NEC

COLOR MONITOR

SERVICE MANUAL

Better Service

Better Reputation

Better Profit

NEC/MITSUBISHI

NEC-MITSUBISHI ELECTRIC VISUAL SYSTEMS

⚠ W A R N I N G

The SERVICE PERSONNEL should have the appropriate technical training knowledge and experience necessary to :

· Be familiar with specialized test equipment, and
· Be careful to follow all safety procedures associated with high voltage CRT circuit designs to minimize danger to themselves and their coworkers.

To avoid electrical chocks, this equipment should be used with an appropriate power cord and be connected only to a properly grounded AC outlet

This equipment utilized a micro-gap power switch. Turn off the monitor by first pushing the front panel power switch. Next, remove the power cord from the AC outlet.

To prevent fire or shock hazards, do not expose this unit to rain or moisture

⚡ This symbol warns the personnel that un-insulated voltage within the unit may have sufficient magnitude to cause electric shock.

⚠ This symbol alerts the personnel that important literature concerning the operation and maintenance of this unit has been included.
Therefore, it should be read carefully in order to avoid any problems.

⚠ PRODUCT SAFETY CAUTION

1. When parts replacement is required for servicing, always use the manufacturer's specified replacement.
2. Comply with all caution and safety-related notes on the product display chassis and picture tube.
3. When replacing the component, always be certain that all the components are put back in the place.
4. When servicing display monitor unit, it is required that the provided lead dress is used in the high voltage circuit area.
5. It is also recommended that shatter proof goggles are worn, when removing, installing and handling the picture tube. People not equipped with the proper precautionary measures mentioned should keep the picture tube away from body while handling.
6. As for a connector, pick and extract housing with fingers properly since a disconnection and improper contacts may occur, when wires of the connector are led.
7. Use a proper screwdriver. If you use screwdriver that does not fit, you may damage the screws.

CONTENTS

1 Precautions

Follow these safety and servicing precautions to prevent damage and to protect against potential hazards such as electrical shock and X-rays.

1.1 Safety Precautions

1-1-1 Warnings

1. For safety purpose, do not attempt to modify the circuit board, and always disconnect the AC power before performing servicing on the monitor.
2. Operation of the monitor outside its cabinet or with the cover removed involves the risk of shock hazard. Repair work on the monitor should only be attempted by service personnel who are thoroughly familiar with all necessary safety precautions and procedures for working on high voltage equipment.
3. Do not lift the CRT by the neck. After completely discharging the high voltage anode, handle the CRT only when wearing shatterproof goggles. Try to keep the CRT away from the body during handling.
4. High voltage should always be kept at the rated value, no higher. Only when high voltage is excessive are X-rays capable of penetrating the shell of the CRT. Operation at high voltages may also cause failure of the CRT or high voltage circuitry.
5. The CRT is especially constructed to limit X-ray emission to 0.5mR/HR at 300 microamperes anode current. To ensure continued X-ray protection, replace the CRT with only the same or equivalent type as the original, and adjust the anode's voltage to the designated maximum rating, never to exceed.

1-1-2 Safety Checks

Before returning the monitor to the user, perform the following safety checks:
1. Inspect to make certain that each lead dress is not pinched or that hardware is not lodged between the chassis and other metal parts in the monitor.
2. Inspect all protective devices such as nonmetallic control knobs, insulating materials, cabinet backs, adjustment and compartment covers or shields, isolation resistor-capacitor networks, mechanical insulators, etc.
3. AC Leakage Current Check
   Always perform the AC Leakage Current Check on the exposed metal parts, including metal cabinets, screwheads and control shafts, as follows:
   a) Plug the AC line cord directly into a rated AC outlet. Do not use an isolation transformer during the check.
   b) Use an AC voltmeter with at least 5000 ohms per volt sensitivity as follows:
      Connect a 1500 ohms, 10 watt resistor paralleled by a 0.15uF AC capacitor in series with all exposed metal cabinet parts and a known earth ground, such as electrical conduct or electrical ground connected to earth ground, as shown in the Figure 1-1. Measure the AC voltage across the combination of resistor and capacitor.

