

## Product Specification of Plasma Display Panel

# TENTATIVE SPECIFICATION

( ) Preliminary Specification

( ○ ) Final Specification

Title	PDP60X5#3## (60" PDP MODULE)
-------	------------------------------

BUYER NAME	GPNC
MODEL NAME	
PART No.	

SUPPLIER	LG Electronics Inc. PDP Division
MODEL NAME	PDP60X5#3#
PART No.	

SIGNATURE	DATE
_____ / _____	_____
_____ / _____	_____
_____ / _____	_____

Please return 1 copy for our confirmation with your signature and comments.

SIGNATURE	DATE
APPROVED BY <u>N.K.LEE / G. Manager</u>	_____
REVIEWED BY <u>J.S. LEE / S. Manager</u>	_____
PREPARED BY <u>H.T. Chun / S. R.</u> <u>Engineer</u>	_____
PDP Engineering Department PDP Division LG Electronics Inc.	

**CONFIDENTIAL**



## **CONTENTS**

<b>NO.</b>	<b>I T E M</b>	<b>Page</b>
-	COVER	1
-	CONTENTS	2
-	RECORD of REVISIONS	3
1.	GENERAL DESCRIPTION	4
2.	ELECTRICAL SPECIFICATIONS	12
3.	CONNECTORS AND CONNECTIONS	20
4.	OPTICAL SPECIFICATIONS	22
5.	MECHANICAL AND RELIABILITY SPECIFICATIONS	25
6.	IMAGE STICKING CHARACTERISTICS	28
7.	WARNING AND CAUTIONS	31

**CONFIDENTIAL**



## **RECORD of REVISIONS**

Revision No.	Effective Date	Contents
00	2003. 11. 10	Final Specification

**CONFIDENTIAL**



# 1. GENERAL DESCRIPTION

## ● DESCRIPTION

The PDP60X5#3## is a 60-inch 16:9 color plasma display module with resolution of 1366(H) X 768(V) pixels. This is the display device which offers vivid colors with adopting AC plasma technology by LG Electronics Inc.

## ● FEATURES

High peak brightness (1000cd/m<sup>2</sup> Typical) and high contrast ratio (1000:1 Typical) enables user to create high performance PDP SET.

## ● APPLICATIONS

Public information display

Video conference systems

Education and training systems



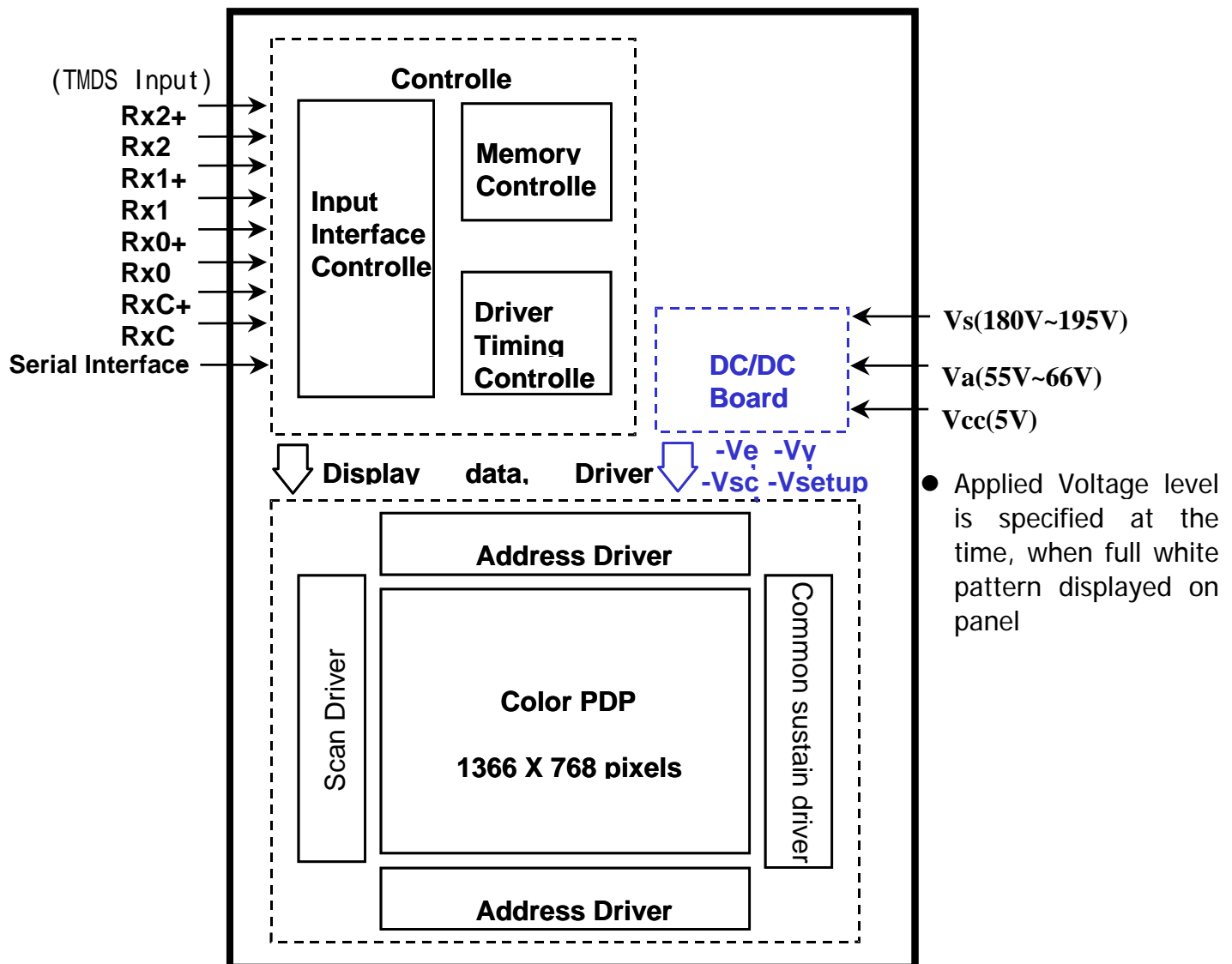
CONFIDENTIAL



## ● ELECTRICAL INTERFACE OF PLASMA DISPLAY

The PDP60X5#3## requires only 8bits of digital video signals for each RGB color. In addition to the video signals, three different DC voltages are required to operate the display. The PDP60X5#3## is equipped with P-CUBE function what it analyze display signal and do optimizing system control factor to show best display performance.

## ● BASIC CONFIGURATION



CONFIDENTIAL

**Product Specification of Plasma Display Panel****● GENERAL SPECIFICATIONS**

Display area	1319.6 (H) x 741.9 (V) $\pm$ 0.5 mm
Outline dimensions <sup>2)</sup>	1408 (H) x 828 (H) x 60 (D) $\pm$ 1 mm
Weight	33.0 $\pm$ 1 Kg (Net : 1 EA), 123 $\pm$ 1 Kg (Gross : 3 EA / 1 Box)
Aspect ratio	16 : 9
Number of pixels	1366 (H) x 768(V) (1 pixels = 3 RGB cells)
Cell Pitch	354um (H) x 966um (V) (stand for Green Cell)
Color arrangement	RGB Fish Bone type
Number of gradations	256 steps for PC RGB
Peak brightness	Typical 1000 cd/ m <sup>2</sup> (1/25 white window pattern at center)
Power Consumption	Max. 570W(Full White)
Contrast ratio	Typical 1000 : 1 ( In dark room with 1/25 white window pattern at center) Typical 55 : 1 (In bright room with 150Lux at center)

**● LIFE EXPECTANCY**

The anticipated life-time is estimated more than 25,000 hours of continuous operations.

