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1. Introduction

This specification describes Q7T4, which is a 17.0" analog interface color TFT LCD monitor without audio. The monitor supports up to 1280x1024 pixel resolution and refresh rate of 75 Hz. The independent 6 bits R, G, B colors are capable of displaying 16.2M colors (RGB-6bit + FRC data). In addition, dithering function is supported. The features summary is shown below,

***All panel spec. in C201 definition depends on the variance of panel source.**

Feature items	Specifications	Remark
Panel supplier & module name	AUO M170EG01	Further divided into v.0 and v.1 versions (spec v.1)
Screen diagonal	17.0" (432mm)	337.920(H) x 270.336(V)
Display Format	SXGA / 1280 (H) x 1024 (V)	
Pixel Pitch	0.264 mm x 0.264 mm	
Viewing Angle (@ Contrast Ratio = 10)	R/L: 70/70 degrees (typ.) and U/D: 70/60 degrees (typ.)	Panel spec.
Analog interface with Scaling supported	Yes	With 15-pin D-sub connector
DVI interface with Scaling supported	No	
Video interface with Scaling supported	No	
Max resolution mode supported	1280 x 1024 @ 75Hz	
Number of Display Colors supported	16.2M colors	(RGB 6-bits + FRC data)
Contrast Ratio	450:1 (typ.)	
Luminance	260 cd/m² (typ.)	White <u>Luminance@CCFL</u> 7.5mA (center)
AC power input	Yes	90-264 Volts, 47-63 Hz.
DC power input (with AC power adapter)	No	
DPMS supported	Yes	≤ 1W at 115±5 VAC ≤ 2W at 230 VAC in Power off Preferred Mode
LED indicator for power status showed	Yes	Green/Amber/Non
OSD for control & information supported	Yes	
Multi-language supported for OSD	Yes	8 languages
Buttons control supported	Yes	6 buttons including 1 monitor power on/off control button.
Flywheel control supported	No	
Scaling function supported	Yes	
Auto adjustment function supported	Yes	"i-key" function
DDC function supported (EDID ver. 1.3)	Yes	DDC2B only
Audio speakers supported	No	
Audio Jack (input connector) supported	No	
Earphone Jack (input connector) supported	No	
Microphone function supported	No	
Mechanical Tilt base design	Yes	From -5 to +20 degree
VESA wall mounting design	Yes	
Mechanical Rotate design	No	
Mechanical Lift base design	No	
Kensington compatible lock design	Yes	

2. Operational Specification

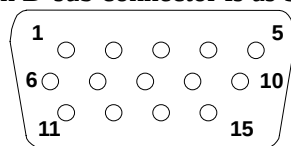
2.1 Power supply

Item	Condition	Spec	OK	N.A	Remark
Input Voltage range	Universal input full range	90~264VAC /47~63Hz	√		
Input Current range	90 ~ 264VAC	≤ 2.0 Arms	√		
Power Consumption	Normal “On” operation	≤ 40 W	√		LED: Green
DPMS	DPMS “Off” state	≤ 1 W in power preferred mode, 115V ≤ 2 W, 230V	√		LED: Amber
Inrush Current	110 VAC 220 VAC	< 30 A (peak) < 60 A (peak)	√		Cold-start
Earth Leakage Current	264 VAC/50Hz	< 3.5 mA	√		
Hi-Pot	1. 1500VAC, 1 sec 2. Ground test: 30A, 1sec	Without damage < 0.1 ohm	√		(on-line test) (in-lab test)
Power Line Transient	IEC1000-4-4	1KV	√		
	IEC1000-4-5 (Surge)	Common: 2KV, Differential: 1KV	√		
CCFL operation range	90 ~ 264VAC	3 mA ~8mA	√		Panel Spec. 3.0 ~ 8.0mA rms
CCFL Frequency	90 ~ 264VAC	40KHz ~ 80KHz	√		Panel Spec. 40KHz ~ 80KHz
Power cord		Color: Black Length: 1500 +/- 50 mm	√		

2.2 Signal interface

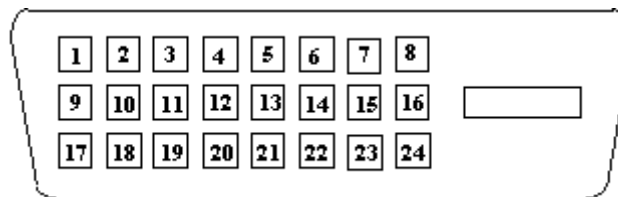
Item	Condition	Spec	OK	N.A	Remark
Signal Cable	15-pin D-Sub	Color: Black Length: 1500 +/- 30 mm	√		
	24-pin DVI-D	Color: Black Length: 2000 +/- 50 mm		√	
Pin assignment	15-pin D-sub connector	See Note-1	√		For 15-pin D-sub
	24-pin DVI-D connector	See Note-2		√	For 24-pin DVI-D
Video input	Signal type	Separate analog R/G/B	√		For 15-pin D-sub
	Level	700 mV (peak to peak)	√		
	Impedance	75 Ohms +/- 1.5 Ohms	√		
Sync input	Signal type	Separate H/V-sync Composite H/V-sync (Positive/Negative)	√		For 15-pin D-sub
	Level	Logic High: 2.4V ~ 5.5V Logic Low: 0V ~ 0.5V (TTL level)	√		Refer to VESA VSIS Standard V1R1
	Impedance	Minimum 2.2KΩ (pull down)	√		10KΩ for application
	Sync Pulse Width (SPW)	0.7 μs < H-SPW 1H < V-SPW	√		

Note-1: The pin assignment of 15-pin D-sub connector is as below,



Pin	Signal Assignment	Pin	Signal Assignment
1	Red video	9	PC5V (+5 volt power)
2	Green video	10	Sync Ground
3	Blue video	11	Ground
4	Ground	12	SDA
5	Cable Detected	13	H-Sync (or H+V)
6	Red Ground	14	V-sync
7	Green Ground	15	SCL
8	Blue Ground		

Note-2: The pin assignment of 24-pin DVI-D connector is as below,



Pin	Signal Assignment	Pin	Signal Assignment
1	TMDS RX2-	13	Floating
2	TMDS RX2+	14	+5V Power
3	TMDS Ground	15	Ground
4	Floating	16	Hot Plug Detect
5	Floating	17	TMDS RX0-
6	DDC Clock	18	TMDS RX0+
7	DDC Data	19	TMDS Ground
8	Floating	20	Floating
9	TMDS RX1-	21	Floating
10	TMDS RX1+	22	TMDS Ground
11	TMDS Ground	23	TMDS Clock+
12	Floating	24	TMDS Clock-

2.3 Video performance

Item	Condition	Spec	OK	N.A	Remark
Max. support Pixel rate		135 MHz	√		
Max. Resolution		1280 x 1024	√		
Rise time + Fall time		< 6.25 ns (50% of minimum pixel clock period)	√		1280 x 1024 @ 75Hz (max. support timing)
Settling Time after overshoot /undershoot		< 5% final full-scale value	√		Refer to VESA VSIS Standard V1R1
Overshoot/Undershoot		< 12% of step function voltage level over the full voltage range	√		Refer to VESA VSIS Standard V1R1

2.4 Scan range

Item	Condition	Spec	OK	N.A	Remark
Horizontal		30 ~ 83 KHz	√		
Vertical		56 ~ 76 Hz	√		Without Frame buffer

2.5 Plug & Play DDC2B Support

Item	Condition	Spec	OK	N.A	Remark
DDC channel type		DDC2B	√		
EDID		Version 1.3	√		Refer to Q7C4 S/W spec. document to see the detailed EDID data definition.

2.6 Support Timings

Input Timing				Actual Output			
Resolution	Horizontal	Vertical	Dot Clock	Actual display	OK	N.A	Remark
640x350	31.47(P)	70.08(N)	25.17	1280x943	√		DOS
720x400	31.47(N)	70.08(P)	28.32	1280x1024	√		DOS
640x480	31.47(N)	60.00(N)	25.18	1280x1024	√		DOS
640x480	35.00(N)	67.00(N)	30.24	1280x1024	√		Macintosh
640x480	37.86(N)	72.80(N)	31.5	1280x1024	√		VESA
640x480	37.50(N)	75.00(N)	31.5	1280x1024	√		VESA
800x600	37.88(P)	60.32(P)	40.00	1280x1024	√		VESA
800x600	48.08(P)	72.19(P)	50.00	1280x1024	√		VESA
800x600	46.86(P)	75.00(P)	49.50	1280x1024	√		VESA
832X624	49.72(N)	74.55(N)	57.29	1280x1024	√		Macintosh
1024x768	48.36(N)	60.00(N)	65.00	1280x1024	√		VESA
1024x768	56.48(N)	70.10(N)	75.00	1280x1024	√		VESA
1024x768	60.02(P)	75.00(P)	78.75	1280x1024	√		VESA
1024X768	60.24(N)	74.93(N)	80.00	1280x1024	√		Macintosh
1152x864	67.50(P)	75.00(P)	108.00	1280x1024	√		VESA
1152x870	68.68(N)	75.06(N)	100.00	1280x1024	√		Macintosh
1152x900	61.80(N)	66.00(N)	94.50	1280x1024	√		SUN 66
1152x900	71.81(N)	76.14(N)	108.00	1280x1024	√		SUN
1280x1024	64.00(P)	60.00(P)	108.00	1280x1024	√		VESA
1280x1024	75.83(N)	71.53(N)	128.00	1280x1024	√		IBM1
1280x1024	80.00(P)	75.00(P)	135.00	1280x1024	√		VESA
1280x1024	81.18(N)	76.16(N)	135.09	1280x1024	√		SPARC2

Note-3: “P”, “N” stands for “Positive”, “Negative” polarity of incoming H-sync/V-sync (input timing).

3. Operational & Functional Specification

3.1 Video performance

Item	Condition	Spec	OK	N.A	Remark
Resolution	Any input resolution modes which are under 1280 x 1024	1280 x 1024	√		
Contrast ratio		450:1 (typ.)	√		
Brightness	At R/G/B saturated condition	260 cd/m ² (typ.) @ 7.5mA	√		
Response time	Rising + Falling time	16 ms (typ.)	√		
Viewing angle	At Contrast ratio = 10	R/L: 70/70 degrees (typ.)	√		
	At Contrast ratio = 10	U/D: 70/60 degrees (typ.)	√		
CIE coordinate of White		(0.31, 0.33) +/- (0.03, 0.03)	√		
Display colors		16.2M colors (RGB 6-bits + FRC data)	√		Support dithering

3.2 Brightness Adjustable Range

Item	Condition	Spec	OK	N.A	Remark
Brightness adjustable range	At default contrast level (saturate point) & Full-white color pattern	(Max. brightness value – Min. brightness value) ≥ 100 cd/m ²	√		

3.3 Acoustical Noise

Item	Condition	Spec	OK	N.A	Remark
Acoustical Noise	At 1 meter distance & “Audio” function disabled	≤ 40 dB/A		√	

3.4 Environment

Item	Condition	Spec	OK	N.A	Remark
Temperature	Operating	0 ~ +40 °C	√		
	Non-operating	-20 ~ +60 °C	√		
Humidity	Operating	10 ~ 90%	√		Non-condensing
	Non-operating	5 ~ 95%	√		Non-condensing
Altitude	Operating	0~3048m (10,000ft)	√		Without packing
	Non-operating	0~12,192m (40,000ft)	√		With packing

3.5 Transportation

Item	Condition	Spec	OK	N.A	Remark
(1) Vibration	Package, Non-Operating	(1) Sine wave 5~200Hz 1.5G, 1 octave/min, 15 min dwell on each resonant frequency, all primary axis, one sweep (30 min minimum) per orientation, total of 90+ min.	√		

		(2) Random 5 ~100 Hz, 0 dB/Oct. 0.015 g ² /Hz 100 ~200 Hz, -6 dB/Oct. 200 Hz, 0.0038 g ² /Hz Equivalent to 1.47 Grms, All primary axis, 20 min per-orientation, total is 60 min. (3) Procedure: Confirmed sample with appearance and function ready before testing then compare with after test record as brightness, uniformity and contrast ratio. Perform random vibration after sine-wave vibration test.			
(2) Unpackaged Vibration	Unpackaged, Non-Operating	Test Spectrum: 20 Hz 0.0185(g ² /Hz) 200Hz 0.0185(g ² /Hz) Duration : 5 Minutes Axis : 3 axis (Horizontal and Vertical axis ,Z axis)	√		
(3) Drop	Package, Non-Operating	91 cm Height (MP stage) (1 corner, 3 edges, 6 faces)	√		
(4) Shock	Wooden package, Non-Operating	Waveform: half sine Faces: 6 sides/ per orientation 3 shocks. Duration: <3ms Velocity accelerate: 75g	√		

3.6 Electrostatic Discharge Requirements

Item	Condition	Spec	OK	N.A	Remark
Electrostatic Discharge	IEC801-2 standard	Contact: 8KV Air: 15KV	√		

3.7 EMC

Item	Condition	Spec	OK	N.A	Remark
TCO03	Electric	Band 1 < 10 V/m Band 2 < 1 V/m	√		
	Magnetic	Band 1 < 200nT Band 2 < 25nT	√		
EMI	FCC part 15J class B	After Mass production under 1dBuv for constant measure. Besides DNSF and VCCI class-2 are optional.	√		
	EN55022 class B				

3.8 Reliability

Item	Condition	Spec	OK	N.A	Remark
MTBF Prediction	Refer to MIL-217F	> 60,000 Hours	√		Excluding CCFL
CCFL Life time	At 25±2°C, under 7.0mA	50,000 Hours (typ.)	√		See Note-4

Note-4: CCFL lifetime is determined as the time at which brightness of lamp is 50%. The typical lifetime of CCFL is on the condition at 7.5mA lamp current.

3.9 Audio performance

Item	Condition	Spec	OK	N.A	Remark
Preamplifier + Power amp					
(1)Output power		1 W _{rms} /CH @ 1KHz		√	
(2)THD (@ 1W)		<1%		√	
(3)S/N ratio		>40dB		√	
Speaker Driver					
(1)Nominal impedance		8 ohm		√	
(2)Rated input power		2 W/CH		√	
(3)Frequency response		180~20KHz SPL-10dB		√	
(4)Output sound pressure level		84 ± 3 dB (1W 0.5M)		√	
(5)Dimension of box		62x33cx20 mm ²		√	
Audio Control					
(1)Volume range		0 ~100 levels		√	
(2)Mute		On/Off		√	

4. LCD Characteristics

4.1 The Physical definition & Technology summary of LCD panel

Item	Condition	Spec	OK	N.A	Remark
LCD Panel Supplier		AUO	√		
Panel type of Supplier		M170EG01 V1	√		
Screen Diagonal		432mm(17.0")	√		
Display area	Unit=mm	337.920(H) x 270.336(V)	√		
Physical Size	Unit=mm	358.5(H) x 296.5(V) x 17.0 (D) (typ.)	√		
Weight	Unit=gram	1900 (typ.)	√		
Technology		TN type	√		
Pixel pitch	Unit=mm	0.264 x 0.264	√		Per one triad
Pixel arrangement		R/G/B vertical stripe	√		
Display mode		Normally white	√		
Support color		16.2M colors (RGB 6-bits + FRC data)	√		

4.2 Optical characteristics of LCD panel

Item	Unit	Conditions	Min.	Typ.	Max.	Remark
Viewing Angle	[degree]	Horizontal (Right)	60	70	-	
	[degree]	CR = 10 (Left)	60	70	-	
	[degree]	Vertical (Up)	60	70	-	
	[degree]	CR = 10 (Down)	50	60	-	
Contrast ratio		Normal Direction	250	450		
Response Time	[msec]	Rising Time	-	12	20	
	[msec]	Falling Time	-	4	5	
	[msec]	Rising + Falling	-	16	25	
Color / Chromaticity		Red x	0.61	0.64	0.67	
		Red y	0.31	0.34	0.37	

Coordinates (CIE)		Green x	0.26	0.29	0.32	
		Green y	0.58	0.61	0.64	
		Blue x	0.11	0.14	0.17	
		Blue y	0.04	0.07	0.10	
Color Coordinates (CIE) White		White x	0.28	0.31	0.34	
		White y	0.30	0.33	0.36	
Luminance Uniformity	[%]	9 points measurement	75	80	-	
White Luminance @ CCFL 7.5mA (center)	[cd/m ²]		210	260	-	
Crosstalk (in 75Hz)	[%]				1.5	

* The test methods for the above items' definition, please refer to the relative panel specification.

5. User Controls

5.1 User's hardware control definition

Item	Condition	Spec	OK	N.A	Remark
Monitor Power button			√		
Enter button			√		
Right/Inc. button			√		
Left/Dec. button			√		
Exit /Volume button			√		
I-key button			√		
Mode Selection button				√	
Mute button				√	
Input source select button				√	

5.2 OSD control function definition

Item	Condition	Spec	OK	N.A	Remark
Auto Adjust		Auto-Geometry	√		
Brightness			√		
Contrast			√		
Horizontal Position			√		
Vertical Position			√		
Pixel Clock			√		
Phase			√		
Color		Bluish Reddish sRGB User: Separate R/G/B adjustment	√		
OSD Position		OSD Horizontal position OSD Vertical position	√		
OSD Time		From 5 sec to 60 sec	√		
Language		8 languages	√		
Recall		Color recall Recall All	√		
Mode Selection				√	

Input Select		D-sub DVI	√	
Sharpness			√	
Display Information		For input timing	√	
Volume			√	
Mute			√	
Hot key for Brightness			√	
Hot key for Contrast			√	
Hot key for Volume			√	
Hot key for Mode			√	

* The detailed firmware functions' specification, please refer to C212 S/W spec. document.

