

Engineering Specification

**Type 22.2 QUXGA-Wide Color TFT/LCD Monitor
Model Name:MD22292B2**

Document Control Number : OEM I-MD22292B2-01

Note:Specification is subject to change without notice. Consequently it is better to contact to International Display Technology before proceeding with the design of your product incorporating this module.

**Product Development
International Display Technology**

i Contents

- i Contents
- ii Record of Revision
- 1.0 Handling Precautions**
- 2.0 General Description**
 - 2.1 Monitor Characteristics
 - 2.2 Functional Block Diagram
 - 2.2.1 Supported Video I/F Cables
 - 2.3 Deliverables
 - 2.4 Protection of Customer Investment
 - 2.4.1 Application Programs
 - 2.4.2 Hardware And Operating System
- 3.0 Function Elements Descriptions**
 - 3.1 Color TFT-LCD Module
 - 3.1.1 Summary of Type 22.2 QUXGA-Wide Module
 - 3.1.2 Test Conditions
 - 3.1.3 Image Stabilizing Time
 - 3.2 Monitor Interface Card
 - 3.2.1 Summary of the Monitor Interface Card Functions
 - 3.2.2 Geometry Conversion Control
 - 3.2.3 Scan Conversion
 - 3.2.4 Scaling
 - 3.2.5 LED Status Indicator
 - 3.2.6 Debug switch
 - 3.2.7 Power management
 - 3.3 AC/DC Adapter Unit
 - 3.3.1 AC Input
 - 3.3.2 Input Power Harmonic Distortion Content
 - 3.3.3 Input Frequency
 - 3.3.4 DC output
 - 3.4 Switch Card
 - 3.5 Tilt Stand
- 4.0 Mechanical Characteristics**
 - 4.1 Mechanical Drawing
 - 4.2 Weight
 - 4.3 Protective Front Filter
 - 4.3.1 Rigidity
 - 4.3.2 Panel Breakage Test
 - 4.3.3 Non-Glare
 - 4.4 Display Area
 - 4.4.1 Active Area
 - 4.4.2 Pixel Dimension
- 5.0 System Interface**
 - 5.1 Physical Interface
 - 5.1.1 Digital Video Signal Connector
 - 5.1.2 EEDID Data
 - 5.1.3 DC-IN Connector
 - 5.1.4 Connector Location
 - 5.2 Electrical Interface Requirements
 - 5.3 Interface Timings (each DVI input)
 - 5.4 Input Powers

5.4.1 Power Specifications

6.0 Front of Screen Performance

6.1 General

6.2 White Luminance

6.2.1 White Luminance Specifications

6.3 Color

6.3.1 Chromaticity

6.3.2 White Balance

6.4 Finger Pressure Distortion

6.5 Gray Scale

6.6 Optical Response Time

6.6.1 Definition

6.6.2 Characteristics

7.0 EMC Requirements

7.1 EMI Performance

7.2 Very/Extra Low Frequency Magnetic Field

7.3 Very/Extra Low Frequency Electric Field

8.0 Environment

8.1 Temperature and Humidity

8.1.1 Operating Conditions

8.1.2 Shipping Conditions

8.2 Atmospheric Pressure

9.0 Industry Standards (IEEE, ISO, IEC, and so on)

10.0 Backlight Life

ii Record of Revision

Date	Document Revision	Page	Summary
November 15,2001	OEM I-MD22292B2-01	All	First Edition for customer Based on Internal Spec. Rev.1.20 as of September 28,2001. MD22292B0 : TFT-LCD Color Display Unit with ; <ul style="list-style-type: none"> • Tilt Stand • AC/DC Adapter Unit • AC Line Cord (Selective) MD22292B1 : TFT-LCD Color Display Unit with ; <ul style="list-style-type: none"> • Tilt Stand • AC/DC Adapter Unit • Interface cables for Matrox G200MMS (x2) • Video adapter card Matrox G200MMS custom version • AC Line Cord (Selective) MD22292B2 : TFT-LCD Color Display Unit with; <ul style="list-style-type: none"> • Tilt Stand • AC/DC Adapter Unit • Interface cables for DVI (such as ATI FireGL4) • AC Line Cord (Selective)

1.0 Handling Precautions

- Do not exert strong pressure to the surface of the monitor screen. You may break the LCD panel.
- Do not place heavy objects on top of this product. They may damage the monitor.
- Do not touch the monitor screen with your fingers. Fingerprints and oil stains may remain on the screen surface. They are difficult to wipe off.
- The monitor is heavy. Ask the help of others if you cannot carry it by yourself.
- When leaving your office for a long vacation, always unplug the power cords from the main outlet.
- The liquid crystals in the display panel contain several irritants. If the panel is damaged or broken, do not let the liquid come in contact with your skin, eyes, or mouth. If you do come in contact with the liquid, flush the affected part with running water for at least 15 minutes. If any symptom remains, consult a doctor.
- The fluorescent lamp in the liquid crystal display (LCD) contains mercury (50 mg. (0.002 oz.) maximum). Do not place in trash that is disposed of in landfills. Dispose of it as required by local ordinances or regulations.
- The front polarizer can be easily damaged. Take care not to scratch the front surface with any hard or abrasive material. Dust, finger marks, grease etc. can be removed with a soft damp cloth (a small amount of mild detergent can be used on the damp cloth). Do not apply water or detergent directly to the front surface as this may cause staining or damage the electronic components.
- Never use any solvent on the front polarizer or module as this may cause permanent damage.
- Do not open or modify the monitor assembly.
- Continuous operation of the monitor with the same screen content may result in some image sticking. Over 10 hours operation with the same content is not recommended.
- Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

- | |
|--|
| <ul style="list-style-type: none">• The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by International Display Technology for any infringements of patents or other right of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of International Display Technology or others.• The information contained herein may be changed without prior notice. It is therefore advisable to contact International Display Technology before proceeding with the design of equipment incorporating this product. |
|--|

2.0 General Description

This is a desktop monitor which uses 56.4 cm (22.2" Type) high resolution color TFT-LCD technology as the display device.

The screen format and electrical interface are intended to support the QUXGA-Wide (3840(H) x 2400(V), 16:10 aspect) screen.

Supported colors are native 16M colors(RGB 8-bit data driver).

Video input signals are DVI x4 (TMDS x4) or DVI x2 (TMDS x2) interface compatible.

2.1 Monitor Characteristics

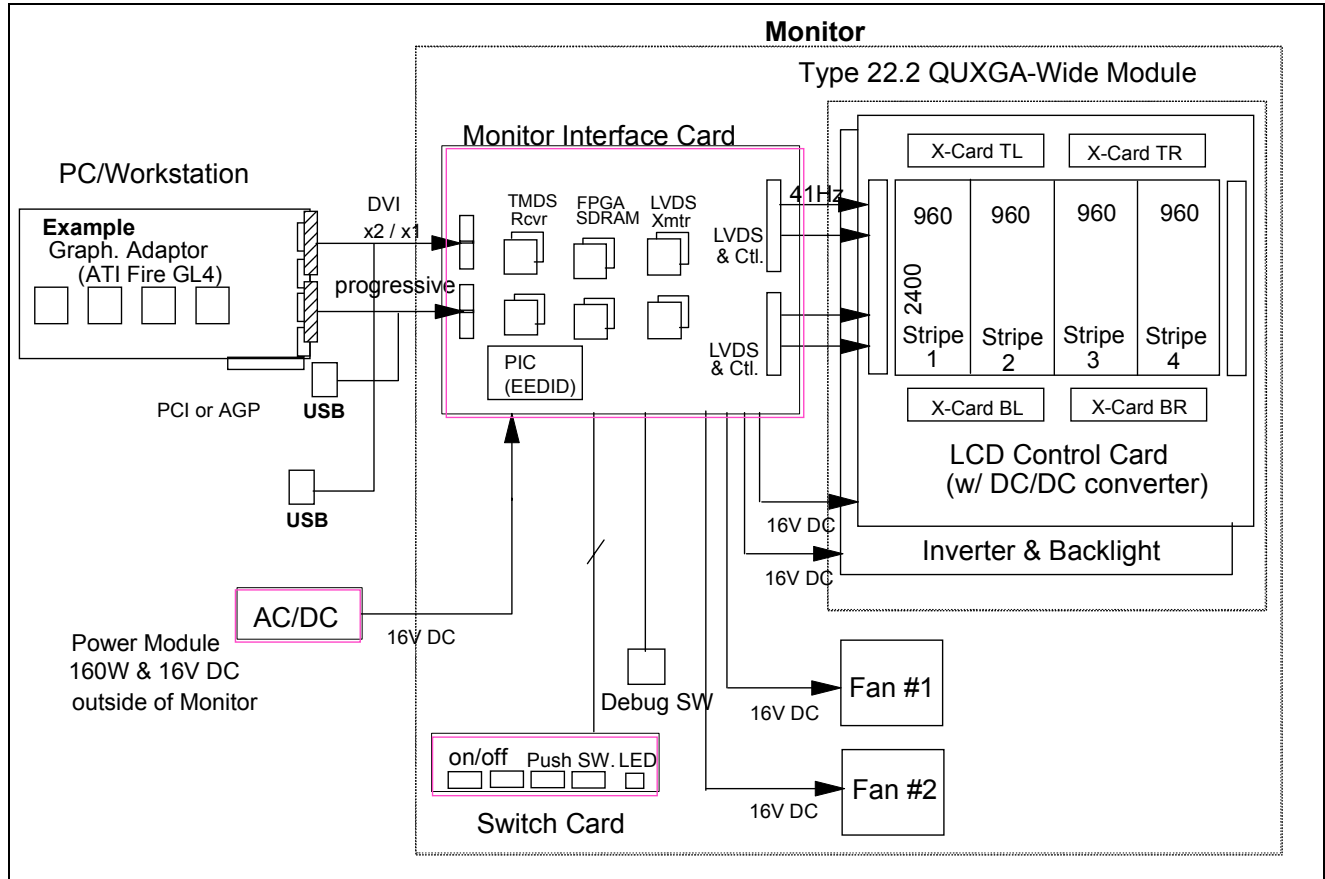
The following items are characteristics summary on the table under 25 degree C condition:

CHARACTERISTICS ITEMS	SPECIFICATIONS
Screen Diagonal [cm]	56.4 (22.2 inch)
Pixels H x V	3840(H) x 2400(V)
Screen Active Area [mm]	478.1(H) x 298.8(V)
Pixel Pitch [mm]	0.1245 (per one triad) x 0.1245
Pixel Arrangement	R,G,B Vertical Stripe
Weight [Kg]	12.12 typ.
Physical Size [mm]	547(W) x 399(H) x 76(D) w/o stand. 547(W) x 437(H) x196(D) w/ stand
Display Mode	Dual domain IPS, Normally Black
Supported Color	16M (RGB 8-bit data)
White Luminance [cd/m ²]	235 typ.
Contrast Ratio	400 : 1 typ. (in the dark room)
Optical Rise Time [msec]	25 typ.
Optical Fall Time [msec]	25 typ.
White Point (x, y)	0.313, 0.329 Typ.
Viewing Angle Range[deg]	+/- 85 Typ. (Horizontal, Vertical) (15:1 Contrast Ratio) +/- 85 Min. (Horizontal, Vertical) (10:1 Contrast Ratio)
Input Voltage [V DC]	+16 (15.5 to 16.8)
Power Consumption [W]	150 max, 135 typ.
Video Interface	DVI 4 Channels with Two Cables DVI 2 Channels with One Cable
Temperature Range [degree C] Operating Storage (Shipping)	0 to +35 -20 to +60
Humidity [%RH]	8 to 80 (Operating / Non-Operating) Max wet bulb temp. 23deg.C, No condensation

2.2 Functional Block Diagram

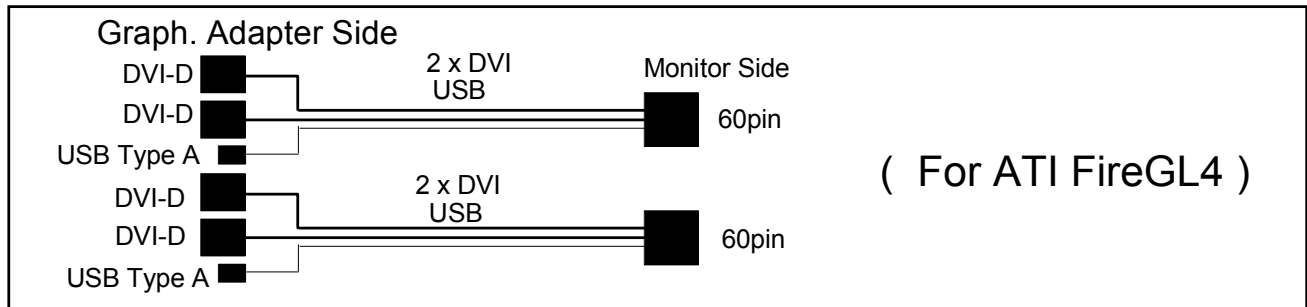
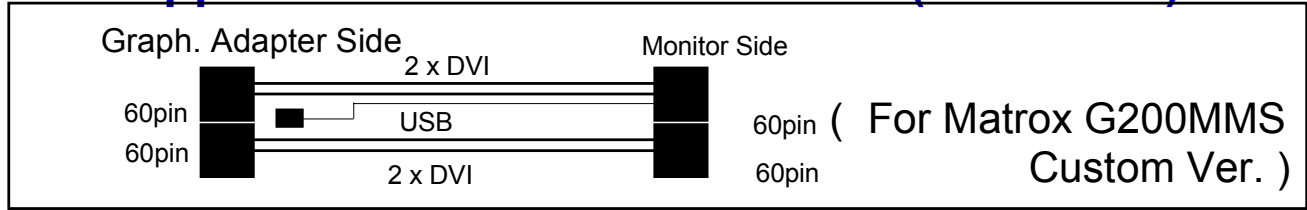
The following diagram shows the functional block of monitor 56.4 cm(Type 22.2) Color TFT-LCD Monitor.