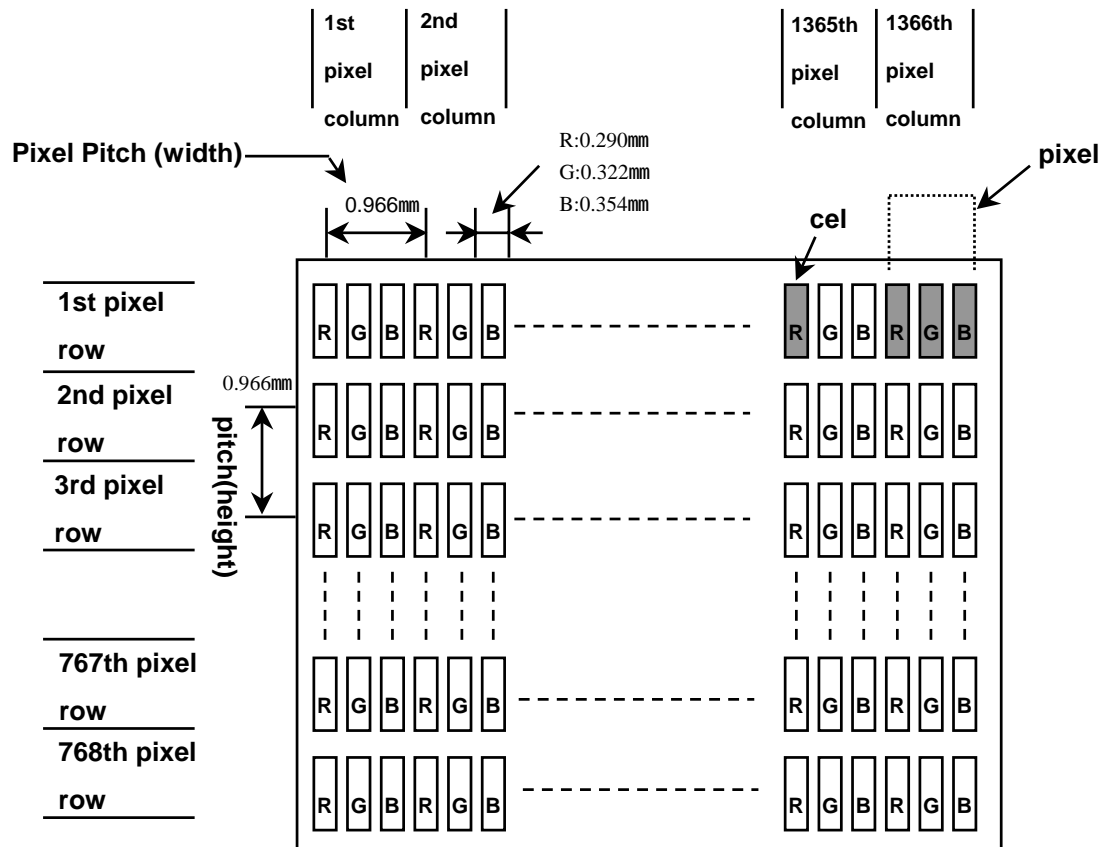
Average life time is the time when the brightness level becomes half of its initial value.

<sup>2)</sup> See detail of dimension in rear view.

**CONFIDENTIAL**



## ● DISPLAY DOT DIAGRAM



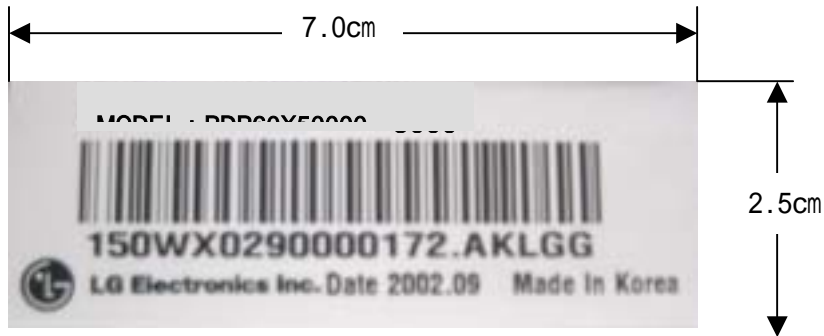
CONFIDENTIAL



## ● LABEL

### Description

1) LABEL : Identification Label



Model Name

Bar Code (Code 128, Contains The Manufacture No. )

Manufacture No.

The Trade Name of LG Electronics

Manufactured Date (Year & Month)

The Place of Origin

Model Suffix

2) LABEL : Warning Label ( High Voltage)

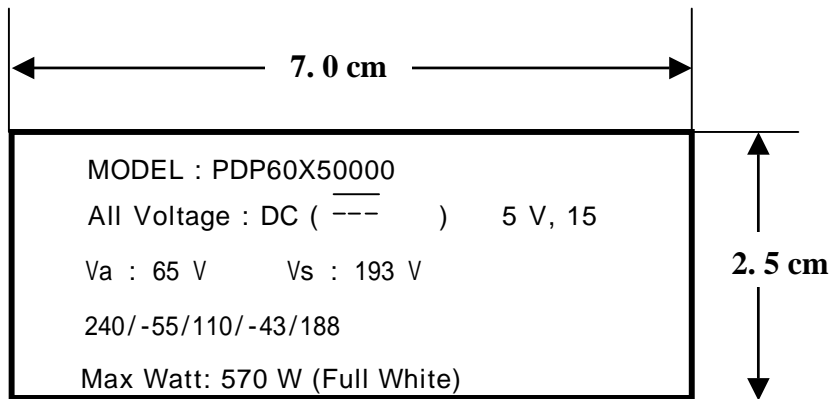
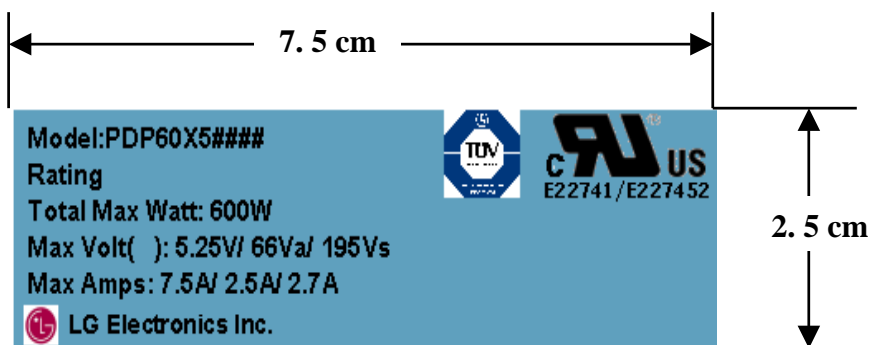


3) LABEL : Warning Label ( Hot Surface)



CONFIDENTIAL



**4) LABEL** : Caution Label ( Mechanical Hazard)**5) LABEL** : Voltage Label (Model Name & The Operational Voltage )**6) LABEL** : Safety Approval Label

Model name

Max. Watt(Full White)

Max. Volts

Max. Amps.