6. Mechanical Characteristics

6.1 Dimension

Item	Condition	Spec	OK	N.A	Remark
Bezel opening		339.84 x 272.24 mm	√		
Monitor without Stand	L x W x H mm	323.75*378*60.5mm	√		
Monitor with Stand	L x W x H mm	362*378*135.31 mm	√		
Carton Box (outside)	L x W x H mm	456(L)*423(W)*114(H)	√		
Tilt and Swivel range		Tilt: -5 ~ +20 degree Swivel: 0 degrees	√		

6.2 Weight

Item	Condition	Spec	OK	N.A	Remark
Monitor (Net)		3.8 Kg	√		
Monitor with packing (Gross)		5.7 Kg	√		

6.3 Plastic

Item	Condition	Spec	OK	N.A	Remark
Flammability		94-HB	√		
Heat deflection To	ABS	65 °C	√		
UV stability	ABS	Delta E < 8.0	√		
Resin		MPRII: ABS (VW55/VE0856/D350)	√		
Texture		MT-11020	√		Bezel texture MT-11000
Color		BCS-Y5003A	√		Bezel painting T8020C

6.4 Carton

Item	Condition	Spec	OK	N.A	Remark
Color		Kraft	√		
Material		B Flute	√		
Compression strength		288 KGF	√		
Burst Strength		16 KGF/cm ²	√		
Stacked quantity		18 Layers	√		

7. Pallet & Shipment

7.1 Container Specification

Stowing Type	Container	Quantity of products (sets) (Every container)	Quantity of Products (sets) (Every Pallet)	Quantity of pallet (sets) (Every Container)
With pallet	20'	1080	Pallet A: 90	Pallet A: 12
			Pallet B: 72	Pallet B: 12
	40'	2520	Pallet A: 90	Pallet A: 14
			Pallet B: 72	Pallet B: 14
Without pallet	20'		X	X
			X	X
	40'		X	X
			X	X

7.2 Carton Specification

Product:

Net Weight (Kg)	Gross Weight (Kg)	Dimension w/o Base L*W*H (mm)	Dimension w/ Base L*W*H (mm)
3.8Kg	5.7Kg	323.75*378*60.5mm	362*378*135.31 mm

Package:

Carton Interior Dimension (mm) L*W*H	Carton External Dimension (mm) L*W*H
448(L)*415(W)*100(H)	456(L)*423(W)*114(H)

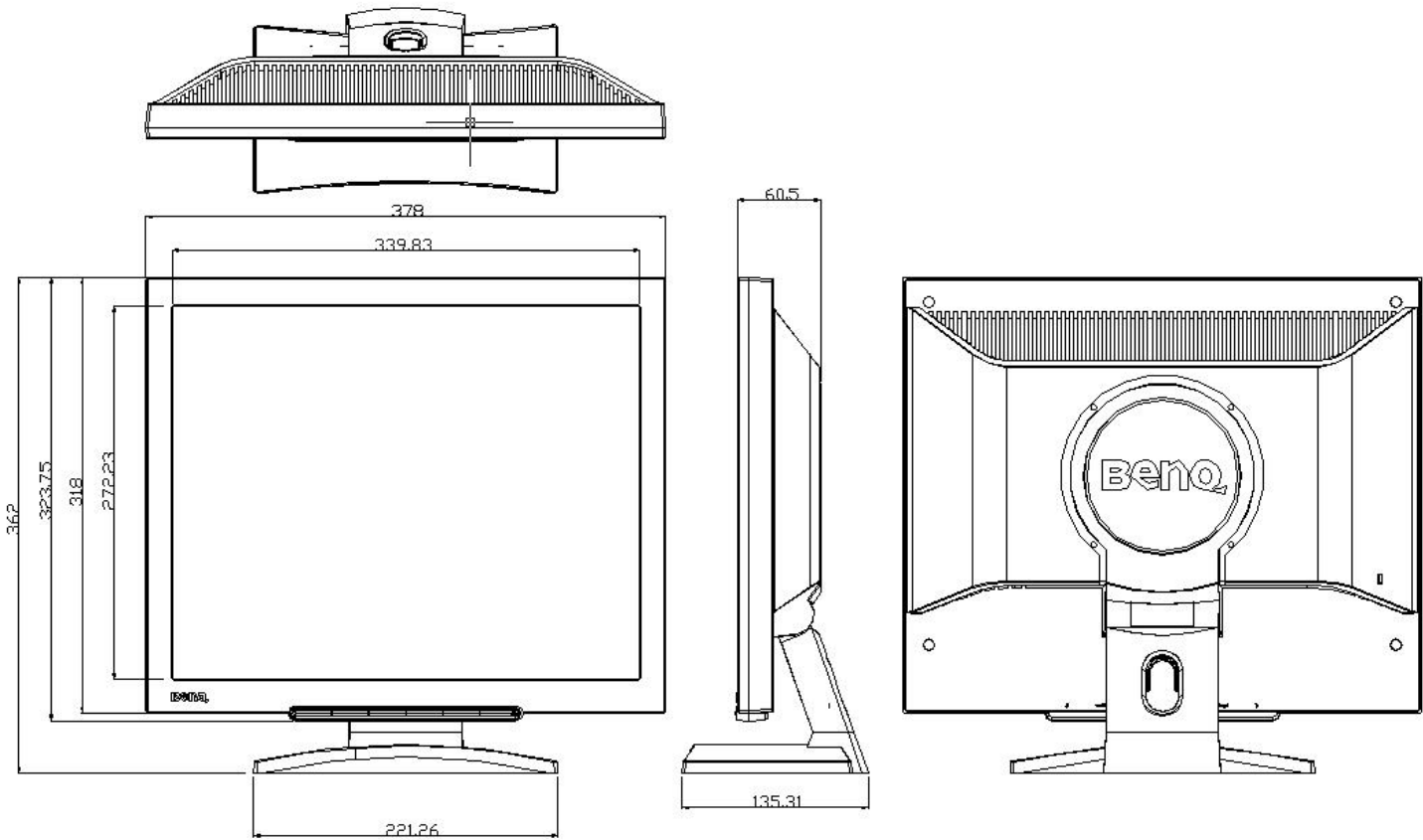
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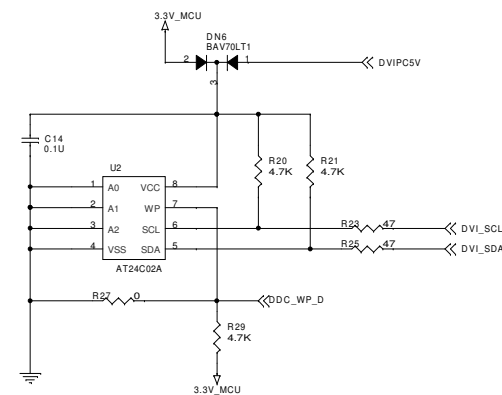
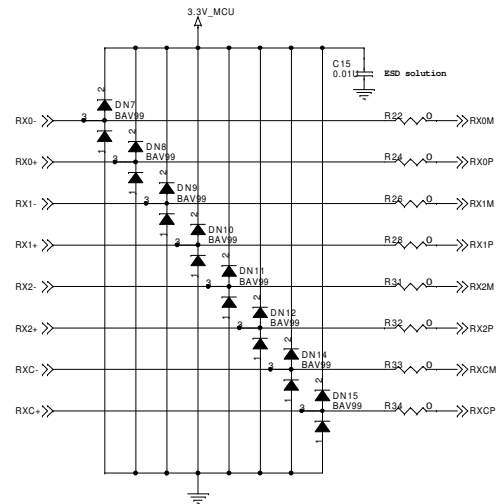
Item	Condition	Spec	OK	N.A	Remark
Environment	Green design	API Doc. 715-C49	√		ISO14000 Requirement
	Blue Angel	German Standard		√	
	E-2000	Switzerland		√	

	EPA	USA Standard	√		
	TCO'99		√		
	TCO'03		√		
	Green Mark		√		
PC-Monitor	Microsoft Windows	PC98/99	√		
	DPMS	VESA	√		
	DDC 2B	Version 1.3	√		
	USB	External		√	
Safety	UL (USA)	UL60950 3 rd edition	√		
	CSA (Canada)	CAN/CSA-C22.2 No. 60950		√	
	Nordic / D.N.S.F	EN60950		√	
	FIMKO	EN60950	√		
	CE Mark	73/23/EEC	√		
	IEC60950		√		
	EN60950		√		
	CB	EN60950	√		
	TUV/GS	EN60950 / EK1-ITB 2000:2003	√		
	CCC (China)		√		
	GOST	EN60950	√		
	SASO		√		
EMC	CE Mark	89/336/EEC	√		
	FCC (USA)	FCC Part 15 B	√		
	EN55022	Class B	√		
	CISPR 22	Class B	√		
	VCCI (Japan)	VCCI Class B	√		
	BSMI (Taiwan)	CNS 13438	√		
	C-Tick (Australia)	AS/ NZS CISPR22	√		
X- Ray Requirement	DHHS (21 CFR)	USA X- Ray Standard		√	
	DNHW			√	
	PTB	German X- Ray standard		√	
Ergonomics	TUV / Ergo		√		
	ISO 13406-2		√		
	prEN50279		√		

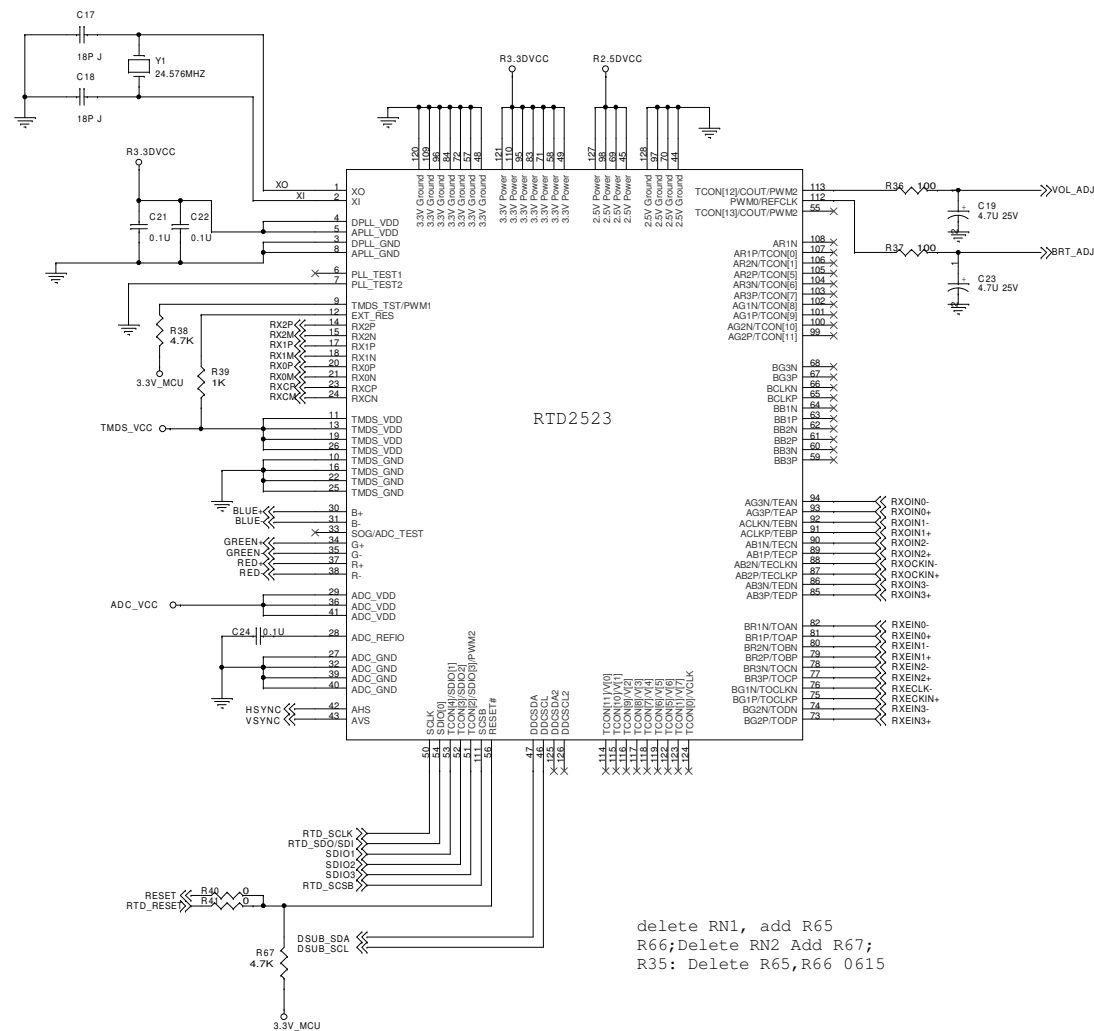
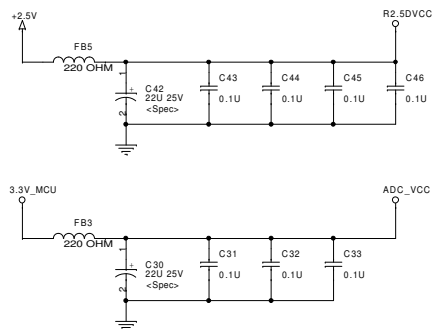
Appendix: Physical Dimension Front View and Side view

Fig. 1 Physical Dimension Front View and Side view



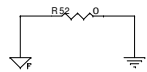
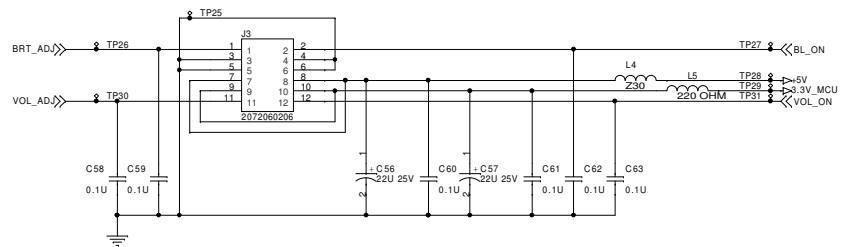
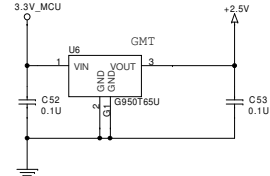
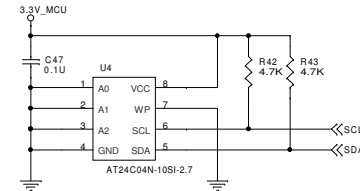


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Title INTERFACE BOARD					
Size <Size>	PCB P/N 48.L1C01.S02	PCB Rev. S02	Document Number 99.L1C72.000-C3-C04-001	Rev. 1	
Date: Thursday, July 29, 2004					
Prepared By ANGEL HU		Reviewed By ALLEN PC LEE		Sheet 1 of 6 Approved By DAVEN WU	

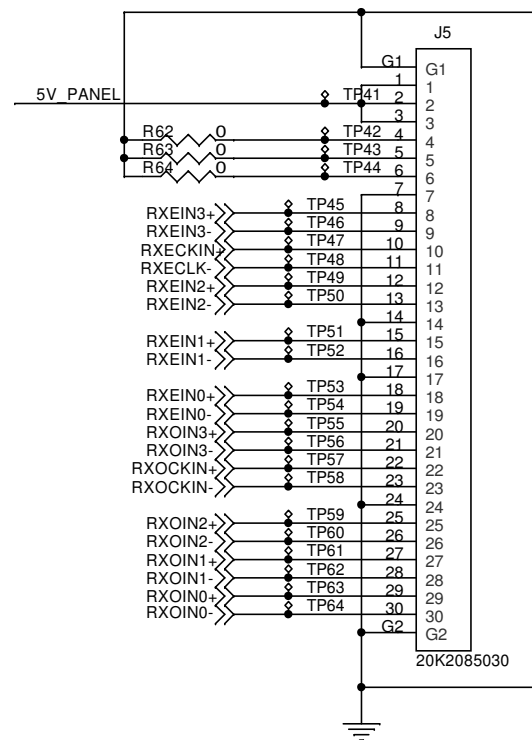
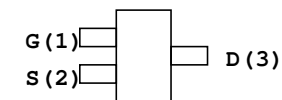
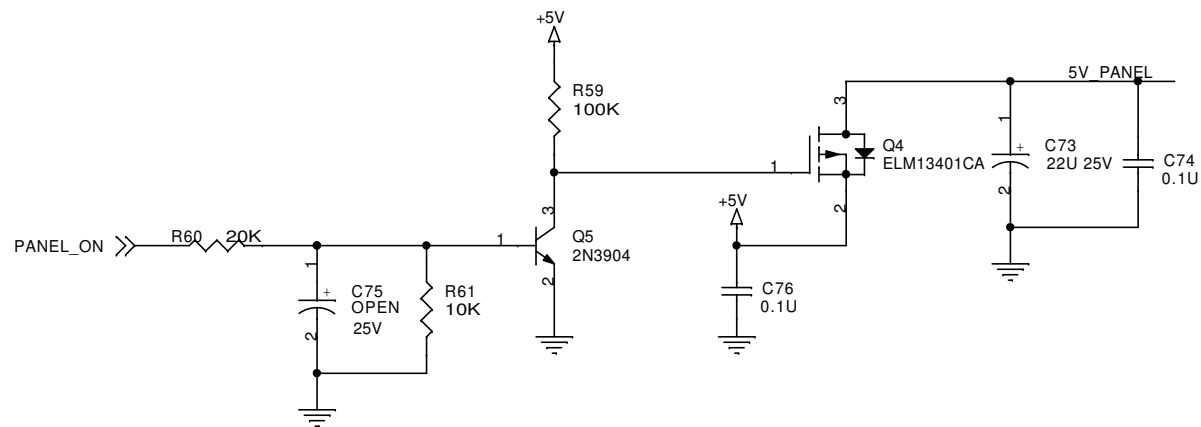


Benq Corporation				
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Size -Size-	PCB P/N 48.LIC101.S02	PCB Rev. S02	Document Number 99.LIC72.000-C33-C04-001	Rev. 1.0
Date: Thursday, July 29, 2004		Sheet 2 of 6		
Prepared By ANGEL HU		Reviewed By ALLEN PC LEE		Approved By DAVEN WU

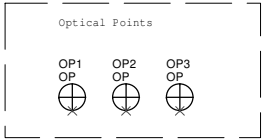
```
**C50 close to scaler, R43 close to MCU.
```



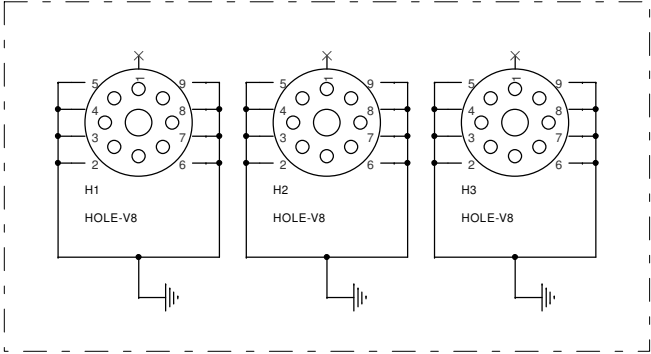
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Title INTERFACE BOARD					
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Date: Thursday, July 29, 2004		Sheet 3 of 6			
Prepared By ANGEL HU		Reviewed By ALLEN PC LEE		Approved By DAVEN WU	



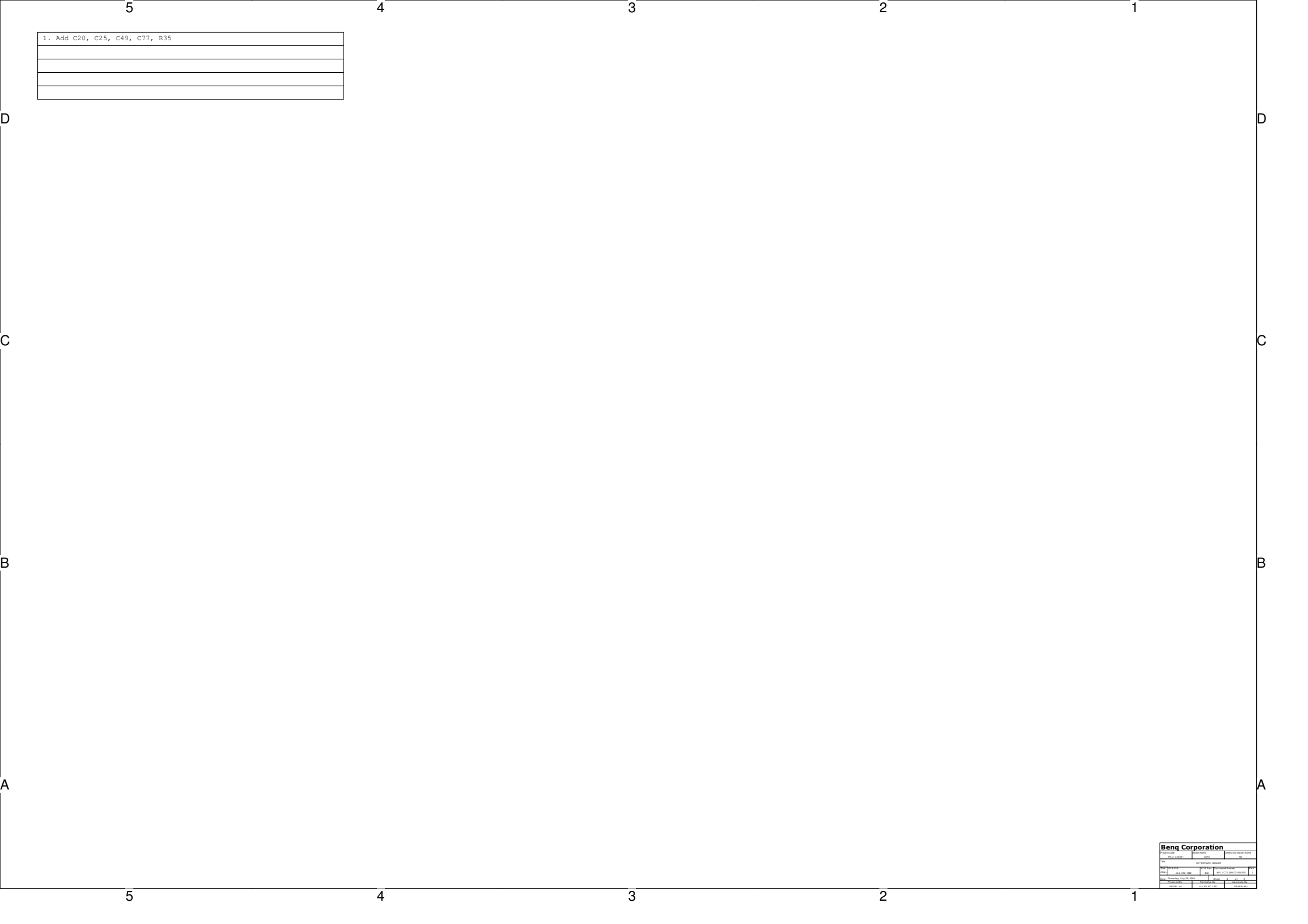
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Title INTERFACE BOARD				
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Date: Thursday, July 29, 2004			Sheet 4 of 6	
Prepared By ANGEL HU		Reviewed By ALLEN PC LEE		Approved By DAVEN WU



