



# ***TFT-LCD MONITOR***

## ***Product Information***

**MODEL NO. : T190E1D1**

**Date : 2009.03.24 Revision 2.2**

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This product specification is subject to change without any notice.



## Records of Revision

Date	Rev. No.	Summary	Page
2007.02.11	1.0	First Release	1
2007.04.16	2.0	Optical Characteristic Note(1) revised	7
		LED Driving Mode Revised/Increased	12
2007.08.03	2.1	3.1 Absolute Ratings... Note(1)&(2) added	6
		4.0 White Uniformity Added	7
		4.0 Note(7) added	8
		5.2.2 Backlight Life Time Added	10
		5.2.2 Backlight Unit & LED Driver Note(1) revised	10
		5.2.2 Note (2) Added	10
2009/3/24	2.2	Top Revised to -10 ~ +60 C	6/23

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<b>Contents</b>	<b>Page</b>
<b>1.0 Handling Precautions</b>	<b>4</b>
<b>2.0 General Description</b>	<b>5</b>
2.1 General Application	5
2.2 Main Features	5
2.3 General Information	5
2.3.1 Display Characteristics	5
2.3.2 Mechanical Dimensions	6
<b>3.0 Absolute Maximum Ratings</b>	<b>6</b>
3.1 Absolute Ratings of Environment Requirement	6
3.2 Electrical Absolute Ratings	7
3.2.1 TFT-LCD Module	7
3.2.2 Backlight Module(LED)	7
<b>4.0 Optical Characteristics</b>	<b>8</b>
<b>5.0 Electrical Characteristics</b>	<b>10</b>
5.1 AC Timing Characteristics	10
5.2 DC Characteristics	10
5.2.1 TFT-LCD Module	10
5.2.2 Backlight Unit & LED Driver	11
5.3 Input Terminal Pin Assignment	11
5.3.1 Signal Input Interface	11
5.3.2 LED Driver Unit	12
5.3.3 Color Data Reference	13
5.4 Input Timing Chart	15
<b>6.0 Pixel Format Image</b>	<b>16</b>
<b>7.0 Display Outline Dimensions</b>	<b>16</b>
<b>8.0 Labeling, Packaging &amp; Others</b>	<b>20</b>
<b>9.0 General Notices</b>	<b>22</b>
9.1 Reliability Test Item	22
9.2 Storage, Operation & Others	23



## 1.0 Handling Precaution

- 1.) Handle with care. Pay attention not to press or scratch the surface of the monitor, especially the polarizer. Do not twist or bend the monitor. It may cause un-recoverable damage.
- 2.) Do not drop or bump the monitor since this monitor contains fragile glass components. Breakage of this monitor might cause leakage of the liquid crystal sealed inside the glasses. Do not touch the liquid crystal liquid in case of leakage. **Flush with massive water immediately in case of contact with your skin by liquid crystal fluid and call for doctor for immediate medical treatment.**
- 3.) Be sure to turn off power supply while plug or un-plug the power input connector.
- 4.) Clean up the polarizer only with soft solvent if necessary. The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, toluene, Ethyl acid or Methyl chloride. It will permanently damage the polarizer due to chemical reaction. 5.) Wipe off fluid drop immediately to prevent from possible discoloration or spots on the polarizer.
- 6.) Do not twist nor bend the monitor structure, even momentarily. Bending or twisting torque may likely damage the internal components of the monitor.
- 7.) The cold cathode fluorescent lamp in LCD contains small amount of mercury (Hg). Please refer to the design specification for application and the local regulations and environmental laws for disposal purpose.
- 8.) Protect the monitor from static environment to prevent from damage to the CMOS gate array IC.



## 2.0 General Description

T190E1D1 is a 19 inch (5:4 aspect ratio) color active matrix TFT LCD monitor with excellent display performance driven by a pure **DIGITAL** LVDS interface assembled in a compact and slim **LED backlight** unit. This LCD supports 1280(H) x RGB x 1024(V) stripe color pixel format and 16.7M colors (RGB 8 bits) with vivid color image. Its outstanding performances with high color saturation of 72%, high brightness, **300 nits(typ.)**, super wide viewing angle(160°/160°) and ultra high contrast ratio 800:1, make this LCD module very suitable for terminal and video applications.

### 2.1 General Applications

- Display terminal for applications of Video, Industrial, Medical, Gaming, Amusement, Advertisement or more.

### 2.2 Main Features

- 5:4 1280 x RGB x 1024 Display Aspect Ratio
- LED Backlight Good Brightness of 300 nits
- Excellent Brightness at Low Temperature, 300 nits @ -30 °C
- Extremely Wide Dimming Range
- Super Wide Viewing Angle
- High Contrast Ratio
- High Color Saturation of 72%
- Pure 2ch Digital LVDS (Low Voltage Differential Signaling) Interface
- DE (Data Enable) Mode
- All-in-one Design, LED driver Enclosed
- RoHS Compliance & High Safety Product

### 2.3 General Information

#### 2.3.1 Display Characteristics

Item	Specification	Unit	Note
Display Area (HxV)	376.3 x 301.1	mm	19" Diagonal
Driver Element	a-Si TFT Active Matrix	-	-
Number of Pixels (HxV)	1280 x RGB x 1024	pixel	Std. 5:4
Pixel Arrangement	R.G.B Vertical Stripe	-	-
Dot Pitch (HxV)	(0.098x3) x 0.294	mm	Dot
Viewing Angle (H/V)	160/160	degree	6 o'clock
Signal Interface	Digital RGB 24 bits (2 ch LVDS)		16.7M colors
Display Mode	Normally White	-	-