The Trade Name of LG Electronics

TUV Approval Mark

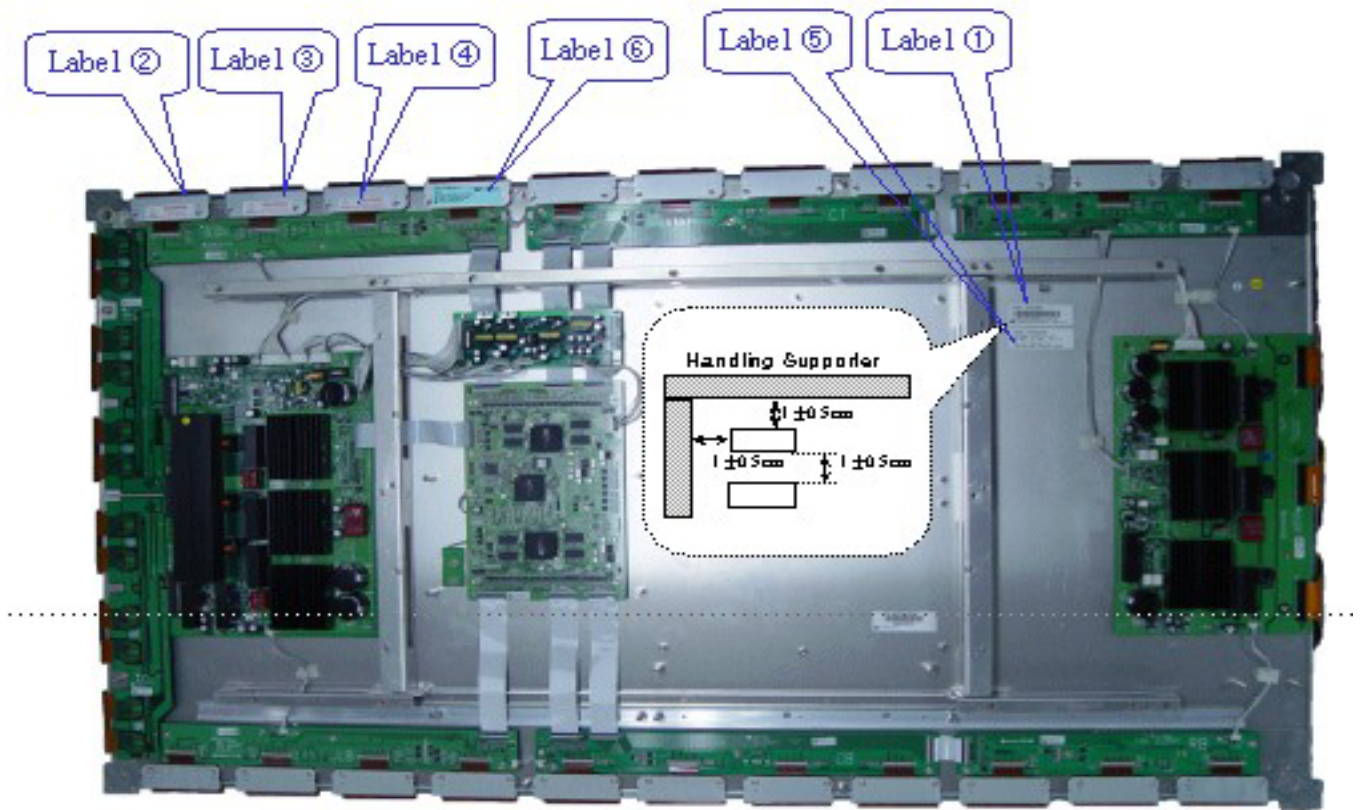
UL Approval Mark

UL Approval No.

**CONFIDENTIAL**



## Sticking Position



CONFIDENTIAL

**● CONDITIONS OF ACCEPTABILITY****1) Main Power Supply**

In order to supply the main power, the manufacturer of end-user products should adopt suitable Main SMPS, DC/DC Converter which are equipped with OCP and OVP. These characteristics of OCP and OVP should be as follows.

POINT	+5V	Va	Vs
OCP	13~25.5 Arms	2.8~5.25 A (mean)	3.0~6.0A
OVP	5.5~7.0 Vrms	67~80 V	205~220V

- OCP (Over current protection): This functions to protect power supply or load from output current applied in excess of limited value.
- OVP (Over voltage protection): This functions to protect against output voltage exceeding a fixed value and against over voltage load.

**2) Insulation**

- The end-user product should satisfy the insulation and material requirements on Safety Standards of Information Technology Equipment IEC 60950, UL60950 and CSA C22.2 No 60950, or IEC 60065, UL 6500 and C22.2 No 60065
- The screen filter(Black mask filter) of end-user products should satisfy the supplementary insulation.

**3) Additional requirements**

- Proper fire enclosure
- Proper mechanical enclosure
- Safety test including Power Supply Board should be performed as a part of the end-user product investigation.

**CONFIDENTIAL**



## 2. ELECTRICAL SPECIFICATIONS

### ● Absolute Power Specifications

Item	Symbol	Conditions	Min	Max	Unit	Mark
Logic Voltage	Vcc	25°C	4.5	6	V	
Data Voltage	Va	25°C	—	72	V	
Sustain Voltage	Vs	25°C	—	200	V	

### ● Input Power Type and Specifications

Logic Power Supply (Vcc)

Item	Condition	Min	Typ	Max	Unit
Voltage Range	—	4.75	5	5.25	V
Voltage Stability	—	—	—	±3.0	%
Current	—	4.5	6	7.5	Amean
Ripple	—	—	—	150	mVp-p
Noise	—	—	—	300	mVp-p

### ● Data Power Supply (Va)

Item	Condition and Remarks	Min	Typ	Max	Unit
Voltage Range	Dependent on the characteristics of each PDP	55	—	66	V
Voltage Stability	—	—	—	±1.5	%
Average Current	Varied correspondence to the image	0.05	—	2.5	Amean
Ripple & Noise	—	—	—	300	mVp-p

Note : Voltage should be set to a specified value which is located on a label attached to the module

CONFIDENTIAL



## Product Specification of Plasma Display Panel

## ● Sustain Power Supply (Vs)

Item	Condition and Remarks	Min	Typ	Max	Unit
Voltage Range	Dependent on the characteristics of each PDP	180	—	195	V
Voltage Stability	—	—	—	±1.0	%
Peak Current	Full white	—	—	21	A
Average Current	Dependent on the characteristics of each PDP	0.1	—	2.7	Amean
Voltage Regulation	At peak current	—	—	5	V
Ripple & Noise	—	—	—	500	mVp-p

## Setup Power Supply(Vset\_up)

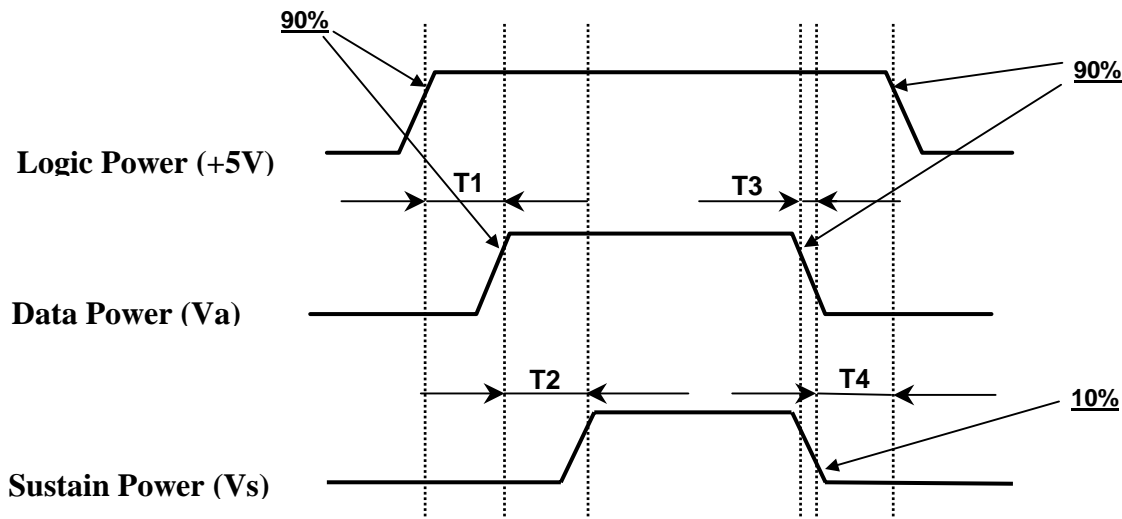
Item	Condition	Min	Typ	Max	Unit
Voltage Range	Dependent on the characteristics of each PDP	210	—	260	V
Voltage Stability	—	—	—	±1.0	%
Average Current	—	1	—	50	mAmean
Voltage Regulation	At the peak current	—	—	5	V
Ripple & Noise	—	—	—	1	Vp-p

## Vsc Power Supply(Vsc)

Item	Condition	Min	Typ	Max	Unit
Voltage Range	Dependent on the characteristics of each PDP	90	—	120	V
Voltage Stability	—	—	—	±1.0	%
Average Current	—	1	—	50	mAmean
Voltage Regulation	At the peak current	—	—	2	V
Ripple & Noise	—	—	—	500	mVp-p

Note : Voltage should be set to a specified value which is located on a label attached to the module.

CONFIDENTIAL

**\*Supply Voltage Sequence****Power On/Off sequence**

Turn On Sequence : +5V → Va → Vs

Turn Off Sequence : Vs → Va → +5V

If power sequence does not meet to above sequence diagram, PDP drivers may have a permanent damage. Even though AC input of power supply is switched ON/OFF, above sequence should be kept.

T1 : Min 500 msec (From 90% of +5V voltage to 90% of Va voltage time)

T2 : Min 0 msec (From 90% of Va voltage to 90% of Vs voltage time)

T3 : Max 500 msec (From 90% of Va, Vs voltage to 10% of Va, Vs voltage time)

T4 : Min 20 msec ( From 10% of Va, Vs voltage to 90% of +5V voltage time )

Note : **Dispen** signal must turn on ("HIGH") after all voltages reach at least 90% of their working voltage.