Screw Holes



Benq Corporation			
Project Code		Model Name	OEM/ODM Model Name
99.L1C72.001		Q7T4	NA
Title			
INTERFACE BOARD			
Size	PCB P/N	PCB Rev.	Document Number
<Size>	48.L1C01.S02	S02	99.L1C72.000-C3-304-001
Date: Thursday, July 29, 2004		Sheet	5 of 6
Prepared By		Reviewed By	Approved By
ANGEL HU		ALLEN PC LEE	DAVEN WU



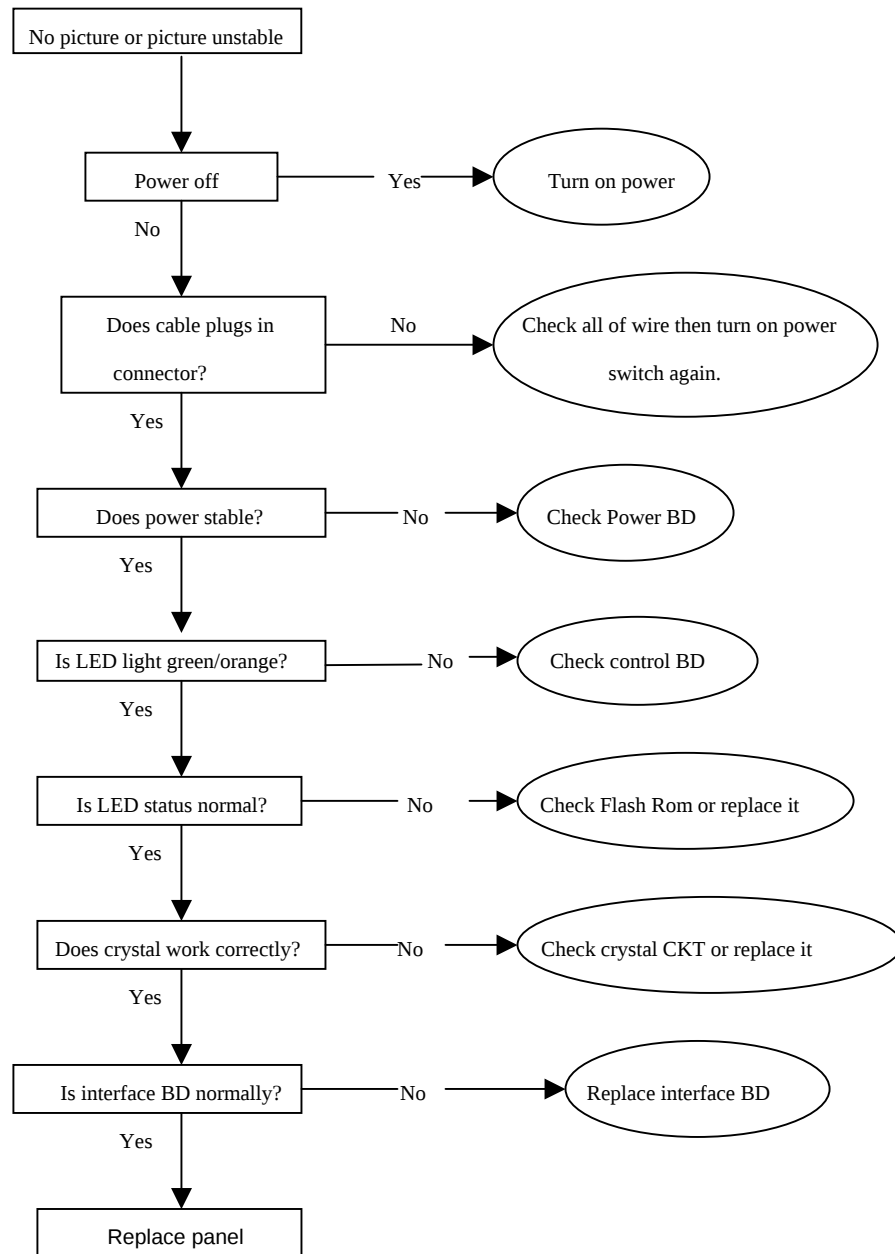
1. Add C20, C25, C49, C77, R35

Beng Corporation			
Company Name	Ben Name	Product Name/Code	
001-1234567	0001	00	
Part	Part No.	Part Name/Description	
001-1234567	0001	001-1234567-0001	
Part Description/Notes	Part No.	Part Name/Description	Part No.
001-1234567-0001	0001	001-1234567-0001	0001

Q7T4 TROUBLE SHOOTING GUIDE

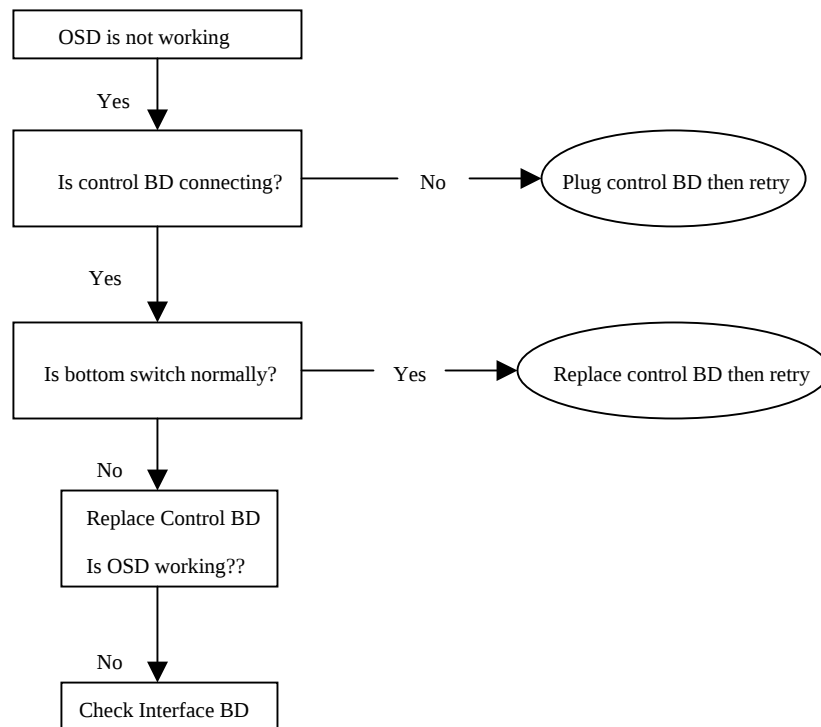
No Display or display is unstable:

1.1 Interface Board:

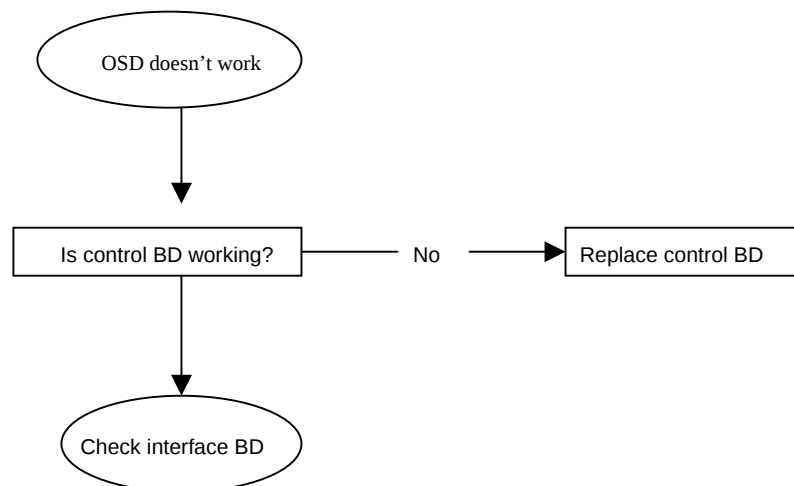


2. BUTTON function:

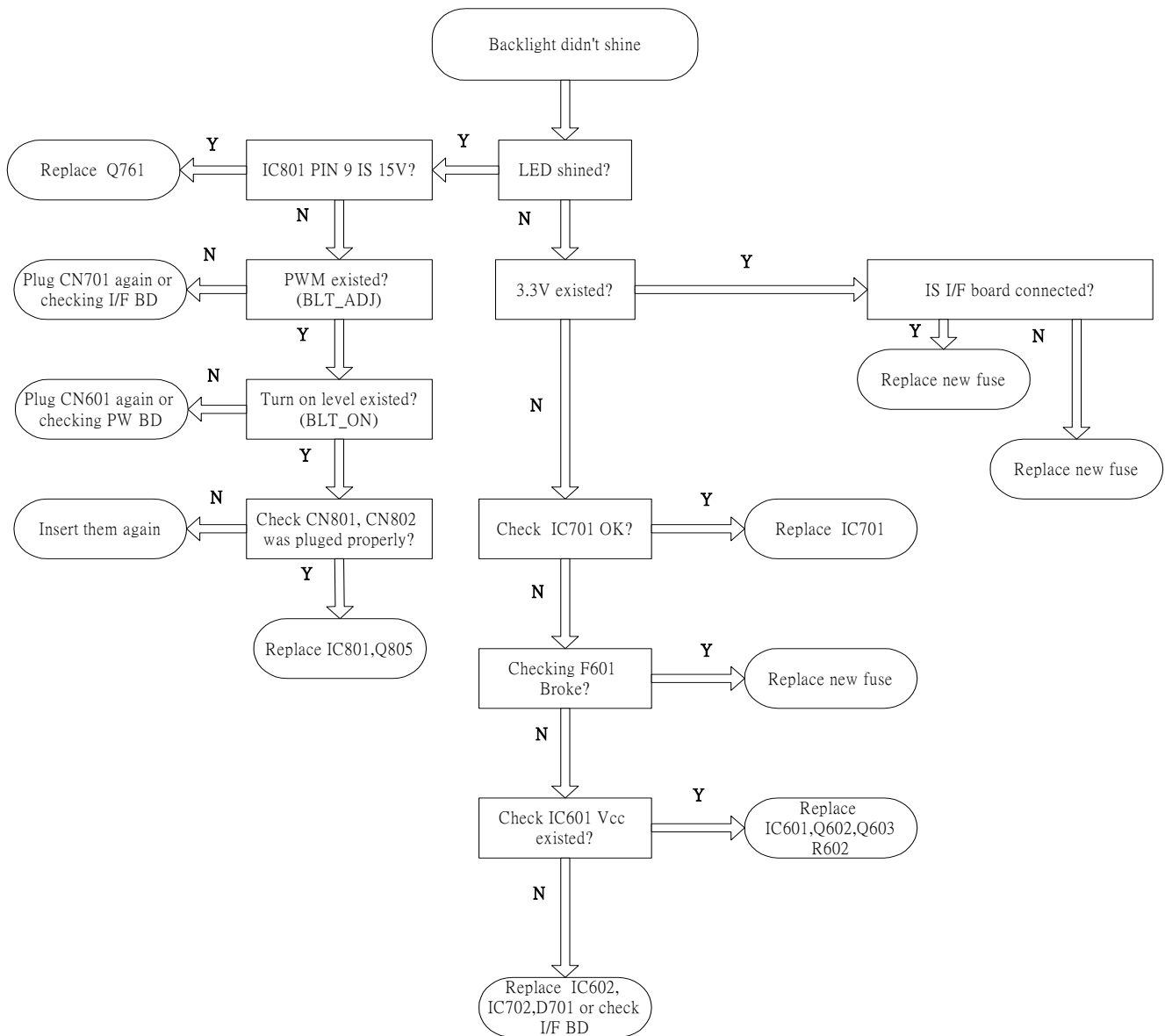
2.1 Control Board

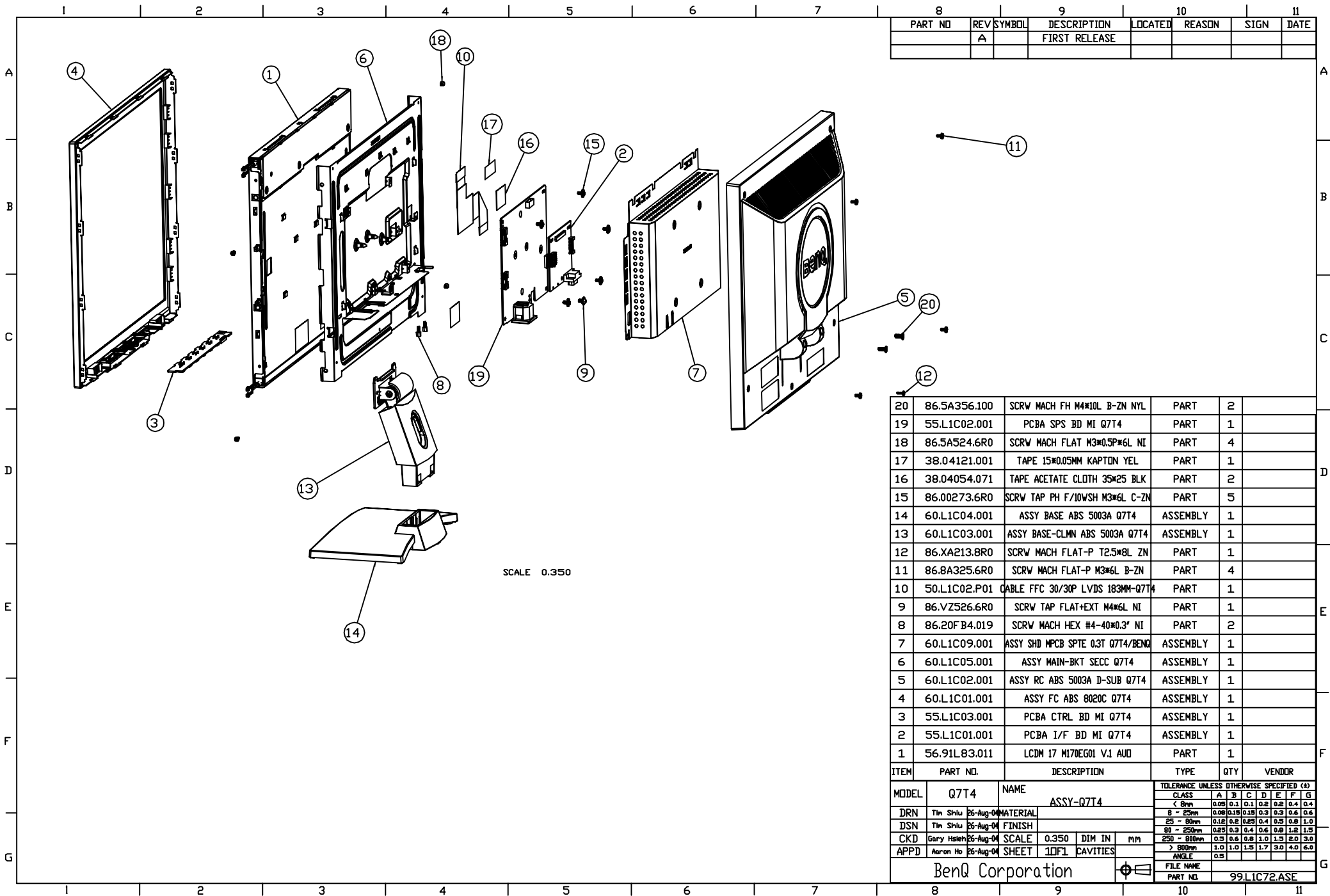


3. OSD function:



4. Power Board





BENQ LCD Q7T4(FP71G) Spare Parts List

P/N: 99.L1C72.ASE

ITEM	DESCRIPTION	PART NO.	LOCATION
1	PCBA I/F BD MI AUO M170EG01	55.L1C01.001	
2	IC CONTROLLER RTD2023 QFP 128P	71.02023.00E	U3
3	IC EEPROM AT24C02N-10SI-1.8SON	72.02402.C01	U1
4	IC EEPROM AT24C04N-10SI-2.7SON	72.02404.N01	U4
5	IC VR G950T65U SOT-223	74.95065.03C	U6
6	IC FLASH MTV312MV64 (AJ) PLCC44	71.31264.A03	U5
7	PCBA SPS BD MI QT74 EG01	55.L1C02.001	
8	PCBA CTRL BD MI Q7T4	55.L1C03.001	
9	LCDM 17 M170EG01 V.1 AUO	56.91L83.011	
10	ASSY FC ABS 8020C Q7T4	60.L1C01.001	
11	ASSY RC ABS 5003A Q7T4	60.L1C02.001	
12	ASSY BASE-CLUM ABS 5003A Q7T4	60.L1C03.001	
13	CTN B 456*423*114 Q7T4/BENQ	44.L1C01.001	
14	CSN BTM EPS Q7T4	47.L1C01.001	
15	CSN TOP EPS Q7T4	47.L1C02.001	
16	CABLE SIGNAL 15/15P CORE*1 1.5M	50.L9005.501	
17	CD MANUAL Q7T4	53.L1C01.001	
18	ASSY BASE ABS 5003A Q7T4	60.L1C04.001	

*** THIS PARTS LIST MAY BE SUBJECT TO CHANGE
WITH PRIOR NOTICE BY CSD OF BENQ.**

1. Alignment procedure (for function adjustment)

A. Preparation:

1. Setup input timing ICL-605(1280x1024@75Hz), 32-Grays pattern.
2. Setup unit and keep it warm up at least 30 minutes.

B. Timing adjustment:

1. Enter factory setting area (press “ENTER”, “EXIT” and then press “SOFTPOWER”).
2. Check the settings to following values:

Contrast = 50

Brightness = 90

OSD time = 20

Color = Normal

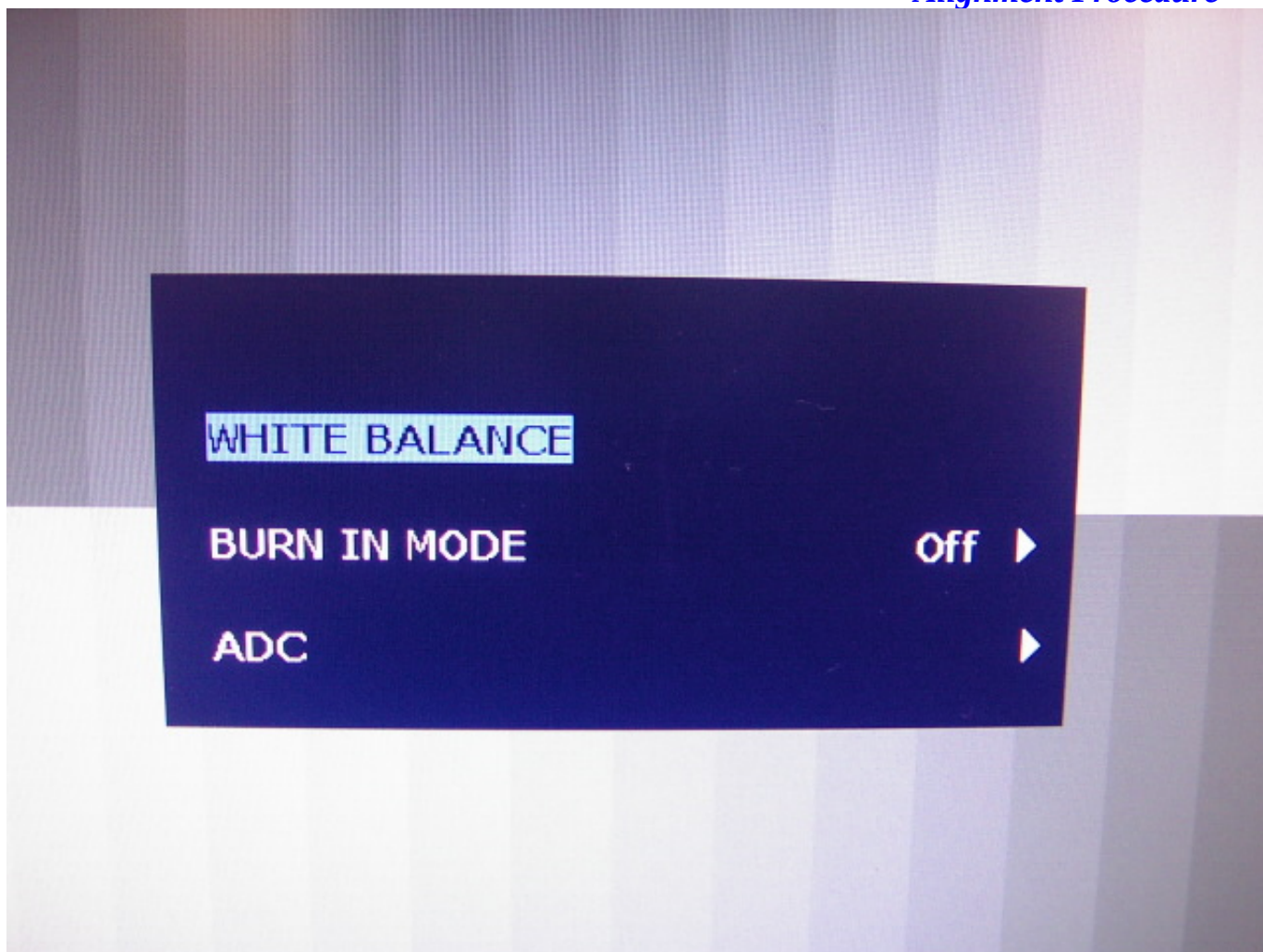
Language = English

Then, turn off the monitor power.