Figure 1-1. Set Up For AC Leakage Current Check

To known Earth ground

To exposed metal Cabinet part

0.15ufd

1500 ohm 10 watt

1
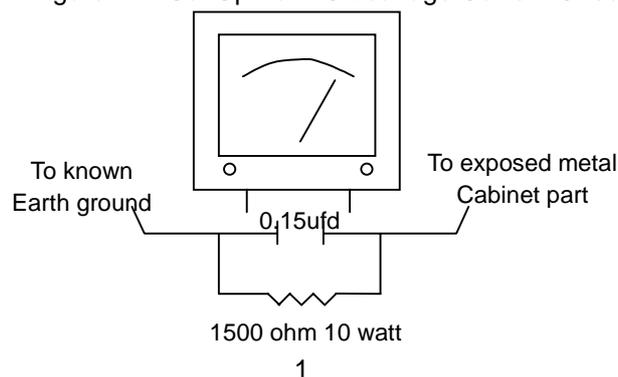
c) Reverse the AC plug at the AC outlet and repeat the steps for AC voltage measurements for each exposed metal part.

d) Voltage reading must not exceed 0.3 volts RMS, equivalent to 0.2 milliampere AC. Any value exceeding this limits ill constitute a potential shock hazard and must be corrected immediately

1-1-3 Product Safety Notices

Many electrical and mechanical parts in this chassis have special safety-related characteristics which are often not evident from visual inspection. The protection afforded by them may not be obtained by replacing them with components rated for higher voltage, wattage, etc. Before replacing any of these components, consult the Recommended Spare Parts List given at the end of this manual. Any of the replacements that do not provide the same safety characteristics may result in shock, fire, X-ray emission or other hazards.

1.2 Servicing Precautions

Warning: An electrolytic capacitor installed with the wrong polarity might explode.

Caution: Before performing servicing covered by this service manual, read and follow the Safety Precautions section of this manual.

Note: If unforeseen conflict between the following servicing precautions and of the safety precautions, always follow the safety precautions

1. Follow closely the servicing precautions printed on the monitor cabinet and chassis.
2. Always unplug the AC power cord from the AC power source before removing or installing any component or assembly, disconnection PCB plugs or connectors and connecting a test component in parallel with a capacitor.
3. When replacing parts or circuit boards, clamp the lead wires around the unit before soldering.
4. When replacing a high wattage resistor (>0.5W metal oxide film resistor) in the circuit board, keep the resistor about 1 cm (1/2 inch) away from the circuit board.
5. Keep wires away from the high voltage or high temperature components.
6. Keep wires in their original positions so as to minimize interference.
7. Always connect a test instrument's ground lead to the instrument chassis ground before connecting the positive lead; always remove the instrument's ground lead last.

SPECIFICATION

Monitor Specifications	MS75F/AS75F Monitor	Notes
Picture Tube Diagonal:	43cm(17inch)	90° deflection, 0.25mm grille pitch, medium
Viewable Image Size:	40.6cm(16.0inch)	short persistence phosphor, aperture grille CRT,
Radius:	50000mm	multi-layered, anti- static screen coating, dark screen.
Input Signal Video:	ANALOG 0.7Vp-p/75 Ohms	
Sync:	Separate sync. TTL Level	
	Horizontal sync. Positive/ Negative	
	Vertical sync. Positive/Negative	
Display Colors Analog input:	Unlimited number of Colors	Depends on display card used.
Synchronization Horizontal:	31 kHz to 70 kHz	Automatically
Range Vertical:	55 Hz to 120 Hz	Automatically
Resolutions Supported Resolution based on horizontal and vertical frequencies only	640×480 @ 60 to 120 Hz 800×600 @ 55 to 110 Hz 832×624 @ 55 to 106 Hz 1024×768 @ 55 to 87 Hz …… 1152×870 @ 55 to 77 Hz 1280×1024 @ 55 to 66 Hz	Some systems may not support all modes listed. NEC cites recommended resolution at 85 Hz for optimal display performance.
Active Display Area Horizontal:	310mm	Dependent upon signal timing used,
(Factory Setting) Vertical:	232mm	and does not include border area.
Active Display Area	325mm	Dependent upon signal timing used,
(Full Scan)	243mm	and does not include border area.
Power Supply	AC 100 - 240V, 50 / 60Hz	
Current Rating	1.8A @ 100 - 240V	
Dimensions	$403(W) \times 420(H) \times 420(D)$ mm	
Weight (Net)	16.7 kg	
Environmental Considerations Operating Temperature: Humidity: Altitude: Storage Temperature: Humidity: Altitude:	0° C to + 35° C 30% to 80% 0 to 3000 m -20° C to + 60° C 10% to 90% 0 to 13700 m	

NOTE: Technical specifications are subject to change without notice.