Functional Block Diagram



2.2.1 Supported Video I/F Cables

Supported Video Interface Cables (Reference)



[Note] The USB interface is not activated for the initial announced version, and is initially referred to as a 'service interface'. It is used to update the monitor firmware. It is also planned that it can be used for setting parameters for the Color Adjustment (White Point and Gamma Curve correction) function which is planned to be built-in the later version.

2.3 Deliverables

TFT-LCD Color Display Unit with;

- ▶ Tilt Stand
- ▶ AC/DC Adapter Unit
- ▶ Interface Cables for DVI (such as ATI FireGL4)
- ▶ AC Line Cord (Selective)

2.4 Protection of Customer Investment

2.4.1 Application Programs

Existing programs which conform to published interfaces will continue to run without change.

2.4.2 Hardware And Operating System

Graphics Adapter / Video Interface :

ATI FireGL4 Video Graphics Card, 2 x DVI USB Cable (x1 or x2) or

Matrox G200MMS Custom Ver. Video Graphics Card, 2 x DVI Cable (x1 or x2)

(refer to 2.2.1 Supported Video I/F Cables.)

O/S : Windows 2000, Linux

Supported input video format

(in case of max. frequency, refer to 5.3)

Addressability		DVI Input	Horizontal Frequency (KHz)	Vertical Frequency (Hz)	Dot Clock Frequency (MHz)	Actual Display Resolution
VGA	640x400	ch1	31.5 (N,P)	59.9 (N,P)	25.2	3200x2000
	640x480	ch1	37.9 (N,P)	72.8 (N,P)	31.5	3200x2400
	640x480	ch1	37.5 (N,P)	75.0 (N,P)	31.5	3200x2400
	640x480	ch1	43.3 (N,P)	85.0 (N,P)	36.0	3200x2400
SVGA	800x600	ch1	35.2 (P,N)	56.3 (P,N)	36.0	3200x2400
	800x600	ch1	37.9 (P,N)	60.3 (P,N)	40.0	3200x2400
	800x600	ch1	48.1 (P,N)	72.2 (P,N)	50.0	3200x2400
	800x600	ch1	46.9 (P,N)	75.0 (P,N)	49.5	3200x2400
	800x600	ch1	53.7 (P,N)	85.1 (P,N)	56.3	3200x2400
Matrox VGA	960x1200	ch1	67.3 (P,N)	55.7 (P,N)	71.0	1920x2400
XGA	1024x768	ch1	48.4 (N,P)	60.0 (N,P)	65.0	3072x2304
	1024x768	ch1	56.5 (N,P)	70.1 (N,P)	75.0	3072x2304
	1024x768	ch1	60.0 (P,N)	75.0 (P,N)	78.8	3072x2304
	1024x768	ch1	68.7 (P,N)	85.0 (P,N)	94.5	3072x2304
SXGA	1280x1024	ch1	64.0 (P,N)	60.0 (P,N)	108.0	2560x2048
	1280x1024	ch1	80.0 (P,N)	75.0 (P,N)	135.0	2560x2048
UXGA	1600x1200	ch1	75.0 (P,N)	60.0 (P,N)	162.0	3200x2400
QUXGA-W	(1920x1200)x4	ch1,ch2,ch3,ch4	49.6 (P,N)	40.9 (P,N)	104.8	3840x2400
	(1920x2400)x2	ch1, ch2	61.2 (P,N)	25.1 (P,N)	125.0	3840x2400
	(1920x2400)x2	ch1, ch2	58.7 (P,N)	24.1 (P,N)	120.0	3840x2400
	(1920x2400)x2	ch1, ch2	48.9 (P,N)	20.1 (P,N)	100.0	3840x2400
	(960x2400)x4	ch1,ch2,ch3,ch4	99.2 (P,N)	40.9 (P,N)	104.8	3840x2400

[Note] : P, N stands for "Positive", "Negative" polarity of incoming timing respectively.

3.0 Function Elements Descriptions

3.1 Color TFT-LCD Module

The summary of Front of Screen specification of the complete system is shown below.

3.1.1 Summary of Type 22.2 QUXGA-Wide Module

Screen Diagonal [cm]	56.4 (22.2 inch)
Pixels H x V	3840(H) x 2400(V)
Active Area [mm]	478.1(H) x 298.8(V)
Pixel Pitch [mm]	0.1245 x 0.1245
Pixel Arrangement	R,G,B Sub-pixel Vertical Stripe
Display Mode	Dual Domain IPS, Normally Black
Supported Color	16M (RGB 8-bit each)
White Luminance [cd/m ²]	235 typ.
Contrast Ratio	400 : 1 typ.(In the Dark room)
Optical Rise+Fall Time [msec]	50 typ.
Color Point (x, y)	0.313, 0.329
Viewing Angle Range[degree]	+/- 85 typ. (Horizontal, Vertical) (10:1 CR)

3.1.2 Test Conditions

1. The backlight on, the brightness control set to maximum.
2. In a dark room
3. At 25 +/- 3 degree C
4. At a nominal input voltage
5. A photometer shall measure an area at the center of LCD that is larger than a single pixel. Viewing direction is normal to the surface of the LCD.
6. Input signal timing listed in typical of "5.3,Interface Timings" .

3.1.3 Image Stabilizing Time

The image will begin to be visible within 3 seconds of application of power and input signals. The image will be stabilized within 10 seconds of application of power and input signals. "stabilized" means that using the unaided eyes, no significant change will occur in terms of the image quality specifications, such as luminance, uniformity, color, and so on. The light output will meet the brightness specifications after 60 minutes of the application of power and input signals.

3.2 Monitor Interface Card

The monitor interface card converts TMDS video signals in DVI x4 or DVI x2 interfaces to 8 sets (even/odd x 4) of LVDS signals with image processing for TFT-LCD module.

Two digital video interface connectors are mounted on the monitor interface card and each connector accommodates two DVI video signal sets.

The monitor interface card has an interface to the Switch Card.

3.2.1 Summary of the Monitor Interface Card Functions

1. Conversion of data from TMDS to LVDS
2. Geometry conversion
3. Scan conversion
4. Scaling
5. On Screen Display (OSD)
6. LED control (power and standby)
7. Debug switch support
8. Power management
9. Fan control
10. DDC interface

3.2.2 Geometry Conversion Control

The monitor interface card converts following geometry into four 960 x 2400 vertical stripes for TFT-LCD module.

- I. Single image
- II. Two Vertical Stripe images
- III. Four Vertical Stripe images
- IV. Four Tile images

3.2.3 Scan Conversion

Since, maximum scan rate of the TFT-LCD is up to 41 Hz, the monitor interface card converts various range of input frequencies into the 41Hz. The monitor interface card also support 20.5Hz to 41Hz up conversion to reduce flicker effect under slow refresh mode.

- I. Down conversion: 56 ~ 85 Hz to 41Hz
- II. Up conversion: 20.1, 24.1 Hz, 25.1 Hz, to 41Hz

3.2.4 Scaling

The monitor interface card provides a scaling function to fit nonnative resolution images to the screen.

Addressability		Scaling		After Scaling
		H	V	
VGA	640 x 480	x 5	x 5	3200 x 2400
SVGA	800 x 600	x 4	x 4	3200 x 2400
XGA	1024 x 768	x 3	x 3	3072 x 2304
SXGA	1280 x 1024	x 2	x 2	2560 x 2048
UXGA	1600 x 1200	x 2	x 2	3200 x 2400
QUXGA-W	3840 x 2400	x 1	x 1	3840 x 2400

3.2.5 LED Status Indicator

Indication of states with two LEDs in one LED package.

Power LED	Standby LED	Color *1	Status	Backlight	FAN
Off	Off	---	Monitor power off	Off	Off
On	Off	Green	Normal operation mode	On	On
Off	On	Orange	Standby mode (no signal)	Off	Off
Off	Flash	Orange(flash-1Hz)	Unsupported signal *2	Off	Off
Off	Flash	Orange(flash-4Hz)	Caution(FAN stops)	Off	Off

Note *1: Color of indicator.

When power LED is ON --> Color will be GREEN

When standby LED is ON --> Color will be ORANGE

Note *2: Display appears black pattern.

Please check Interface timing with tolerance.

3.2.6 Debug switch

Monitor has a debug switch. Once this switch is pressed, the backlight will be on in any cases until power is off by pressing main power switch.
This is not for users but for problem determination purpose.

Pressing this switch for more than 5 seconds make Monitor enter the debug mode.
In the debug mode, Monitor displays some debug patterns The debug pattern changes automatically as follows.

AG0 : Full White(1sec) -> Full Black(1sec) -> Full White(1sec) -> Full Black(1sec)
AG1 : Full White(1sec) -> Full Black(1sec) -> Full White(1sec) -> Full Black(1sec)

AG2 : Subpixel Checker pattern (ichimatsu) 4 sec.
AG3 : Gray scale (White) from Top (dark) to Bot(bright) 4 sec.
AG4 : Gray scale (Red) from Top (dark) to Bot(bright) 4 sec.
AG5 : Gray scale (Green) from Top (dark) to Bot(bright) 4 sec.
AG6 : Gray scale (Blue) from Top (dark) to Bot(bright) 4 sec.

3.2.7 Power management

Monitor incorporates a Power Management Function on the connector card to reduce power consumption.

Power consumption in power saving mode(no sync.) is

- Less than 15 watts (incl. AC adapter loss)

3.3 AC/DC Adapter Unit

The AC/DC Adapter units(IBM P/N 07N2277) provide +16 V DC for the monitor assembly.

Single AC/DC Adapters are required for the monitor.

The AC/DC Adapter has 3 prong, and also PFC(Power Factor Correction) function for Power Line Harmonics.

3.3.1 AC Input

The adapter operates over the entire input voltage range (100 - 240V AC) or automatically selects an appropriate voltage range without manual intervention.

AC input

	Minimum	Maximum	Nominal(Rating)
Low Range	90 V AC	137 V AC	100 - 127 V AC
High Range	180 V AC	265 V AC	200 - 240 V AC

3.3.2 Input Power Harmonic Distortion Content

The harmonic distortion content of the input AC voltage shall not exceed 5 %.

3.3.3 Input Frequency

The input frequency range shall be 50 +/- 3Hz, 60 +/- 3Hz.

3.3.4 DC output

DC output

Connector Pin	Output	Regulation Tolerance (From Nominal)	Pin Maximum Current
Pin 4,5,6	+ 16.0 V	+ 0.8 V / - 0.5 V	10.5 A
Pin 1,2,3	DC Return	-	10.5 A

3.4 Switch Card

The following external controls are provided with Switch Card on Monitor.

- Monitor power on/off
- Brightness up/down
- Enter the Menu of OSD
- LED for indication of Power on/off, Power saving mode, Malfunction.

