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Record of revision

Version	Revise Date	Page	Description
1.0			First issue
2.0	2013/06/04		1. Fix power trace for reliability Change OSD Option and Setup item 2. Added ZIF1 FFC/FPC connector (section 4.10)
2.1	2014/2/21		1. Add new mode 800x600@70 (mode 112) and 800x480@55 (mode 113) 2. delete ZIF1 FFC/FPC connector (section 4.10)
2.2	2015/01/27		Revised LVDS pin assignment of W8
2.3	2015/06/03		Revised pin definition of W1
2.4	2015/11/10		Revised Mode 65 from 1280x1024 To 1360x768
2.5	2016/02/15		Modified pin assignment of J2 on page 9
2.6	2016/04/14		Add part number and mating type for each wafer connector
2.7	2017/03/06		Modified power key description in section 4.10



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General Description

FBD4660LV is an advanced TFT-LCD Monitor Driving Board. This design enabled a traditional CRT monitor and/or video & audio replacement with a large size Active Matrix LCD module. It is suitable for panel resolution up to WUXGA @ 60Hz and in all display modes. The full display area of the module is used.

FBD4660LV is designed to support various TFT-LCDS up to WUXGA resolution by BIOS option.

1. General Features

**** FBD4660LV:**

Acceptable Graphic input		VGA : Max. 1920*1200@60Hz.
		DVI : Max. 1920*1200 @ 165MHz.
Panel	Interface	LVDS 6/8bit, single/dual channel, Max. WUXGA.
	Power*	3.3V/5V/12V selectable by jumper PNLP.
	Backlight Power*	5V/12V selectable by jumper BLP.
OSD	Keypad	4_OSD_IO_key + power key.
	UART(5V) input	Command stream from Host.
EDID	Interface	VESA DDC2Bi/2B+/Ci.
Power source		Single voltage 12V~ 24V DC_IN.
Power Consumption		Standby Mode : 0.24W (w/o TFT panel).
		Continue Mode: 2.4W (w/o TFT panel).
Operation temperature		0~70 °C.



2. Electrical Characteristics

2.1) Absolute maximum ratings:

GND = 0V, VCC = 3.3, Ta = 25 °C

Parameter	Symbol	Max	Unit	Remark
Analog signal input level	Signal	1.4	Vp-p	
Power supply	DC IN	27	V	
Digital signal input level		Vcc+0.3	V	

2.2) Recommended operating condition:

GND = 0V, VCC= 3.3, DC-IN=12V, Ta = 25 °C ,

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Power supply	DC IN	4.5	12	25	V	
	Current		200		mA	Note22
Standby power consumption	Watt		0.24		W	Note22
Continue Power consumption	Watt		2.4		W	Note22
Analog signal input level RGB/Composite AV	Signal	0.5	0.7	1.2	Vp-p	
	DC	GND	-	0.3	V	
Digital input H/V sync , Ext. keys	VI-H	0.7Vcc	-	Vcc	V	
	VI-L	GND	-	0.3Vcc	V	
Storage Temperature		-40		130	°C	
Operation Temperature		0		70	°C	

Note22:

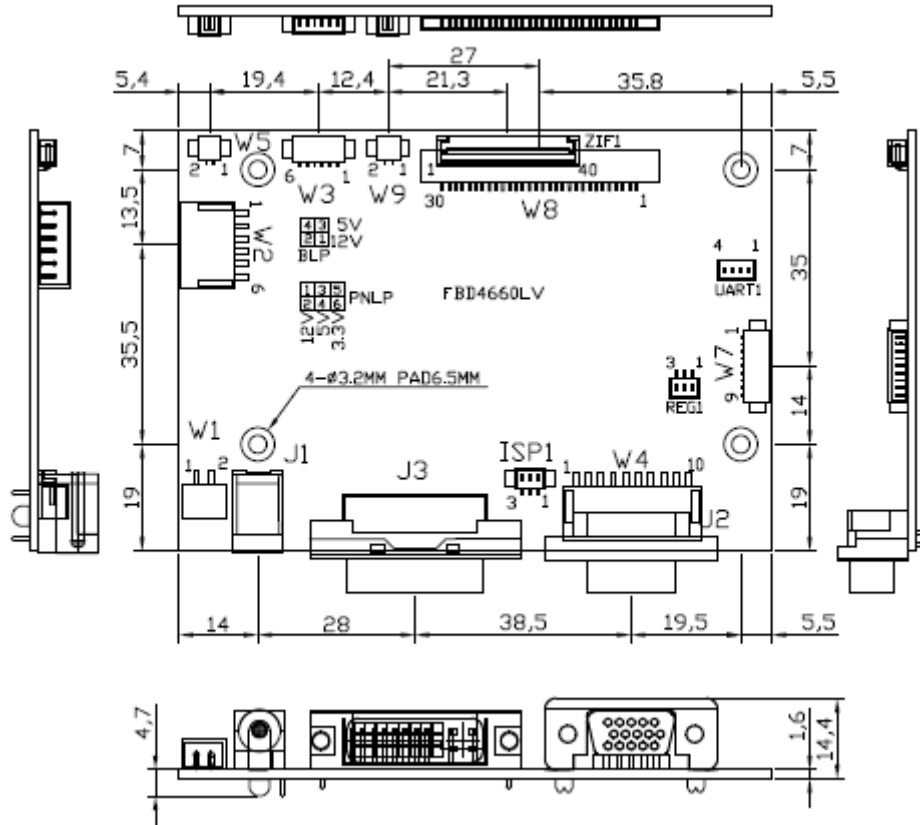
The results of measurement were measured without panel, backlight.



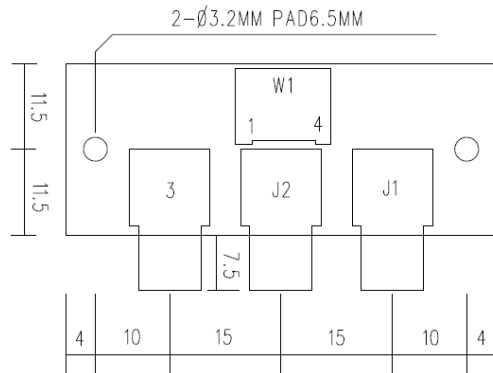
3. Dimension of Driving Board

3.1) Driving Board

Dimension :105.5 mm(L) ×75 mm(W) ×17.5 mm(H)



3.2) YPbPr Daughter Board





3.3) Connector Overview

■ : An alternative item.

Pin	Description	Remarks
J1	DC Power Jack	DC-Jack. Center pin:2.0mm.
W1	Substitute J1(option)	Wafer 2 pin, 2.0mm.
J3	DVI connector	24 pin DVI-D, female.
J2	VGA connector	15 pin D-Sub, female.
W4	Substitute J2 (option)	Wafer 10 pin, 2.0mm.
W2	External module wafer(option)	Wafer 6 pin, 2.0mm.
W3	Backlight wafer	Wafer 6 pin, 1.25mm.
W5	External light sensor wafer	Wafer 2 pin, 1.25mm.
W7	OSD keypad wafer	Wafer 9 pin, 1.25mm.
UART1	OSD menu control over RS232	Wafer 4 pin, 1.25mm.
W8	LVDS Dual link connector	DF14-30S-1.25mm.
BLP	Jumper for Backlight Power selection	Header 2x2 pin, 2.0mm, DIP Straight.
PNLP	Jumper for Panel Power selection	Header 3x2 pin, 2.0mm, DIP Straight.

4. Pin assignment of Connector

4.1) J1 –DC power Jack/Side entry

Pin NO	Signal	I/O	Description
1	Center Pin	I	Ext. DC 12V or 24V input
2	GND	P	Ground

4.2) W1: Substitute power wafer/Side entry

Connector Type / Part Number	A2001WR-S
Mating Housing / Part Number	PHR-2 (JST) or equivalent

Pin NO	Signal	I/O	Description
1	GND	P	Ground
2	Power pin	I	Ext. DC 12V or 24V input

Note: There is only one connector will be existed, either one J1 or W1.

