing: TBD	Add 10.1 Packaging material and 10.2 Packing	
	25		Update Outline Drawing	
	26		Update Outline Drawing	
0.2 2013/1/29	4	Contrast Ratio : TBD (typ)	Contrast Ratio : 800 (typ)	
	4	Optical Response Time: TBD(Typ, on/off)	Optical Response Time: 10(Typ, on/off)	
	5		Update Viewing Angle Spec	
	5		Update Contrat Ratio Spec	
	5		Update Optical Response time Spec	
	16		Update Strat from ledt side drawing	
	20	7.1.1 Connector Manufacturer: HRS	Update: 7.1.1 Connector Manufacturer: Hirose	
	21	7.2.2 Pin Assignment: Pin6 discription ”PWM dimming”	Update 7.2.2 Pin Assignment: Pin6 discription	
	25		Add Box stacked drawing	
0.3 2013/2/20	5		Add Optical Response time Note	
	5		Add Color / Chromaticity Coordinates (CIE) spec Note	
	5		Add NTSC min. and Max. and Note	
	8		Update 3.0 Functional Block Diagram	

		23		Update shipping label	
1.0	2013/3/11	4		Updtae Optical ResponseTime	
		5		Updtae viewing angle when CR=5	
		5		Update Optical Response time Spec	
		5		Update Color / Chromaticity Coordinates (CIE) spec (Wx, Wy)	

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