PIN ASSIGNMENT
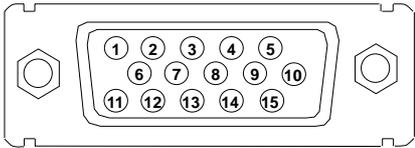
PIN NO.	Mini D-SUB-15P
1	RED
2	GREEN
3	BLUE
4	GROUND
5	GROUND
6	GROUND
7	GROUND
8	GROUND
9	NO PIN
10	GROUND
11	GROUND
12	SDA
13	H.SYNC.
14	V.SYNC.
15	SCL

CONTROLS

① "SELECT": To display OSM windows, mode changes, or activate the degaussing or OSM window color selection.

② CONTROL BUTTON (-,+): Without OSM — Adjust the contrast.

                                  With OSM — Select icon and adjust.

③ "RESET": Return the adjustment item to the factory setting.

④ Power indicator LED: The LED indicate Power management state.

⑤ POWER SWITCH: Push/push to turn the monitor on and off.

⑥ Power input: To connect with the power cord.

⑦ Signal input with the captive cable: To connect with personal computers' analogue RGB output.

      ① ②③   ④⑤   ① ②③   ④⑤

              ⑥   ⑦
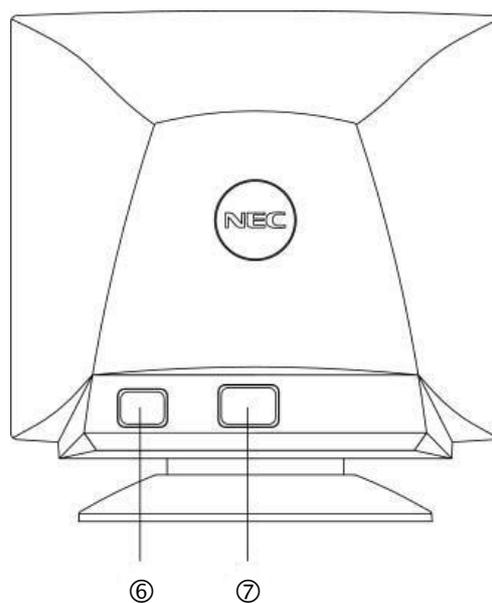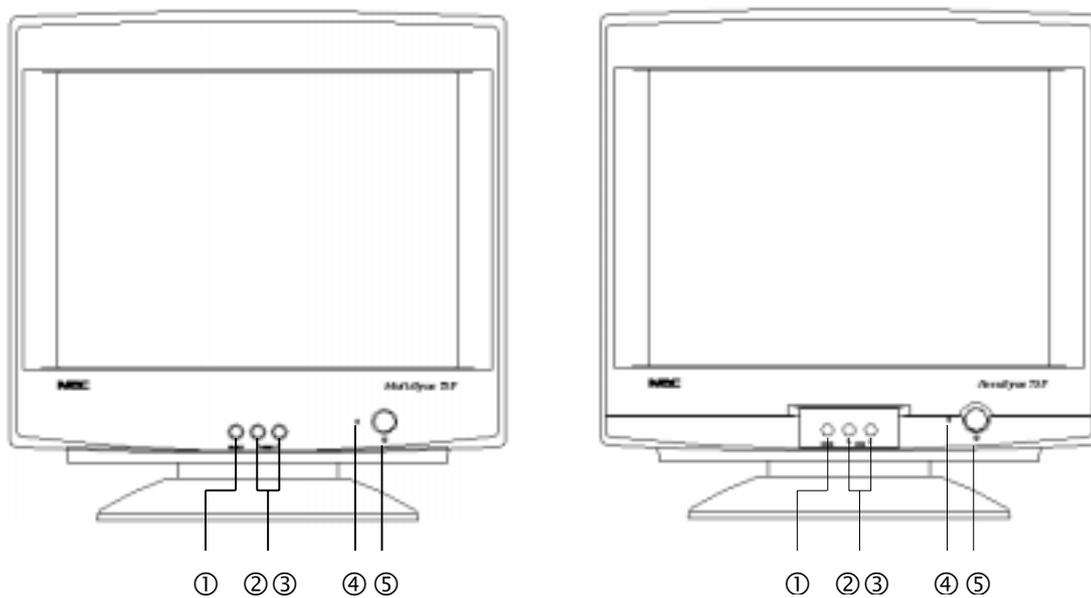
OSD OPERATION

_{*m*}ℙFUNCTION VALUE ADJUSTMENT

If OSD off, press UP key to increase Contrast value,

press DOWN key to decrease Contrast value.

press SELECT key to display OSD and Brightness icon is active (Fig. 1)
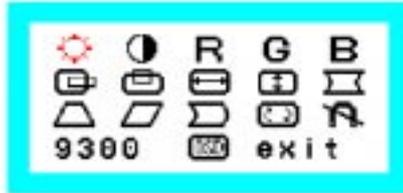
Fig. 1

Press UP key or DOWN key to select icon right or left and the selected icon display red color
If selected icon is DAC out, press SELECT key will display DAC value bar (fig 2)

Fig. 2

User can press UP key or DOWN key to adjust DAC value.
Press SELECT key to close DAV value bar and UP key or DOWN key to select the other icon.