**4.3) J3: DVI input connector/Side entry**

Pin NO	Symbol	Description
1	TMDS DATA2-	DATA2 Differential Negative signal
2	TMDS DATA2+	DATA2 Differential Positive signal
3	Shield2	Shield for TMDS channel 2
4	NC	Not connected
5	NC	Not connected
6	DDC Clock	Clock DDC Interface
7	DDC Data	Data DDC Interface
8	NC	Not connected
9	TMDS DATA 1-	DATA1 Differential Negative signal
10	TMDS DATA 1+	DATA1 Differential Positive signal
11	Shield1	Shield for TMDS channel 1
12	NC	Not connected
13	NC	Not Connected
14	+5V Power	+5V input for EDID reading
15	GND(for 5V)	Ground for +5V Power pin ,Sync return
16	HPD	Monitor presence identification, 5V pull-up.
17	TMDS DATA0-	DATA0 Differential Negative signal
18	TMDS DATA0+	DATA0 Differential Positive signal
19	Shield0	Shield for TMDS channel 0
20	NC	Not connected
21	NC	Not connected
22	Clock Shield	Shield for Clock differential pair
23	TMDS Clock+	Differential Clock, Positive signal
24	TMDS Clock-	Differential Clock, Negative signal

4.4) J2: VGA input connector/Side entry

Pin NO	Signal	I/O	Description
1	Red	I	Red analog input
2	Green	I	Green analog input
3	Blue	I	Blue analog input
4	NC (TX)	O	Keep vacant, for factory use only
5	NC		Vacant



6	AGND	P	Red Channel Ground
7	AGND	P	Green Channel Ground
8	AGND	P	Blue Channel Ground
9	VGA 5V	I	Ext. +5V input for EDID reading
10	VGA HPD	I	Hot Plug Detect (fort internal use)
11	NC (RX)	I	Keep vacant, for factory use only
12	SDA	I/O	Serial Data Line for DDC
13	HSYNC	I	Horizontal Sync
14	VSYNC	I	Vertical Sync
15	SCL	I	Serial clock input for DDC

4.5) W4: Substitute VGA wafer/Side entry

Connector Type / Part Number	A120WR
Mating Housing / Part Number	PHR-10 (JST) or equivalent

Pin NO	Signal	I/O	Description
1	Red	I	Red analog input
2	Green	I	Green analog input
3	Blue	I	Blue analog input
4	GND	P	Ground
5	HSYNC	I	Horizontal Sync
6	VSYNC	I	Vertical Sync
7	GND	P	Ground
8	SCL	I	Serial clock input for DDC
9	SDA	I/O	Serial Data Line for DDC
10	VGA 5V	I	+5V input for EDID reading

Note: There is only one connector will be existed, either one J3 or W4.

4.6) W2: External module wafer/Side entry

Connector Type / Part Number	A120WR
Mating Housing / Part Number	PHR-6 (JST) or equivalent

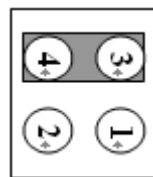
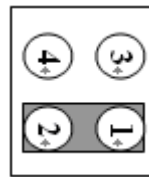


Pin NO	Signal	I/O	Description
1	Power pin	I	Ext. DC 12V input(Depends on W1 power)
2	GND	P	GND
3	Mute control	O	A control signal of logical level 5V. For Ext.
4	Volume control	O	A PWM signal of logical level 5V. For Ext.
5	Backlight Enabled	O	Same as pin5 of W3
6	PWM	O	Same as pin6 of W3

4.7) W3: Backlight wafer/Side entry

Connector Type / Part Number	A1250WR-S
Mating Housing / Part Number	51021 (Molex) or equivalent

Pin NO	Signal	I/O	Description
1	Power 5V/12V/24V	O	Refer to the BLP Power Jumper
2	Power 5V/12V/24V	O	Refer to the BLP Power Jumper
3	GND	P	Ground
4	GND	P	Ground
5	Backlight Enabled	O	Logical level 5V, Active High
6	Backlight-Adj	O	Logical level 5V, Freq. 300Hz

The BLP power Jumper:**5V****12V or 24V**

Voltage selection for Backlight power	Description	Note
DC12V/ 24V	Pin1 and Pin2 short	NoteA
DC 5V	Pin3 and Pin4 short	

NoteA:

Either 12V or 24V will be provided as the Backlight power, it depends on the input from J1 (DC Jack). Warning!!! If the voltage setting did not fits to the power of backlight driver board. It may cause fatal damage to the board / display.