3. Turn on power enter user area.

C. Color balance adjustment:

1. Enter factory setting area (press “ENTER”, “I-Key” and then press “SOFTPOWER”).
2. Setup input timing ICL-605(1280x1024@75Hz), 32-Gray pattern (pattern 48) .
3. Press “I-KEY”, and than OSD will show “White Balance” item and than press “ENTER” button to do auto color.



D. Color adjustment:

1. Setup input timing ICL-605, white pattern .
2. Confirm auto color adjustment had already done.
3. Measure color temperature by Minolta CA-110 (or equivalent equipment).
4. Check the color temperature Bluish, Reddish & Normal. The color temperature specification as follows:

White Balance (Bluish, 9300K set on OSD)	X+-	0.283+(-) 0.03
	Y+-	0.297+(-) 0.03
White Balance (Reddish, 5800K set on OSD)	X+-	0. 326+(-) 0.03
	Y+-	0. 342+(-) 0.03
White Balance (sRGB, 6500K set on OSD)	X+-	0.313+(-) 0.03
	Y+-	0. 329 +(-) 0.03

5. Setup input timing , 32 -Gray pattern.

To check if there are any abnormal display problems of preset timing modes .

Check the following preset timings with General pattern:

No.	Mode	H	V
1	720×400 @ 70Hz	31.468	70.8
2	640×480 @ 60Hz	31.469	59.940
3	640×480 @ 75Hz	37.500	75.000
4	800×600 @ 60Hz	37.879	60.317
5	800×600 @ 75Hz	46.875	75.000
6	1024×768 @ 60Hz	48.363	60.004
7	1024×768 @ 75Hz	60.023	75.029
8	1152×864 @ 75Hz	67.500	75.000
9	1280×1024 @ 60Hz	63.981	60.020
10	1280×1024 @ 75Hz	79.976	75.025

6. Checking if the picture is no good, reject this monitor.
7. To check the power consumption by disabling “burn-in mode” setting
8. To clear user data and program complete DDC data to monitor by IIC bus communication.

E. Writing EDID file:

1. Setup a PC with DDC card.
2. Connect PC to monitor with a D-sub signal cable.
3. Please refer to the C212 for the correct EDID file.
4. Runs the writing program to write the EDID file into EEPROM .
5. Read EEPROM data and confirm it to match with the C212 document definition.

F. Command definition :

PC Host will send 0x7C IIC slave address and then following 4 bytes command

I2C Send Command	Byte1	Byte2	Byte3	Byte4	OK	N.A.	Remark
Write Contrast to MCU RAM	CA	55	Data	cksum	✓		Write data to MCU RAM and update the related register to refresh the screen immediately. Don't store data to EEPROM.
Write Brightness to MCU RAM	CA	56	Data	cksum	✓		
Write Red Gain to MCU RAM	CA	57	Data	cksum	✓		
Write Green Gain to MCU RAM	CA	58	Data	cksum	✓		
Write Blue Gain to MCU RAM	CA	59	Data	cksum	✓		Base on current color index to read back the right gain value.
Read Contrast from MCU RAM	C3	55	XX	cksum	✓		
Read Brightness from MCU RAM	C3	56	XX	cksum	✓		
Read Red Gain from MCU RAM by color index	C3	57	XX	cksum	✓		
Read Green Gain from MCU RAM by color index	C3	58	XX	cksum	✓		
Read Blue Gain from MCU RAM by color index	C3	59	XX	cksum	✓		
Write C1 (Bluish) R-Gain Data to EEPROM	AA	3C	Data	cksum	✓		
Write C1 (Bluish) G-Gain Data to EEPROM	AA	3D	Data	cksum	✓		
Write C1 (Bluish) B-Gain Data to EEPROM	AA	3E	Data	cksum	✓		
Write C2 (sRGB) R-Gain Data to EEPROM	AA	4C	Data	cksum	✓		
Write C2 (sRGB) G-Gain Data to EEPROM	AA	4D	Data	cksum	✓		
Write C2 (sRGB) B-Gain Data to EEPROM	AA	4E	Data	cksum	✓		

Write C3 (Reddish) R-Gain Data to EEPROM	AA	5C	Data	cksum	✓		
Write C3 (Reddish) G-Gain Data to EEPROM	AA	5D	Data	cksum	✓		
Write C3 (Reddish) B-Gain Data to EEPROM	AA	5E	Data	cksum	✓		
Write User R-Gain Data to EEPROM	AA	6C	Data	cksum	✓		
Write User G-Gain Data to EEPROM	AA	6D	Data	cksum	✓		
Write User B-Gain Data to EEPROM	AA	6E	Data	cksum	✓		
Write Cx R-Gain Data to EEPROM	AA	7C	Data	cksum		✓	Reserved for some model have extra color temperature
Write Cx G-Gain Data to EEPROM	AA	7D	Data	cksum		✓	
Write Cx B-Gain Data to EEPROM	AA	7E	Data	cksum		✓	
Write Contrast to EEPROM	AA	92	Data	cksum	✓		
Write Brightness to EEPROM	AA	93	Data	cksum	✓		
							1=C1/9300/Bluish, 2=C2/6500/sRGB/, 3=C3/5800/Reddish, 4=User, 5=Cx
Write C/T index to EEPROM	AA	94	0~4	cksum	✓		
Write OSD-Hpos to EEPROM	AA	95	Data	cksum	✓		
Write OSD-Vpos to EEPROM	AA	96	Data	cksum	✓		
							0=DE, 1=EN, 2=ES, 3=FR, 4=IT, 5=JA, 6=繁中, 7=簡中 (Also Update MCU RAM)
Write Language to EEPROM	AA	97	0~7	cksum	✓		
Write EEPROM OSD Timer	AA	98	Data	cksum	✓		
Write EEPROM Volume	AA	99	Data	cksum	✓		
Write EEPROM Gamma index	AA	9A	Data	cksum		✓	For model with Gamma curve selection function
Write OSD Transparency to EEPROM	AA	9E	Data	cksum		✓	
Write OSD Rotation to EEPROM	AA	9F	Data	cksum		✓	
Read C1 (Bluish) R-Gain data from EEPROM	A3	3C	XX	cksum	✓		
Read C1 (Bluish) G-Gain data from EEPROM	A3	3D	XX	cksum	✓		
Read C1 (Bluish) B-Gain data from EEPROM	A3	3E	XX	cksum	✓		
Read C2 (sRGB) R-Gain data from EEPROM	A3	4C	XX	cksum	✓		
Read C2 (sRGB) G-Gain data from EEPROM	A3	4D	XX	cksum	✓		
Read C2 (sRGB) B-Gain data from EEPROM	A3	4E	XX	cksum	✓		
Read C3 (Reddish) R-Gain data from EEPROM	A3	5C	XX	cksum	✓		
Read C3 (Reddish) G-Gain data from EEPROM	A3	5D	XX	cksum	✓		
Read C3 (Reddish) B-Gain data from EEPROM	A3	5E	XX	cksum	✓		
Read User R-Gain data from EEPROM	A3	6C	XX	cksum	✓		
Read User G-Gain data from EEPROM	A3	6D	XX	cksum	✓		
Read User B-Gain data from EEPROM	A3	6E	XX	cksum	✓		
Read Cx R-Gain data from EEPROM	A3	7C	XX	cksum		✓	Reserved for some model have extra color temperature
Read Cx G-Gain data from EEPROM	A3	7D	XX	cksum		✓	
Read Cx B-Gain data from EEPROM	A3	7E	XX	cksum		✓	
Read Contrast from EEPROM	A3	92	XX	cksum	✓		
Read Brightness from EEPROM	A3	93	XX	cksum	✓		

Q7T4-FP71G LCD Monitor Service Guide

Alignment Procedure

							1=C1/9300/Bluish, 2=C2/6500/sRGB/ 3=C3/5800/Reddish, 4=User, 5=Cx
Read C/T index from EEPROM	A3	94	XX	cksum	✓		
Read OSD-Hpos EEPROM	A3	95	XX	cksum	✓		
Read OSD-Vpos from EEPROM	A3	96	XX	cksum	✓		
Read Language from EEPROM	A3	97	XX	cksum	✓		0=DE, 1=EN, 2=ES, 3=FR, 4=IT, 5=JA, 6=繁中, 7=簡中
Read OSD Timer from EEPROM	A3	98	XX	cksum	✓		
Read Volume from EEPROM	A3	99	XX	cksum	✓		
Read Gamma index from EEPROM	A3	9A	XX	cksum		✓	For model with Gamma curve selection function
Read OSD Transparency from EEPROM	A3	9E	XX	cksum		✓	
Read OSD Rotation from EEPROM	A3	9F	XX	cksum		✓	
Change Color Temp. to C1/9300K/Bluish	CC	01	XX	cksum	✓		Change C/T immediately. And store C/T index to EEPROM.
Change Color Temp. to C2/6500K/sRGB	CC	02	XX	cksum	✓		
Change Color Temp. to C3/5800K/Reddish	CC	03	XX	cksum	✓		
Change Color Temp. to User	CC	04	XX	cksum	✓		
Change Color Temp. to Cx	CC	05	XX	cksum		✓	Reserved
Change Input Source to D-Sub	CD	01	XX	cksum		✓	
Change Input Source to DVI	CD	02	XX	cksum		✓	
On burn in mode	CE	01	XX	cksum	✓		Store data to EEPROM
Off burn in mode	CE	XX*	XX	cksum	✓		XX* = Non "1" value Store data to EEPROM
Monitor is forced power saving	CF	01	XX	cksum		✓	
Monitor wake up from power saving	CF	XX*	XX	cksum		✓	XX* = Non "1" value
User mode to factory mode	1A	5A	XX	cksum	✓		
Auto Color (Offset1, Offset2, Gain)	1B	5A	XX	cksum		✓	
Copy EDID Serial number to EEPROM	1C	5A	XX	cksum		✓	For specified "Industry Customer" model.
Factory mode to User mode	1E	5A	XX	cksum	✓		
Clear user mode and factory recall	1F	5A	XX	cksum	✓		Store data to EEPROM
Write EDID data to MCU DDC RAM	55	NA	NA	NA	✓		For MTV312 MCU type
Copy DDC RAM data to EEPROM	BB	NA	NA	NA	✓		For MTV312 MCU type
Drive WP pin to low to enable write DDC IC	55	NA	NA	NA		✓	For stand alone DDC IC
Drive WP pin to high to disenable write function	BB	NA	NA	NA		✓	For stand alone DDC IC
EEPROM Bank R/W (For Debug using only, not for Production Line Write EEPROM directly)							
Read EEPROM Bank 0	B0	Address	XX	cksum	✓		
Read EEPROM Bank 1	B1	Address	XX	cksum	✓		
Read EEPROM Bank 2	B2	Address	XX	cksum		✓	(For 24C08 type)
Read EEPROM Bank 3	B3	Address	XX	cksum		✓	(For 24C08 type)
Write EEPROM Bank 0	B8	Address	Data	cksum	✓		
Write EEPROM Bank 1	B9	Address	Data	cksum	✓		
Write EEPROM Bank 2	BA	Address	Data	cksum		✓	(For 24C08 type)
Write EEPROM Bank 3	BB	Address	Data	cksum		✓	(For 24C08 type)

Note A: Byte4 (cksum) = Byte1 + Byte2 + Byte3

Note B: Data = The value write to MCU or EEPROM

Note C: XX = don't care, any value ($\leq 0xFF$).

When PC Host sends 0x7D command to MCU, MCU must return as following (2 bytes)

Return Code	R-Byte1	R-Byte2
Checksum error code	FC	AA
Normal return code	the above Byte3 (/data)	FC
If normal return code is exact FCh	FC	CF