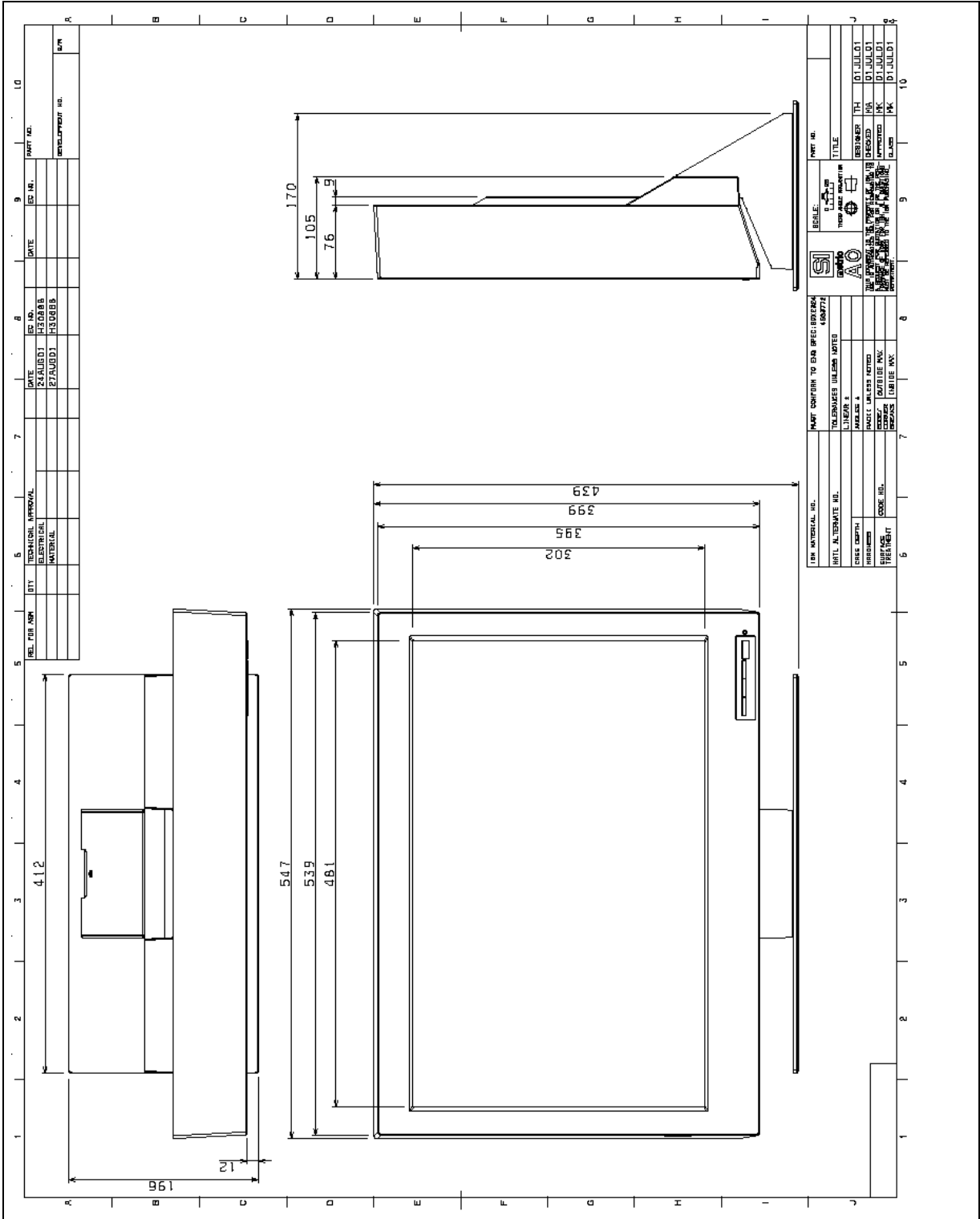
3.5 Tilt Stand

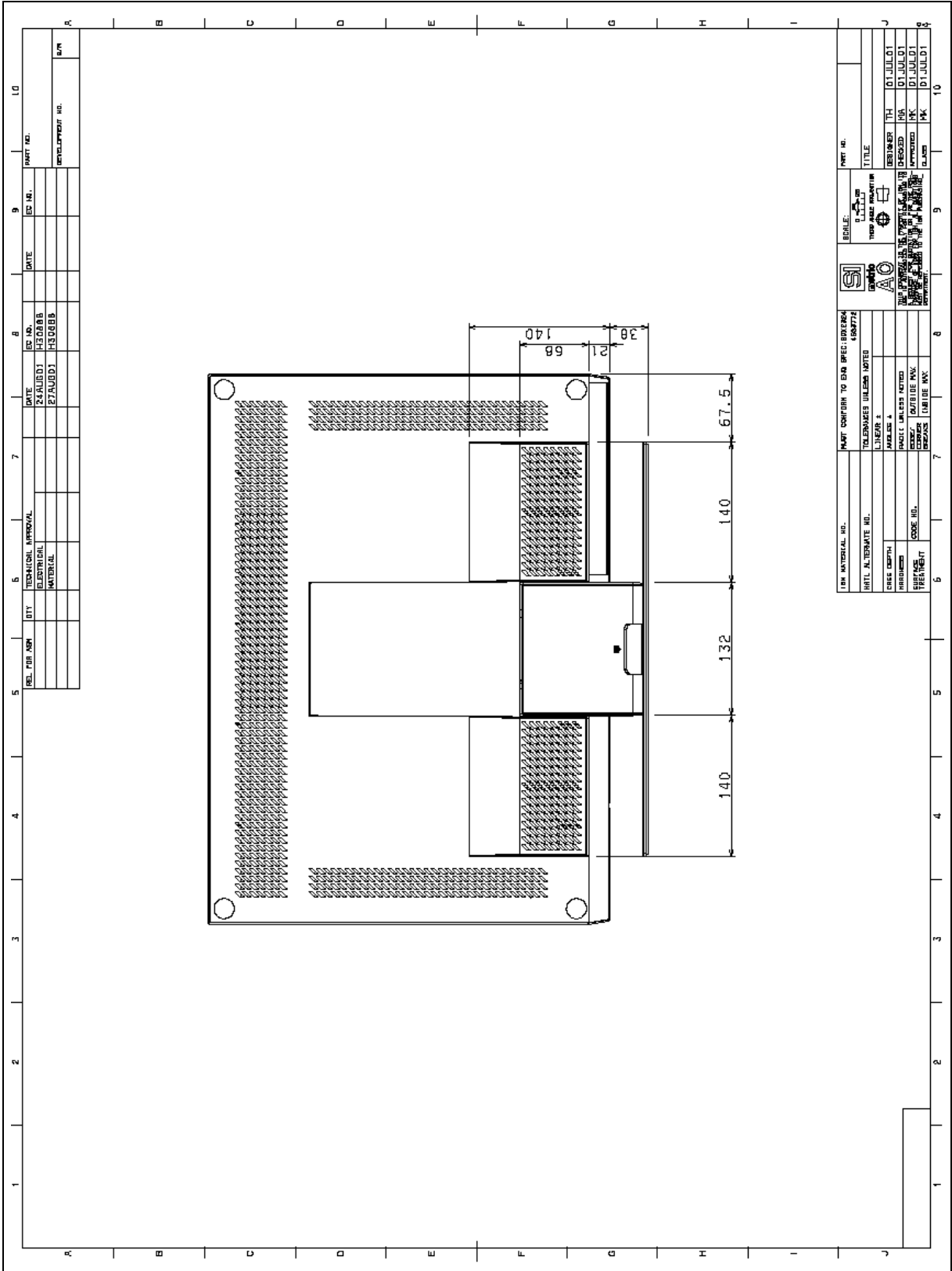
A Tilt Stand is supplied to allow this monitor to be positioned for optimum viewing.

Tilt Range : 30 Degrees Backwards, 5 Degrees Forward

4.0 Mechanical Characteristics

4.1 Mechanical Drawing





(C) Copyright International Display Technology 2001 All Rights reserved.

November 15, 2001

OEM I-MD22292B2-01

18/59

4.2 Weight

The weight of monitor is as follows, respectively.

8.82 Kg +/- 5% (without stand)

12.12 Kg +/- 5% (with stand)

4.3 Protective Front Filter

The front filter described in this section is included in the LCD module. The film is adhered to the LCD surface to minimize optical interference.

The objective of the filter is:

- to protect the display from impact and prevent any glass from breaking into pieces and scattering.
- to provide good control of glare.

4.3.1 Rigidity

The film filter may not be rigid enough to protect the LCD from breakage but it will prevent pieces of the glass from scattering when it is broken. The screen hardness is 3H or greater.

NOTE: Refer to JIS Standard K5400 (Method of Rockwell Hardness Test for Plastic).

4.3.2 Panel Breakage Test

The module shall pass the following breakage test :

A single impact of 6.8 joules (5 foot-pounds) at the center of the viewing area. The impact shall be from a solid steel sphere with a 50 mm diameter and weighing 535 grams.

The module is deemed acceptable if :

1. There is no exposure of sharp edges of glass.
2. All glass particles are retained by the anti-glare protective panel and do not scatter. Small glass particles (i.e. powder) in the area where the steel ball impacts the panel are excluded from this requirement.

4.3.3 Non-Glare

To minimize glare, the black matrix is made of anti glare material. In addition, the film has anti glare treatment. The LCD has a maximum measure of 80 gloss units, measured at 60 degrees' angle of incidence with a VG-2PD Glossmeter(Nippon Denshoku), or equivalent.

4.4 Display Area

4.4.1 Active Area

Active Area

Height	298.8 [mm]
Width	478.1 [mm]

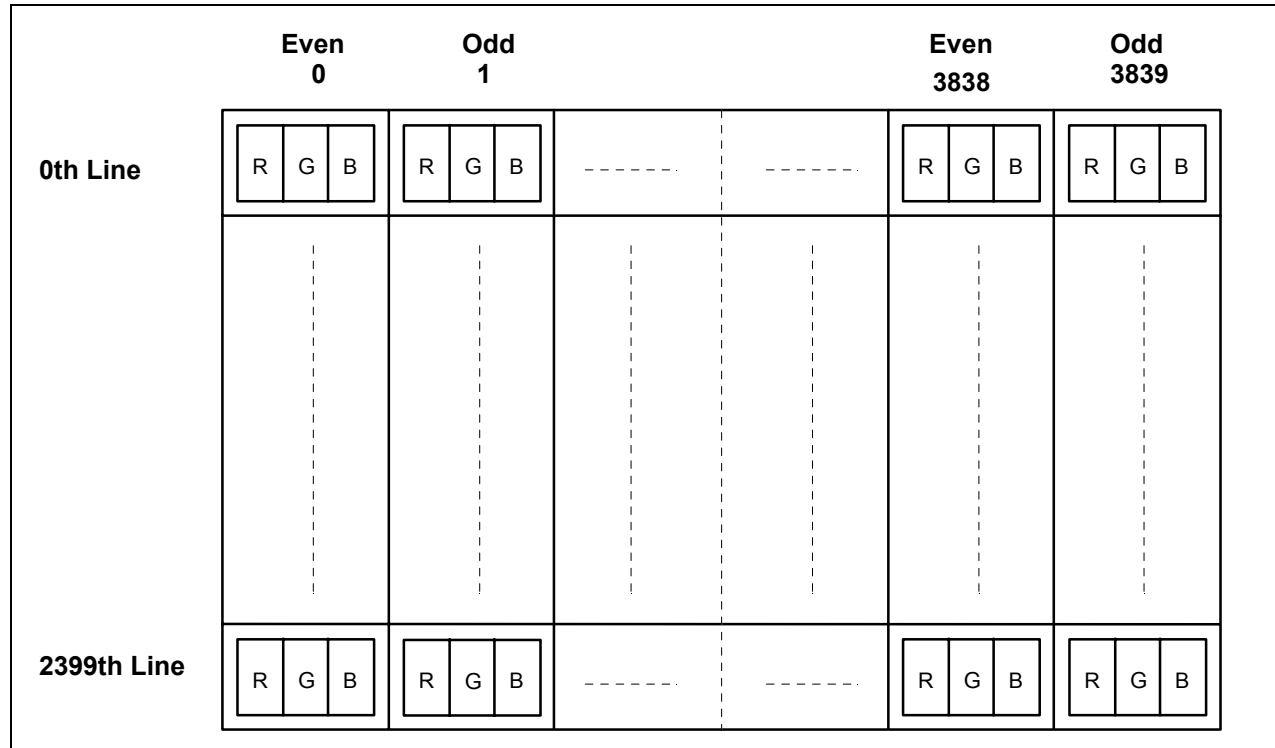
4.4.2 Pixel Dimension

Pixel Dimension

	Height	Width
Pixel	0.1245 [mm]	0.1245 [mm]
Sub-pixel	0.1245 [mm]	0.0415 [mm]

Following figure shows the relationship of the input signals and LCD pixel format image. Odd and even pair of RGB data are sampled at a time.

Color Arrangement



5.0 System Interface

5.1 Physical Interface

Physical interface is described as for the connector on monitor.

These connectors are capable of accommodating the following signals and will be following components.

5.1.1 Digital Video Signal Connector

Signal Connector A, B

Connector Name / Designation	Signal Connector
Manufacturer	MOLEX
Type / Part Number	70928-2000
Mating Type / Part Number	MOLEX 70929-2000

Signal Connector A Pin Assignment

PIN #	SIGNAL NAME	PIN #	SIGNAL NAME
1	Ground	31	Left TMDS Data 1+ (twisted pair)
2	Not connected	32	Left TMDS Data 1 - (twisted pair)
3	Not connected	33	Left TMDS Clock data+ (twisted pair)
4	Ground	34	Left TMDS Clock data - (twisted pair)
5	V _{EEDID} + 5V Power input (MAX 1A) (Note2,3)	35	+3.3V Power output (MAX 1A)
6	CLK _{EEDID} Left SCL (DDC) (Note2,4)	36	Hot plug detection
7	Data _{EEDID} Left SDA (DDC) (Note2,4)	37	+3.3V Power output (MAX 1A)
8	Not connected	38	Ground
9	Data _{EEDID} Right SDA (DDC) (Note2,4)	39	Not connected
10	CLK _{EEDID} Right SCL (DDC) (Note2,4)	40	Hot plug detection
11	V _{EEDID} + 5V Power input (MAX 1A) (Note2,3)	41	Not connected
12	Ground	42	Right TMDS Clock data - (twisted pair)
13	Not connected	43	Right TMDS Clock data+ (twisted pair)
14	Not connected	44	Right TMDS Data 1 - (twisted pair)
15	Ground	45	Right TMDS Data 1+ (twisted pair)
16	Right TMDS Data 0+ (twisted pair)	46	Ground
17	Right TMDS Data 0 - (twisted pair)	47	Not connected

18	Right TMDS Data 2+ (twisted pair)	48	Not connected
19	Right TMDS Data 2 - (twisted pair)	49	Ground
20	Not connected	50	Not connected
21	USB -	51	Not connected
22	Not connected	52	Ground
23	Not connected	53	Not connected
24	Not connected	54	Ground
25	USB +	55	Not connected
26	+3.3V Power output (MAX 1A)	56	Not connected
27	Left TMDS Data 2 - (twisted pair)	57	Ground
28	Left TMDS Data 2+ (twisted pair)	58	Not connected
29	Left TMDS Data 0 - (twisted pair)	59	Not connected
30	Left TMDS Data 0+ (twisted pair)	60	Ground

[Note]

- 1) The signals whose name starts with "Left" are used for displaying on Ch-a quarter block in case of Four Vertical Stripe mode or Four Tile mode, or used for displaying on Ch-a half block in case of Two Stripe mode. On the other hand, the signals whose name starts with "Right" are used for displaying on Ch-b quarter block in case of Four Vertical Stripe mode or Four Tile mode, or used for displaying on Ch-b half block in case of Two Stripe mode. (refer to 5.2 for the Electrical Interface Requirement)
- 2) This LCD Monitor complies with "VESA ENHANCED EXTENDED DISPLAY IDENTIFICATION DATA STANDARD Release A, Revision 1" and supports "EEDID version 1.3".
- 3) V_{EEDID} power source shall be the current limited circuit which has not exceeding 1A. (Reference Document : "Enhanced Display Data Channel (E-DDC™) Proposed Standard", VESA)
- 4) Both CLK_{EEDID} line and $Data_{EEDID}$ line are pulled-up with 10K ohm resistor to V_{EEDID} power source line at LCD Monitor, respectively.
- 5) Pin #21 (USB -) and pin #25 (USB +) are not used for the mode using 60pin Conn. - 60pin Conn.cables