### 5.2.1 Mechanical Dimensions

Item		Min.	Typ.	Max.	Unit	Note
Dimension	Horizontal		396.0		mm	±0.5 mm
	Vertical		324.0			±0.5 mm
	Depth	-	17.5			+0.5 mm
Weight		-	-	2500	g	±10 g

## 3.0 Absolute Maximum Ratings

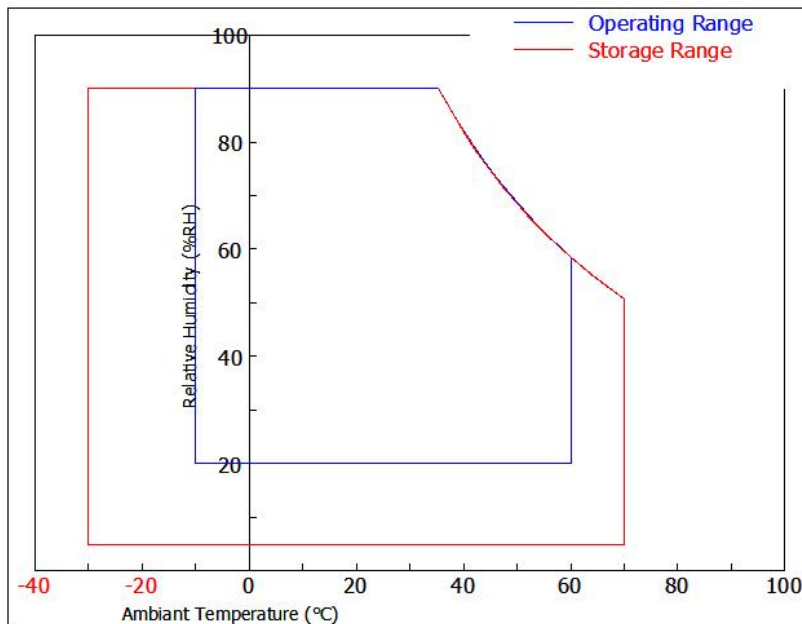
### 3.1 Absolute Ratings of Environment Requirement

Item	Symbol	Min.	Max.	Unit	Note
Storage Temperature	Tstg	-30	+70	°C	
Operation Temperature (Ambient Temperature)	Top	-10	+60	°C	(2)

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

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

Maximum wet – bulb temperature at  $39^{\circ}\text{C}$  or less. ( $T_a > 40^{\circ}\text{C}$ ) No condensation.



**Note(2)** : Uniformity might be degraded below  $-20^{\circ}\text{C}$ .



### 3.2 Electrical Absolute Ratings

#### 3.2.1 TFT-LCD Module

(Ta=25±2°C), GND=0V)

Item	SYMBOL	Min.	Max.	UNIT	NOTE
Power Supply Voltage	V <sub>CC-in</sub>	-0.3	5.5	V	(1),(2)

#### 3.2.2 Backlight Module(LED Driver)

Item	SYMBOL	MIN	MAX	UNIT	NOTE
Input DC Voltage	V <sub>BL</sub>		15	V	(1),(2)

**Note (1)** Within operating temperature

**Note (2)** Permanent damage to the device may occur if maximum values are exceeded.

Functional operation should be restricted to the conditions described under normal operating conditions.



## 4.0 Optical Characteristics

The following items are measured under stable conditions in a dark room or equivalent state.

### 3.2.3 Measuring Equipment: BM-5A, PR-650

( $V_{cc-in}=5V$ ,  $f_v=60Hz$ ,  $T_a=25\pm 2^\circ C$ )

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio	CR	At optimized Viewing Angle	600	800	-	-	(1)(2) (4)	
Response Time at 25°C	Rising	$\theta=0^\circ$	-	15	-	ms	(3)	
	Falling		-	5	-			
Luminance(center)	$Y_L$	$V_{DIM=max}$	230	300	-	cd/m <sup>2</sup>	(1)(2) (6)	
Color Chromaticity (CIE 1931)	White	$W_X$	$\theta=0^\circ$	-	TBD	-	-	(2)(6)
		$W_Y$	$\theta=0^\circ$	-	TBD	-	-	
Viewing Angle	Hor.	$\theta_L$	CR $\geq$ 10 at center point	-	80	-	Degree	(2)(5)
		$\theta_R$		-	80	-		
	Ver.	$\theta_H$		-	80	-		
		$\theta_L$		-	80	-		
White Uniformity	$\delta_w$			0.75		%	(2)(7)	

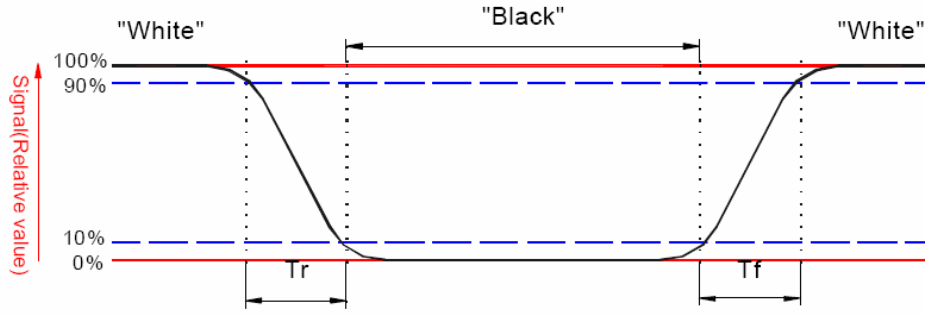
**Note (1)** : Ambient temperature =25°C, and , using the Mode 2 of LED control scheme and  $V_{DIM}=0V$  to get the maximum brightness. To be measured in the dark room.