4. Wire Dressing and assembling concern

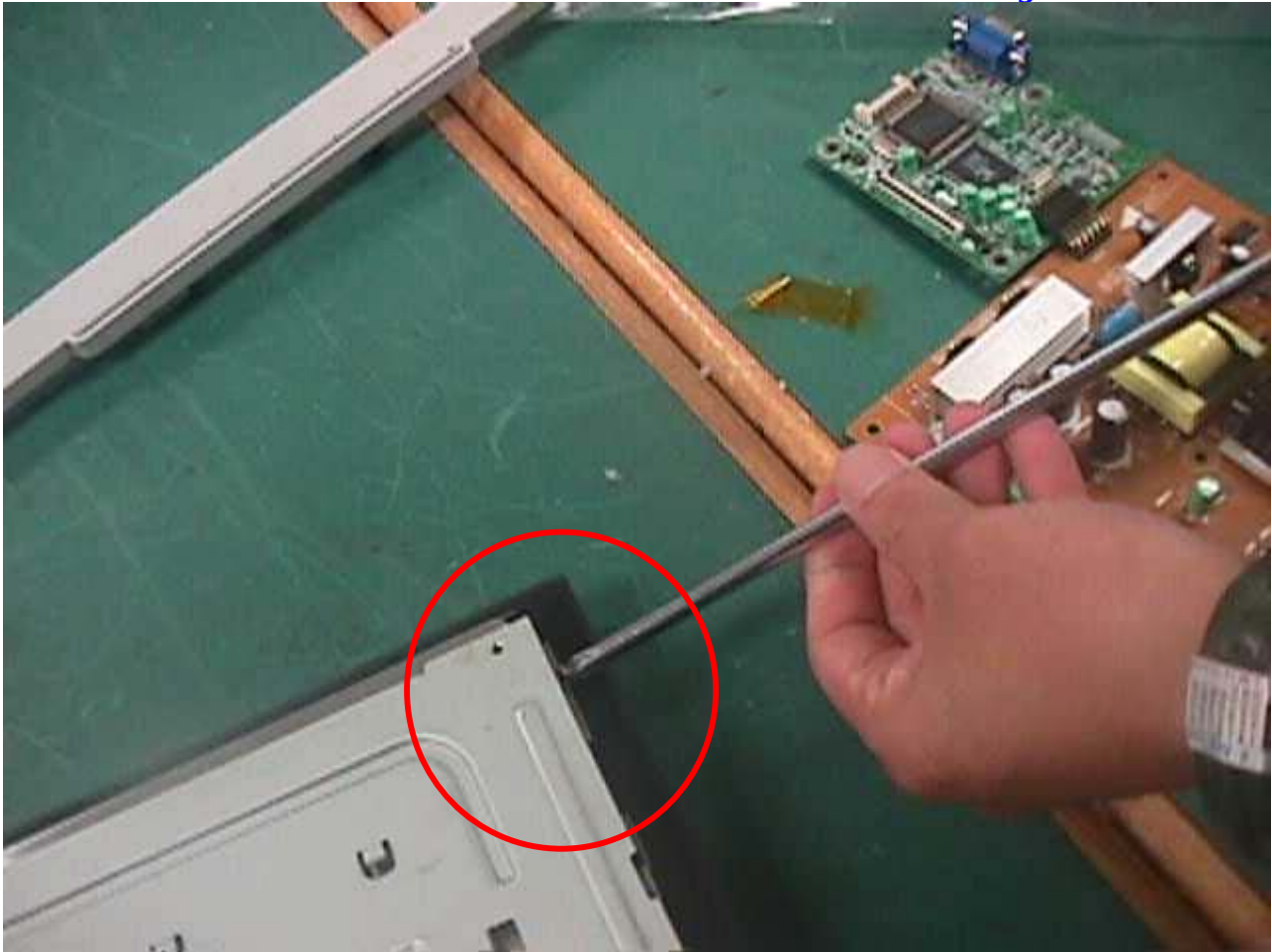
Prepare 1 panel



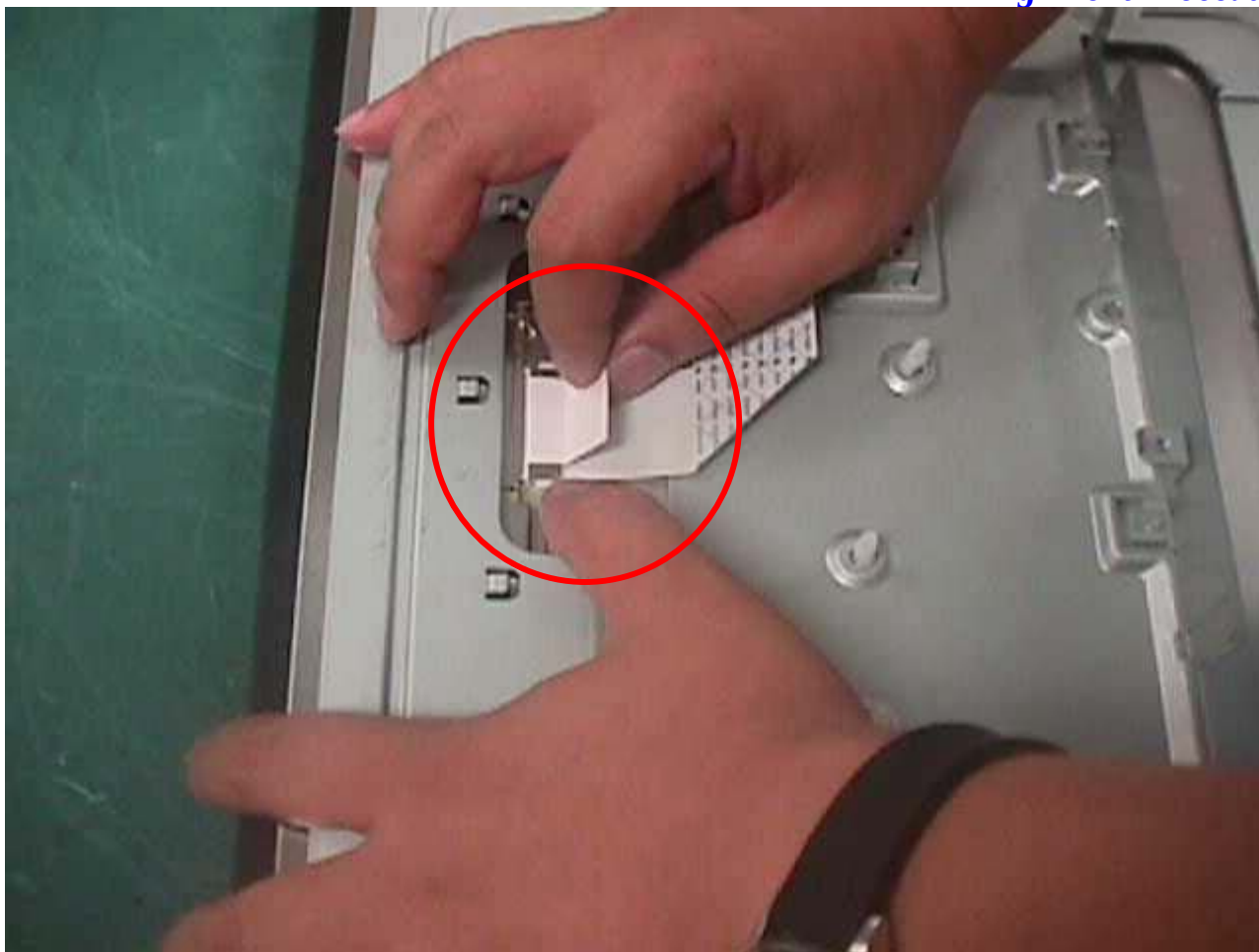
Assembly panel and main BKT



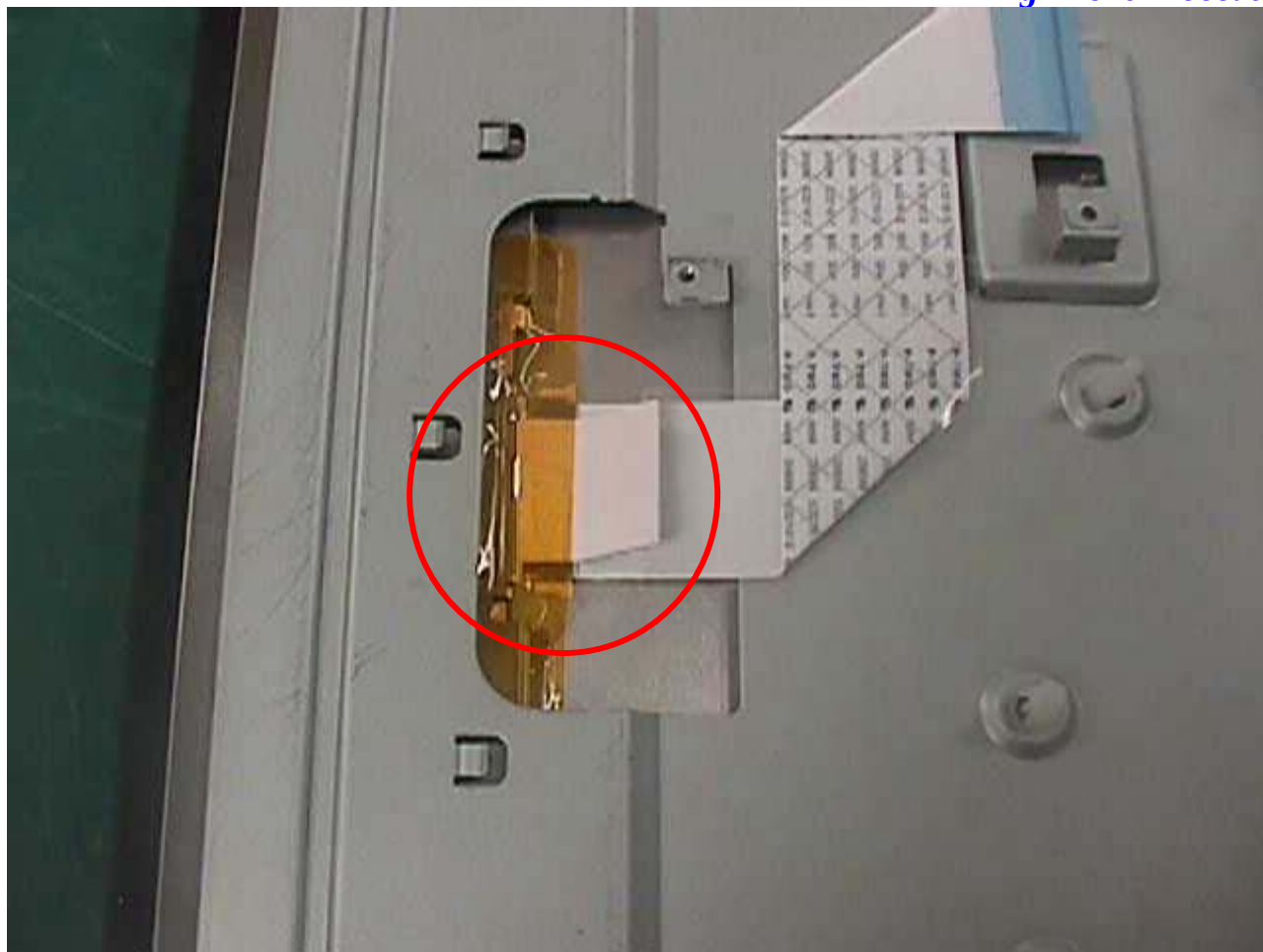
Add 4 screw between panel and main BKT



Add FFC



Add Tape



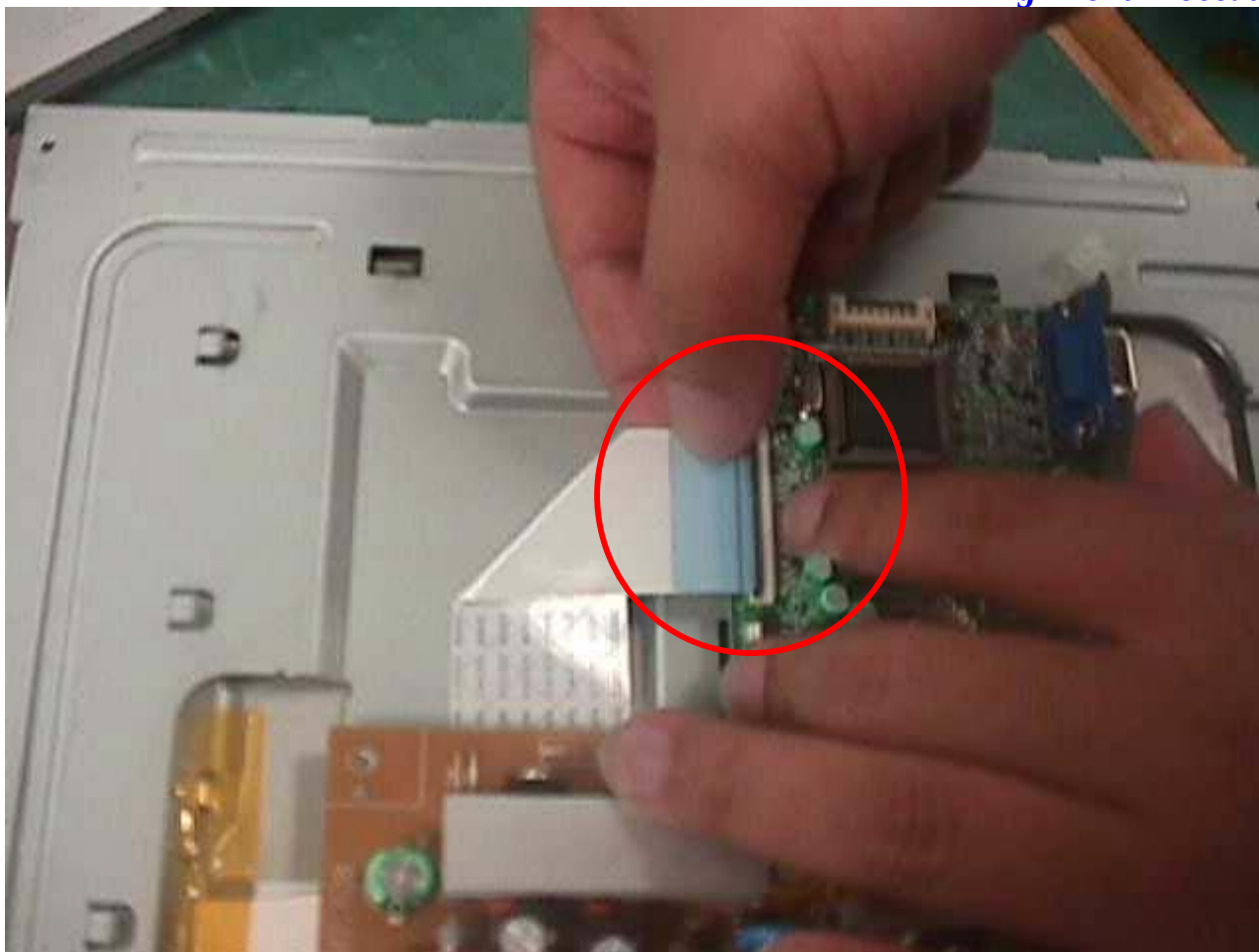
Assembly IF board and Power Board



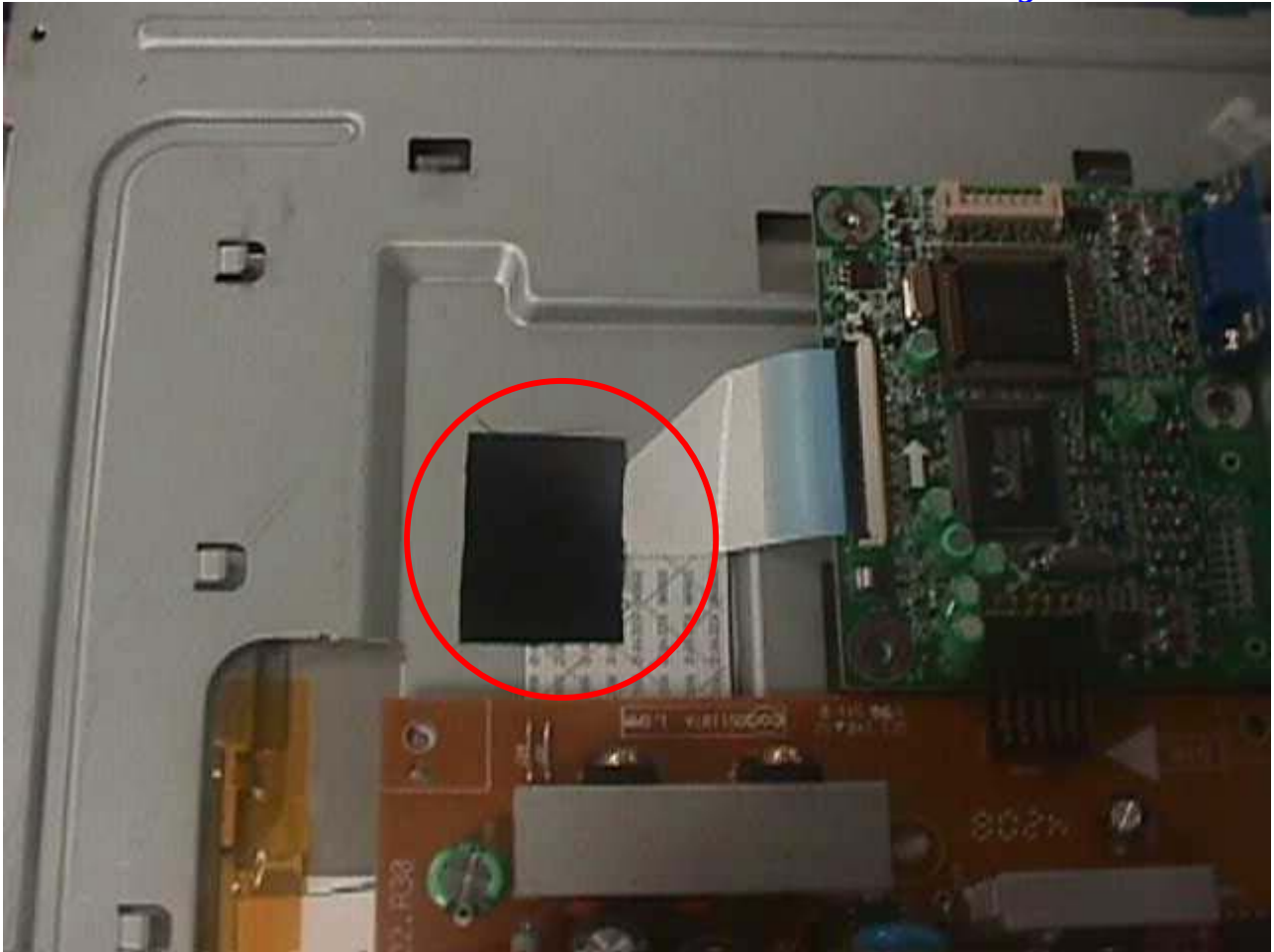
Assembly PCB module and main BKT



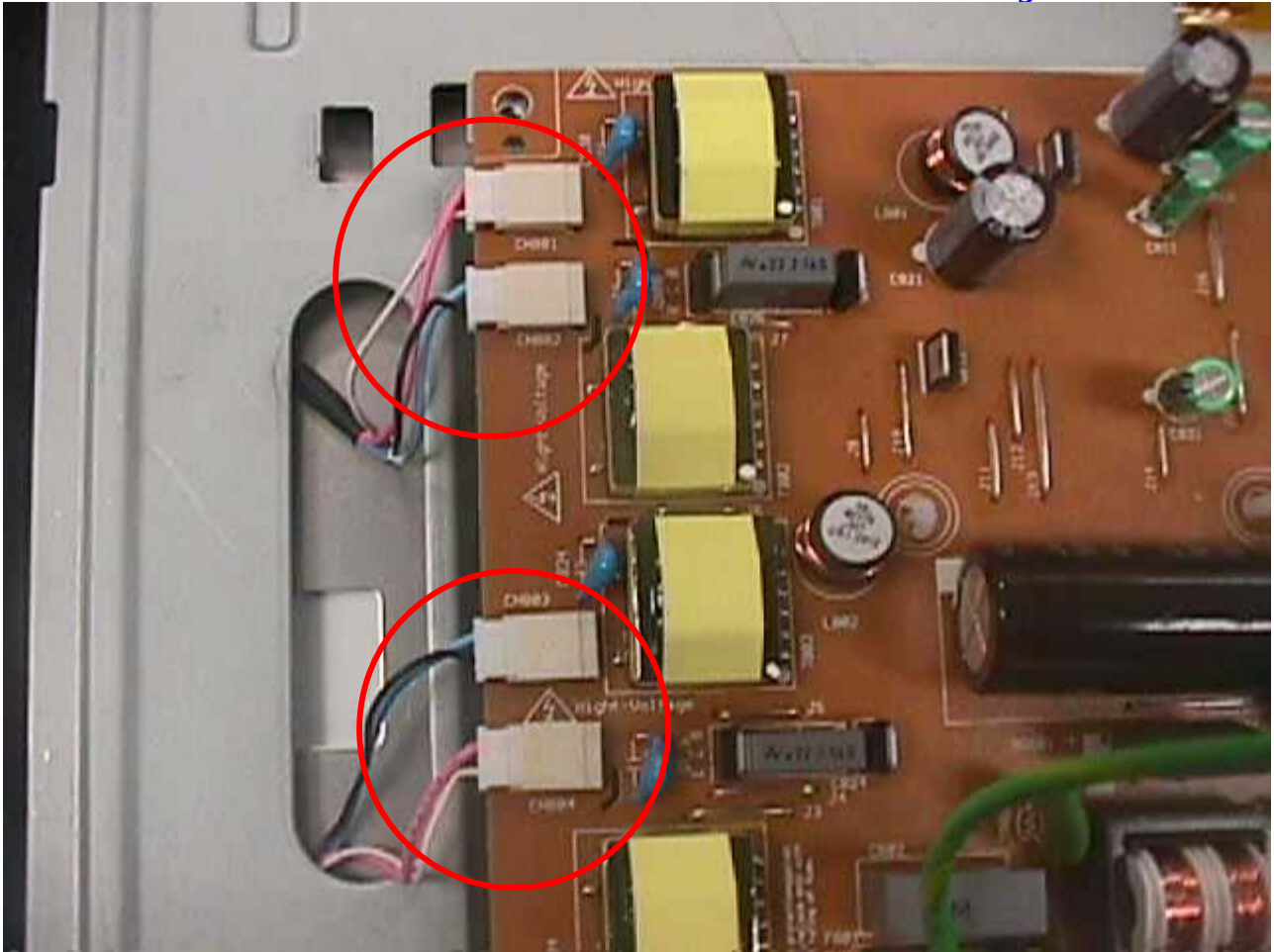
Assembly IF board and FFC



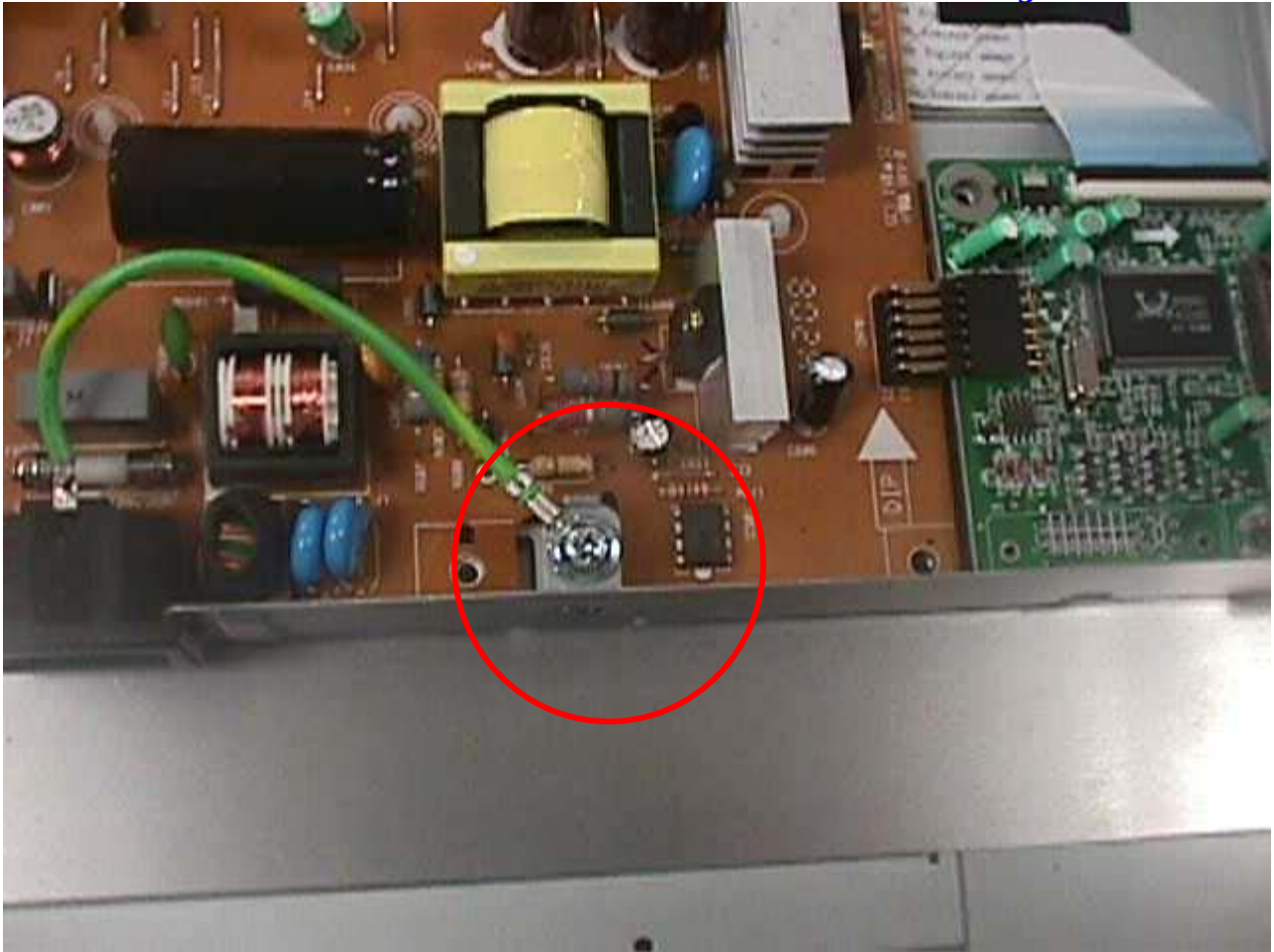
Add one tape



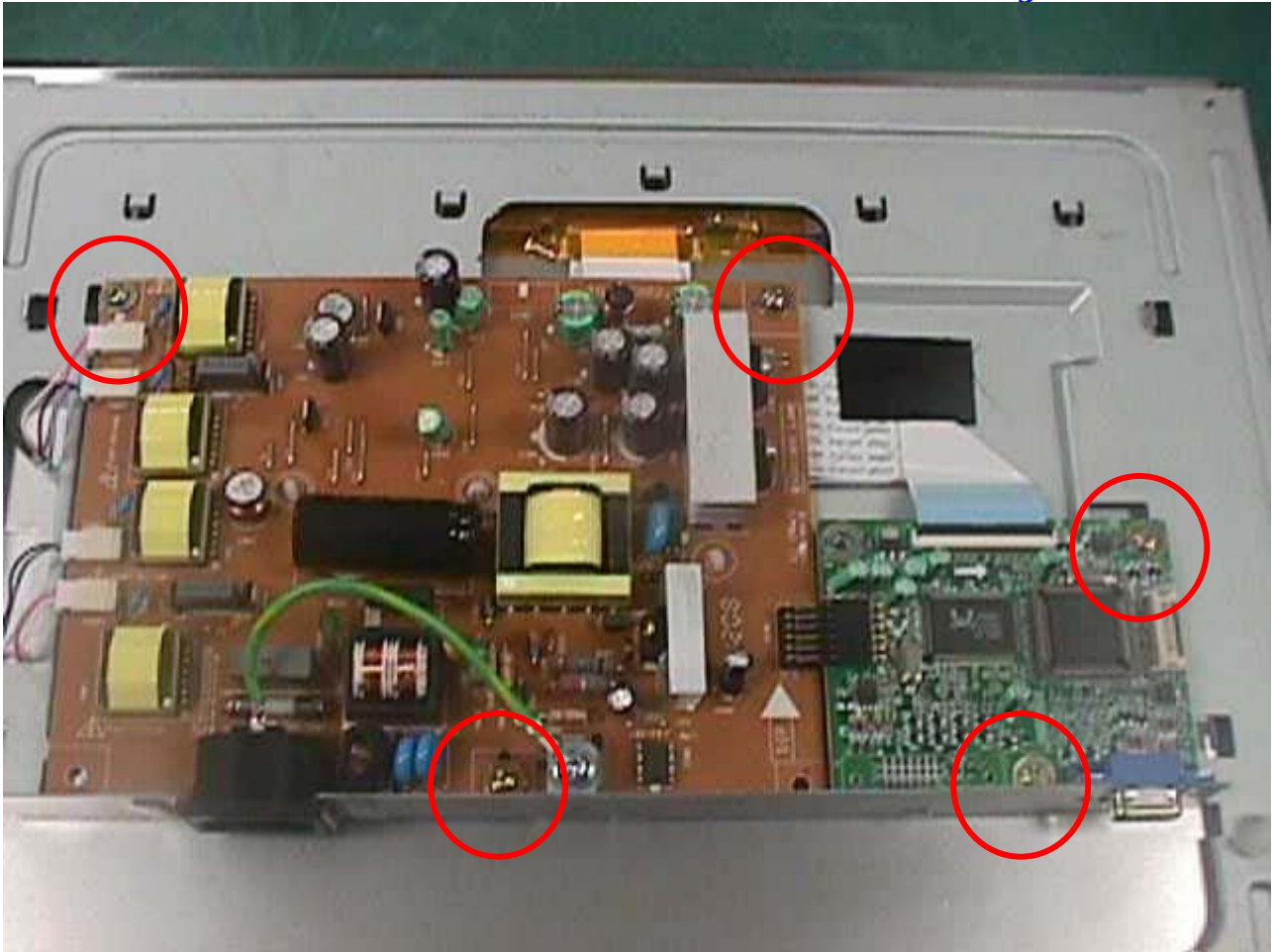
Assembly lamp wire and Power Board



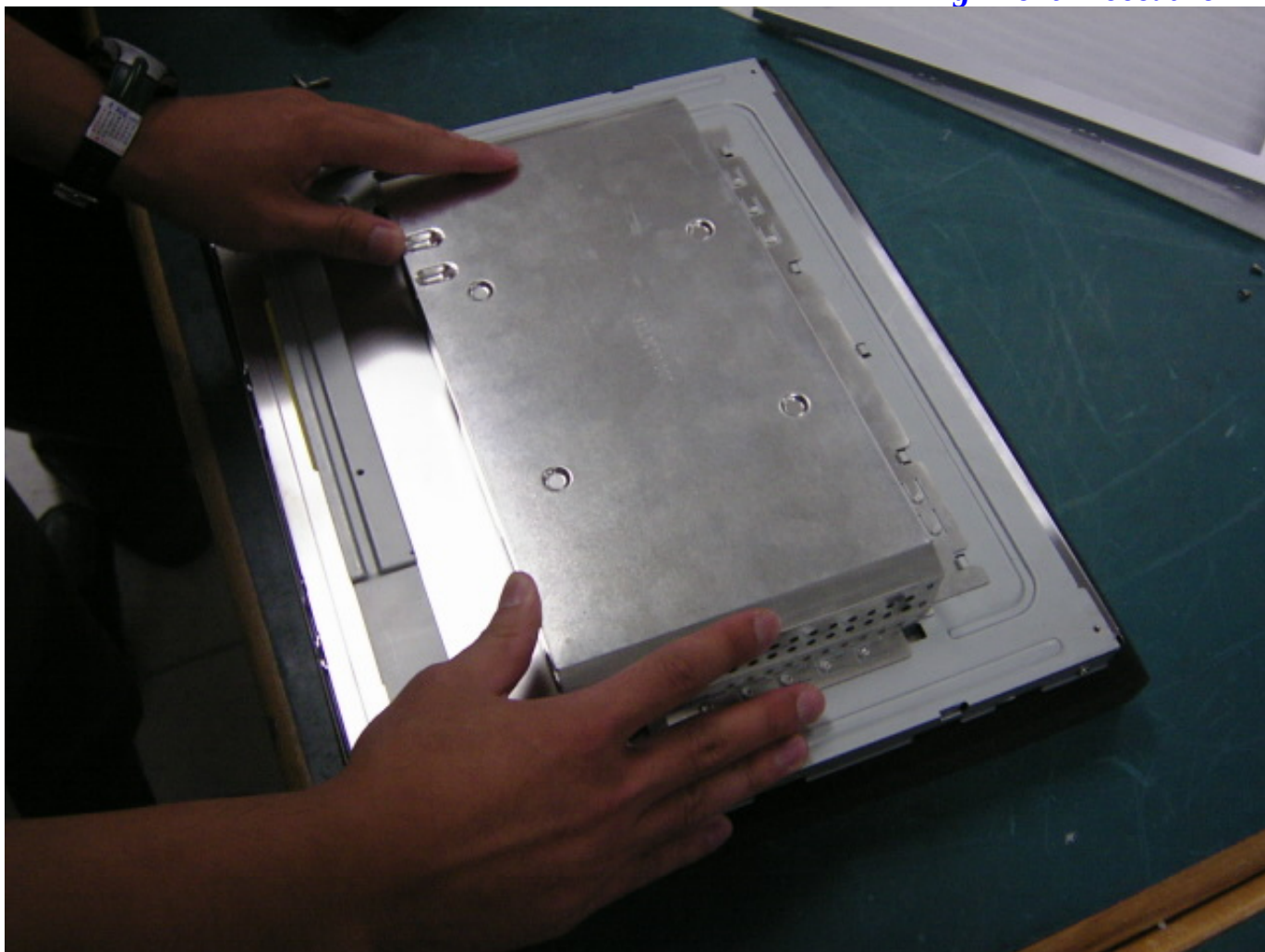
Add one screw



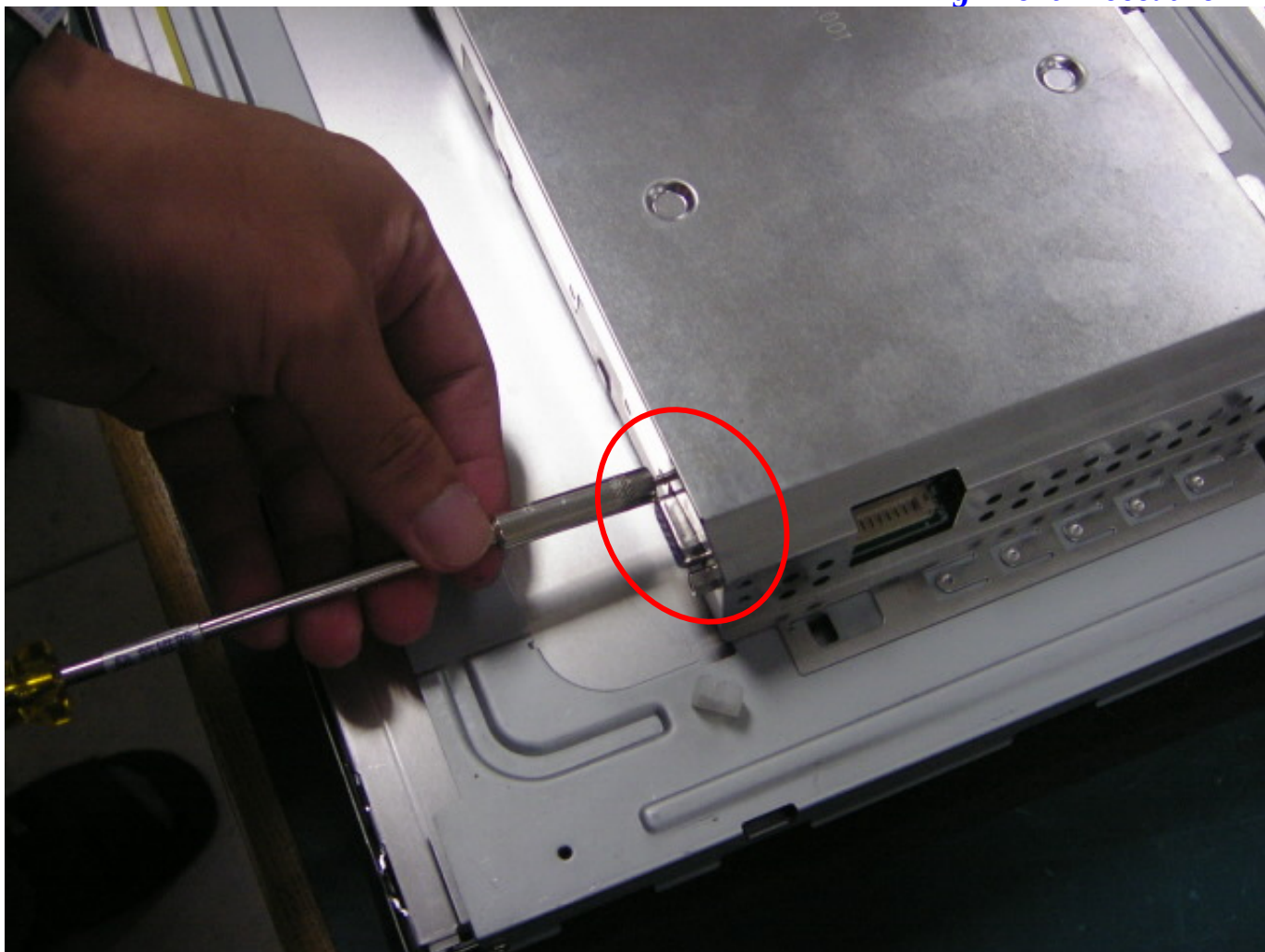
Add 5 screw



Assembly main shielding and main BKT

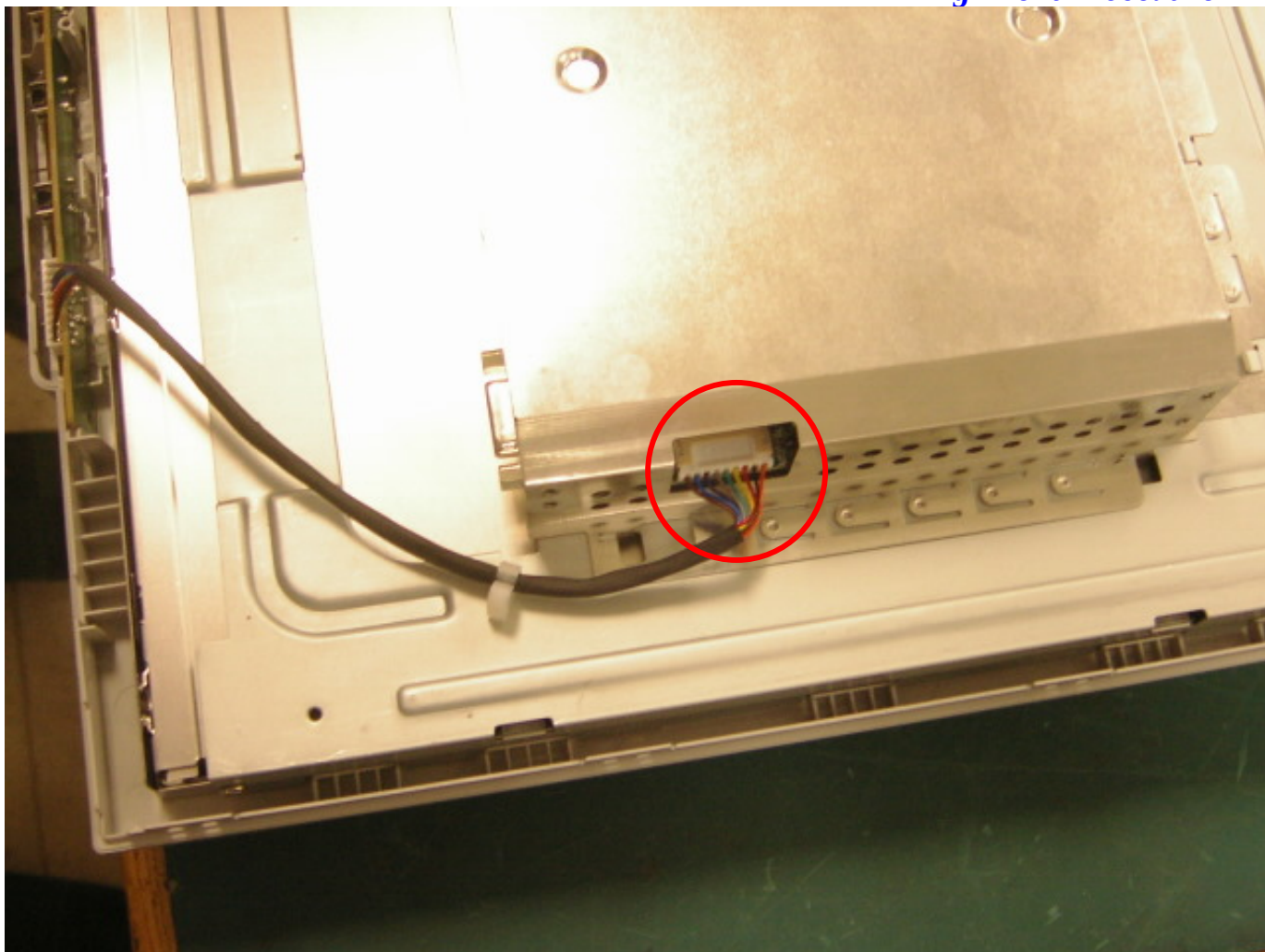


Add 2 screw

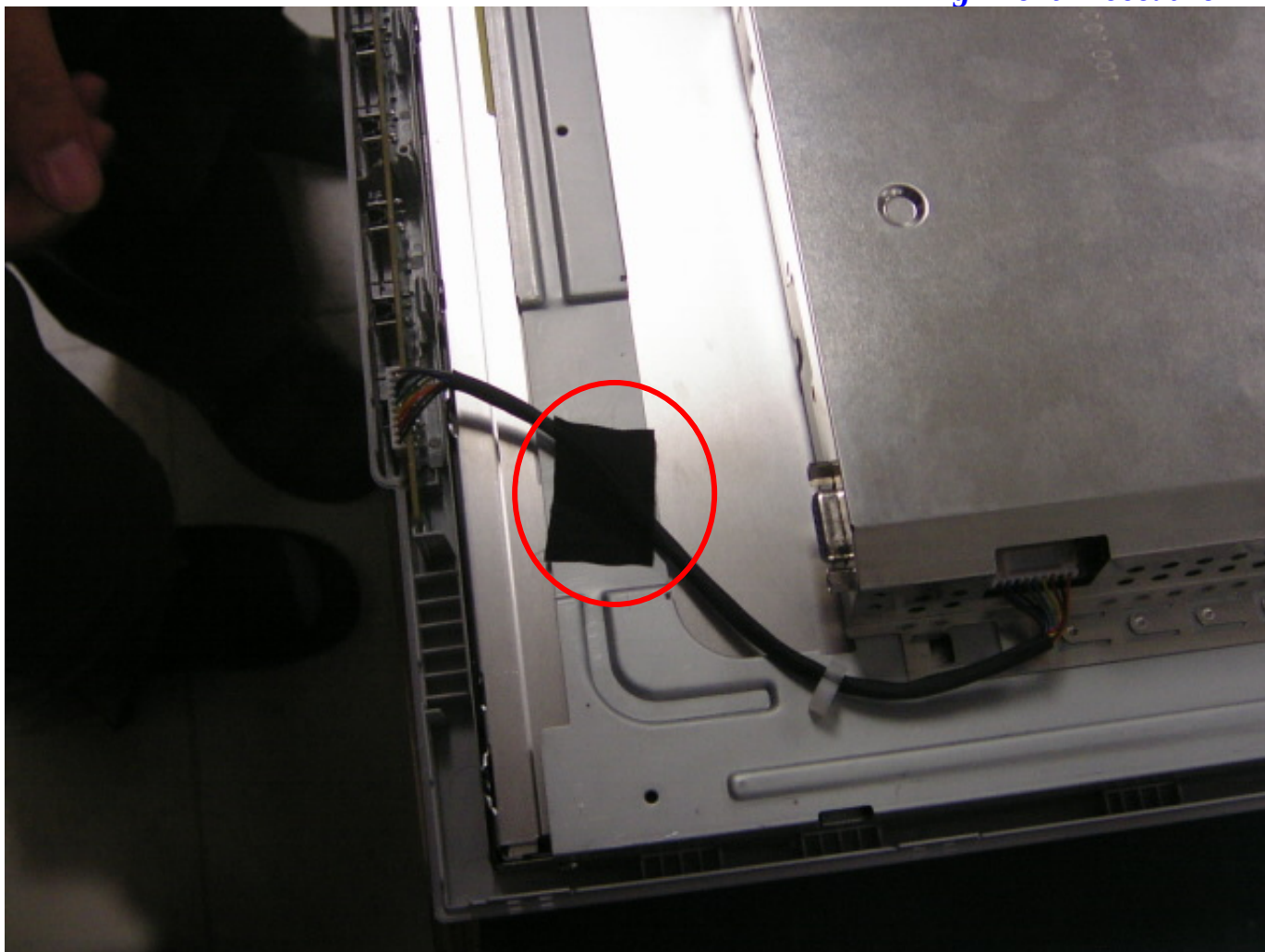


Assembly control board wire and IF board





Add one tape



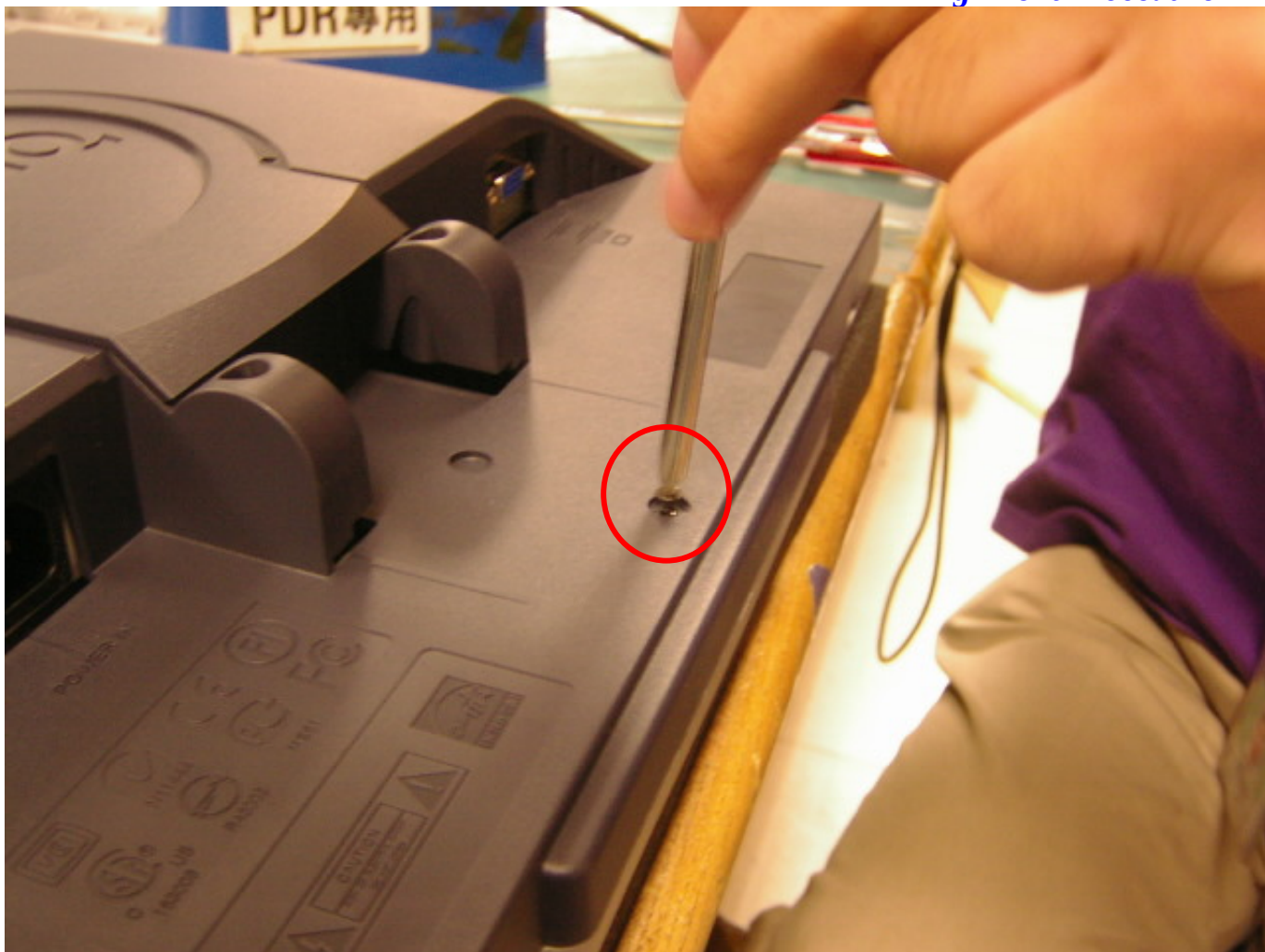
Assembly Bezel and Rear Cover



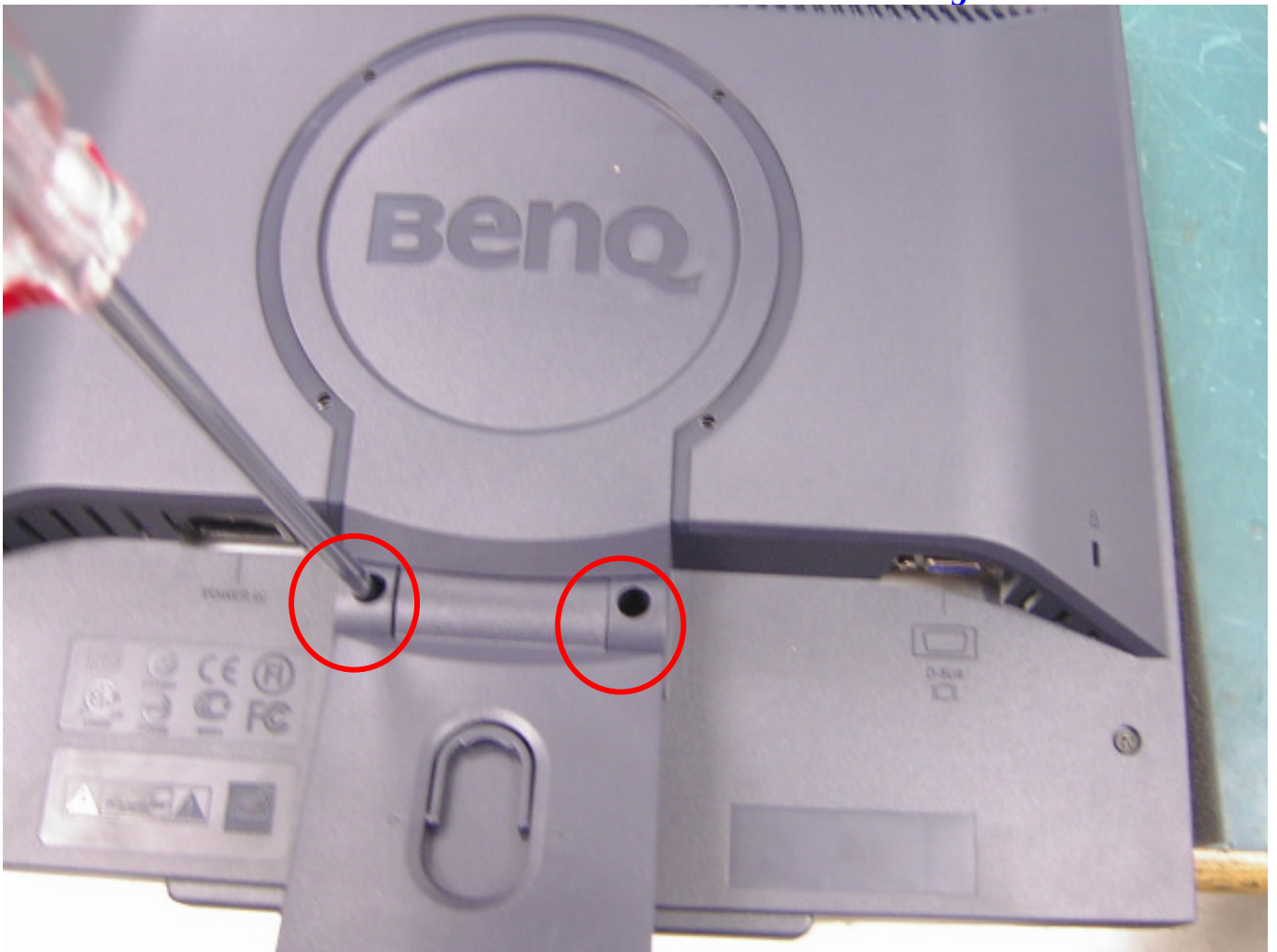
Add 4 screw



Add 1 screw



Assembly Base and Rear cover



Finished



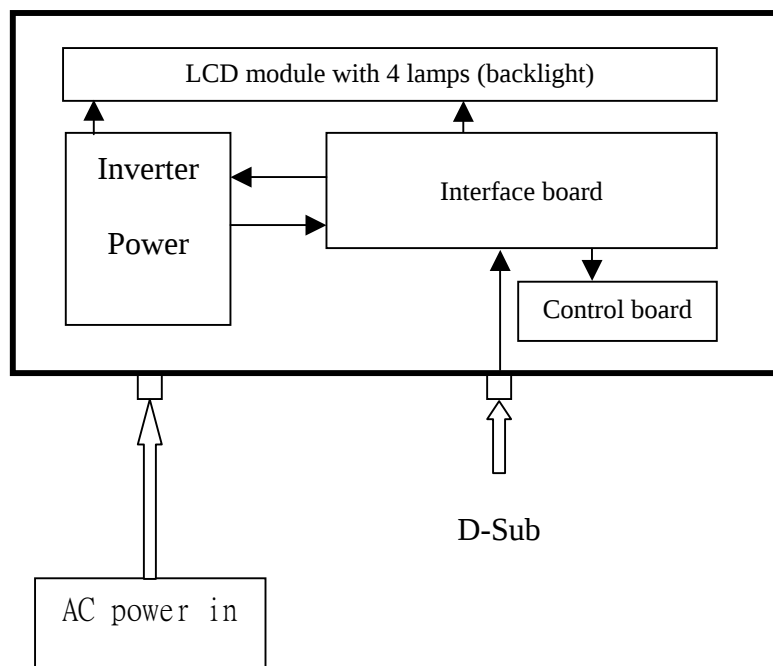


I. Introduction:

The Q7T4 is a 17" SXGA (1280x1024) , 16.2M colors(R, G, B 6-bit data+FRC data) TFT LCD monitor. It's an analog only interface LCD monitor with a 15 pins D-sub signal cable. it's compliant with VESA specification to offer a smart power management and power saving function. It also offers OSD menu for users to control the adjustable items and get some information about this monitor, and the best function is to offer users an easy method to set all adjustable items well just by pressing one key, we called it "Auto key" which can auto adjusting all controlled items. Q7T4 also offer DDC2 function to meet VESA standard.

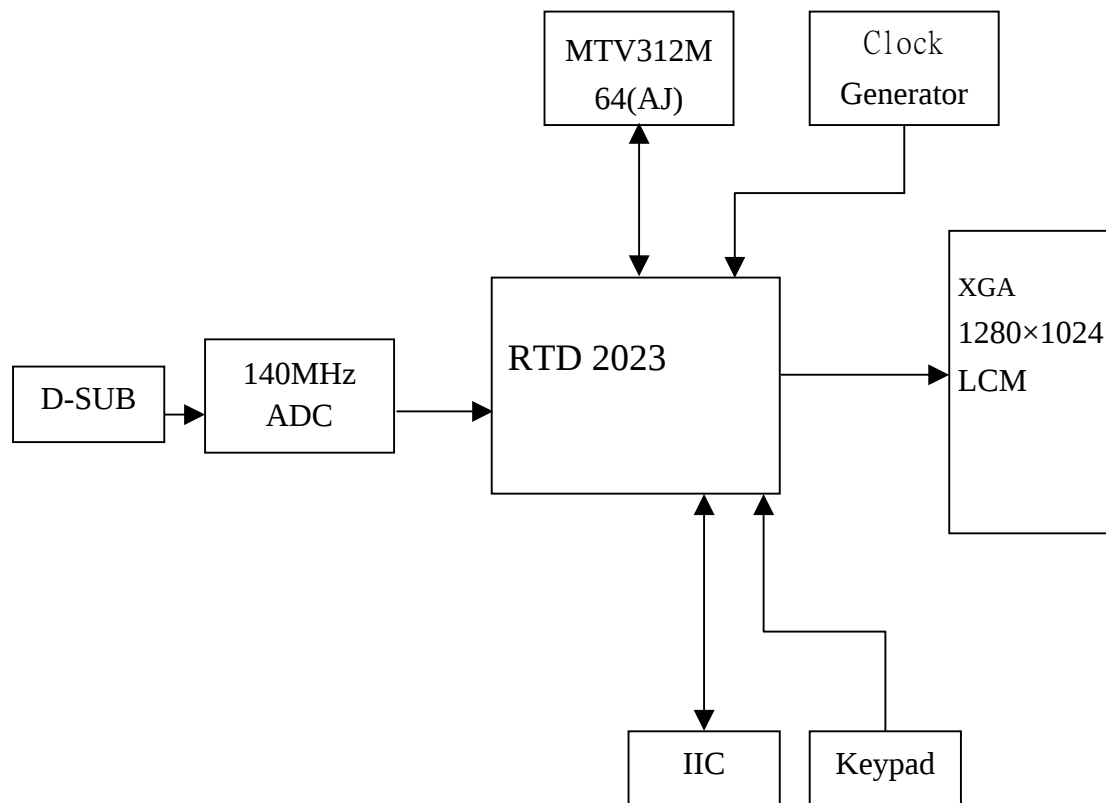