Signal Connector B Pin Assignment

PIN #	SIGNAL NAME	PIN #	SIGNAL NAME
1	Ground	31	Left TMDS Data 1+ (twisted pair)
2	Not connected	32	Left TMDS Data 1 - (twisted pair)
3	Not connected	33	Left TMDS Clock data+ (twisted pair)
4	Ground	34	Left TMDS Clock data - (twisted pair)
5	V_{EEDID} + 5V Power input (MAX 1A) (Note2,3)	35	+3.3V Power output (MAX 1A)
6	CLK_{EEDID} Left SCL (DDC) (Note2,4)	36	Hot plug detection

7	Data _{EEDID} Left SDA (DDC) (Note2,4)	37	+3.3V Power output (MAX 1A)
8	Not connected	38	Ground
9	Data _{EEDID} Right SDA (DDC) (Note2,4)	39	Not connected
10	CLK _{EEDID} Right SCL (DDC) (Note2,4)	40	Hot plug detection
11	V _{EEDID} + 5V Power input (MAX 1A) (Note2,3)	41	Not connected
12	Ground	42	Right TMDS Clock data - (twisted pair)
13	Not connected	43	Right TMDS Clock data+ (twisted pair)
14	Not connected	44	Right TMDS Data 1 - (twisted pair)
15	Ground	45	Right TMDS Data 1+ (twisted pair)
16	Right TMDS Data 0+ (twisted pair)	46	Ground
17	Right TMDS Data 0 - (twisted pair)	47	Not connected
18	Right TMDS Data 2+ (twisted pair)	48	Not connected
19	Right TMDS Data 2 - (twisted pair)	49	Ground
20	Not connected	50	Not connected
21	Not connected	51	Not connected
22	Not connected	52	Ground
23	Not connected	53	Not connected
24	Not connected	54	Ground
25	Not connected	55	Not connected
26	+3.3V Power output (MAX 1A)	56	Not connected
27	Left TMDS Data 2 - (twisted pair)	57	Ground
28	Left TMDS Data 2+ (twisted pair)	58	Not connected
29	Left TMDS Data 0 - (twisted pair)	59	Not connected
30	Left TMDS Data 0+ (twisted pair)	60	Ground

[Note]

- 1) The signals whose name starts with "Left" are used for displaying on Ch-c quarter block only in case of Four Vertical Stripe mode or Four Tile mode. On the other hand, the signals whose name starts with "Right" are used for displaying on Ch-d quarter block only in case of Four Vertical Stripe mode or Four Tile mode. (refer to 5.2 for the Electrical Interface Requirements)
- 2) This LCD Monitor complies with "VESA ENHANCED EXTENDED DISPLAY IDENTIFICATION DATA STANDARD Release A, Revision 1" and supports "EEDID version 1.3".
- 3) V_{EEDID} power source shall be the current limited circuit which has not exceeding 1A. (Reference Document : "Enhanced Display Data Channel (E-DDC™) Proposed Standard", VESA)
- 4) Both CLK_{EEDID} line and Data_{EEDID} line are pulled-up with 10K ohm resistor to V_{EEDID} power source line at LCD Monitor, respectively.

5.1.2 EEDID Data

Item	Value		
	(BIN)	(HEX)	(DEC)
EISA Manufacture code (IBM=0x24)		24	
EISA Manufacture code, ASCII (IBM=0x4D)		4D	
Product Code			9503
32bit serial number (1st 8bit)		01	
32bit serial number (2nd 8bit)		01	
32bit serial number (3rd 8bit)		01	
32bit serial number (4th 8bit)		01	
Week of manufacture			1
Year of manufacture			2001
EDID Version			1
EDID Revision			3
Video Input: Analog=0, Degtal=1	1		1
Video Input: Signal Level	0		0
Video Input: Setup	0		0
Video Input: Sync. Input Supported	0000		0
Max. Horizontal Image Size (cm)			12
Max. Vertical Image Size(cm)			30
Gamma Value			2.2
Feature Support: Stand-By (Supported=1)	1		1
Feature Support: Suspend	1		1
Feature Support: Active Off	1		1
Feature Support: Display Type (01=RGB Monitor)	01		1
Feature Support: Standard Default Color Space	0		0
Feature Support: Preferred Timing Mode	0		0
Feature Support: GTF supported	0		0
Color Characteristics : Red_x			638
Color Characteristics : Red_y			340
Color Characteristics : Green_x			292
Color Characteristics : Green_y			611
Color Characteristics : Blue_x			146
Color Characteristics : Blue_y			85
Color Characteristics : White_x			313
Color Characteristics : White_y			329
Established Timing I : 720x400 @ 70Hz	0		0
Established Timing I : 720x400 @ 88Hz	0		0
Established Timing I : 640x480 @ 60Hz	1		1
Established Timing I : 640x480 @ 67Hz	0		0
Established Timing I : 640x480 @ 72Hz	1		1
Established Timing I : 640x480 @ 75Hz	1		1
Established Timing I : 800x600 @ 56Hz	1		1
Established Timing I : 800x600 @ 60Hz	1		1
Established Timing II : 800x600 @ 72Hz	1		1
Established Timing II : 800x600 @ 75Hz	1		1
Established Timing II : 832x624 @ 75Hz	0		0
Established Timing II : 1024x768 @ 87Hz	0		0
Established Timing II : 1024x768 @ 60Hz	1		1
Established Timing II : 1024x768 @ 70Hz	1		1
Established Timing II : 1024x768 @ 75Hz	1		1
Established Timing II : 1280x1024 @ 75Hz	1		1
Established Timing III : 1152x870 @ 75Hz	0		0

Item	Value		
	(BIN)	(HEX)	(DEC)
Standard Timing 1 : Horizontal active pixels (256-2288 pixel)			640
Standard Timing 1 : Image Aspect ratio	01		1
Standard Timing 1 : Refresh Rate (Hz)			85
Standard Timing 2 : Horizontal active pixels (256-2288 pixel)			800
Standard Timing 2 : Image Aspect ratio	01		1
Standard Timing 2 : Refresh Rate (Hz)			85
Standard Timing 3 : Horizontal active pixels (256-2288 pixel)			1024
Standard Timing 3 : Image Aspect ratio	01		1
Standard Timing 3 : Refresh Rate (Hz)			85
Standard Timing 4 : Horizontal active pixels (256-2288 pixel)			1280
Standard Timing 4 : Image Aspect ratio	10		2
Standard Timing 4 : Refresh Rate (Hz)			60
Standard Timing 5 : Horizontal active pixels (256-2288 pixel)			1600
Standard Timing 5 : Image Aspect ratio	01		1
Standard Timing 5 : Refresh Rate (Hz)			60
Standard Timing 6 : Horizontal active pixels (256-2288 pixel)			1920
Standard Timing 6 : Image Aspect ratio	11		3
Standard Timing 6 : Refresh Rate (Hz)			60
Standard Timing 7 : Horizontal active pixels (256-2288 pixel)			256
Standard Timing 7 : Image Aspect ratio	0		0
Standard Timing 7 : Refresh Rate (Hz)			61
Standard Timing 8 : Horizontal active pixels (256-2288 pixel)			256
Standard Timing 8 : Image Aspect ratio	0		0
Standard Timing 8 : Refresh Rate (Hz)			61
Detailed Timing 1 : Pixel clock (MHz)			10478
Detailed Timing 1 : Horizontal Active (pixels, 12bit)			960
Detailed Timing 1 : Horizontal Blanking (pixels, 12bit)			96
Detailed Timing 1 : Vertical Active (pixels, 12bit)			2400
Detailed Timing 1 : Vertical Blanking (pixels, 12bit)			24
Detailed Timing 1 : Horizontal Sync. Offset (pixels, 10bit)			8
Detailed Timing 1 : Horizontal Sync Pulse Width (pixels, 10bit)			32
Detailed Timing 1 : Vertical Sync Offset (lines, 6bit)			2
Detailed Timing 1 : Vertical Sync Pulse Width (lines, 6bit)			2
Detailed Timing 1 : Horizontal Image Size (mm, 12bit)			120
Detailed Timing 1 : Vertical Image Size (mm, 12bit)			300
Detailed Timing 1 : Horizontal Border (pixels)			0
Detailed Timing 1 : Vertical Border (lines)			0
Detailed Timing 1 : Flags	00011110	1E	30
Detailed Timing 2 : Descriptor Flag (2byte)			0
Detailed Timing 2 : Flag (1byte)			0
Detailed Timing 2 : Data Tag (0xFF=Monitor S/N)		FF	
Detailed Timing 3 : Descriptor Flag (2byte)			0
Detailed Timing 3 : Flag (1byte)			0
Detailed Timing 3 : Data Tag (0xFD=Monitor Range Limits)		FD	
Detailed Timing 3 : Min Vertical rate (Hz, use in interlace mode)			20
Detailed Timing 3 : Max Vertical rate (Hz, use in interlace mode)			86
Detailed Timing 3 : Min Horizontal rate (KHz)			31
Detailed Timing 3 : Max Horizontal rate (KHz)			105
Detailed Timing 3 : Max Supported Pixel Clock (MHz)			170
Detailed Timing 3 : GTF: set 00 if unused for GTF		00	
Detailed Timing 3 : GTF: set 0A if unused for GTF		0A	
Detailed Timing 3 : GTF: set 20 if unused for GTF		20	
Detailed Timing 4 : Descriptor Flag (2byte)			0
Detailed Timing 4 : Flag (1byte)			0
Detailed Timing 4 : Data Tag (0xFC=Monitor Name)		FC	
Extention Flag			0

EEDID Law Data for Reference

HEX ->	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	00	FF	FF	FF	FF	FF	FF	00	24	4D	1F	25	01	01	01	01
1	01	0B	01	03	80	0C	1E	78	E8	83	94	9F	55	49	98	24
2	15	4E	52	2F	CF	00	31	59	45	59	61	59	81	80	A9	40
3	D1	C0	01	01	01	01	EE	28	C0	60	30	60	18	90	08	20
4	22	00	78	2C	01	00	00	1E	00	00	00	FF	00	39	39	2D
5	39	39	39	39	39	0A	20	20	20	20	00	00	00	FD	00	14
6	56	1F	69	11	00	0A	20	20	20	20	20	20	00	00	00	FC
7	00	49	42	4D	39	35	30	33	2D	54	32	32	31	0A	00	C0

(Note) This LCD Monitor complies with "VESA ENHANCED EXTENDED DISPLAY IDENTIFICATION DATA STANDARD Release A, Revision 1" and supports "EEDID version 1.3".

5.1.3 DC - IN Connector

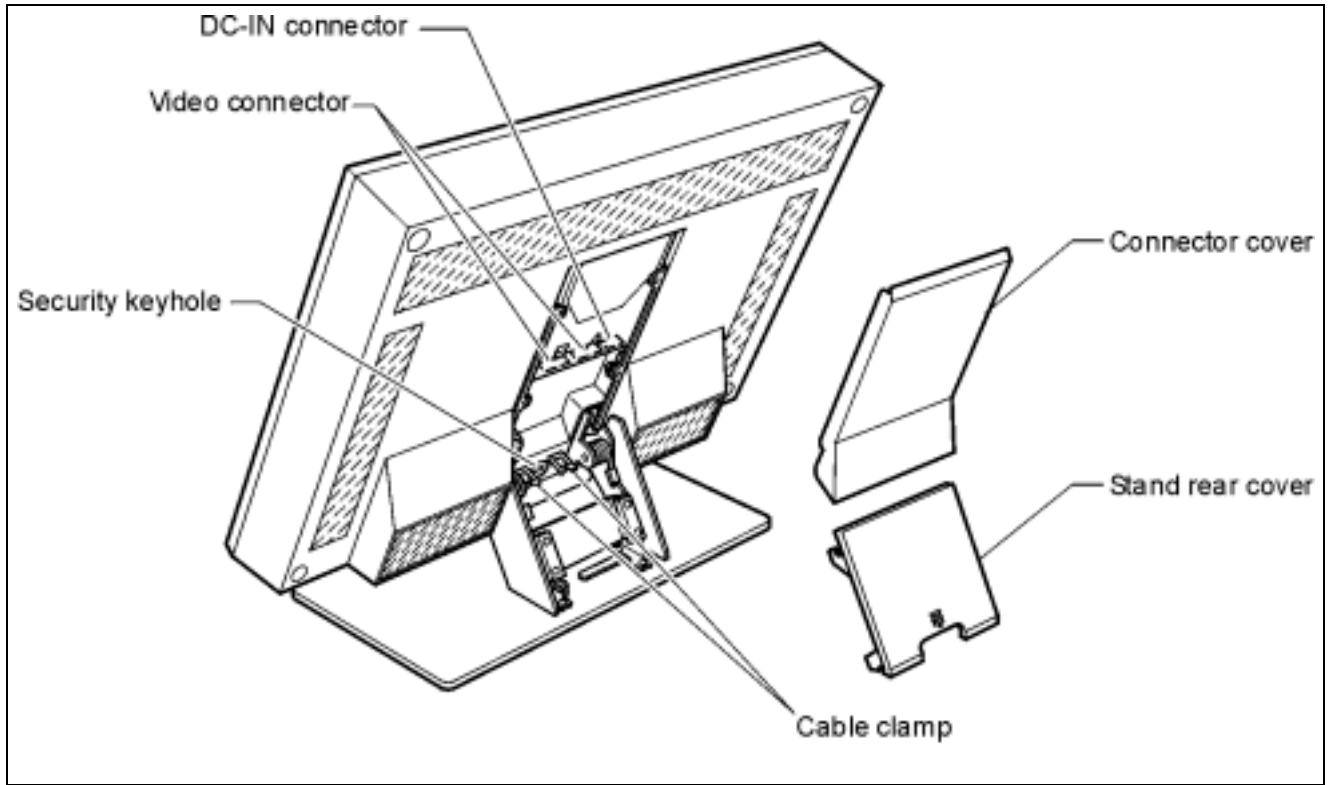
DC-IN Connector

Connector Name / Designation	DC Power Input Connector
Manufacturer	JWT
Type / Part Number	C4201WR0-6P-NL