**CONFIDENTIAL**



- **Input Signal Type(TMDS) and Specifications**

Symbol	Signal Definition and Function
Rx2+	Channel-2 Pos. Receiver Input
Rx2-	Channel-2 Neg. Receiver Input
Rx1+	Channel-1 Pos. Receiver Input
Rx1-	Channel-1 Neg. Receiver Input
Rx0+	Channel-0 Pos. Receiver Input
Rx0-	Channel-0 Neg. Receiver Input
RxC+	Clock Pos. Receiver Input
RxC-	Clock Neg. Receiver Input

Note : The RGB video signal is compensated with inverse  $\gamma$  circuit. Therefore you need not compensation again.

**CONFIDENTIAL**



● TMD5 Receiver Output type and Pin Number

Pin Number	Symbol	Pin Number	Symbol	Pin Number	Symbol
10	BE0	49	BO0	40	/DISPEN
11	BE1	50	BO1		
12	BE2	51	BO2	44	/PIX_CLK
13	BE3	52	BO3		
14	BE4	53	BO4	46	/BLANK
15	BE5	54	BO5		
16	BE6	55	BO6	47	/VSYNC
17	BE7	56	BO7	48	/HSYNC
20	GE0	59	GO0		
21	GE1	60	GO1		
22	GE2	61	GO2		
23	GE3	62	GO3		
24	GE4	63	GO4		
25	GE5	64	GO5		
26	GE6	65	GO6		
27	GE7	66	GO7		
30	RE0	69	RO0		
31	RE1	70	RO1		
32	RE2	71	RO2		
33	RE3	72	RO3		
34	RE4	73	RO4		
35	RE5	74	RO5		
36	RE6	75	RO6		
37	RE7	77	RO7		

\* BE0-BE7, GE0-GE7, RE0-RE7 : First pixel data

\* BO0-BO7, GO0-GO7, RO0-RO7 : Second pixel data

\* TMD5 Receiver type : TI TFP201(alternative type: Silicon Image SILAC151-100)

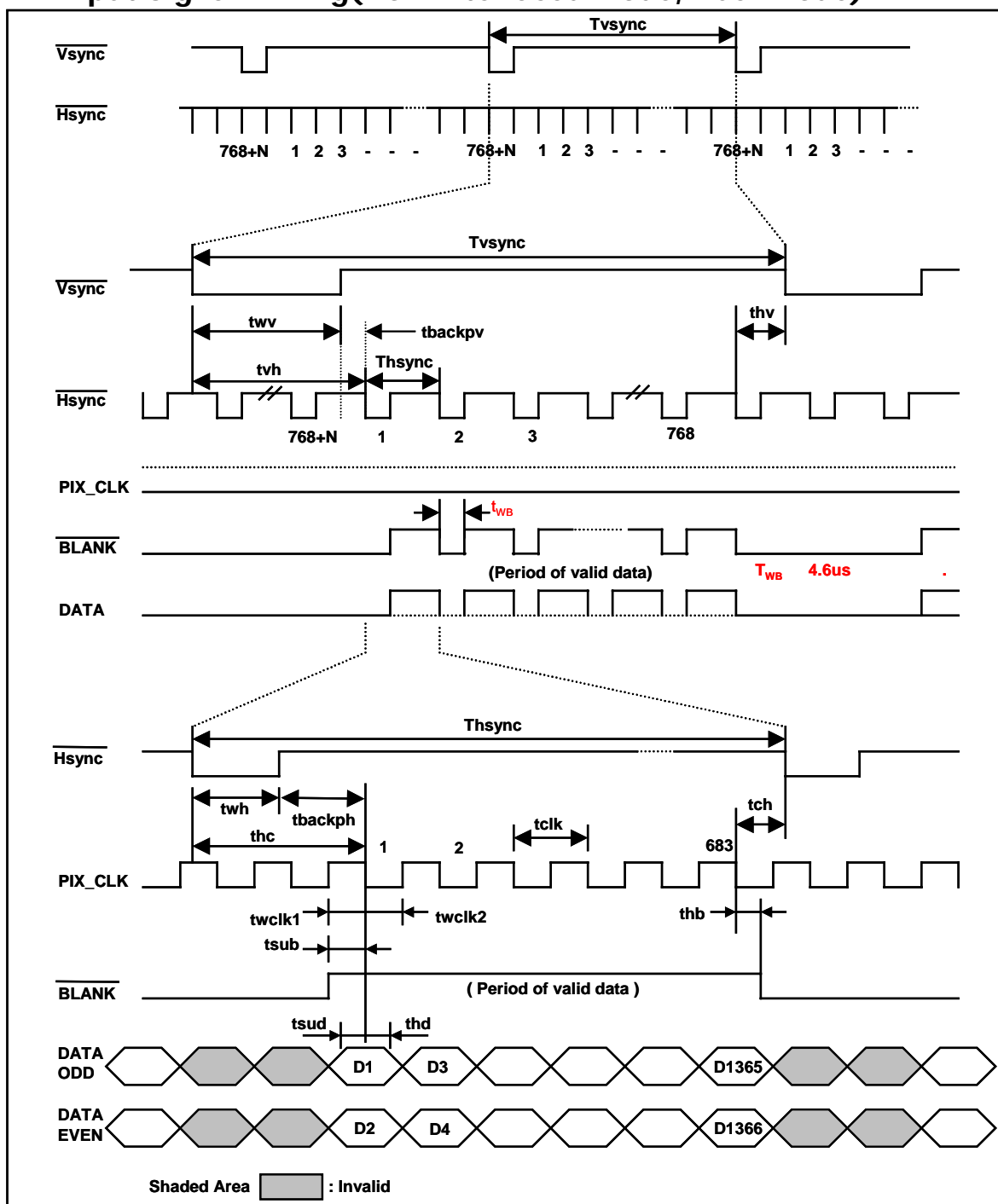
\* Tx : Dual mode recommand (for reduction noise)

\* PC / AV : 50 Hz / 60 Hz (Multi-Function)

CONFIDENTIAL



- **Input Signal Timing(Non-interlaced Mode, Dual Mode)**



**CONFIDENTIAL**



## Product Specification of Plasma Display Panel

## ● Input Signal Timing Specification(60Hz Mode)

[Dual Mode]

No	Symbol	Min	Typ	Max	Unit	Remark
1	<i>Tvsync</i>	16.582(796H)	16.665(800H)	17.999(864H)	ms(H)	1 frame= 55.56 ~ 60.30 Hz
2	<i>twv</i>	21(1H)	63(3H)	146(7H)	μs(H)	
3	<i>tvh</i>	333(16H)	396(19H)	458(22H)	μs(H)	
4	<i>thv</i>	—	271(13H)	—	μs(H)	
5	<i>Thsync</i>	20.74(1770D)	20.83(1778D)	21.53(1838D)	μs(D)	For 1ch. (1D=11.715ns)
6	<i>twh</i>	1.38(118D)	1.50(128D)	1.62(138D)	μs(D)	For 1ch. (1D=11.715ns)
7	<i>thc</i>	3.51(300D)	3.98(340D)	4.34(370D)	μs(D)	For 1ch. (1D=11.715ns)
8	<i>tch</i>	—	0.84(72D)	—	μs(D)	For 1ch. (1D=11.715ns)
9	<i>tclk</i>	23.2	23.43	24.0	ns	tclk = tclk1+tclk2
10	<i>tclk1</i>	—	11.715	—	ns	
11	<i>tclk2</i>	—	11.715	—	ns	
12	<i>tsub</i>		6	—	ns	tsub tch
13	<i>thb</i>		5	—	ns	thb tch
14	<i>tsud</i>		6	—	ns	
15	<i>thd</i>		5	—	ns	

Note : Min. &amp; Max. of each signal is measured value when other signal is Typ.

CONFIDENTIAL



## Product Specification of Plasma Display Panel

## ● Input Signal Timing Specification(50Hz Mode)

[Dual Mode]

No	Symbol	Min	Typ	Max	Unit	Remark
1	<i>Tvsync</i>	17.790(950H)	19.998(960H)	20.624(990H)	ms(H)	1 frame= 48.49 ~ 50.53 Hz
2	<i>twv</i>	21(1H)	63(3H)	146(7H)	μs(H)	
3	<i>tvh</i>	333(16H)	396(19H)	458(22H)	μs(H)	
4	<i>thv</i>	—	3633(173H)	—	μs(H)	
5	<i>Thsync</i>	20.74(1770D)	20.83(1778D)	21.53(1838D)	μs(D)	For 1ch. (1D=11.715ns)
6	<i>twh</i>	1.38(118D)	1.50(128D)	1.62(138D)	μs(D)	For 1ch. (1D=11.715ns)
7	<i>thc</i>	3.51(300D)	3.98(340D)	4.34(370D)	μs(D)	For 1ch. (1D=11.715ns)
8	<i>tch</i>	—	0.84(72D)	—	μs(D)	For 1ch. (1D=11.715ns)
9	<i>tclk</i>	23.2	23.43	24.0	ns	tclk = tclk1 + tclk2
10	<i>tclk1</i>	—	11.715	—	ns	
11	<i>tclk2</i>	—	11.715	—	ns	
12	<i>tsub</i>		6	—	ns	tsub tch
13	<i>thb</i>		5	—	ns	thb tch
14	<i>tsud</i>		6	—	ns	
15	<i>thd</i>		5	—	ns	

Note : Min. &amp; Max. of each signal is measured value when other signal is Typ.