**Note (2)** : To be measured on the center area of panel with a viewing cone of 1° by Topcon Luminance Meter BM-5, after 10 minutes operation.

**Note (3)** : 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 below.

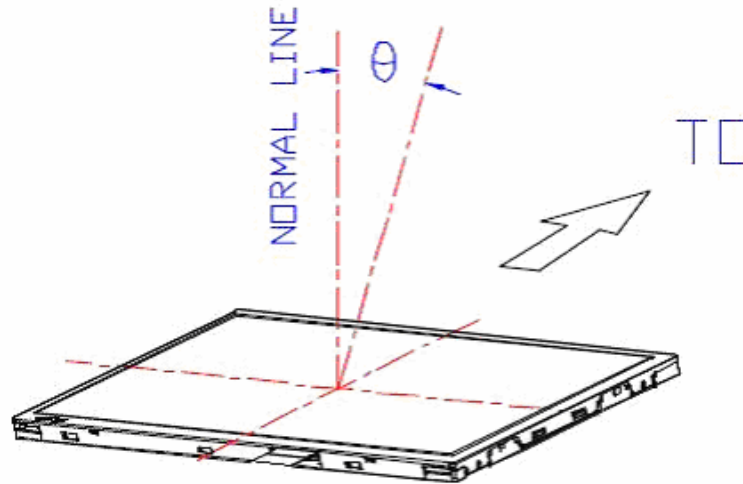


**Note (4) :** Definition of contrast ratio:

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 (5) :** Definition of viewing angle, Refer to figure as below.

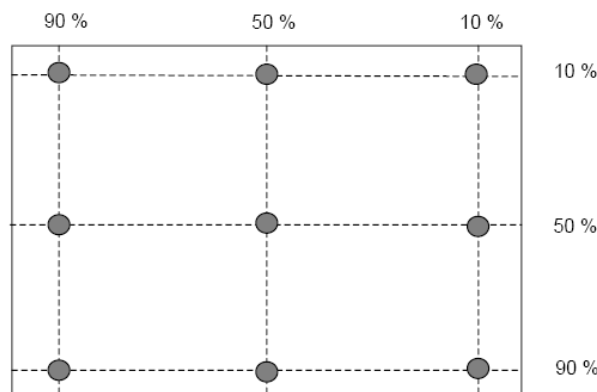


**Note (6) :** Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

**Note (7) :** Definition of White Uniformity :

Luminance is measured at the following 9 points.

$$\Delta_w = \frac{\text{Minimum Brightness of 9 points}}{\text{Mximum Brightness of 9 points}}$$





## 5.0 Electrical Characteristics

### 5.1 AC Timing Characteristics

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	45	54	68	MHz	-
	Period	Tc	14.71	18.52	22.22	ns	-
Vertical Active Display Term	Frame Rate	Fr	56	60	75	Hz	Tv=Tvd+Tvb
	Total	Tv	1044	1066	1300	Th	-
	Display	Tvd	1024	1024	1024	Th	-
	Blank	Tvb	20	42	Tv-Tvd	Th	-
Horizontal Active Display Term	Total	Th	710	844	980	Tc	Th=Thd+Thb
	Display	Thd	640	640	640	Tc	-
	Blank	Thb	70	204	Th-Thd	Tc	-

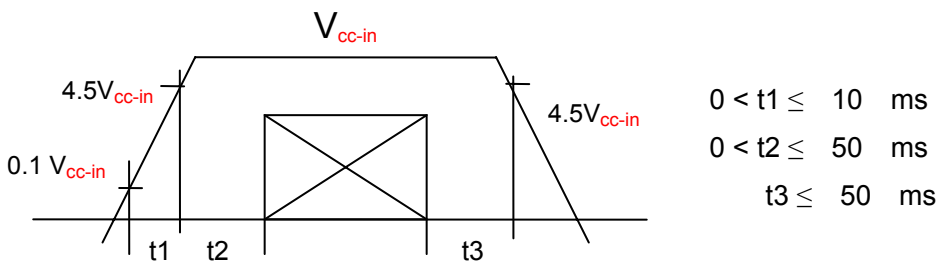
Note : (1) Hsync and Vsync input signals should be set to low logic level or ground because this LCD module is operated by "DE only" mode. Otherwise, this module would operate abnormally.

### 5.2 DC Characteristics

#### 5.2.1 TFT-LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply	V <sub>cc-in</sub>	4.5	5.0	5.5	V	(1)
	I <sub>cc-in</sub>	-	1.5	1.7	A	V <sub>cc-in</sub> =+5V
Permissive Input Ripple Voltage	V <sub>RF</sub>	100	-	-	mV <sub>P-P</sub>	V <sub>cc-in</sub> =+5V
Differential Impedance	Z <sub>m</sub>	90	100	110	ohm	
LVDS Differential Input Voltage	V <sub>id</sub>	-100	-	100	mV	
LVDS Common Input Voltage	V <sub>ic</sub>	1.125	1.25	1.375	V	

Note (1) V<sub>cc-in</sub> Power-On Condition :





### 5.2.2 Backlight Unit & LED Driver

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply	$V_{BL}$	10.8	12	13.2	V	
	$I_{BL}$	-	1.5	-	Amp	Note1
Backlight Life Time		40,000	50,000		hour	Note 1,2

**Note (1)** :  $V_{BL} = 12V$ , using the Mode 2 of LED control scheme and  $V_{DIM} = 0V$  to get the maximum brightness.