DC-IN Connector Pin Assignment

PIN #	SIGNAL NAME	Description
4, 5, 6	+ 16 V	+16.0V Power Supply for monitor assembly
1, 2, 3	RTN	+16.0V Return

5.1.4 Connector Location



5.2 Electrical Interface Requirements

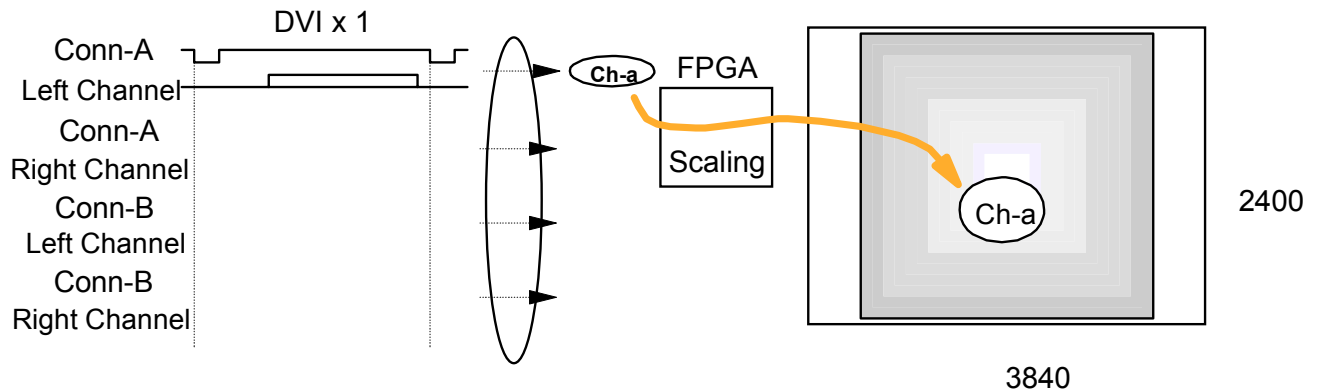
The monitor can accept only digital video data of TMDS in DVI interface. The monitor is driven with up to four DVI interfaces in two video cables. Each video cable accommodates two DVI signal sets.

The video data signal in each DVI interface shall meet requirements of the DVI specification.

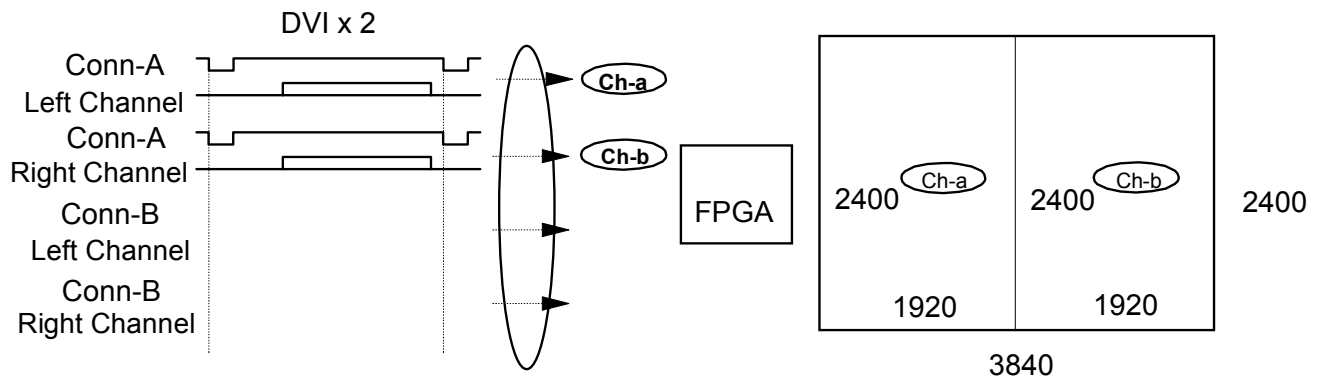
The monitor support following four modes:

- 1) Single Screen mode
- 2) Two Vertical Stripe mode
- 3) Four Vertical Stripe mode
- 4) Four Tile mode

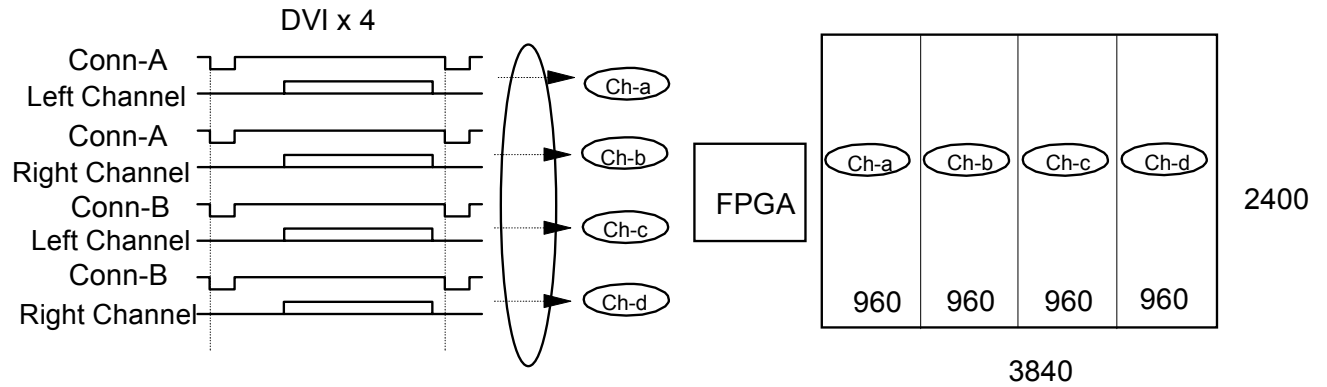
Single Screen mode



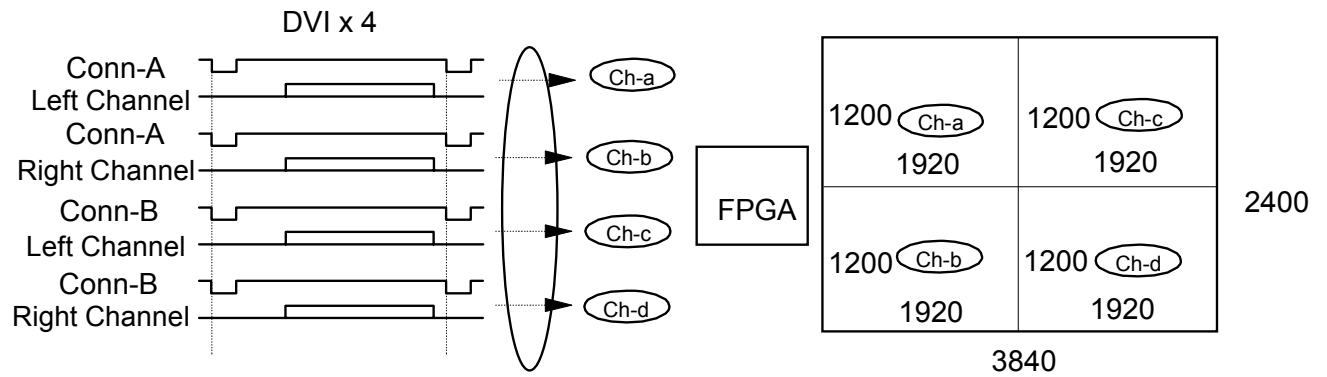
Two Vertical Stripe mode



Four Vertical Stripe mode

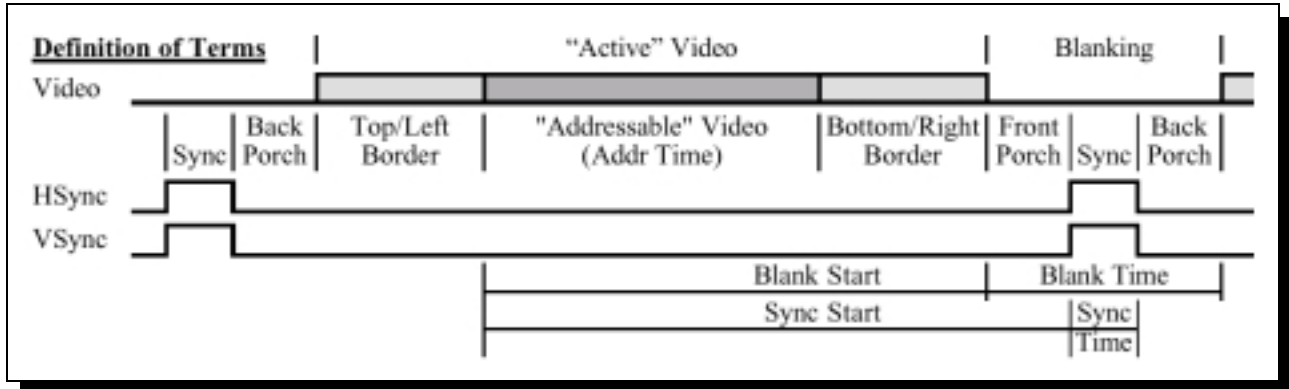


Four Tile mode

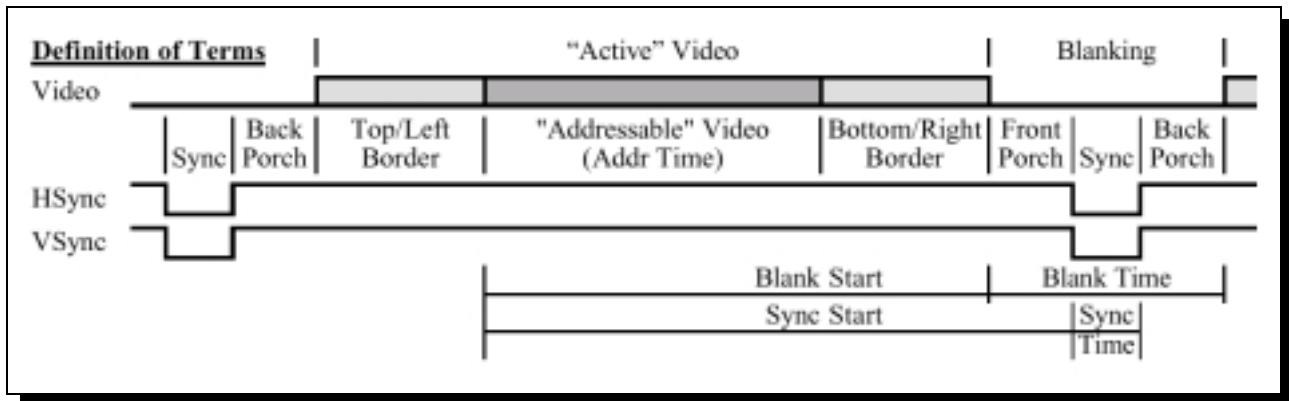


5.3 Interface Timings (each DVI input)

Reference Timing Chart (HSync: Positive, VSync: Positive Case)



Reference Timing Chart (HSync: Negative, VSync: Negative Case)



3840 x 2400 @ 41Hz, Four Vertical Stripe Mode (Each DVI Input Channel)

[Recommended Timing]

Timing Name	=	960x2400		
Hor Pixels	=	960		
Ver Pixels	=	2400		
Hor Frequency	=	99.22 Khz	=	10.078 usec
Ver Frequency	=	40.93 Hz	=	24.43 msec
Pixel Clock	=	104.78 MHz	=	9.544 nsec
Scan Type	=	Non-Interlaced		
Hor Sync Polarity	=	Positive / Negative		
Ver Sync Polarity	=	Positive / Negative		
Disp. Enable Polarity	=	Positive		
Hor Total Time	=	10.078 usec	=	1056 Pixels
Hor Addr Time	=	9.162 usec	=	960 Pixels
Hor Blank Start	=	9.162 usec	=	960 Pixels
Hor Blank Time	=	0.916 usec	=	96 Pixels
Hor Sync Start	=	9.238 usec	=	968 Pixels
Hor Right Border	=	0.000 usec	=	0 Pixels
Hor Front Porch	=	0.076 usec	=	8 Pixels
Hor Sync Time	=	0.305 usec	=	32 Pixels
Hor Back Porch	=	0.534 usec	=	56 Pixels
Hor Left Border	=	0.000 usec	=	0 Pixels
Ver Total Time	=	24.43 msec	=	2424 lines
Ver Addr Time	=	24.19 msec	=	2400 lines
Ver Blank Start	=	24.19 msec	=	2400 lines
Ver Blank Time	=	0.241 msec	=	24 lines
Ver Sync Start	=	24.03 msec	=	2402 lines
Ver Bottom Border	=	0.000 msec	=	0 lines
Ver Front Porch	=	0.020 msec	=	2 line
Ver Sync Time	=	0.020 msec	=	2 lines
Ver Back Porch	=	0.201 msec	=	20 lines
Ver Top Border	=	0.000 msec	=	0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 2 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

[Inter Channel Tolerance]

All 4 channels must be synchronized one another within the tolerance of 970 Pixels at maximum.