_{*m*}ℙSPECIAL FUNCTION OPERATION

1. Degauss Active

If selected icon is degauss icon, press SELECT key to activate degauss (Fig. 3).

Fig. 3

2. Color Temperature Select

If selected icon is 9300/7500/6500/user color icon, press SELECT key to select Color Temperature for 9300, 7500, 6500 or user defined (Fig 4 – 7).

Fig. 4

Fig. 5

Fig. 6
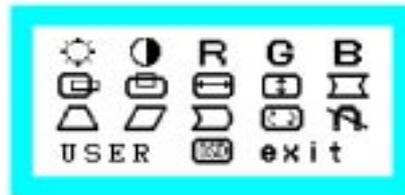
Fig. 7

3. OSD Color Select

If OSD icon is selected, press SELECT key to change OSD color, there are three kinds of OSD color can be selected (Fig. 8 – 10).

Fig. 8

Fig.9

Fig. 10

Background	white	blue	black
Action icon	red	red	red
Normal icon	black	white	white
Value bar	blue	yellow	green

4. SYNC OSD Display

If EXIT icon is selected, press SELECT key to close OSD menu and then display sync information for 2 sec. This sync information will not be close until release SELECT key (Fig. 11).

```
Hor_sync 48kHz
Ver_sync 72Hz
```

Fig. 11

5. Factory mode

Press SELECT key + UP key and power on, system enter factory mode.

OSD will display "FA" to indicate in factory mode (Fig. 12 – 13).

Operation of factory mode is same as normal mode except below 2 condition:

a. adjustment value is saved to user and factory area.

b. R, G, B value are saved to current color temperature.
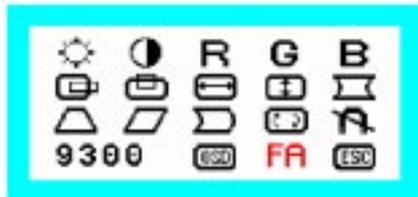
Fig. 12   **Fig. 13**

6. OSD Move Mode

Press DOWN key and power on, system enter OSD move mode, user can move OSD display position in this mode.

Press SELECT key then OSD display following figure (Fig. 14) and only 3 icons OSD H-position / OSD V-position / ESC can be selected.

Fig. 14

Function explanation

Brightness: Adjusts the overall image and background screen brightness.

Contrast: Adjusts the image brightness in relation to the background.
(Contrast control is also effective with "-, +" button even through
OSM window is not existing.)

R **Red Color Control**: Adjust the red contrast of the display.

G **Green Color Control**: Adjust the green contrast of the display.

B **Blue Color Control**: Adjust the blue contrast of the display.

Horizontal position: Moves the image horizontally left or right.

Vertical position: Moves the image vertically up or down.

Horizontal size: Increases or decreases the horizontal size of the image.

Vertical size: Increases or decreases the vertical size of the image.

Pincushion/Barrel: Increases or decreases the curvature of the sides either
inward or outward.

Trapezoid: Increases or decreases the bottom of the screen to be the same as
the top.

Parallelogram: Increases or decreases the tilt of the sides either to the left or
right.

Bow (Pincushion Balance): Increases or decreases the curvature of the sides
either left or right.

Rotation: Rotate the image.

Degauss: Select the degauss icon on "Icon select window" and push "SELECT" button. It will eliminate the stray magnetic field and correct the scan the electron beam, and will affect the purity, focus, convergence. Caution: Allow a minimum interval of 20 minutes to elapse between uses of the degauss function.

9300K Color Temperature: Select the Color Temperature icon on "Icon Select Window" and push "SELECT" button. It can be switched the different color Temperature.

OSD **OSD**: There are 3 background colors (Blue, Black, and white). These can be selected by "SELECT" button after the selection of "OSD" on "Icon select window".

exit **EXIT**: To exit the OSM window. Select EXIT on "Icon select window". Then push "SELECT" button to exit OSM window.
Note: If you do not push buttons over 10 seconds in OSM condition, the window will automatically disappear.

SERIAL NUMBER INFORMATION

Refer to the serial number information shown below.