**Note (2)** : Since LED is consumables, the backlight life time stated in the above list is referential value and is not guaranteed by PowerView. The LED life time is defined as when brightness becomes 50% of the original value that is applied under continuous turning on at the typical value of the power supplied into the backlight, as defined above, at +25°C in a stable environment.



### 5.3 Input Terminal Pin Assignment

#### 5.3.1 Signal Input Interface

JAE Connector: 30 pin/1 mm pitch JAE-FI-X30SSL-HF

Mating Connector : JAE FI-XB30SSL-HF15 or equivalent

Pin No	Symbol	Description	Remark
1	RxO0-	LVDS receiver signal channel 0 (Odd ch)	
2	RxO0+		
3	RxO1-	LVDS receiver signal channel 1 (Odd ch)	
4	RxO1+		
5	RxO2-	LVDS receiver signal channel 2 (Odd ch)	
6	RxO2+		
7	GND	Ground	
8	RxOC-	LVDS receiver signal clock (Odd ch)	
9	RxOC+		
10	RxO3-	LVDS receiver signal channel 3 (Odd ch)	
11	RxO3+		
12	RxE0-	LVDS receiver signal channel 0 (Even ch)	
13	RxE0+		
14	GND	Ground	
15	RxE1-	LVDS receiver signal channel 1 (Even ch)	
16	RxE1+		
17	GND	Ground	
18	RxE2-	LVDS receiver signal channel 2 (Even ch)	
19	RxE2+		
20	RxEC-	LVDS receiver signal clock (Even ch)	
21	RxEC+		
22	RxE3-	LVDS receiver signal channel 3 (Even ch)	
23	RxE3+		
24	GND	Ground	
25	GND	Ground	
26	NC	No Connection	
27	GND	Ground	
28	V <sub>cc_IN</sub>	Power supply (+5V)	
29	V <sub>cc_IN</sub>	Power Supply (+5V)	
30	V <sub>cc_IN</sub>	Power Supply (+5V)	



**5.3.2 LED Driver Unit**

Connector : ACES 88290-0601 pitch 2.0mm 6 pins CN

**Mode 1 :**

Matching Connector : ACES 86809-0600 CN

Pin No.	Symbol	Description	Remark
1	V <sub>BL</sub>	Power Supply for LED Driver	
2	V <sub>BL</sub>	Power Supply for LED Driver	
3	EN	LED Enable & Dimming Control Input	Note 1
4	DIM	Connect this pin to GND at this mode	Note 2
5	GND	Ground Pin for LED Driver	
6	GND	Ground Pin for LED Driver	

Note 1 : The “Enable & Dimming Control” of the LED driver shares the same pinning.

The LED backlight will turn on when the input voltage of this pin exceeds +0.6V.

The LED current/brightness will be adjustable by applying an analog voltage between +0.8 ~ +1.4V(Max. Brightness).

Note 2: The “DIM” pin should be connected to GND in order to get the full brightness.

**Mode 2:**

Pin No.	Symbol	Description	Remark
1	V <sub>BL</sub>	Power Supply for LED Driver	
2	V <sub>BL</sub>	Power Supply for LED Driver	
3	EN	LED Enable Control Input	Note 1
4	DIM	Dimming Control Input	Note 2
5	GND	Ground Pin for LED Driver	
6	GND	Ground Pin for LED Driver	

Note 1 : Disable V<sub>EN</sub><0.6 V, Enable V<sub>EN</sub>>1.8 V

Note 2 : Max Brightness V<sub>DIM</sub> : 0V, Min Brightness V<sub>DIM</sub> : 2.2V ( ≈ 0 Nit )

**Mode 3:**

Pin No.	Symbol	Description	Remark
1	V <sub>BL</sub>	Power Supply for LED Driver	
2	V <sub>BL</sub>	Power Supply for LED Driver	
3	EN	PWM Control Pulse Input	Note 1, 2
4	DIM	Connect this pin to GND at this mode	Note 3
5	GND	Ground Pin for LED Driver	
6	GND	Ground Pin for LED Driver	

Note 1: Valley of PWM Pulse V<sub>PWM</sub><0.6 V, Peak of PWM Pulse V<sub>PWM</sub> >1.8 V

Note 2: The frequency of each completed PWM cycle: 100~300 Hz

Note 3: The “DIM” pin should be connected to GND in order to get the full brightness.



### 5.3.3 Color Data Reference

The below table is about input signal, Basic display colors and gray scale of each color.

0 : Low Level Voltage      1 : High Level Voltage

Each basic color can be displayed in 256 gray scales from 8 bit data signals. With the combination of total 24 bit data signals, the 16,777,216 color display can be achieved on the screen.