CONFIDENTIAL

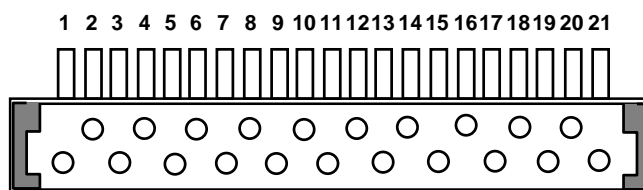


### 3. CONNECTORS AND CONNECTIONS

- **Signal Input Connectors (P1001)** Connector type:LG Cable, GT121-21P-TD

Pin No.	Symbol	Pin No.	Symbol
1	GND	12	R1+
2	ScIk	13	R1-
3	Sle	14	GND
4	Sdata	15	R0+
5	NC	16	R0-
6	GND	17	GND
7	GND	18	RxC+
8	GND	19	RxC-
9	R2+	20	GND
10	R2-	21	NC
11	GND		

GT121-21P-TD pin number ( Top view )



CONFIDENTIAL

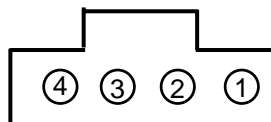


## ● Power Input Connector

### CN1 Pin Assignment (DC/DC Board)

Pin No.	Symbol
1	GND
2	GND
3	+5V
4	+5V

GP390-4P-TS Pin numbers  
(View from the pin connection side)



Module side connector : GP390-4P-TS(Header)

Mating Connector : GP390-4S-CS(Housing)

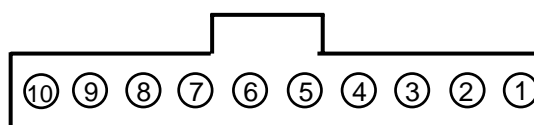
Connector Supplier : LG Cable Co.

### CN2 Pin Assignment (DC/DC Board)

Pin No.	Symbol	Pin No.	Symbol
1	VS	6	GND
2	VS	7	GND
3	VS	8	GND
4	NC	9	Va
5	GND	10	Va

GP390-10P-TS Pin numbers  
(View from the pin connection

side)



Module side connector : GP390-10P-TS(Header)

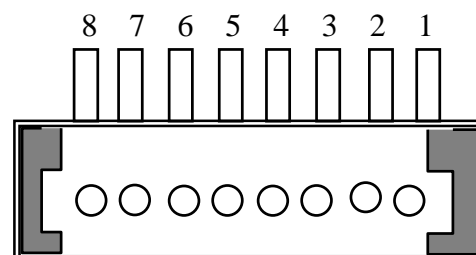
Mating Connector : GP390-10S-CS(Housing)

Connector Supplier : LG Cable Co.

### P1200 Pin Assignment (Control Board )

Pin No.	Symbol	Pin No	Symbol
1	+5V	5	GND
2	+5V	6	GND
3	+5V	7	GND
4	+5V	8	GND

GT200-8P-SS-A Pin numbers  
(View from the pin connection side)



Module side connector : GT200-8P-SS-A(Header)

Mating Connector : GIL-S-8S-S2CS-S(Housing)

Connector Supplier : LG Cable Co.

CONFIDENTIAL



## 4. OPTICAL SPECIFICATION

### ● Electro Optical characteristic Specification (60Hz)

Item		Sym -bol	Condition	Min	Typ	Max	Unit
White Peak Brightness		$B_{WP}$	1/25 White Window	750	1000		$cd/m^2$
White Average Brightness		$B_W$	Full white	135	160		$cd/m^2$
Brightness Uniformity		$B_V$	Full white	-15	0	+15	%
Color Coordinate		$x_W$	Full White	0.280	0.300	0.320	
		$y_W$		0.280	0.300	0.320	
Color Coordinate Uniformity		$C_V$	Full white	-0.010	Avrg	0.010	
Contrast Ratio	Office room	$CR_{BR}$	150 Lux at center	50:1	55:1		* Measure the dark position of panel while Window pattern is ON state.
	Dark room	$CR_{DR}$	1/25 White Window	750:1	1000:1		
Viewing angle		$\theta_i$	Full white		160		Degree
Power Consumption		$P_W$	Full white			570	W

CONFIDENTIAL



## Product Specification of Plasma Display Panel

## ● Display Cell Defect Specifications

Zone	A - Zone	B - Zone	Defect Distance
<b>Non-Ignition Dot</b> (Dark Defect) Cells which are not working.  And <b>Unstable Dot</b> (Flickering) Cell which repeats on(brightness) and off (darkness).	* Total : $N \leq 4$ [Cells/Full scn]  * 2 cell conjunction point : $N \leq 2$  * 3 cell conjunction point : $N = 0$	* Total : $N \leq 11$ [Cells/Full scn]  * 2 cell conjunction point : $N \leq 2$  * 3cell conjunction point : $N = 0$	* Cell defect distance (D: Semidiameter) $D \leq 25\text{mm}$ , $N \leq 1$ ; however, include conjunctive cell, $N = 0$
<b>Uncontrollable Dot</b>  Cell which is brighter or on than other cells around it because of unstable working condition.	* Total : $N \leq 3$ [Cells/Full scn]	* Total : $N \leq 5$ [Cells/Full scn]	
<b>Non-Extinguishing Dot</b>  (brightness defect)  Cell which is always working "ON".	* $N = 0$	* $N = 0$	
<b>Total Number of Dot Defects per Entire Panel:</b> $N \leq 21$ [Cells / Full scn]			
<b>Stain</b>  Cell blob due to local color contamination in white or simple color pattern	* $1 \leq D \leq 5$ , $N \leq 6$ ( Stain Distance : 50 mm)		* D : mm
	* $D > 5$ , $N = 0$ ( Stain Distance : 50 mm)		

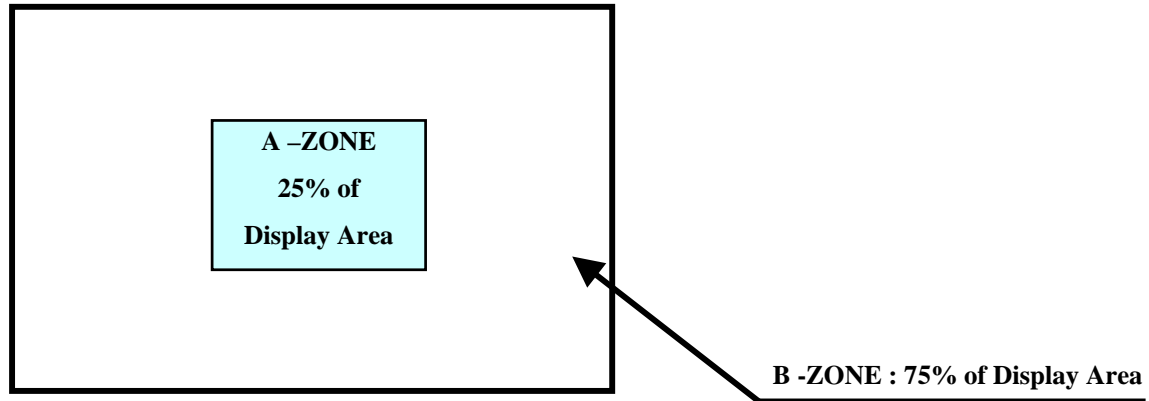
## Quality decision point

- \* Cell defect definition
  - Non-ignition dot(dark defect) : In a ignited cell, the cell that a ignited size is less than 50%.
  - Non-extinguishing dot(brightness defect) : In a extinguished cell, the cell that a ignited size is more than 50%.
- \* Test results are satisfied with each full red, green, blue, black and white test pattern.
  - Specifically, The full white test pattern is used to decide the number of continuous cell defects and Non-Ignition defects, The full black test pattern is used to decide the number of Non-extinguishing cell defects.
  - The decision distance is 2.2 m(3H) away from the panel, intensity of illumination is between 100 Lux and 200 Lux.
- \* Cell defects do not increase or progress as time goes.