3840 x 2400 @ 20Hz, Two Vertical Stripe Mode (Each DVI Input Channel)

[Recommended Timing]

Timing Name	=	1920x2400	
Hor Pixels	=	1920	
Ver Pixels	=	2400	
Hor Frequency	=	48.924 Khz	= 20.440 usec
Ver Frequency	=	20.100 Hz	= 49.751 msec
Pixel Clock	=	100.000 MHz	= 10.000 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Positive / Negative	
Ver Sync Polarity	=	Positive / Negative	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	20.440 usec	= 2044 Pixels
Hor Addr Time	=	19.200 usec	= 1920 Pixels
Hor Blank Start	=	19.200 usec	= 1920 Pixels
Hor Blank Time	=	1.240 usec	= 124 Pixels
Hor Sync Start	=	19.280 usec	= 1928 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	0.080 usec	= 8 Pixels
Hor Sync Time	=	0.520 usec	= 52 Pixels
Hor Back Porch	=	0.640 usec	= 64 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	49.751 msec	= 2434 lines
Ver Addr Time	=	49.056 msec	= 2400 lines
Ver Blank Start	=	49.056 msec	= 2400 lines
Ver Blank Time	=	0.695 msec	= 34 lines
Ver Sync Start	=	49.097 msec	= 2402 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.041 msec	= 2 lines
Ver Sync Time	=	0.041 msec	= 2 lines
Ver Back Porch	=	0.613 msec	= 30 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

[Inter Channel Tolerance]

Both 2 channels must be synchronized each other within the tolerance of 970 Pixels at maximum.

3840 x 2400 @ 24Hz, Two Vertical Stripe Mode (Each DVI Input Channel)

[Recommended Timing]

Timing Name	=	1920x2400		
Hor Pixels	=	1920		
Ver Pixels	=	2400		
Hor Frequency	=	58.708 Khz	=	17.033 usec
Ver Frequency	=	24.120 Hz	=	41.459 msec
Pixel Clock	=	120.000 MHz	=	8.333 nsec
Scan Type	=	Non-Interlaced		
Hor Sync Polarity	=	Positive / Negative		
Ver Sync Polarity	=	Positive / Negative		
Disp. Enable Polarity	=	Positive		
Hor Total Time	=	17.033 usec	=	2044 Pixels
Hor Addr Time	=	16.000 usec	=	1920 Pixels
Hor Blank Start	=	16.000 usec	=	1920 Pixels
Hor Blank Time	=	1.033 usec	=	124 Pixels
Hor Sync Start	=	16.067 usec	=	1928 Pixels
Hor Right Border	=	0.000 usec	=	0 Pixels
Hor Front Porch	=	0.067 usec	=	8 Pixels
Hor Sync Time	=	0.433 usec	=	52 Pixels
Hor Back Porch	=	0.533 usec	=	64 Pixels
Hor Left Border	=	0.000 usec	=	0 Pixels
Ver Total Time	=	41.459 msec	=	2434 lines
Ver Addr Time	=	40.880 msec	=	2400 lines
Ver Blank Start	=	40.880 msec	=	2400 lines
Ver Blank Time	=	0.579 msec	=	34 lines
Ver Sync Start	=	40.914 msec	=	2402 lines
Ver Bottom Border	=	0.000 msec	=	0 lines
Ver Front Porch	=	0.034 msec	=	2 lines
Ver Sync Time	=	0.034 msec	=	2 lines
Ver Back Porch	=	0.511 msec	=	30 lines
Ver Top Border	=	0.000 msec	=	0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

[Inter Channel Tolerance]

Both 2 channels must be synchronized each other within the tolerance of 970 Pixels at maximum.

3840 x 2400 @ 25Hz, Two Vertical Stripe Mode (Each DVI Input Channel)

[Recommended Timing]

Timing Name	=	1920x2400		
Hor Pixels	=	1920		
Ver Pixels	=	2400		
Hor Frequency	=	61.155 Khz	=	16.352 usec
Ver Frequency	=	25.125 Hz	=	39.801 msec
Pixel Clock	=	125.000 MHz	=	8.000 nsec
Scan Type	=	Non-Interlaced		
Hor Sync Polarity	=	Positive / Negative		
Ver Sync Polarity	=	Positive / Negative		
Disp. Enable Polarity	=	Positive		
Hor Total Time	=	16.352 usec	=	2044 Pixels
Hor Addr Time	=	15.360 usec	=	1920 Pixels
Hor Blank Start	=	15.360 usec	=	1920 Pixels
Hor Blank Time	=	0.992 usec	=	124 Pixels
Hor Sync Start	=	15.424 usec	=	1928 Pixels
Hor Right Border	=	0.000 usec	=	0 Pixels
Hor Front Porch	=	0.064 usec	=	8 Pixels
Hor Sync Time	=	0.416 usec	=	52 Pixels
Hor Back Porch	=	0.512 usec	=	64 Pixels
Hor Left Border	=	0.000 usec	=	0 Pixels
Ver Total Time	=	39.801 msec	=	2434 lines
Ver Addr Time	=	39.245 msec	=	2400 lines
Ver Blank Start	=	39.245 msec	=	2400 lines
Ver Blank Time	=	0.556 msec	=	34 lines
Ver Sync Start	=	39.278 msec	=	2402 lines
Ver Bottom Border	=	0.000 msec	=	0 lines
Ver Front Porch	=	0.033 msec	=	2 lines
Ver Sync Time	=	0.033 msec	=	2 lines
Ver Back Porch	=	0.491 msec	=	30 lines
Ver Top Border	=	0.000 msec	=	0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

[Inter Channel Tolerance]

Both 2 channels must be synchronized each other within the tolerance of 970 Pixels line at maximum.



1920 x 1200 @ 41Hz, Four Tile Mode (Each DVI Input Channel)

[Recommended Timing]

Timing Name	=	1920x1200		
Hor Pixels	=	1920		
Ver Pixels	=	1200		
Hor Frequency	=	49.61 Khz	=	20.156 usec
Ver Frequency	=	40.93 Hz	=	24.43 msec
Pixel Clock	=	104.78 MHz	=	9.544 nsec
Scan Type	=	Non-Interlaced		
Hor Sync Polarity	=	Negative / Positive		
Ver Sync Polarity	=	Negative / Positive		
Disp. Enable Polarity	=	Positive		
Hor Total Time	=	20.156 usec	=	2112 Pixels
Hor Addr Time	=	18.324 usec	=	1920 Pixels
Hor Blank Start	=	18.324 usec	=	1920 Pixels
Hor Blank Time	=	1.832 usec	=	192 Pixels
Hor Sync Start	=	18.400 usec	=	1928 Pixels
Hor Right Border	=	0.000 usec	=	0 Pixels
Hor Front Porch	=	0.076 usec	=	8 Pixels
Hor Sync Time	=	0.305 usec	=	32 Pixels
Hor Back Porch	=	1.452 usec	=	152 Pixels
Hor Left Border	=	0.000 usec	=	0 Pixels
Ver Total Time	=	24.43 msec	=	1212 lines
Ver Addr Time	=	24.19 msec	=	1200 lines
Ver Blank Start	=	24.19 msec	=	1200 lines
Ver Blank Time	=	0.241 msec	=	12 lines
Ver Sync Start	=	24.21 msec	=	1201 lines
Ver Bottom Border	=	0.000 msec	=	0 lines
Ver Front Porch	=	0.020 msec	=	1 line
Ver Sync Time	=	0.040 msec	=	2 lines
Ver Back Porch	=	0.181 msec	=	9 lines
Ver Top Border	=	0.000 msec	=	0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

[Inter Channel Tolerance]

All 4 channels must be synchronized one another within the tolerance of 970 Pixels at maximum.

640 x 480 @ 60Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	640 x 480 @ 60Hz	
Hor Pixels	=	640 Pixels	
Ver Pixels	=	480 Lines	
Hor Frequency	=	31.469 Khz	= 31.8 usec / line
Ver Frequency	=	59.940 Hz	= 16.7 msec / frame
Pixel Clock	=	25.175 MHz	= 39.7 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Negative / Positive	
Ver Sync Polarity	=	Negative / Positive	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	31.778 usec	= 800 Pixels
Hor Addr Time	=	25.422 usec	= 640 Pixels
Hor Blank Start	=	25.740 usec	= 648 Pixels
Hor Blank Time	=	5.720 usec	= 144 Pixels
Hor Sync Start	=	26.058 usec	= 656 Pixels
Hor Right Border	=	0.318 usec	= 8 Pixels
Hor Front Porch	=	0.318 usec	= 8 Pixels
Hor Sync Time	=	3.813 usec	= 96 Pixels
Hor Back Porch	=	1.589 usec	= 40 Pixels
Hor Left Border	=	0.318 usec	= 8 Pixels
Ver Total Time	=	16.683 msec	= 525 lines
Ver Addr Time	=	15.253 msec	= 480 lines
Ver Blank Start	=	15.507 msec	= 488 lines
Ver Blank Time	=	0.922 msec	= 29 lines
Ver Sync Start	=	15.571 msec	= 490 lines
Ver Bottom Border	=	0.254 msec	= 8 lines
Ver Front Porch	=	0.064 msec	= 2 lines
Ver Sync Time	=	0.064 msec	= 2 lines
Ver Back Porch	=	0.794 msec	= 25 lines
Ver Top Border	=	0.254 msec	= 8 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

640 x 480 @ 72Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	640 x 480 @ 72Hz	
Hor Pixels	=	640 Pixels	
Ver Pixels	=	480 Lines	
Hor Frequency	=	37.861 Khz	= 26.4 usec / line
Ver Frequency	=	72.809 Hz	= 13.7 msec / frame
Pixel Clock	=	31.500 MHz	= 31.7 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Negative / Positive	
Ver Sync Polarity	=	Negative / Positive	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	26.413 usec	= 832 Pixels
Hor Addr Time	=	20.317 usec	= 640 Pixels
Hor Blank Start	=	20.571 usec	= 648 Pixels
Hor Blank Time	=	5.587 usec	= 176 Pixels
Hor Sync Start	=	21.079 usec	= 664 Pixels
Hor Right Border	=	0.254 usec	= 8 Pixels
Hor Front Porch	=	0.508 usec	= 16 Pixels
Hor Sync Time	=	1.270 usec	= 40 Pixels
Hor Back Porch	=	3.810 usec	= 120 Pixels
Hor Left Border	=	0.254 usec	= 8 Pixels
Ver Total Time	=	13.735 msec	= 520 lines
Ver Addr Time	=	12.678 msec	= 480 lines
Ver Blank Start	=	12.889 msec	= 488 lines
Ver Blank Time	=	0.634 msec	= 24 lines
Ver Sync Start	=	12.916 msec	= 489 lines
Ver Bottom Border	=	0.211 msec	= 8 lines
Ver Front Porch	=	0.026 msec	= 1 lines
Ver Sync Time	=	0.079 msec	= 3 lines
Ver Back Porch	=	0.528 msec	= 20 lines
Ver Top Border	=	0.211 msec	= 8 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec



640 x 480 @ 75Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	640 x 480 @ 75Hz	
Hor Pixels	=	640 Pixels	
Ver Pixels	=	480 Lines	
Hor Frequency	=	37.500 Khz	= 26.7 usec / line
Ver Frequency	=	75.000 Hz	= 13.3 msec / frame
Pixel Clock	=	31.500 MHz	= 31.7 nsec (+/- 0.5%)
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Negative / Positive	
Ver Sync Polarity	=	Negative / Positive	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	26.667 usec	= 840 Pixels
Hor Addr Time	=	20.317 usec	= 640 Pixels
Hor Blank Start	=	20.317 usec	= 640 Pixels
Hor Blank Time	=	6.349 usec	= 200 Pixels
Hor Sync Start	=	20.825 usec	= 656 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	0.508 usec	= 16 Pixels
Hor Sync Time	=	2.032 usec	= 64 Pixels
Hor Back Porch	=	3.810 usec	= 120 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	13.333 msec	= 500 lines
Ver Addr Time	=	12.800 msec	= 480 lines
Ver Blank Start	=	12.800 msec	= 480 lines
Ver Blank Time	=	0.533 msec	= 20 lines
Ver Sync Start	=	12.827 msec	= 481 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.027 msec	= 1 lines
Ver Sync Time	=	0.080 msec	= 3 lines
Ver Back Porch	=	0.427 msec	= 16 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

640 x 480 @ 85Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	640 x 480 @ 85Hz	
Hor Pixels	=	640 Pixels	
Ver Pixels	=	480 Lines	
Hor Frequency	=	43.269 Khz	= 23.1 usec / line
Ver Frequency	=	85.008 Hz	= 11.8 msec / frame
Pixel Clock	=	36.000 MHz	= 27.8 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Negative / Positive	
Ver Sync Polarity	=	Negative / Positive	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	23.111 usec	= 832 Pixels
Hor Addr Time	=	17.778 usec	= 640 Pixels
Hor Blank Start	=	17.778 usec	= 640 Pixels
Hor Blank Time	=	5.333 usec	= 192 Pixels
Hor Sync Start	=	19.333 usec	= 696 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	1.556 usec	= 56 Pixels
Hor Sync Time	=	1.556 usec	= 56 Pixels
Hor Back Porch	=	2.222 usec	= 80 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	11.764 msec	= 509 lines
Ver Addr Time	=	11.093 msec	= 480 lines
Ver Blank Start	=	11.093 msec	= 480 lines
Ver Blank Time	=	0.670 msec	= 29 lines
Ver Sync Start	=	11.116 msec	= 481 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.023 msec	= 1 lines
Ver Sync Time	=	0.069 msec	= 3 lines
Ver Back Porch	=	0.578 msec	= 25 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