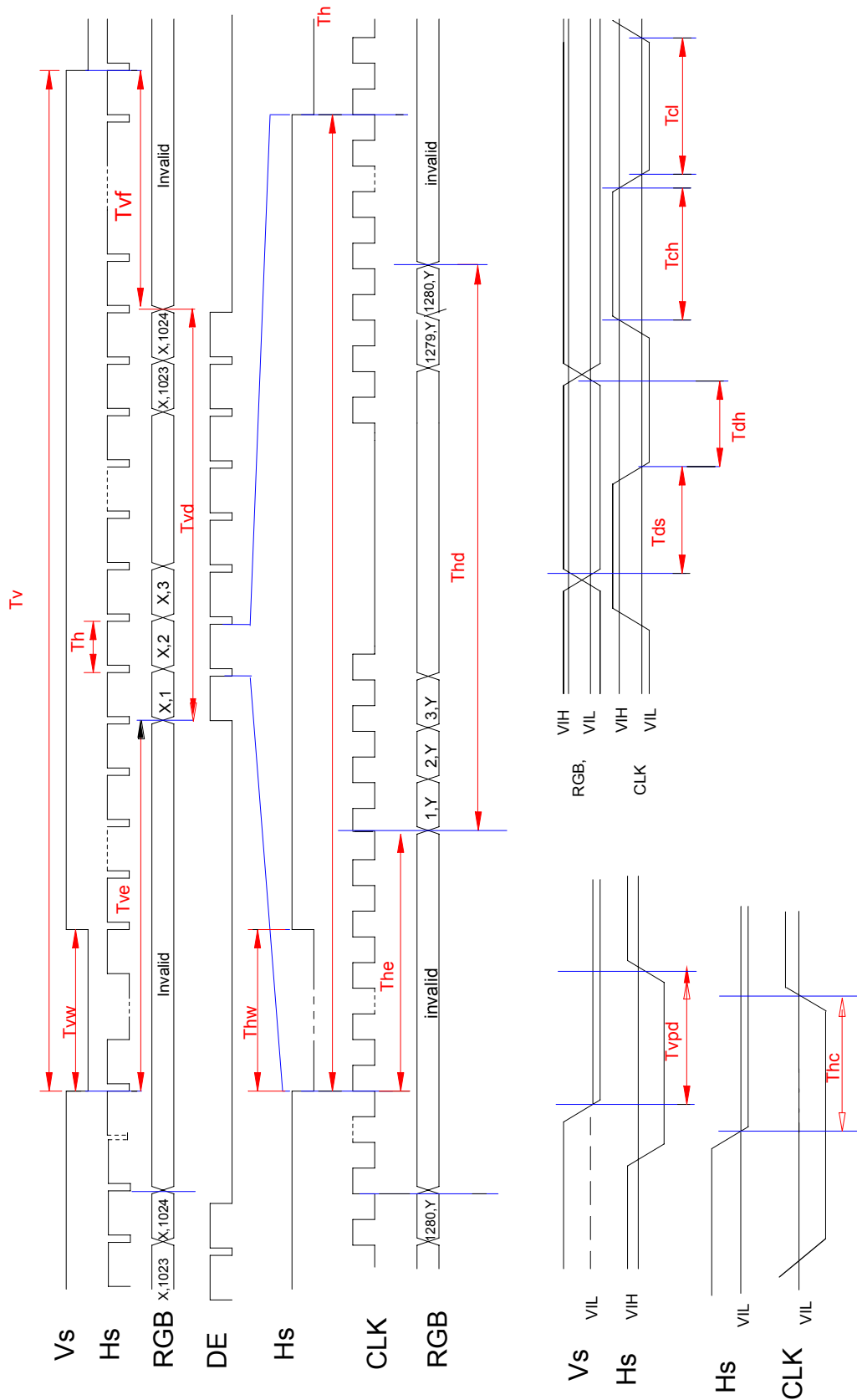
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	Colors & Gray Scale	Data Signal																								
		Gray Scale	R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
Basic Color	Black	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	-	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	-	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	-	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	-	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	1	1	1	1	1	1
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	↓					↓							↓								↓				
	↓	↓					↓							↓								↓				
	Brighter	GS253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↓	GS254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	↓					↓							↓								↓				
	↓	↓					↓							↓								↓				
	Brighter	GS253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	↓	GS254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	GS255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	↑	↓					↓							↓								↓				
	↓	↓					↓							↓								↓				
	Brighter	GS253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	↓	GS254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Blue	GS255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

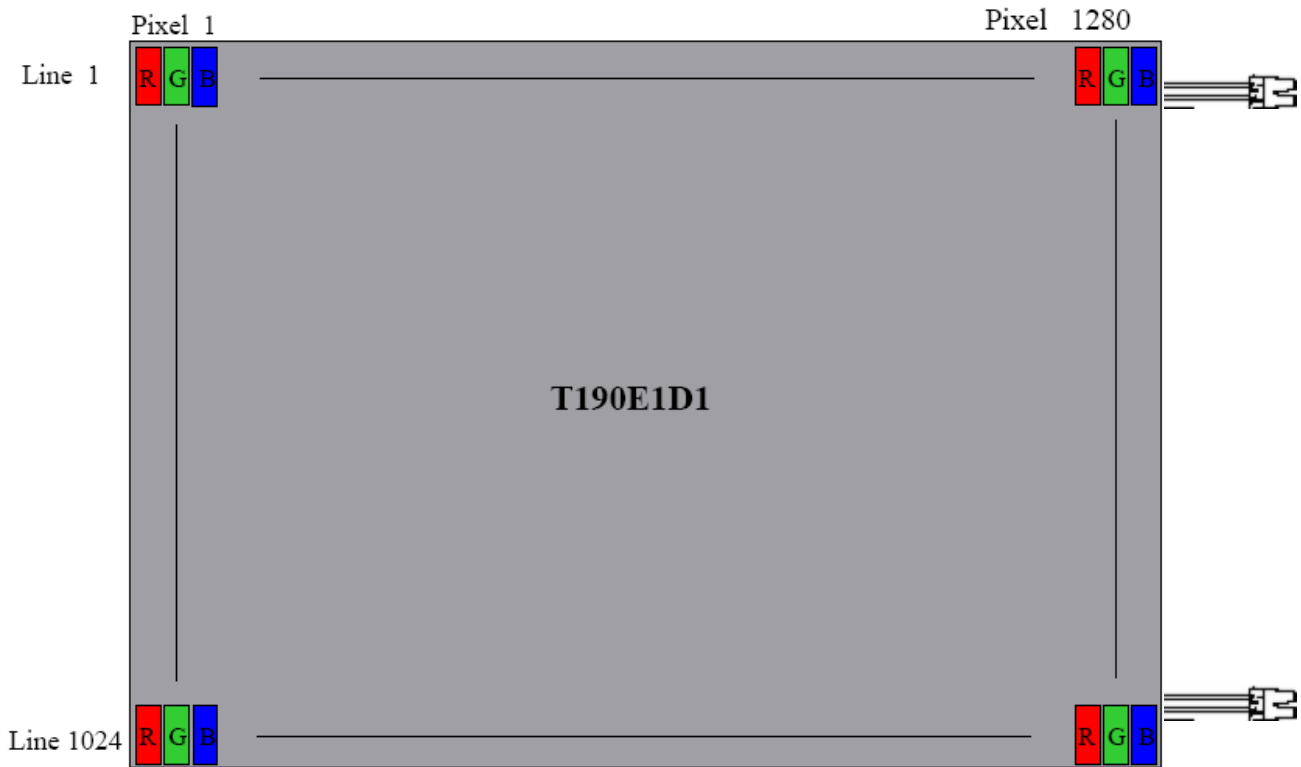
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### 5.4 Input Timing Chart