CONFIDENTIAL



### Definition of cell defect Zone



CONFIDENTIAL





## 5. MECHANICAL AND RELIABILITY SPECIFICATIONS

### ● MODULE MECHANICAL SPECIFICATIONS

Outline Dimensions		1408 (H) x 828 (H) x 61 (D) $\pm$ 1 mm	Details : Mechanical Drawing
Display Area		1319.6 (H) x 741.9 (V) $\pm$ 0.5 mm	
Weight	Net	33 $\pm$ 1 Kg (Net : 1 EA)	
	Gross	123 $\pm$ 1 Kg (Gross : 3 EA / 1 Box)	

### ● ENVIRONMENTAL CONDITIONS

Temperature	Operational	0 ~ 40 (Max. glass panel surface temp. under 70 )
	Non-Operational	-10 ~ 50
Humidity	Operational	20% ~ 80% (without condensation )
	Non-Operational	10% ~ 90% (without condensation )
Pressure	Operational	800 ~ 1100 hPa (Altitude : 0 to 2000 m)
	Non-Operational	700 ~ 1100 hPa (Altitude : 0 to 3000 m)

### ● MECHANICAL TEST CONDITIONS

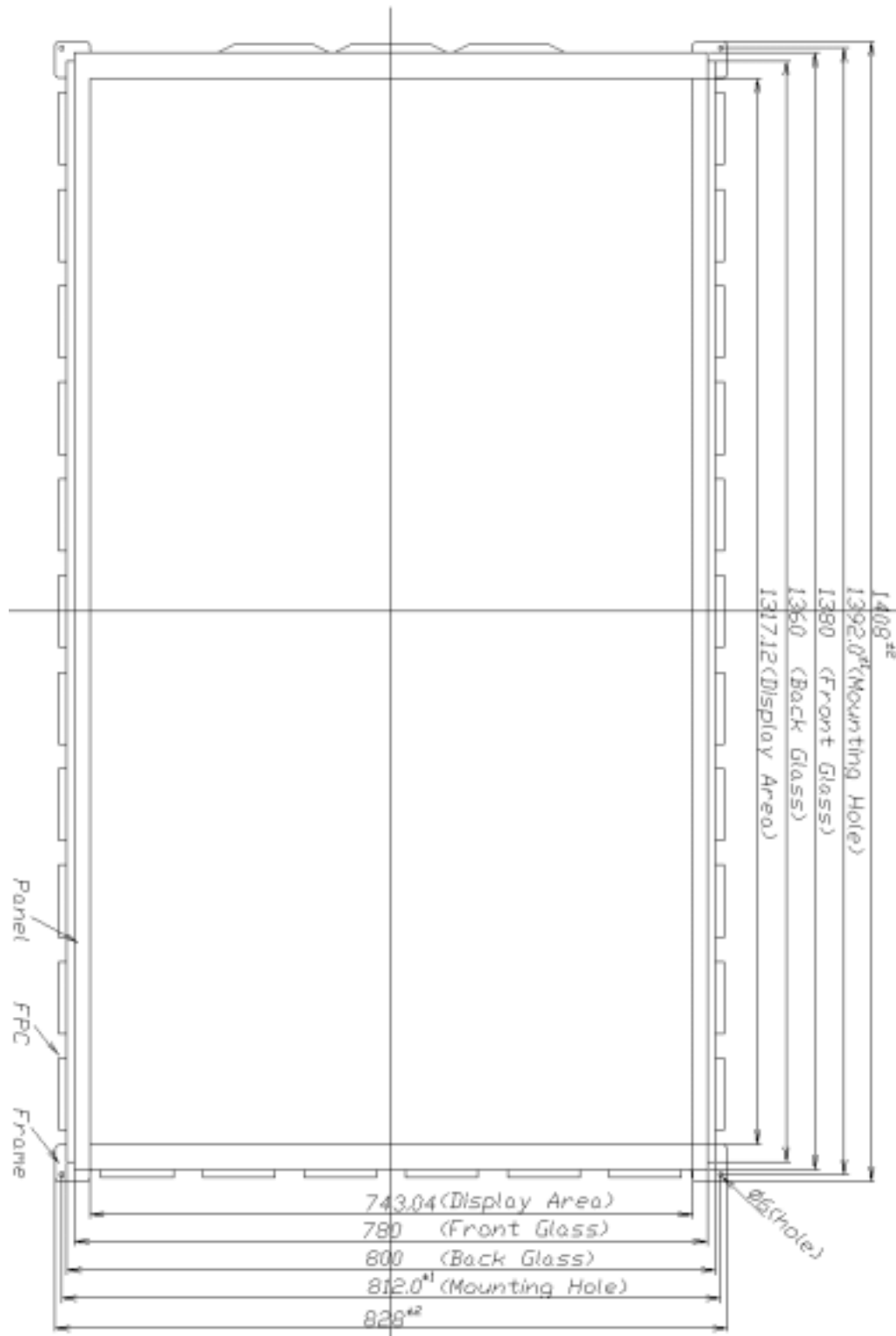
Vibration	Operational (Mounted in TV set)	0.5G, 10 to 55Hz (Sweep Time : 2 Min.) X,Y, Z directions, 10 minutes each
	Non-Operational (Packed State)	1.25G, 5 to 55Hz (Sweep Time : 2 Min.) Y direction, 60 minutes
Drop (Packed State)	Bottom	Free Falling: 30 cm
	The rest (Side , Front, Backside)	Inclined Falling: 30 cm

CONFIDENTIAL



● Mechanical Drawing (Unit: mm)