800 x 600 @ 56Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	800 x 600 @ 56Hz	
Hor Pixels	=	800 Pixels	
Ver Pixels	=	600 Lines	
Hor Frequency	=	35.156 Khz	= 28.4 usec / line
Ver Frequency	=	56.250 Hz	= 17.8 msec / frame
Pixel Clock	=	36.000 MHz	= 27.8 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Positive / Negative	
Ver Sync Polarity	=	Positive / Negative	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	28.444 usec	= 1024 Pixels
Hor Addr Time	=	22.222 usec	= 800 Pixels
Hor Blank Start	=	22.222 usec	= 800 Pixels
Hor Blank Time	=	6.222 usec	= 224 Pixels
Hor Sync Start	=	22.889 usec	= 824 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	0.667 usec	= 24 Pixels
Hor Sync Time	=	2.000 usec	= 72 Pixels
Hor Back Porch	=	3.556 usec	= 128 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	17.778 msec	= 625 lines
Ver Addr Time	=	17.067 msec	= 600 lines
Ver Blank Start	=	17.067 msec	= 600 lines
Ver Blank Time	=	0.711 msec	= 25 lines
Ver Sync Start	=	17.095 msec	= 601 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.028 msec	= 1 lines
Ver Sync Time	=	0.057 msec	= 2 lines
Ver Back Porch	=	0.626 msec	= 22 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

800 x 600 @ 60Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	800 x 600 @ 60Hz	
Hor Pixels	=	800 Pixels	
Ver Pixels	=	600 Lines	
Hor Frequency	=	37.879 Khz	= 26.4 usec / line
Ver Frequency	=	60.317 Hz	= 16.6 msec / frame
Pixel Clock	=	40.000 MHz	= 25.0 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Positive / Negative	
Ver Sync Polarity	=	Positive / Negative	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	26.400 usec	= 1056 Pixels
Hor Addr Time	=	20.000 usec	= 800 Pixels
Hor Blank Start	=	20.000 usec	= 800 Pixels
Hor Blank Time	=	6.400 usec	= 256 Pixels
Hor Sync Start	=	21.000 usec	= 840 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	1.000 usec	= 40 Pixels
Hor Sync Time	=	3.200 usec	= 128 Pixels
Hor Back Porch	=	2.200 usec	= 88 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	16.579 msec	= 628 lines
Ver Addr Time	=	15.840 msec	= 600 lines
Ver Blank Start	=	15.840 msec	= 600 lines
Ver Blank Time	=	0.739 msec	= 28 lines
Ver Sync Start	=	15.866 msec	= 601 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.026 msec	= 1 lines
Ver Sync Time	=	0.106 msec	= 4 lines
Ver Back Porch	=	0.607 msec	= 23 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

800 x 600 @ 72Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	800 x 600 @ 72Hz	
Hor Pixels	=	800 Pixels	
Ver Pixels	=	600 Lines	
Hor Frequency	=	48.077 Khz	= 20.8 usec / line
Ver Frequency	=	72.188 Hz	= 13.9 msec / frame
Pixel Clock	=	50.000 MHz	= 20.0 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Positive / Negative	
Ver Sync Polarity	=	Positive / Negative	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	20.800 usec	= 1040 Pixels
Hor Addr Time	=	16.000 usec	= 800 Pixels
Hor Blank Start	=	16.000 usec	= 800 Pixels
Hor Blank Time	=	4.800 usec	= 240 Pixels
Hor Sync Start	=	17.120 usec	= 856 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	1.120 usec	= 56 Pixels
Hor Sync Time	=	2.400 usec	= 120 Pixels
Hor Back Porch	=	1.280 usec	= 64 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	13.853 msec	= 666 lines
Ver Addr Time	=	12.480 msec	= 600 lines
Ver Blank Start	=	12.480 msec	= 600 lines
Ver Blank Time	=	1.373 msec	= 66 lines
Ver Sync Start	=	13.250 msec	= 637 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.770 msec	= 37 lines
Ver Sync Time	=	0.125 msec	= 6 lines
Ver Back Porch	=	0.478 msec	= 23 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec



800 x 600 @ 75Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	800 x 600 @ 75Hz	
Hor Pixels	=	800 Pixels	
Ver Pixels	=	600 Lines	
Hor Frequency	=	46.875 Khz	= 21.3 usec / line
Ver Frequency	=	75.000 Hz	= 13.3 msec / frame
Pixel Clock	=	49.500 MHz	= 20.2 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Positive / Negative	
Ver Sync Polarity	=	Positive / Negative	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	21.333 usec	= 1056 Pixels
Hor Addr Time	=	16.162 usec	= 800 Pixels
Hor Blank Start	=	16.162 usec	= 800 Pixels
Hor Blank Time	=	5.172 usec	= 256 Pixels
Hor Sync Start	=	16.485 usec	= 816 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	0.323 usec	= 16 Pixels
Hor Sync Time	=	1.616 usec	= 80 Pixels
Hor Back Porch	=	3.232 usec	= 160 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	13.333 msec	= 625 lines
Ver Addr Time	=	12.800 msec	= 600 lines
Ver Blank Start	=	12.800 msec	= 600 lines
Ver Blank Time	=	0.533 msec	= 25 lines
Ver Sync Start	=	12.821 msec	= 601 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.021 msec	= 1 lines
Ver Sync Time	=	0.064 msec	= 3 lines
Ver Back Porch	=	0.448 msec	= 21 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

800 x 600 @ 85Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	800 x 600 @ 85Hz	
Hor Pixels	=	800 Pixels	
Ver Pixels	=	600 Lines	
Hor Frequency	=	53.674 Khz	= 18.6 usec / line
Ver Frequency	=	85.061 Hz	= 11.8 msec / frame
Pixel Clock	=	56.250 MHz	= 17.8 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Positive / Negative	
Ver Sync Polarity	=	Positive / Negative	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	18.631 usec	= 1048 Pixels
Hor Addr Time	=	14.222 usec	= 800 Pixels
Hor Blank Start	=	14.222 usec	= 800 Pixels
Hor Blank Time	=	4.409 usec	= 248 Pixels
Hor Sync Start	=	14.791 usec	= 832 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	0.569 usec	= 32 Pixels
Hor Sync Time	=	1.138 usec	= 64 Pixels
Hor Back Porch	=	2.702 usec	= 152 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	11.756 msec	= 631 lines
Ver Addr Time	=	11.179 msec	= 600 lines
Ver Blank Start	=	11.179 msec	= 600 lines
Ver Blank Time	=	0.578 msec	= 31 lines
Ver Sync Start	=	11.197 msec	= 601 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.019 msec	= 1 lines
Ver Sync Time	=	0.056 msec	= 3 lines
Ver Back Porch	=	0.503 msec	= 27 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

1024 x 768 @ 60Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	1024 x 768 @ 60Hz	
Hor Pixels	=	1024 Pixels	
Ver Pixels	=	768 Lines	
Hor Frequency	=	48.363 Khz	= 20.7 usec / line
Ver Frequency	=	60.004 Hz	= 16.7 msec / frame
Pixel Clock	=	65.000 MHz	= 15.4 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Negative / Positive	
Ver Sync Polarity	=	Negative / Positive	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	20.677 usec	= 1344 Pixels
Hor Addr Time	=	15.754 usec	= 1024 Pixels
Hor Blank Start	=	15.754 usec	= 1024 Pixels
Hor Blank Time	=	4.923 usec	= 320 Pixels
Hor Sync Start	=	16.123 usec	= 1048 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	0.369 usec	= 24 Pixels
Hor Sync Time	=	2.092 usec	= 136 Pixels
Hor Back Porch	=	2.462 usec	= 160 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	16.666 msec	= 806 lines
Ver Addr Time	=	15.880 msec	= 768 lines
Ver Blank Start	=	15.880 msec	= 768 lines
Ver Blank Time	=	0.786 msec	= 38 lines
Ver Sync Start	=	15.942 msec	= 771 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.062 msec	= 3 lines
Ver Sync Time	=	0.124 msec	= 6 lines
Ver Back Porch	=	0.600 msec	= 29 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

1024 x 768 @ 70Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	1024 x 768 @ 70Hz	
Hor Pixels	=	1024 Pixels	
Ver Pixels	=	768 Lines	
Hor Frequency	=	56.476 Khz	= 17.7 usec / line
Ver Frequency	=	70.069 Hz	= 14.3 msec / frame
Pixel Clock	=	75.000 MHz	= 13.3 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Negative / Positive	
Ver Sync Polarity	=	Negative / Positive	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	17.707 usec	= 1328 Pixels
Hor Addr Time	=	13.653 usec	= 1024 Pixels
Hor Blank Start	=	13.653 usec	= 1024 Pixels
Hor Blank Time	=	4.053 usec	= 304 Pixels
Hor Sync Start	=	13.973 usec	= 1048 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	0.320 usec	= 24 Pixels
Hor Sync Time	=	1.813 usec	= 136 Pixels
Hor Back Porch	=	1.920 usec	= 144 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	14.272 msec	= 806 lines
Ver Addr Time	=	13.599 msec	= 768 lines
Ver Blank Start	=	13.599 msec	= 768 lines
Ver Blank Time	=	0.673 msec	= 38 lines
Ver Sync Start	=	13.652 msec	= 771 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.053 msec	= 3 lines
Ver Sync Time	=	0.106 msec	= 6 lines
Ver Back Porch	=	0.513 msec	= 29 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

1024 x 768 @ 75Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	1024 x 768 @ 75Hz	
Hor Pixels	=	1024 Pixels	
Ver Pixels	=	768 Lines	
Hor Frequency	=	60.023 KHz	= 16.7 usec / line
Ver Frequency	=	75.029 Hz	= 13.3 msec / frame
Pixel Clock	=	78.750 MHz	= 12.7 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Positive / Negative	
Ver Sync Polarity	=	Positive / Negative	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	16.660 usec	= 1312 Pixels
Hor Addr Time	=	13.003 usec	= 1024 Pixels
Hor Blank Start	=	13.003 usec	= 1024 Pixels
Hor Blank Time	=	3.657 usec	= 288 Pixels
Hor Sync Start	=	13.206 usec	= 1040 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	0.203 usec	= 16 Pixels
Hor Sync Time	=	1.219 usec	= 96 Pixels
Hor Back Porch	=	2.235 usec	= 176 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	13.328 msec	= 800 lines
Ver Addr Time	=	12.795 msec	= 768 lines
Ver Blank Start	=	12.795 msec	= 768 lines
Ver Blank Time	=	0.533 msec	= 32 lines
Ver Sync Start	=	12.812 msec	= 769 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.017 msec	= 1 lines
Ver Sync Time	=	0.050 msec	= 3 lines
Ver Back Porch	=	0.466 msec	= 28 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line

Ver Sync Time min. 1 line

Ver Back Porch min. 1 line

Ver Front Porch + Ver Sync Time < 3.3 msec

Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel

Hor Sync Time min 1 Pixel

Hor Back Porch min 1 Pixel

400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

1024 x 768 @ 85Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	1024 x 768 @ 85Hz	
Hor Pixels	=	1024 Pixels	
Ver Pixels	=	768 Lines	
Hor Frequency	=	68.677 Khz	= 14.6 usec / line
Ver Frequency	=	84.997 Hz	= 11.8 msec / frame
Pixel Clock	=	94.500 MHz	= 10.6 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Positive / Negative	
Ver Sync Polarity	=	Positive / Negative	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	14.561 usec	= 1376 Pixels
Hor Addr Time	=	10.836 usec	= 1024 Pixels
Hor Blank Start	=	10.836 usec	= 1024 Pixels
Hor Blank Time	=	3.725 usec	= 352 Pixels
Hor Sync Start	=	11.344 usec	= 1072 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	0.508 usec	= 48 Pixels
Hor Sync Time	=	1.016 usec	= 96 Pixels
Hor Back Porch	=	2.201 usec	= 208 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	11.765 msec	= 808 lines
Ver Addr Time	=	11.183 msec	= 768 lines
Ver Blank Start	=	11.183 msec	= 768 lines
Ver Blank Time	=	0.582 msec	= 40 lines
Ver Sync Start	=	11.197 msec	= 769 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.015 msec	= 1 lines
Ver Sync Time	=	0.044 msec	= 3 lines
Ver Back Porch	=	0.524 msec	= 36 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line

Ver Sync Time min. 1 line

Ver Back Porch min. 1 line

Ver Front Porch + Ver Sync Time < 3.3 msec

Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel

Hor Sync Time min 1 Pixel

Hor Back Porch min 1 Pixel

400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

1280 x 1024 @ 60Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	1280 x 1024 @ 60Hz	
Hor Pixels	=	1280 Pixels	
Ver Pixels	=	1024 Lines	
Hor Frequency	=	63.981 Khz	= 15.6 usec / line
Ver Frequency	=	60.020 Hz	= 16.7 msec / frame
Pixel Clock	=	108.000 MHz	= 9.3 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Positive / Negative	
Ver Sync Polarity	=	Positive / Negative	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	15.630 usec	= 1688 Pixels
Hor Addr Time	=	11.852 usec	= 1280 Pixels
Hor Blank Start	=	11.852 usec	= 1280 Pixels
Hor Blank Time	=	3.778 usec	= 408 Pixels
Hor Sync Start	=	12.296 usec	= 1328 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	0.444 usec	= 48 Pixels
Hor Sync Time	=	1.037 usec	= 112 Pixels
Hor Back Porch	=	2.296 usec	= 248 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	16.661 msec	= 1066 lines
Ver Addr Time	=	16.005 msec	= 1024 lines
Ver Blank Start	=	16.005 msec	= 1024 lines
Ver Blank Time	=	0.656 msec	= 42 lines
Ver Sync Start	=	16.020 msec	= 1025 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.016 msec	= 1 lines
Ver Sync Time	=	0.047 msec	= 3 lines
Ver Back Porch	=	0.594 msec	= 38 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec



1280 x 1024 @ 75Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	1280 x 1024 @ 75Hz	
Hor Pixels	=	1280 Pixels	
Ver Pixels	=	1024 Lines	
Hor Frequency	=	79.976 Khz	= 12.5 usec / line
Ver Frequency	=	75.025 Hz	= 13.3 msec / frame
Pixel Clock	=	135.000 MHz	= 7.4 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Positive / Negative	
Ver Sync Polarity	=	Positive / Negative	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	12.504 usec	= 1688 Pixels
Hor Addr Time	=	9.481 usec	= 1280 Pixels
Hor Blank Start	=	9.481 usec	= 1280 Pixels
Hor Blank Time	=	3.022 usec	= 408 Pixels
Hor Sync Start	=	9.600 usec	= 1296 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	0.119 usec	= 16 Pixels
Hor Sync Time	=	1.067 usec	= 144 Pixels
Hor Back Porch	=	1.837 usec	= 248 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	13.329 msec	= 1066 lines
Ver Addr Time	=	12.804 msec	= 1024 lines
Ver Blank Start	=	12.804 msec	= 1024 lines
Ver Blank Time	=	0.525 msec	= 42 lines
Ver Sync Start	=	12.816 msec	= 1025 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.013 msec	= 1 lines
Ver Sync Time	=	0.038 msec	= 3 lines
Ver Back Porch	=	0.475 msec	= 38 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

1600 x 1200 @ 60Hz Mode (Ch-a DVI Input)

[Recommended Timing] -- based on the VESA Monitor Timing Standard

Timing Name	=	1600 x 1200 @ 60Hz	
Hor Pixels	=	1600 Pixels	
Ver Pixels	=	1200 Lines	
Hor Frequency	=	75.000 Khz	= 13.3 usec / line
Ver Frequency	=	60.000 Hz	= 16.7 msec / frame
Pixel Clock	=	162.000 MHz	= 6.2 nsec
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Positive / Negative	
Ver Sync Polarity	=	Positive / Negative	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	13.333 usec	= 2160 Pixels
Hor Addr Time	=	9.877 usec	= 1600 Pixels
Hor Blank Start	=	9.877 usec	= 1600 Pixels
Hor Blank Time	=	3.457 usec	= 560 Pixels
Hor Sync Start	=	10.272 usec	= 1664 Pixels
Hor Right Border	=	0.000 usec	= 0 Pixels
Hor Front Porch	=	0.395 usec	= 64 Pixels
Hor Sync Time	=	1.185 usec	= 192 Pixels
Hor Back Porch	=	1.877 usec	= 304 Pixels
Hor Left Border	=	0.000 usec	= 0 Pixels
Ver Total Time	=	16.667 msec	= 1250 lines
Ver Addr Time	=	16.000 msec	= 1200 lines
Ver Blank Start	=	16.000 msec	= 1200 lines
Ver Blank Time	=	0.667 msec	= 50 lines
Ver Sync Start	=	16.013 msec	= 1201 lines
Ver Bottom Border	=	0.000 msec	= 0 lines
Ver Front Porch	=	0.013 msec	= 1 lines
Ver Sync Time	=	0.040 msec	= 3 lines
Ver Back Porch	=	0.613 msec	= 46 lines
Ver Top Border	=	0.000 msec	= 0 lines

[Tolerance Condition]

Pixel Clock within +/- 0.5%

Ver Front Porch min. 1 line
 Ver Sync Time min. 1 line
 Ver Back Porch min. 1 line
 Ver Front Porch + Ver Sync Time < 3.3 msec
 Ver Back Porch < 3.3 msec

Hor Front Porch min 0 Pixel
 Hor Sync Time min 1 Pixel
 Hor Back Porch min 1 Pixel
 400 nsec < Hor Blank Time = Hor Front Porch + Hor Sync Time + Hor Back Porch < 3.3 msec

960 x 1200 (Matrox DOS/VGA) @ 56Hz Mode (Ch-a DVI Input)

[Recommended Timing & Tolerance Condition]

Timing Name	=	960x1200	
Hor Pixels	=	960	
Ver Pixels	=	1200	
Hor Frequency	=	67.218 Khz	= 14.88 usec
Ver Frequency	=	55.74 Hz	= 17.94 msec
Pixel Clock	=	70.98 MHz	= 14.088 nsec (min. 60 MHz / Max. 100 MHz)
Scan Type	=	Non-Interlaced	
Hor Sync Polarity	=	Positive / Negative	
Ver Sync Polarity	=	Positive / Negative	
Disp. Enable Polarity	=	Positive	
Hor Total Time	=	14.877 usec	= 1056 Pixels (min. 1036 pixels / Max. 1540 pixels)
Hor Addr Time	=	13.525 usec	= 960 Pixels (only this pixel value is allowed)
Hor Blank Start	=	13.525 usec	= 960 Pixels (only this pixel value is allowed)
Hor Blank Time	=	1.352 usec	= 96 Pixels (min. 76 pixels / Max. 580 pixels)
Hor Sync Start	=	1.364 usec	= 968 Pixels (min. 960 Pixels)
Hor Right Border	=	0.000 usec	= 0 Pixels (only this pixel value is allowed)
Hor Front Porch	=	0.113 usec	= 8 Pixels (min. 0 Pixel)
Hor Sync Time	=	0.451 usec	= 32 Pixels (min. 1 Pixel)
Hor Back Porch	=	0.789 usec	= 56 Pixels (min. 1 Pixel)
Hor Left Border	=	0.000 usec	= 0 Pixels (only this pixel value is allowed)
Ver Total Time	=	17.94 msec	= 1206 lines (min. 1205 lines / Max. 1238 lines)
Ver Addr Time	=	17.85 msec	= 1200 lines (only this line value is allowed)
Ver Blank Start	=	17.85 msec	= 1200 lines (only this line value is allowed)
Ver Blank Time	=	0.089 msec	= 6 lines (min. 5 lines/Max. 38 lines)
Ver Sync Start	=	17.85 msec	= 1200 lines (min. 1200 lines)
Ver Bottom Border	=	0.000 msec	= 0 line (only this line value is allowed)
Ver Front Porch	=	0.000 msec	= 0 line (min. 0 line)
Ver Sync Time	=	0.030 msec	= 2 lines (min. 1 line)
Ver Back Porch	=	0.60 msec	= 4 lines (min. 4 lines)
Ver Top Border	=	0.000 msec	= 0 lines (only this line value is allowed)

5.4 Input Powers

5.4.1 Power Specifications

DC input power specifications are as follows;
 Single AC/DC adapter is required to supply DC power for the monitor. The DC output of each AC/DC adapter shall satisfy the following characteristics.

Power Requirements

SYMBOL	PARAMETER	Min	Typ	Max	UNITS	CONDITION
Vin	+16V DC for monitor assembly	15.5	16	16.8	V	
Iin	DCin Current			10.5	A	Vin=16V
Pin	DCin Power			160	W	Vin=16V
Vin rp	Allowable Ripple Voltage			100	mVp-p	

(Note) AC/DC Adapter used for the monitor should be 160W AC Adapter(IBM P/N : 07N2277).

6.0 Front of Screen Performance

6.1 General

The monitor meet the specifications described in this section. The requirements are satisfied in any specified condition unless otherwise noted.

6.2 White Luminance

1. All the measurements shall be made with the backlight on and after 60 minutes of the application of power and input signals.
2. All the pixels in the unselected state(white).
3. All the measurements shall be made in a dark room(at 25 +/- 3 deg.C) with a photometer that is perpendicular to the screen.

6.2.1 White Luminance Specifications

The white luminance of the display is specified as follows:

White Luminance

Min	Typ	Max	unit
200	235	-	cd/m ²

Brightness Control Range

Min	Typ	Max	unit
20 - 100	10 - 100	-	%

Maximum White Luminance = 100%

6.3 Color

6.3.1 Chromaticity

The color point of each color element which is defined as the C.I.E. 1931 x,y coordinate readings on each primary color through the center of the screen is given in the table shown below.

Chromaticity

Color	x	y
Red	0.638 +/- 0.030	0.340 +/- 0.030
Green	0.292 +/- 0.030	0.611 +/- 0.030
Blue	0.146 +/- 0.030	0.085 +/- 0.030

Note: Initial Value

6.3.2 White Balance

White balance defined as the C.I.E. 1931 x,y coordinate readings on maximum brightness through the center of the screen is given in the table shown below.

White Balance

	Value
x	0.313 +/- 0.030
y	0.329 +/- 0.030

Note: Initial Value

6.4 Finger Pressure Distortion

The pressure distortion is allowed only if any affects disappear in 10 seconds after the removal of pressure at the center of the screen by IEC test finger with a 100g load for 5 seconds at L255 state. It will be evaluated in visual inspection performed at a 500mm viewing distance and the following viewing cone in 500 lux ambient illumination.

Vertical +/-40 degree

Horizontal +/-40 degree

6.5 Gray Scale

The monitor has a gray scale consisting of 256 addressable levels. The code points for these levels are numbered $i=0,1,\dots,255$. $i=0$ is the least luminous level, and $i=255$ is the most luminous level.

Gamma correction will be applied, i.e. the luminance is exponential to gray level(i). The value of power is 2 through 4.5 which approximately compensates human response for luminance. With this feature the gray level can be perceived linear to the human eyes.

Luminance vs Each Gray Level

i (gray level)	LP(i) Typical (%)
L0	0.3
L31	1.0
L63	5.0
L95	12.0
L127	22.0
L159	35.0
L191	53.0
L223	75.0
L255	100.0

6.6 Optical Response Time

6.6.1 Definition

1. Optical response time "ON" is defined as the amount of the time from 10% luminance level to 90% luminance level for a group of pixels in changing the gray scale level from L0 to L255. And optical response time "OFF" is defined as the amount of the time from 90% luminance level to 10% luminance level for a group of pixels in changing the gray scale level from L255 to L0.
2. Optical response time shall be measured over an area on the screen that is larger than a single pixel.
3. Both the "ON" and "OFF" response time shall be measured between all Black and all White.
4. Both the ON and OFF response time shall be measured from the falling edge of the +DSPTMG signal for line 1200. Line 1200 is the center scan line of the test patterns.
5. All the measurements shall be made with the photometer positioned perpendicular to the screen.

6.6.2 Characteristics

Optical response time characteristics are as follows;

Optical Response Time

	environment	value(typ.)	unit
Typical on or off response time	25 deg.C	25	msec
Maximum on or off response time	25 deg.C	50	msec
Maximum on or off response time	0 deg.C	100	msec

7.0 EMC Requirements

The monitor shall satisfy the following electromagnetic compatibility performance, and meet the requirement of N-B 2-0001-038 European Community Electromagnetic Compatibility Directive for CE marking.

- EN55022/24, EN61000-3, for CE Marking

7.1 EMI Performance

The monitor shall meet the following EMI requirements;

- United States Federal Communications Commission (FCC) Rules and Regulation, Part 15 Subpart J for computing device "Class A Limits".
- VCCI Limit Class-A.
- CISPR22 Class A.

7.2 Very/Extra Low Frequency Magnetic Field

The monitor shall meet as follows;

Frequency	Maximum Value	unit(RMS)
5Hz - 2kHz	200	nT
2kHz - 400kHz	25	nT

7.3 Very/Extra Low Frequency Electric Field

The monitor shall meet as follows;

Frequency	Maximum Value	unit(RMS)
5Hz - 2kHz	10	V/m
2kHz - 400kHz	1	V/m

8.0 Environment

The monitor shall meet the provision of this specification during operating condition or after storage or shipment condition specified below. Operation at 10% beyond the specified range will not cause physical damage to the unit.

8.1 Temperature and Humidity

8.1.1 Operating Conditions

The monitor shall operate error free under the following conditions;

Temperature 0 degree C to 35 degree C (Class B extended)
Relative Humidity 8 % to 80%
Wet Bulb Temperature 23.0 degree C (and No condensation)

8.1.2 Shipping Conditions

The monitor shall operate error free after the following conditions;

Temperature -20 degree C to 60 degree C
Relative Humidity 5 % to 95%
Wet Bulb Temperature 39.0 degree C (and No condensation)

8.2 Atmospheric Pressure

The monitor shall be capable of being operated without affecting its operations over the pressure range specified as below;

Atmospheric Pressure

	Pressure	note
Maximum Pressure	104.0 kPa	(Sea level)
Minimum Pressure	67.4 kPa	(3,048 m)

9.0 Industry Standards (IEEE, ISO, IEC, and so on)

The monitor with AC/DC Adapter(s) satisfies the requirements for compliance with

UL 60950, 3rd Ed.	U.S.A. Information Technology Equipment
CSA C22.2 No.60950-00	Canada, Information Technology Equipment
IEC 60950 3rd Ed.	International, Information Technology Equipment
EN 60950 3rd Ed.	Information Technology Equipment (European Norm for IEC60950)
TUV - GS	
Energy Star	

10.0 Backlight Life

Backlight Life Time	30,000(Typ.) Hours	condition 25 degree C
---------------------	--------------------	-----------------------

***** End Of Page *****