II. Block diagram

The Q7T4 consists of a LCD module with 4 lamps, an power board, a control board ,and a interface BD. The block diagram is shown as below.



III. Circuit operation theory:

A-1.) Interface board diagram:

**(a) Circuit operation theory:**

A basic operation theory for the interface board is to convert input signal into digital RGB . Analog RGB signal is converted to digital signal through ADC. The microprocessor RTD2023 receives video data and optimizes the image automatically. It also supports 16 color from a 64k palette bitmap OSD, and keypad controlling. The output data are sent to LCD module.

(b) IC introduction:

- 1.) DDC (Display Data Channel) function: We use DDC IC to support DDC/2B function. DDC data is stored in 24C04(EEPROM). Those data related to LCD monitor specification. PC can read them by “SDA” and “SCL” serial communication for I²C communication for DDC2B.
- 2.) RTD2023 IC: There are triple ADC, LVDS transmitter ,Scaling, and OSD functions in the RTD2023 IC. Scaling IC is revolutionary scaling engine, capable of expanding any source resolution to a highly uniform and sharp image, combined with the critically proven integrated 8 bit triple-ADC and patented Rapid-lock digital clock recovery system. It also

support detect mode and DPMS control.

- 3.) MTV312M64: To store the source code which is accessed by MCU to run program.
- 4.) EEPROM: We use 24C04 to store all the adjustable data and user settings. And use 24C02 to store DVI EDID data.

A-2.) Control board introduction:

There are 6 keys for user's control which includes "Power", "Enter", "Up/Plus", "Down/Minus", "Exit", and "iKey". The following descriptions are the introduction of these keys.

- (1) Power key: to turn/off power of monitor
- (2) "Enter" key: to enter sub-menus or select items.