Front View

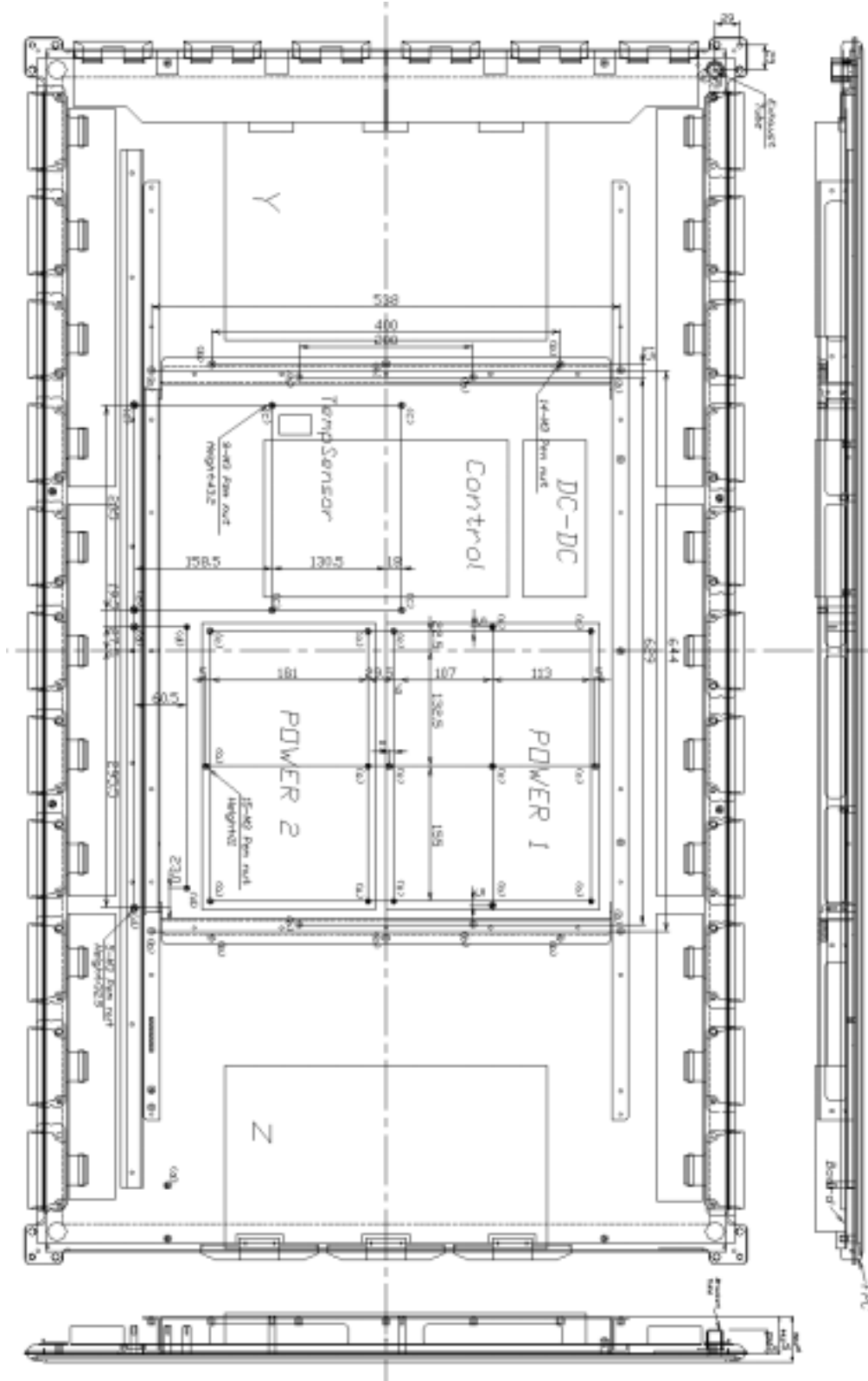


CONFIDENTIAL



- Mechanical Drawing (Unit: mm)

Rear View



CONFIDENTIAL



## 6. IMAGE STICKING CHARACTERISTICS

### 1) Image sticking

The fluorescent substance used in the plasma module loses its brightness with the lapse of lighting time. This deterioration in brightness appears to be a difference in brightness in relation to the surroundings, and comes to be recognized as image sticking.

In other words, the image sticking is defined as follows: when the same pattern (of the fixed display) is displayed for a long time, a difference in brightness is caused around the lighting area and non-lighting area due to deterioration in the fluorescent substance.

When the present pattern is changed over to another one, the boundary comes to be seen between the lighting area and non-lighting area due to difference in brightness in the pattern shown shortly before changeover. If this conditions is accumulated, the boundary or image sticking comes to be seen with the naked eyes.

### 2) Secular change in brightness

The life of brightness, defined as the reduction to half the initial level, is more than 25 thousand hours on average.

Conditions: All white (100% white) input at an ambient temperature of 25°C.

However, this lifetime is not a guarantee value for life and brightness. It should be recognized simply as the data for reference.

### 3) Warranty

Image sticking and faults in brightness and picture elements are excluded from the warranty objects.

### 4) Cause of deterioration in brightness

A major possible cause of deterioration in brightness is damage in the fluorescent substance due to impact caused by ions generated at the time of plasma discharges.

### 5) Practical value for Image sticking

The relationship between integrated lighting time and brightness in this plasma module is described in the attached material. In particular, the deterioration in brightness tends to be accelerated up to 100 hours in the initial period. In the initial period, the fixed display of patterns particularly tends to cause image sticking. The practical value for image sticking is difficult in concrete numerals. As described below, you are advised to take proper measures to make the occurrence of image sticking as slow as possible.

**CONFIDENTIAL**



6) Proposed measures taken to relieve image sticking

So long as there is the reduction of brightness in the fluorescent substance, it is impossible to avoid the occurrence of image sticking. Therefore, to relieve image sticking, we offer you a method of entering an image input that may ensure reluctance to the generation of the difference in brightness reduction among the displayed dots.

The images from TV broadcasting involve a high rate of motion picture displays. Therefore, there is less chance of being a cause of difference in brightness reduction among the cells. Even when the fixed patterns are displayed, they generally last for a few minutes. Since the same pattern is less liable to be displayed, there is almost no influence toward image sticking.

If the fixed patterns tend to be displayed for a long time, however, there occurs a substantial imbalance between the lighting and non-lighting areas, thus causing a difference in brightness as a result. In this document, we offer you some proposals of installation, paying attentions to the two points: the reduction of difference in brightness achieved by integrated lighting time leveling and the method of edge smearing to make image sticking hard to be discerned.

The result from these proposals can, however, greatly depend on the contents of images and the operating environment. Therefore, we consider that it is essential to take the suitable measures in consideration of the customer's operating environment.

Example of Proposal 1: The display position is moved while the fixed display pattern is changed over, or it is scrolled during the display.

Example of Proposal 2: If possible, a pattern of complementary color is incorporated (for integrated time leveling).

Example of Proposal 3: The fixed pattern and the motion picture display are reciprocally exchanged, in order to minimize display period of the fixed pattern.

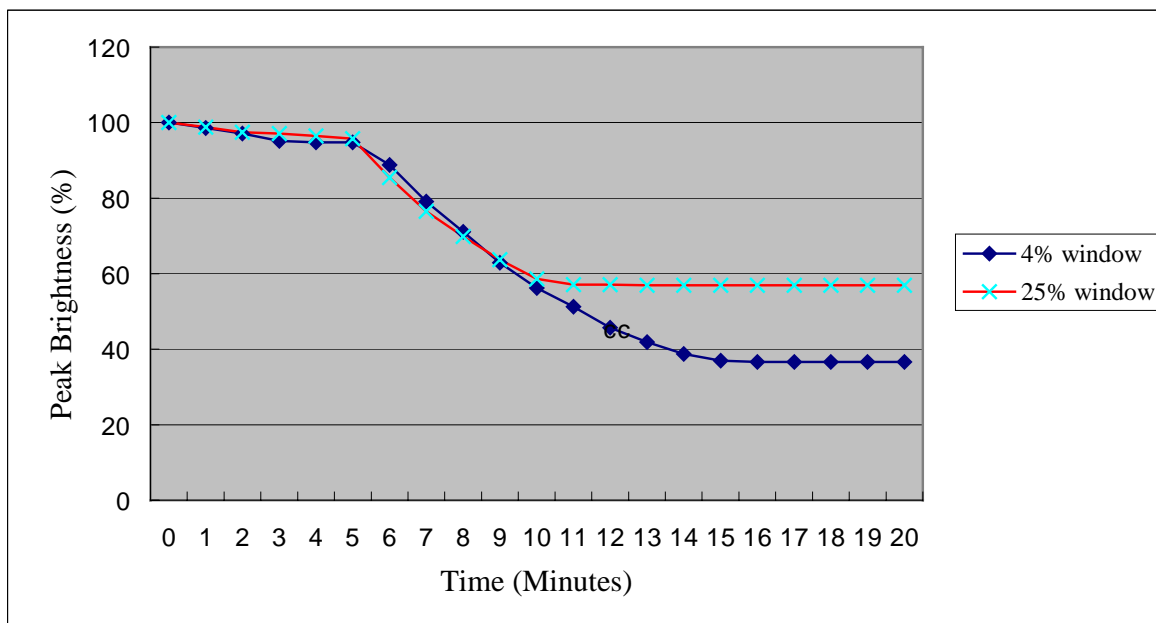
Example of Proposal 4: During operation, the brightness of screen is suppressed as low as possible. For the display patterns, characters are indicated not on the black ground (non-picture area) but on the colored ground (mixture of R, G, B recommended).

CONFIDENTIAL



## ISM Mode (Image Sticking Minimization Mode)

Apart from the above proposal, This module has been equipped with a special method that minimizes the image sticking phenomenon. When in the fixed pattern display mode, the module decreases the brightness over a period of 10 minutes with small steps. The figure blow shows that the decrease in brightness is so small the user will not notice.



The basis of the evaluation was while the ISM Mode in the module was operating, the brightness decrease about 55 % of its initial value at the white window pattern ( 1/25 of full white pattern )

### ISM operational conditions

1. Detective deviation : The change of APL Data is no less than  $\pm 4$  and it will remain for more than 5 minutes.
2. Regardless of time, it will not operate where the display load is over 50%.

CONFIDENTIAL



## 7. WARNING AND CAUTIONS

Warning: Indicates a hazard that may lead to death or injury if the warning is ignored and the product is handled incorrectly.

Caution: Indicates a hazard that can lead to injury or damage to property if the caution is ignored and the product is handled incorrectly.