## 6.0 Pixel Format Image



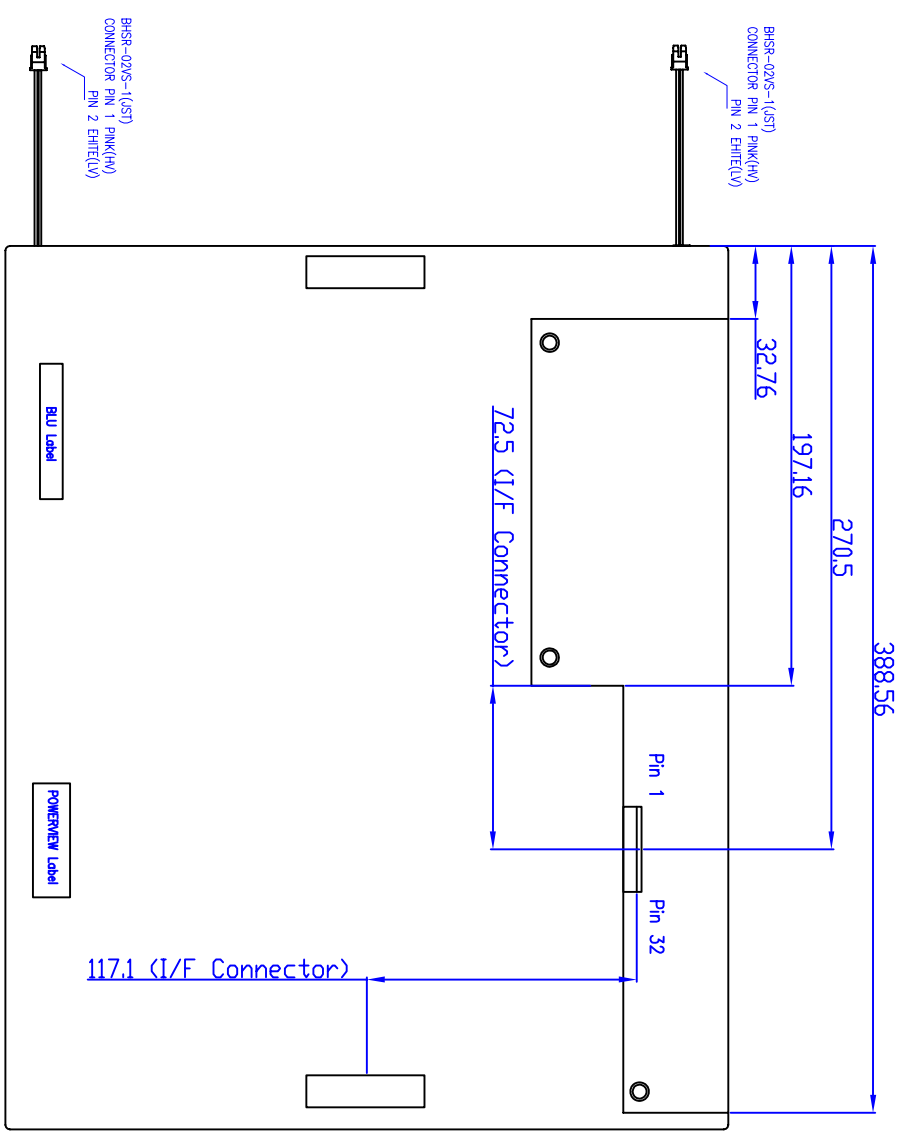
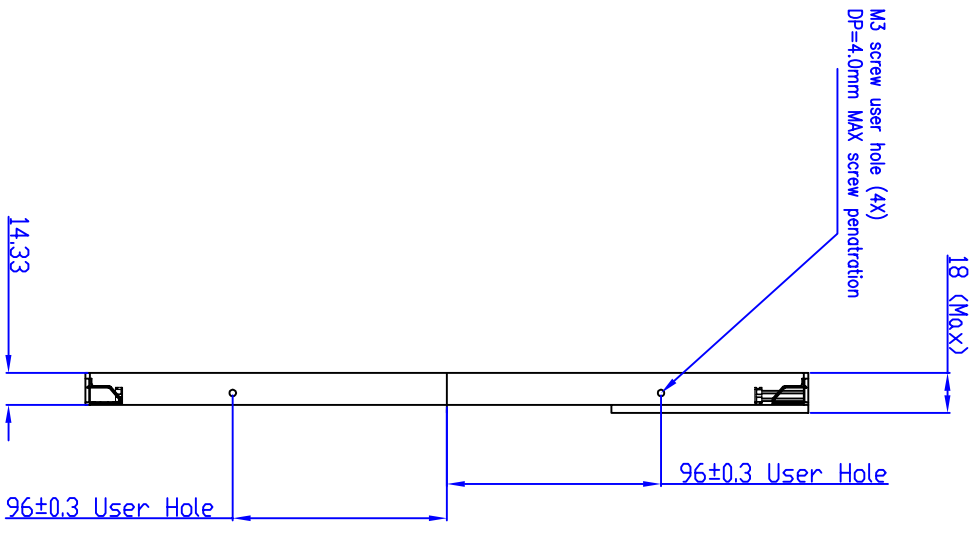
## 7.0 Display Outline Dimensions