- (3) "Up/Plus" key: to select previous and to increase adjustment
- (4) "Down/Minus" key: to select next and to decrease adjustment
- (5) "Exit" key: to back to previous menu, or leave OSD (auto save)
- (6) "iKey": to perform auto adjustment
- (7) **LED**: It indicates the DPMS status of this LCD monitor; green light means DPMS on (Normal operating condition). Amber light means DPMS off (Powersaving).

A-3.) Power board diagram:

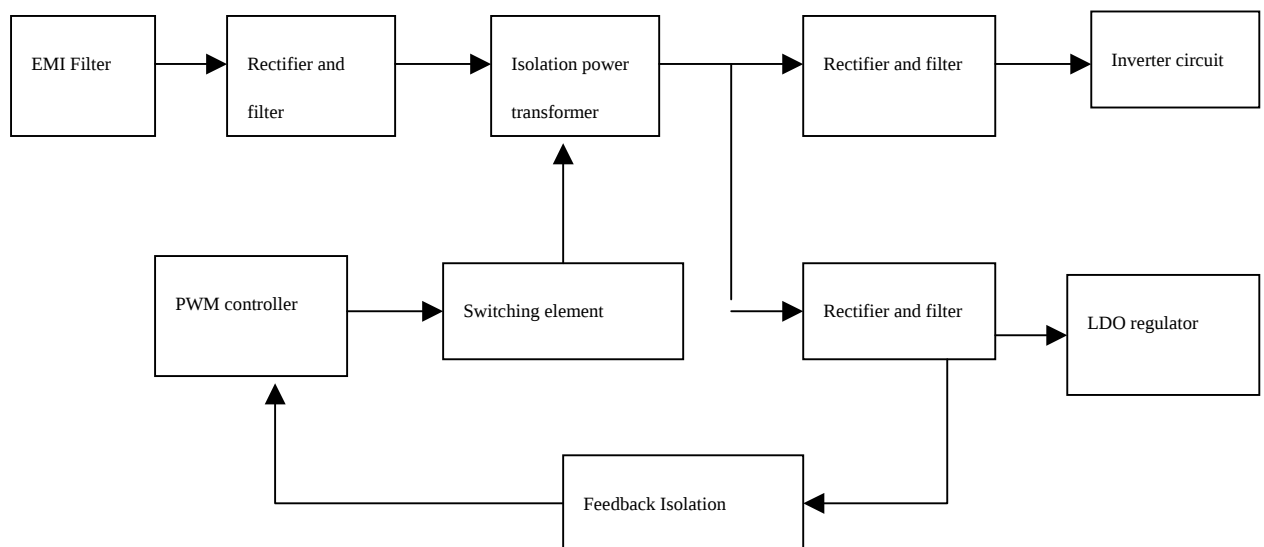


Fig.1

#1 EMI Filter

This circuit (fig. 2) is designed to inhibit electrical and magnetic interference for meeting FCC, VDE, VCCI standard requirements.

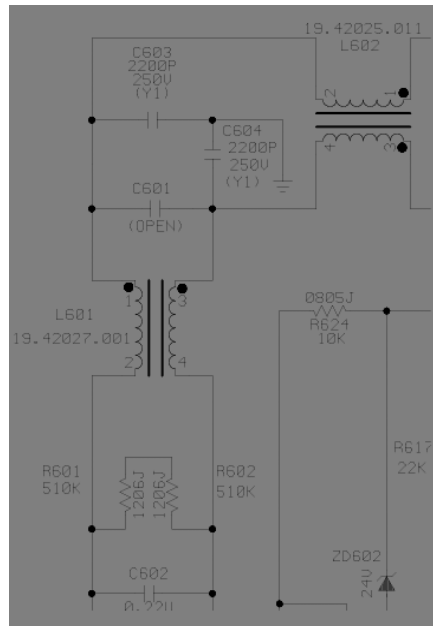


Fig. 2

#2 Rectifier and filter

AC Voltage (90-264V) is rectified and filtered by BD601, C605 (See Fig 3) and the DC Output voltage is $1.4 \times (\text{AC input})$. (See Fig.3)

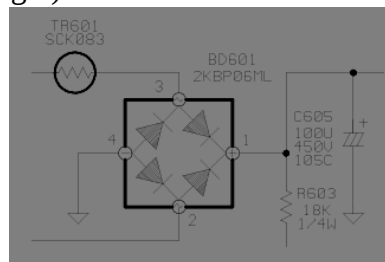


Fig. 3

#3 Switching element and Isolation power transformer

When the Q601 turns on, energy is stored in the transformer. During Q601 turn-off period, the stored energy is delivered to the secondary of transformer. R607, C607 and D601 is a snubber circuit. R615 is current sense resistor to control output power. (See Fig.4)

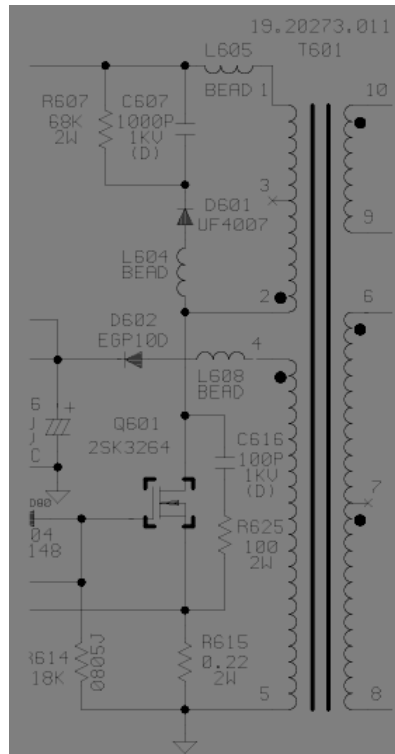


Fig. 4

#4 Rectifier and filter

D701 and C703 are to produce DC output. L701 is used to suppress high Frequency switching spikes. (See Fig.5)

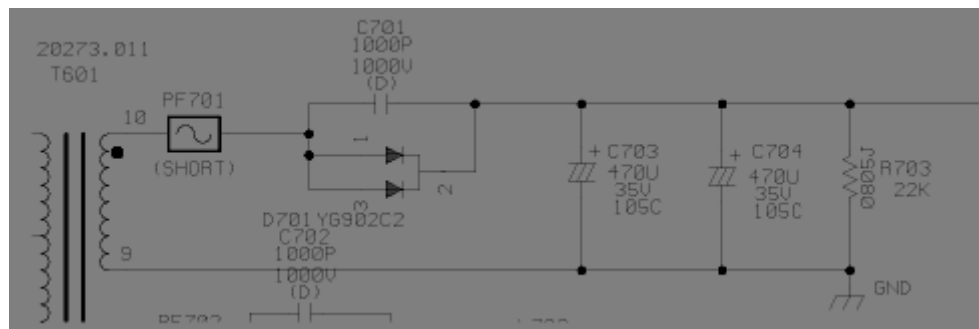


Fig. 5

#5 PWM Controller

The PWM controller NCP1200A implements a standard current mode architecture. With an internal structure operating at a fixed 40KHz. Where the switch time is dictated by the peak current set-point. When the current set-point falls below a given value. The output power demand diminishes, the IC automatically enters the so-called skip cycle mode and provides excellent efficiency.