**4.8) W5: External Light sensor wafer/Side entry**

Connector Type / Part Number	A1250WR-S
Mating Housing / Part Number	51021 (Molex) or equivalent

Pin NO	Signal	I/O	Description
1	Sensor Anode		Analogic photodiode sensor
2	Sensor Cathode		

4.9) W8: LVDS Dual link output

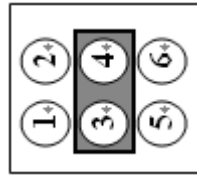
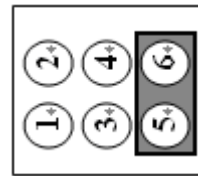
There is only one connector will be existed, either one ZIF1 or W8.

Connector Type / Part Number	A1253WR-S
Mating Housing / Part Number	DF14-30S-1.25C (HRS) or equivalent

Pin NO	Signal	Description
1	RXE3+/ UD	
2	RXE3-/ RL	
3	RXEC+	
4	REXC-	
5	RXE2+	
6	RXE2-	
7	GND	
8	RXE1+	
9	RXE1-	
10	GND	
11	RXE0+	
12	RXE0-	
13	RXO3+	
14	RXO3-	
15	GND	
16	RXOC+	
17	RXOC-	
18	GND	
19	RXO2+	
20	RXO2-	



21	GND	
22	RXO1+	
23	RXO1-	
24	GND	
25	RXO0+	
26	RXO0-	
27	GND	
28	Panel VCC (3.3V/5V/12V)	Refer to the PNLP Power Jumper
29	Panel VCC (3.3V/5V/12V)	Refer to the PNLP Power Jumper
30	Panel VCC (3.3V/5V/12V)	Refer to the PNLP Power Jumper

The PNL P power Jumper:**12V or 24V****5V****3.3V**

Voltage selection for Panel power	Description	Note
DC 12V/ 24V	Pin1 and Pin2 short	NoteB
DC 5V	Pin3 and Pin4 short	
DC 3.3V	Pin5 and Pin6 short	

NoteB:

Either 12V or 24V will be provided as the panel power, it depends on the input from J1 (DC Jack). Warning!!! If the voltage setting did not fits to the power of panel. It may cause fatal damage to the panel display.

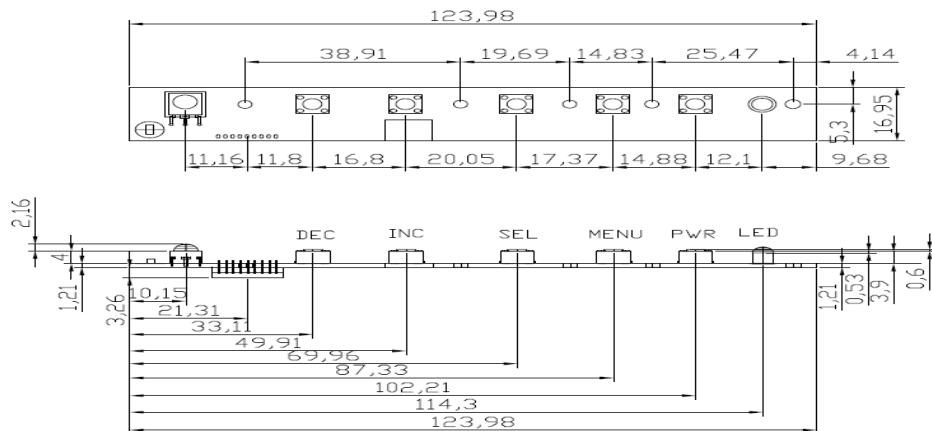


4.10) W7: OSD keypad wafer/Side entry

Connector Type / Part Number	A1253WR-S
Mating Housing / Part Number	51021 (Molex) or equivalent

Pin NO	Signal	I/O	Description
1	LED Signal	O	Flash with an interval of 1 Sec. Active high.
2	Power	O	5V/100mA output
3	NC		Reserved
4	GND	P	Ground
5	Power key	I	Active low
6	Menu key	I	Active low
7	Hot key	I	Active low
8	Up key	I	Active low
9	Down key	I	Active low

- **Power key** : As switch-key to switch video channel by hold less than 1 Sec.
As a power-key to entry Standby mode by hold more than 2 Sec,
Then push once again able to resume from Standby mode.
- **Menu Key** : As menu-on key while menu-off situation.
As item-selection key while menu-on situation.
- **Hot Key** : As auto-adjust key or dimming key can be defined in Setup menu.
- **Inc Key** : As value increase or enter.
- **Dec Key** : As value decrease or enter.
- **LED** : with Green, flashing in an interval of 1 Sec during standby mode.