### 7.1 Monitor Outline Dimensions

- Please refer to the next page



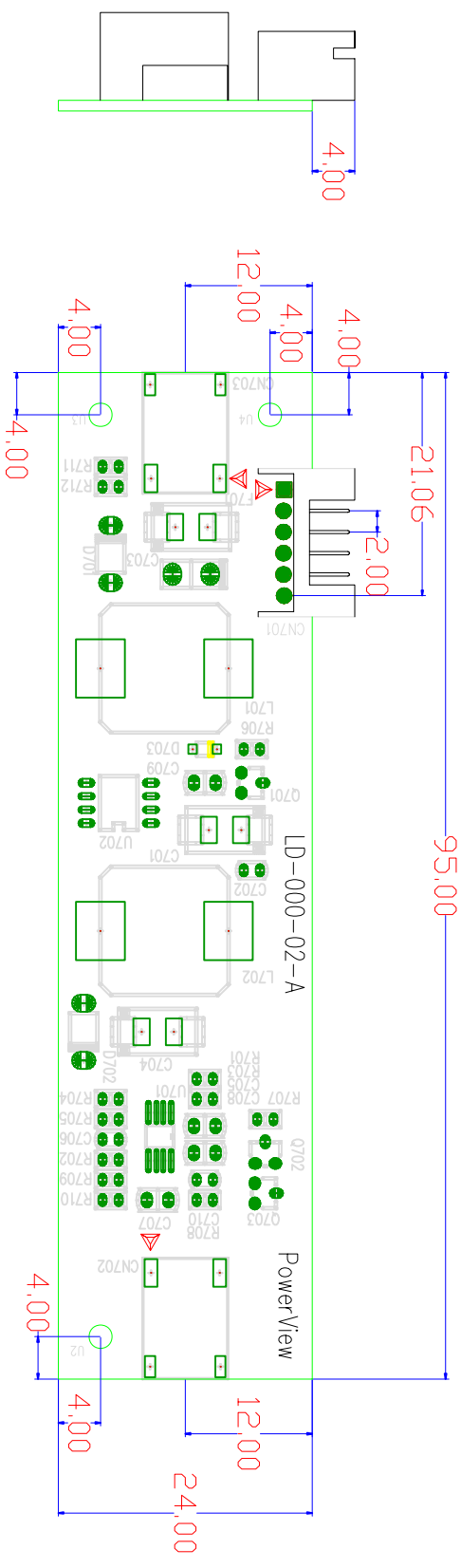
REV	EQ. NUMBER	DESCRIPTION	DATE
1	X00000	X000000	



SIZE	1	2	3	4	5	6	7	8	9	10	11	12
1.6	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
2.0	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
2.5	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
3.2	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
4.0	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
5.0	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
6.3	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
8.0	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
10.0	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
12.5	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13

POVERVIEW DISPLAY CORPORATION		All Rights Reserved	
MATERIAL	See notes	DATE	3rd ANGLE
FINISH	Finish	FORM	1:1/2X
APPROVED		APP'D	
CHECKED		DATE	
DESIGNED	Tim	REV	2
DESIGNED		DATE	007/02/06
49190E10001-2		REV	43
T190E1D1		REV	1-1
TI90E1D1 Outline Dimension		REV	A

REV	EC NUMBER	DESCRIPTION	DATE
1	XXXXXX	XXXXXX	



CN701	
SYMBOL	DESCRIPTION
Pin 1 Vin	Power Supply +12V
Pin 2 Vin	Power Supply +12V
Pin 3 ENA	On/Off Control (On>+1.8V, Off<+0.6V)
Pin 4 DIM	Linear Dim, 0V(Max.) ~ +1.4V(min.)
Pin 5 GND	Ground
Pin 6 GND	Ground

CN702 / CN703	
SYMBOL	DESCRIPTION
Pin 1 Anode	Anode DC Power Supply for Backlight Unit
Pin 2 Cathod	Cathod DC Power Supply for Backlight Unit

Dimension	1	2	3	4	5	6	7	8	9	10	11	12
1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
6	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
8	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
9	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
11	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
12	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