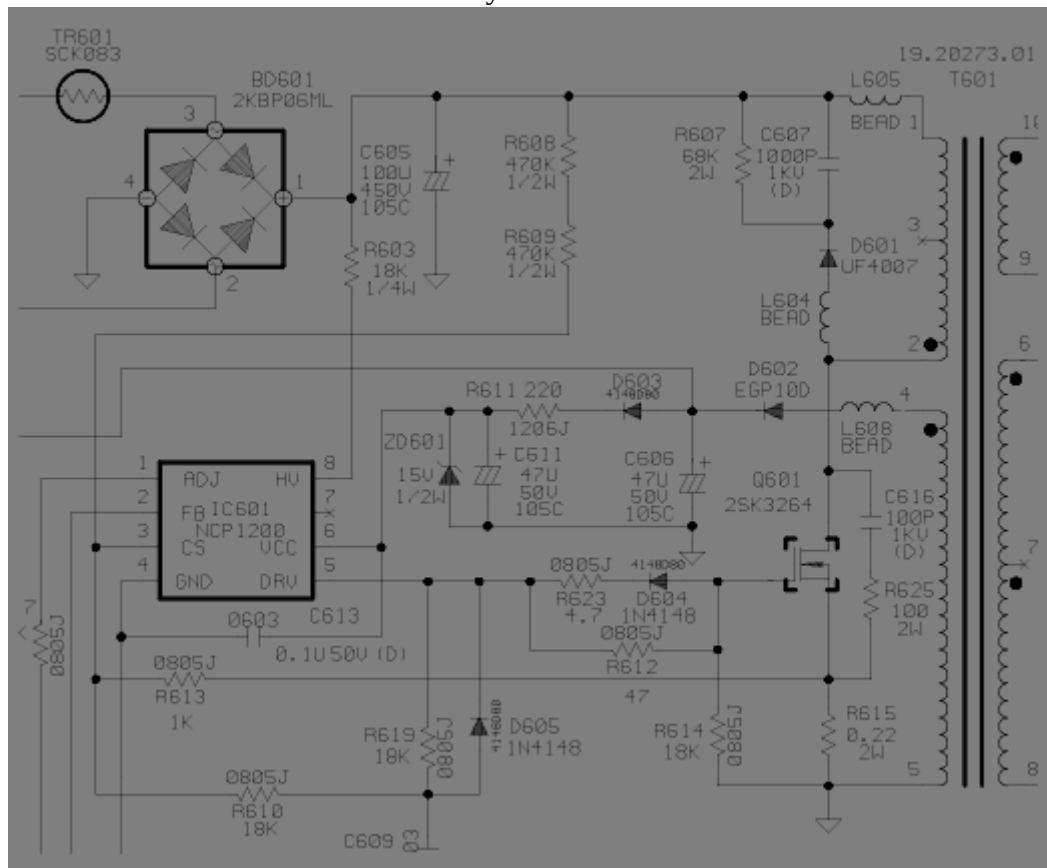


Fig. 6

#6 Feedback circuit

PC123 is a photo-coupler and TL431 is a shunt regulation. They are used to detect the output voltage change and be the primary and secondary isolation. When output voltage changes, the feedback voltage will be compared and duty cycle will be decided to control the correct output voltage. (See Fig.7)

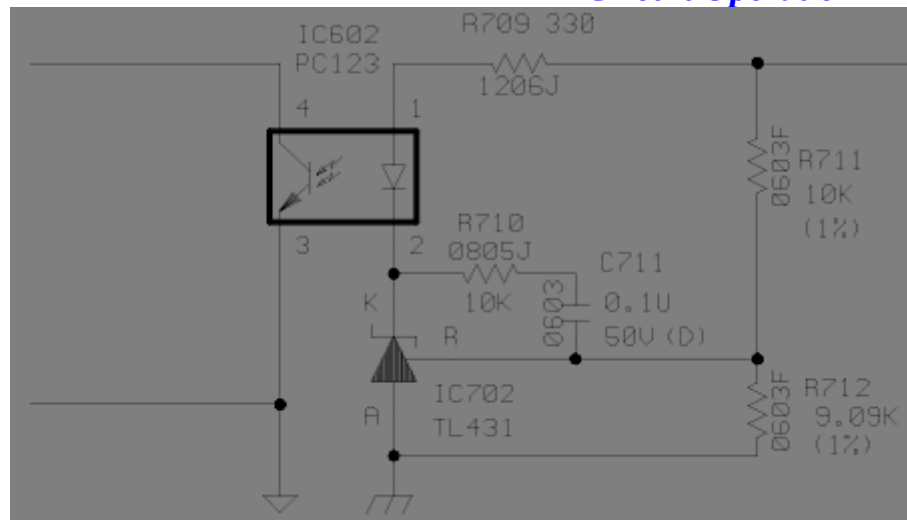


Fig. 7

A-3.) Control board introduction:

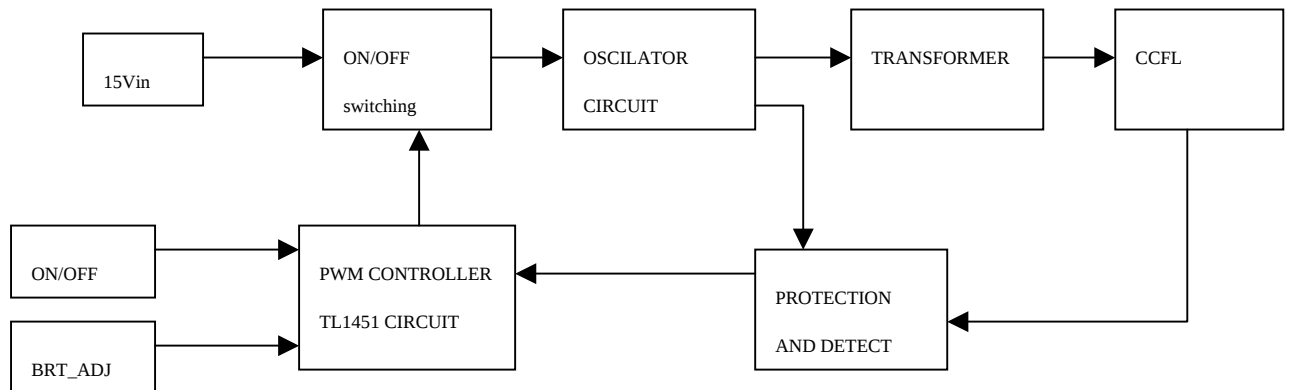
The main parts of the control board are a push button, and a LED.

(a) Push button: It's a simple switch function, pressing it for "ON" to do the auto adjustment function, releasing it for "OFF" to do nothing.

(c) LED: It indicates the DPMS status of this LCD monitor; green light means DPMS on (Normal operating condition). Amber light means DPMS off (Power off condition).

A-4.) Inverter diagram:

1. Block Diagram:



2. General Specification

Input Voltage: 15V

Input Current: 2A max.

ON/OFF Voltage: 5V

PWM Duty: 5V/50KHz

Output Requirement:

Max. Output Current: 7.5mA

Min. Output Current: 3.3mA

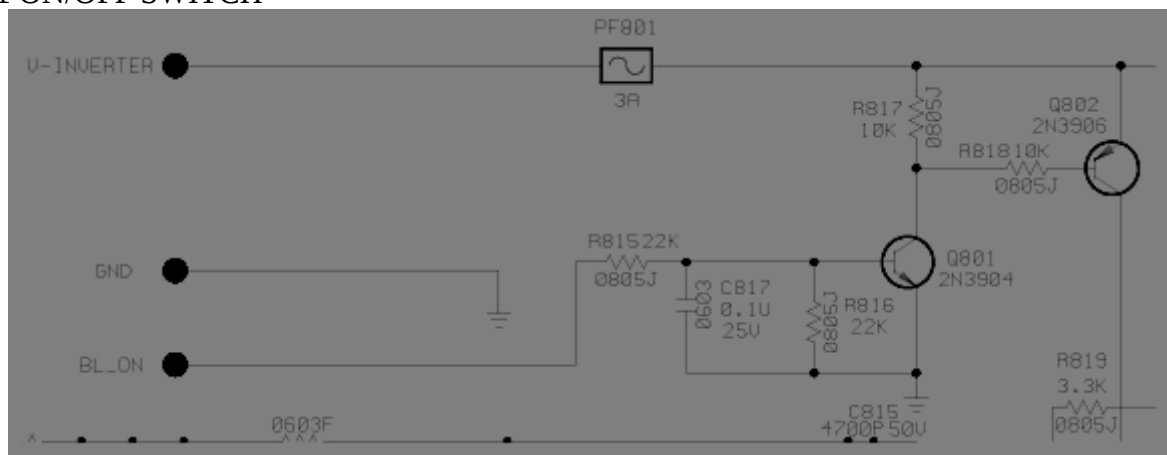
Lamp Working Voltage: 660Vrms

Open Lamp Voltage: 1500Vrms

Frequency: 50KHz

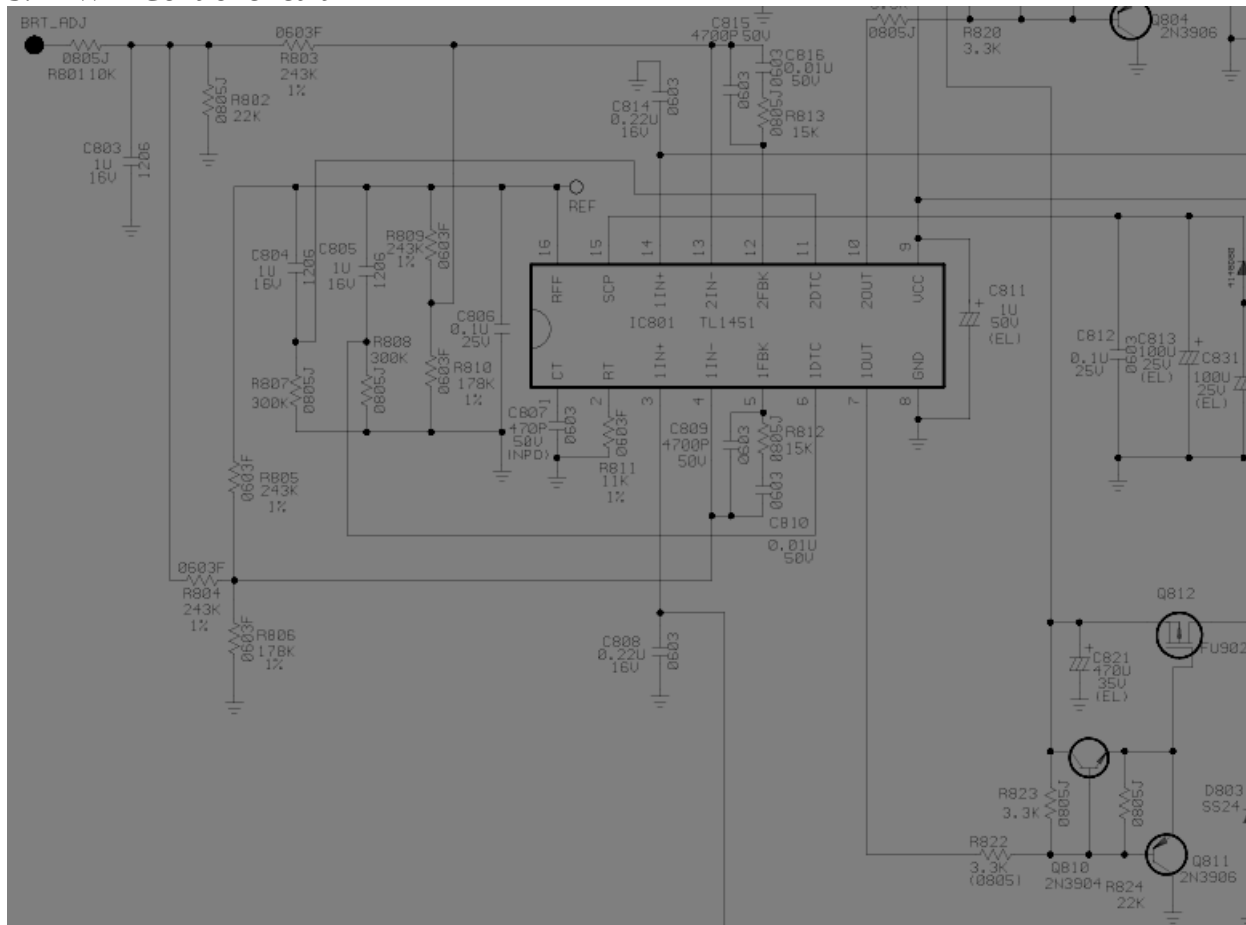
3.Circuit Operation Theorem

3.1 ON/OFF SWITCH

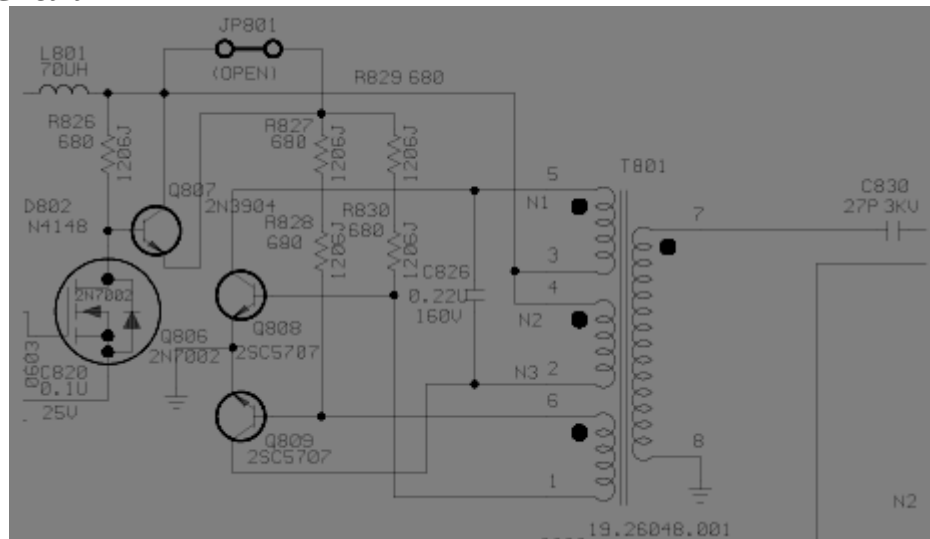


The turn-on voltage was controlled by R815 and R816. The inverter was turned on or off by the switching transistors Q801 and Q802.

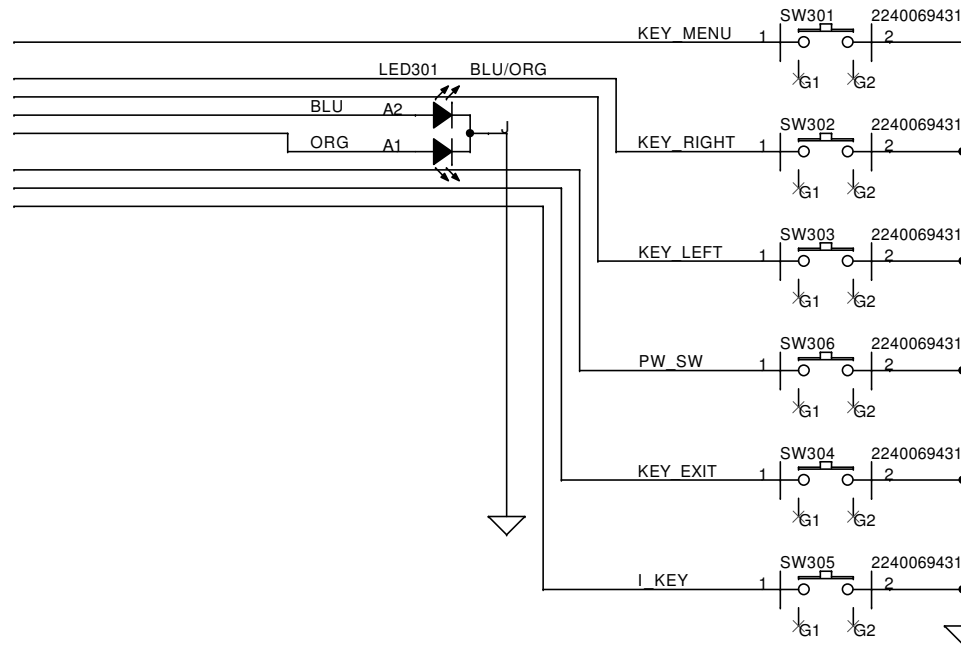
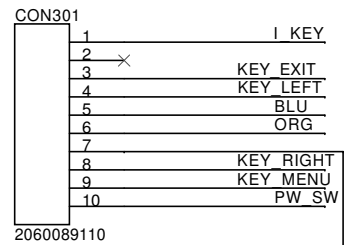
3.2 PWM Control circuit



TL1451 is a dual PWM controller. C807 and R811 decide the working frequency. BLT_ADJ signal is from control board, control pulse width then decide how much energy delivery to CCFL also decide CCFL brightness. Q810 and Q811 be the buffer to rise the drive capability and the totem poles circuit can improve a capable of driving for Q812. C813 decide the striking time delay.

3.3 Oscillator Circuit

Royer circuit uses the characteristic of transformer saturation to oscillate. When the DC power inject, Q808 or Q809 will turns on, and the current I_c increases. After a period, the transistor will leave the saturation status and V_{ce} increase. The result causes the voltage of primary coil get lower. Finally the transistor turn off, and another transistor turn on. These statuses are repeated and the pin7 and pin8 of T801 will get a sine wave to turn on CCFL.



LED use 06.3N5YG.14X;
Key use 22.40069.431

Benq Corporation				
Project Code 99.L1C72.001		Model Name Q7T4		OEM/ODM Model Name NA
Title CTRL BOARD				
Size <Size>	PCB P/N 48.L1C03.S02	PCB Rev. S02	Document Number 99.L1C72.000-C3-304-002	Rev. 0
Date: Thursday, August 26, 2004			Sheet 1 of 1	
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