4.11) UART1: OSD menu control wafer/Straight entry

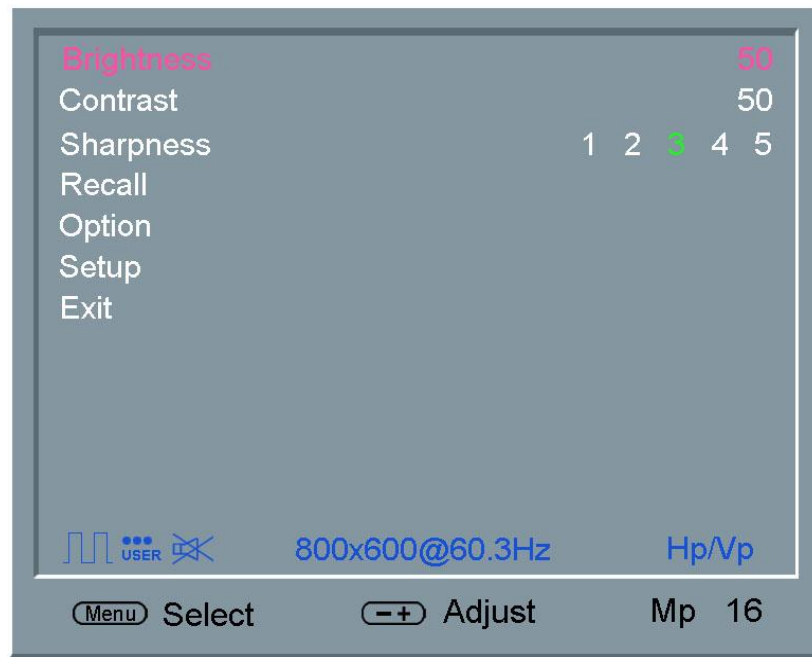
Connector Type / Part Number	A1250WV
Mating Housing / Part Number	51021 (Molex) or equivalent

Baud rate: 4800/N/8/1

Pin NO	Signal	I/O	Description
1	Power	O	DC 5V output
2	TX	O	Logical level 5V
3	RX	I	Logical level 5V
4	GND	P	Ground

5. OSD Function Description

5.1) The main menu for DVI channel:



**5.2) The main menu for VGA channel:**

DVI	VGA	Description
	Auto adjust	Available only as image is full screen.
Brightness	Brightness	Adjust Brightness by Inc/Dec. key
Contrast	Contrast	Adjust contrast by Inc/Dec key.
	Clock	Adjust image focus by Inc/Dec key.
	Phase	Adjust phase alignment of clock by Inc/Dec key.
	H. position	Adjust Horizontal position of image by Inc/Dec key.
	V.position	Adjust Vertical position of image by Inc/Dec key.
Sharpness	Sharpness	Adjust Sharpness of image by Inc/Dec key.
Recall	Recall	Re-load default value.
Option	Option	Entry to the Option menu of Sub-menu
Setup	Setup	Entry to the Setup menu of Sub-menu
Exit	Exit	Quit OSD

**5.3) The Option menu of sub-menu:*******If any items show up with gray color that manes the function be disable.**

Function	Description
Mute	“On”: Audio in mute mode. “Off”: Audio in normal mode. For external Audio module or FBD-4661LV use only.
Volume	A volume adjustment with a 0 ~ 100 duty of PWM signal. For external Audio module or FBD-4661LV use only.
Color temperature	This item has four subjects 9300K, 7500K, 6500K, default. Each item has different color temperature, the lower value will cause image more close to red, the default item is recommended and suitable for panel..
Red	The Red value Range is 0~100 If Color temperature is on, user can set Red value
Green	The Red value Range is 0~100 If Color temperature is on, user can set Green value
Blue	The Red value Range is 0~100 If Color temperature is on, user can set Blue value



Light sensor	If turn on, There are four dimming level can be set. The system will detect the result of Light Sensor and reacting the brightness immediately, according to the setting on level 1 ~ 4.
Level1	Setting the value of Light Sensor for dimming level 1.
Level2	Setting the value of Light Sensor for dimming level 2.
Level3	Setting the value of Light Sensor for dimming level 3.
Level4	Setting the value of Light Sensor for dimming level 4.
Exit	Back to OSD main menu.