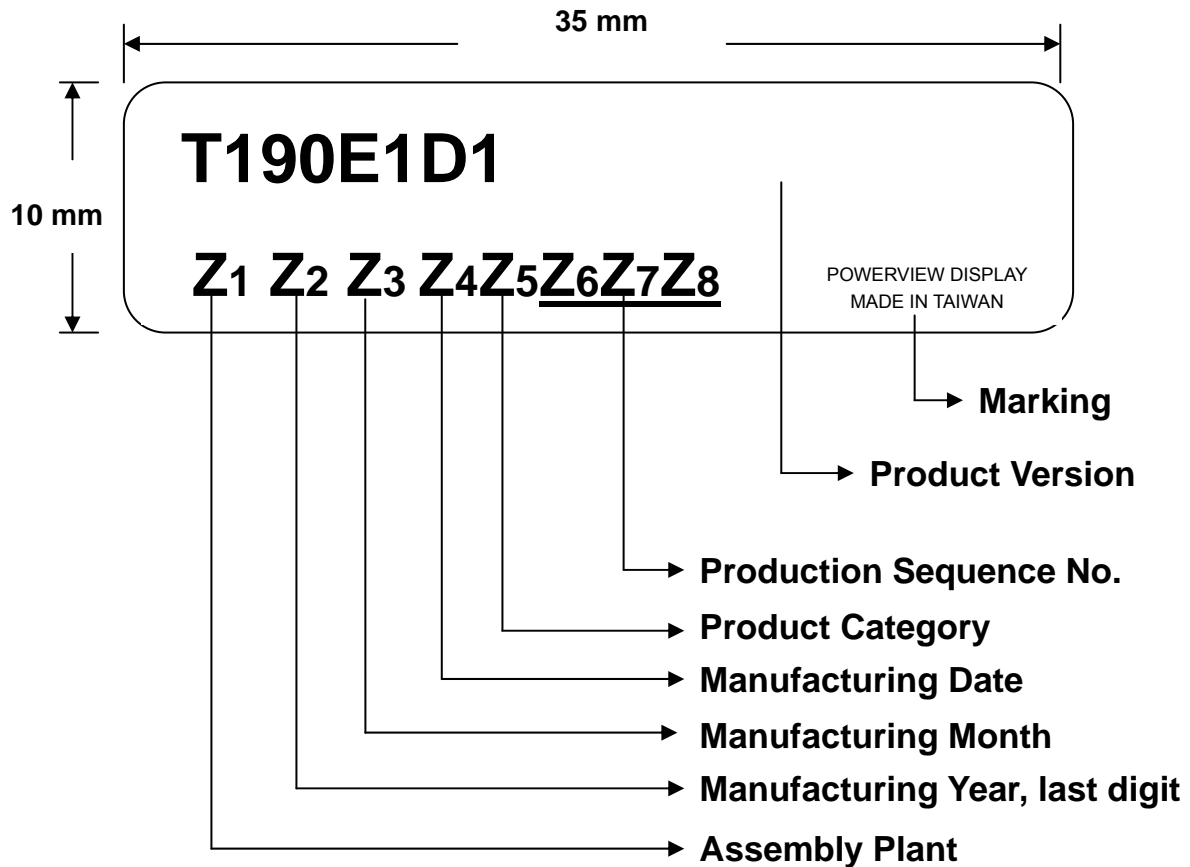
POVERVIEW DISPLAY CORPORATION All Rights Reserved

MATERIAL	See notes	DATE	REV	3rd ANGLE
FINISH	Finish	DATE	REV	
APPROVED	Signature	DATE	REV	
CHECKED	Signature	DATE	REV	
DESIGNED	Signature	DATE	REV	



## 8.0 Labeling, Packaging & Others

### \* Labeling





**\* Packaging**

- TBD



## 9.0 General Notice

### 9.1 Reliability Test Items (Note 2)

No.	Test Items	Conditions	Remark
1	High Temperature Storage	Ta= + 70°C                      240 Hrs	
2	Low Temperature Storage	Ta= - 30°C                      240 Hrs	
3	High Temperature Operation	Ta= + 60°C                      240 Hrs	
4	Low Temperature Operation	Ta= - 10°C                      240 Hrs	
5	High Temperature and High Humidity	Tp= 40°C, 90%RH              240 Hrs	operation
6	Heat Shock	-30~60°C/200 cycles 1Hr/cycle	Non-operation
7	Electrostatic discharge	10KV, 150pF(330Ω), 1 second, 9 positions on the panel, 10 times each place.	Non-operation
8	Vibration	Frequency range : 10~500~10Hz Stoke                      : 1.3mm Sweep                      : 1G Cycle                      : 30 minutes 1 hours for each direction of X,Y,Z	
9	Mechanical Shock	50G, 11ms, ±X±Y±Z once for each direction	
10	Vibration (with carton)	Random vibration : 0.015G <sup>2</sup> /Hz from 5~200Hz -6dB/octave from 200~500Hz	IEC 68-34
11	Drop (with carton)	Height : 60 cm 1 corner, 3 edges, 6 surfaces	JIS Z0202

Note1: Ta: Ambient temperature.

Note 2: In the standard conditions, there is not display function NG issue occurred. All the cosmetic specification is judged before the reliability stress.



## 9.2 Storage, Operation & Others

- (a) 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 35°C and relative humidity of less than 70%.
- (b) Do not store the TFT-LCD module in direct sunlight.
- (c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.
- (d) Do not connect, disconnect the module in the "Power On" condition.
- (e) Power supply should always be turned on/off by the item 3.2 "Electrical Absolute Ratings"
- (f) The liquid-crystal is deteriorated by ultraviolet rays. Do not leave it in direct sunlight and strong ultraviolet rays for many hours.
- (g) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (h) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)  
Otherwise the panel may be damaged.
- (i) 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.
- (j) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.