- (1) This product uses a high voltage (450 V max.). Do not touch the circuitry of this product with your hands when power is supplied to the product or immediately after turning off the power. Be sure to confirm that the voltage has dropped to a sufficiently low level.
- (2) Do not supply a voltage higher than that specified to this product. This may damage the product and may cause a fire.
- (3) Do not use this product in locations where the humidity is extremely high, where it may be splashed with water, or where flammable materials surround it. Do not install or use the product in a location that does not satisfy the specified environmental conditions. This may damage the product and may cause a fire.
- (4) If a foreign substance (such as water, metal, or liquid) gets inside the product, immediately turn off the power. Continuing to use the product, it may cause fire or electric shock.
- (5) If the product emits smoke, an abnormal smell, or makes an abnormal sound, immediately turn off the power. If nothing is displayed or if the display goes out during use, immediately turn off the power. Continuing to use the product as it is may cause fire or electric shock.
- (6) Do not disconnect or connect the connector while power to the product is on. It takes some time for the voltage to drop to a sufficiently low level after the power has been turned off. Confirm that the voltage has dropped to a safe level before disconnecting or connecting the connector. Otherwise, this may cause fire, electric shock, or malfunction.
- (7) Do not pull out or insert the power cable from/to an outlet with wet hands. It may cause electric shock.
- (8) Do not damage or modify the power cable. It may cause fire or electric shock.
- (9) If the power cable is damaged, or if the connector is loose, do not use the product; otherwise, this can lead to fire or electric shock.
- (10) If the power connector or the connector of the power cable becomes dirty or dusty, wipe it with a dry cloth. Otherwise, this can lead to fire.

**CONFIDENTIAL**



- **General**

- (1) Do not place this product in a location that is subject to heavy vibration, or on an unstable surface such as an inclined surface. The product may fall off or fall over, causing injuries.
- (2) When moving the product, be sure to turn off the power and disconnect all the cables. While moving the product, watch your step. The product may be dropped or fall, leading to injuries of electric shock.
- (3) Before disconnecting cable from the product, be sure to turn off the power. Be sure to hold the connector when disconnecting cables. Pulling a cable with excessive force may cause the core of the cable to be exposed or break the cable, and this can lead to fire or electric shock.
- (4) This product should be moved by two or more persons. If one person attempts to carry this product alone, he/she may be injured.
- (5) This product contains glass. The glass may break, causing injuries, if shock, vibration, heat, or distortion is applied to the product.
- (6) The temperature of the glass surface of the display may rise to 80°C or more depending on the conditions of use. If you touch the glass inadvertently, you may be burned.
- (7) Do not poke or strike the glass surface of the display with a hard object. The glass may break or be scratched. If the glass breaks, you may be injured.
- (8) If you glass surface of the display breaks or is scratched, do not touch the broken pieces or the scratches with bare hands. You may be injured.
- (9) Do not place an object on the glass surface of the display. The glass may break or be scratched.

- **Design**

- (1) This product may be damaged if it is subject to excessive stresses (such as excessive voltage, current, or temperature). The absolute maximum ratings specify the limits of these stresses, and system design must ensure that none of the absolute maximum ratings are exceeded.
- (2) The recommended operating conditions are conditions in which the normal operation of this product is guaranteed. All the rated values of the electrical specifications are guaranteed within these conditions.

**CONFIDENTIAL**



**Product Specification of Plasma Display Panel**

Always use the product within the range of the recommended operating conditions. Otherwise, the reliability of the product may be degraded.

- (3) Use of the product with a combination of parameters, conditions, or logic not specified in the specifications of this product is not guaranteed. If intending to use the product in such a way, be sure to consult LGE in advance.
- (4) This product emits near infrared rays (800 to 1000nm) that may cause the remote controllers of other electric products to malfunction. To avoid this, use an infrared absorption filter and thoroughly evaluate the system and environment.
- (5) This product uses high-voltage switching and a high –speed clock. A system using this product should be designed so that it does not affect the other systems, and should be thoroughly evaluated.
- (6) This product has a glass display surface. Design your system so that excessive shock and load are not applied to the glass. Exercise care that the vent at the corner of the glass panel is not damaged. If the glass panel or vent is damaged, the product is inoperable.
- (7) There are some exposed components on the rear panel of this product. Touching these components may cause an electric shock.
- (8) This product uses a high voltage. Design your system so that any residual voltage in this product is dissipated quickly when power is turned off, observing the specifications.
- (9) This product uses heat-emitting components. Take the heat emitted by these components into consideration when designing your system. If the product is used outside the specified temperature range, it may malfunction.
- (10) This product uses a high voltage and, because of its compact design, components are densely mounted on the circuit board. If dust collects on these components, it can cause short-circuiting between the pins of the components and moisture can cause the insulation between the components to break down, causing the product to malfunction.
- (11) Regulations and standards on safety and electromagnetic interference differ depending on the country. Design your system in compliance with the regulations and standards of the country for which your system is intended.
- (12) To obtain approval under certain safety standards (such as UL and EN), a filter that passes a shock test must be fitted over the glass surface of the finished product. In addition, it must be confirmed that the level of UV emissions is within the range specified by such standards.
- (13) If this product is used as a display board to display a static image, “image sticking” occurs. This means that the luminance of areas of the display that remain lit for a long time drops compared with the luminance of areas that are lit for a shorter time, causing uneven luminance across the display. The degree to which this occurs is in proportion to the luminance at which the display is used. To prevent this phenomenon, therefore, avoid static images as much as possible and design your system so that it is used at a low luminance, by reducing signal level difference between bright area and less bright area through signal processing.

**CONFIDENTIAL**



Product Specification of Plasma Display Panel

- (14) Within the warranty period, general faults that occur due to defects in components such as ICs will be rectified by LGE without charge. However, IMAGE STICKING is not included in the warranty. Repairs due to the other faults may be charged for depending on responsibility for the faults.
- (15) In case of AC PDP driving mechanism, Because the brightness of output is not always proportional to input signals. Therefore the non-linearity of gray can occasionally be observed in certain gray levels as well as Contour and Error Diffusion Noise can be appeared when a dark picture is on the screen especially. These are phenomena that can be observed on the PDP driving mechanism. With simple adjustment to picture brightness control, these can be reduced considerably.
- (16) Because of the need to control the power consumption on the PDP driving mechanism, the APL(Average Picture Level) mode was equipped. Thus, as the picture on the screen changes, there can be slightly switched in brightness. This also is a phenomenon that can be observed on the PDP driving mechanism.
- (17) This product is designed to LGE's "Standard" quality grade. If you wish to use the product for applications outside the scope of the "Standard" quality grade, be sure to consult LGE in advance to assess the technological feasibility before starting to design your system.

● Use

- (1) Because this product uses a high voltage, connecting or disconnecting the connectors while power is supplied to the product may cause malfunctioning. Never connect or disconnect the connectors while the power is on. Immediately after power has been turned off, a residual voltage remains in the product. Be sure to confirm that the voltage has dropped to a sufficiently low level.
- (2) Watching the display for a long time can tire the eyes. Take a break at appropriate intervals.
- (3) PDP's brightness and contrast ratio is lower than that of the CRT. The picture is dimmer with surrounding light and better for viewing in dark condition.
- (4) Do not cover or wrap the product with a cloth or other covering while power is supplied to the product.
- (5) Before turning on power to the product, check the wiring of the product and confirm that the supply voltage is within the rated voltage range. If the wiring is wrong or if a voltage outside the rated range is applied, the product may malfunction or be damaged.
- (6) Do not store this product in a location where temperature and humidity are high. This may cause the product to malfunction. Because this product uses a discharge phenomenon, it may take time to light (operation may be delayed) when the product is used after it has been stored for a long time. In this case, it is recommended to light all cells for about 2 hours (aging).
- (7) If the glass surface of the display becomes dirty, wipe it with a soft cloth moistened with a neutral detergent. Do not use acidic or alkaline liquids, or organic solvents.
- (8) Do not tilt or turn upside down while the module package is carried, the product may be damaged.

CONFIDENTIAL



**Product Specification of Plasma Display Panel**

- (9) This product is made from various materials such as glass, metal, and plastic. When discarding it, be sure to contact a professional waste disposal operator.

## Repair and Maintenance

Because this product combines the display panel and driver circuits in a single module, it cannot be repaired or maintained at user's office or plant. Arrangements for maintenance and repair will be determined later.

## Others

- (1) If your system requires the user to observe any particular precautions, in addition to the above warnings and cautions, include such caution and warning statements in the manual for your system.
- (2) If you have any questions concerning design, such as on housing, storage, or operating environment, consult [LGE](#) in advance

**CONFIDENTIAL**