5.4) The Setup menu of sub-menu:

***If any items show up with gray color that manes the function be disable.



Function	Description
Reverse	This item only available if panel has support this function, otherwise this item will no function at all. If reverse on, the image of screen is upside down. Else, it is normal.



Mirror	This item only available if panel has support this function, otherwise this item will no function at all. If the mirror is on, the image of screen is opposite of left and right side. Else, it is normal.
Language	English, French, German, Italian and Mandarin character are all available choose.
Time To Sleep	Set a certain time to sleep mode which will occur after system got into “no signal” situation.
OSD Time Out	Set a certain time to quit from OSD menu which will occur after the OSD menu was in idle situation.
Exit	Back to OSD main menu.

5.5) The OSD control via RS232:

An alternate method likes a keypad to adjust the items value of OSD menu.

The host transmits a byte command to the FBD-4660LV over RS232 with baud rate:4800/n/8/1.

The FBD-4660LV received and implemented it according to command list immediately.

Then return the byte command to the host for error checking.

Regarding to the summary of command list. Please contact with your sales person for detail.

6. Accept frequency table

The table shows all recognized input modes which the FBD4660LV be able to handle in respect to GTF of VESA. But the customized optimizations are possible on request.

FBD4660LVX Acceptable Display Modes						
Mode	Resolution (Visible)	Nominal H_freq (pol) ± 1.2 KHz	Nominal V_freq (pol) ± 1.2Hz	Nominal Pixel Clock MHz	POL H: ,V:	Note
1	640x350	31.5k	70	25.2M	+, -	
2	640x350	37.9k	85	31.5M	+, -	
3	640x400	31.5k	70	25.2M	X, X	No support
4	640x400	37.9k	85	31.5M	X, X	No support



5	640x480	31.5k	60	25.2M	X, X	
6	640x480	35.0k	66	30.2M	X, X	
7	640x480	37.9k	72	31.5M	X, X	
8	640x480	37.5k	75	31.5M	X, X	
9	640x480	43.3k	85	36.0M	X, X	
10	640x500	30.9k	57	25.2M	X, X	
11	720x400	31.5k	70	28.3M	-, +	
12	720x400	37.9k	85	35.4M	-, +	
13	832x624	49.7k	75	57.2M	X, X	
14	800x600	35.2k	56	35.9M	X, X	
15	800x600	37.9k	60	40.0M	X, X	
16	800x600	48.1k	72	50.0M	X, X	
17	800x600	46.9k	75	49.5M	X, X	
18	800x600	53.7k	85	56.2M	X, X	
19	848x480	31.0k	60	33.7M	X, X	
20	848x480	29.8k	60	31.4M	X, X	
21	848x480	35.0k	70	37.5M	X, X	
22	848x480	36.1k	72	39.2M	X, X	
23	848x480	37.7k	75	41.0M	X, X	
24	720x576	35.9k	60	32.7M	X, X	
25	1024x768	35.5k	43	44.8M	X, X	
26	1024x768	48.4k	60	65.0M	X, X	
27	1024x768	56.5k	70	75.0M	X, X	
28	1024x768	57.7k	72	78.4M	X, X	
29	1024x768	60.0k	75	78.7M	X, X	
30	1024x768	61.1k	76	83.0M	X, X	
31	1024x768	68.7k	85	94.5M	X, X	
32	1152x720	44.9k	60	66.8M	X, X	
33	1152x864	54.0k	60	79.9M	X, X	
34	1152x864	63.9k	70	94.5M	X, X	
35	1152x864	67.5k	75	108.0M	X, X	
36	1152x864	77.1k	85	119.6M	X, X	
37	1152x870	68.7k	75	100.0M	X, X	
38	1152x900	61.8k	66	92.9M	X, X	



39	1152x900	71.7k	76	105.5M	X, X	
40	1280x720	45.0k	60	74.2M	X, X	
41	1280x720	56.5k	75	95.8M	X, X	
42	1280x768	47.4k	60	62.8M	X, X	
43	1280x768	47.8k	60	79.5M	X, X	
44	1280x768	56.5k	70	95.8M	X, X	
45	1280x768	57.7k	72	97.8M	X, X	
46	1280x768	60.3k	75	102.2M	X, X	
47	1280x768	68.6k	85	117.4M	X, X	
48	1280x800	49.3k	60	70.9M	X, X	
49	1280x800	49.7k	60	83.4M	X, X	
50	1280x800	72.0k	62	88.1M	X, X	
51	1280x800	60.1k	72	102.8M	X, X	
52	1280x800	62.9k	75	106.6M	X, X	
53	1280x800	71.6k	85	112.5M	X, X	
54	1280x600	60.0k	60	108.0M	X, X	
55	1280x960	75.0k	75	126.0M	X, X	
56	1280x960	85.9k	85	148.4M	X, X	
57	1280x1024	64.0k	60	108.0M	X, X	
58	1280x1024	71.7k	67	117.0M	X, X	
59	1280x1024	74.9k	70	127.0M	X, X	
60	1280x1024	74.4k	70	124.8M	X, X	
61	1280x1024	77.9k	72	134.6M	X, X	
62	1280x1024	80.0k	75	135.0M	X, X	
63	1280x1024	81.2k	76	135.1M	X, X	
64	1280x1024	91.2k	85	157.5M	X, X	
65	1360x768	47.7k	60	85.4M	X, X	
66	1366x768	47.7k	60	85.4M	X, X	
67	1400x1050	64.7k	60	100.9M	X, X	
68	1400x1050	65.3k	60	121.7M	X, X	
69	1400x1050	82.3k	75	156.0M	X, X	
70	1400x1050	93.9k	85	179.5M	X, X	
71	1440x900	55.5k	60	88.8M	X, X	



72	1440x900	55.9k	60	106.4M	X, X	
73	1440x900	70.6k	75	136.6M	X, X	
74	1600x900	55.5k	60	97.6M	X, X	
75	1600x1000	61.7k	60	108.5M	X, X	
76	1600x1000	62.2k	60	132.2M	X, X	
77	1600x1000	78.4k	75	169.3M	X, X	
78	1600x1200	74.0k	60	130.2M	X, X	
79	1600x1200	75.0k	60	162.0M	X, X	
80	1600x1200	81.3k	65	175.6M	X, X	
81	1600x1200	87.5k	70	189.0M	X, X	
82	1600x1200	93.8k	75	202.6M	X, X	
83	1680x1050	64.7kl	60	119.0M	X, X	
84	1680x1050	65.3k	60	146.2M	X, X	
85	1680x1050	82.3k	75	186.9M	X, X	
86	1600x1280	79.5k	60	171.7M	X, X	
87	1920x1080	66.6k	60	138.5M	X, X	
88	1920x1080	67.2k	60	173.1M	X, X	
89	1920x1080	67.5k	60	192.5M	X, X	
90	1920x1200	61.4k	50	127.7M	X, X	
91	1920x1200	74.0k	60	153.9M	X, X	
92	1920x1200	74.6k	60	193.3M	X, X	
93	720x480P	31.5k	60	27.0M	X, X	
94	720x576P	31.3k	50	32.8M	X, X	
95	720x576p	36.0k	60	32.8M	X, X	
96	128x720P	37.5k	50	74.2M	X, X	
97	1920x1080P	56.3k	50	148.6M	X, X	
98	720x480I	15.7k	60	13.4M	X, X	
99	1440x480I	15.7k	60	26.9M	X, X	
100	2880x480I	15.7k	60	53.8M	X, X	
101	1920x1080I	33.8k	60	74.3M	X, X	
102	720x576I	15.7k	50	13.5M	X, X	
103	1440x576I	15.7k	50	27.1M	X, X	
104	2880x576I	15.7k	50	54.2M	X, X	



105	1920x1280I	32.2k	50	74.1M	X, X	
106	1920x1080I	28.1k	50	74.1M	X, X	
107	2048x1152	70.1k	60	154.7M	X, X	
108	2048x1152	71.6k	60	197.0M	X, X	
109	1280x600	37.7k	60	63.6M	X, X	
110	1024x600	37.3k	60	48.9M	X, X	
111	1920x1080I	31.3k	50	72.1M	X, X	
112	800x600	43.8k	70	45.6M	X, X	
113	800x480	28.2k	55	29.6M	X, X	