Ex.)   SERIAL NUMBER LABEL

MODEL	MS75F/AS75F
SERIAL No.	*********
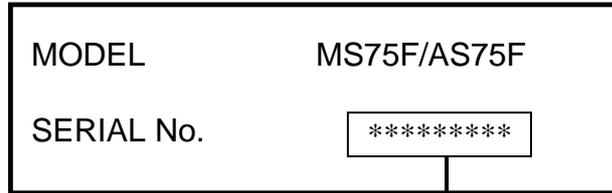
8 6 0 0 0 0 1 Y ☐

Manufactured Year :
(Last digit)

Manufactured Month :
January to September   1 to 9
October   X
November   Y
December   Z

00001 ~ on ward
(Start from 00001 ~ when
month is changed.)

Factory mark :

NEC NAGANO	"C"
NAGANO KOGYOU	"D"
TECMA	"E"
NIITAKA	"H"
GEORGIA PLANT-A	"K"
E2L	"L"
PLANT-B	"M"
UK	"T"
NPG CHINA	"Y"
SIAM NEC	"Z"

Control Code ⋯ A

DISASSEMBLY

Tilt / swivel base fixing, removing

Fixing

This product consists of the MultiSync monitor and the tilt / swivel base.

When fixing the tilt / swivel base to the MultiSync monitor, please follow the steps below.

- Push the six hooks of the tilt / swivel base into the six holes at the bottom of the MultiSync monitor.
- Then slide the tilt / swivel base forward.
- Then the latch above the tilt / swivel base engages it is secure.
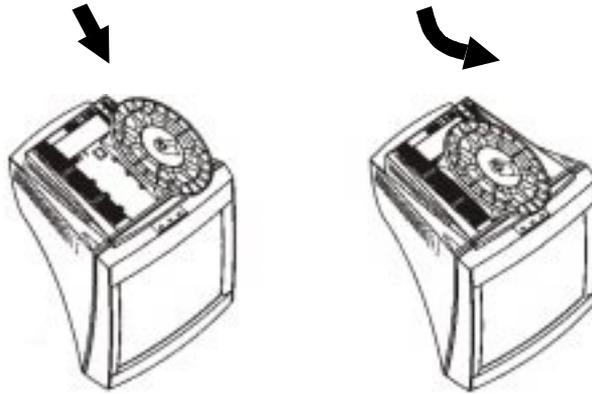
Removing

Please removing the tilt / swivel base when transporting for repair.

- Push down the latch of the MultiSync monitor and pull out the tilt / swivel base.
- Slide backward the tilt / swivel base from the front of the MultiSync monitor.
- Pull out the tilt / swivel base from the holes of the MultiSync monitor.

Cabinet Back
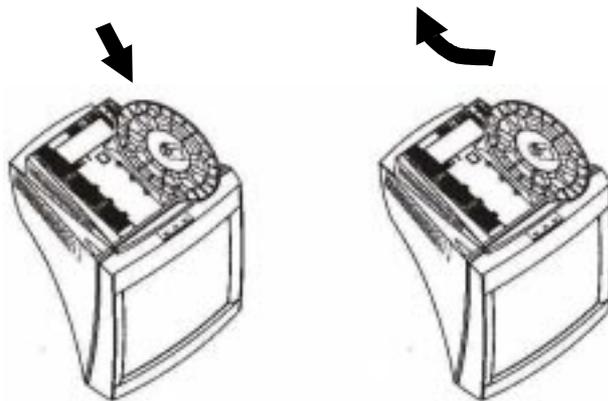
Cabinet Back

Screw "b"

1. Turn the monitor CRT face down on a clean static free surface to prevent scratching CRT face.
2. Remove the screw "b".
3. Raise the signal cable vicinity of a cabinet back and lightly hit part (figure 1 reference) of a top of the cabinet back and remove the cabinet back.

Cabinet Back

Hitting Position
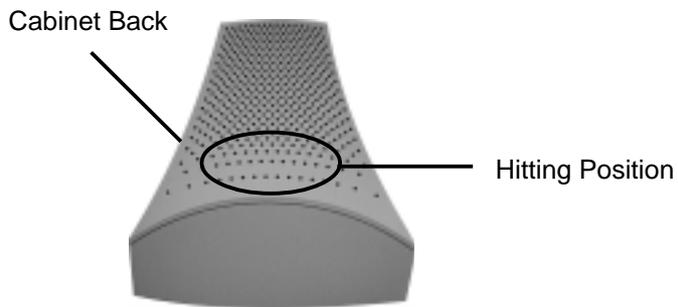
Fig. 1

MAIN BOARD and CRT BOARD

CRT BOARD ASSY

MAIN BOARD ASSY

CRT
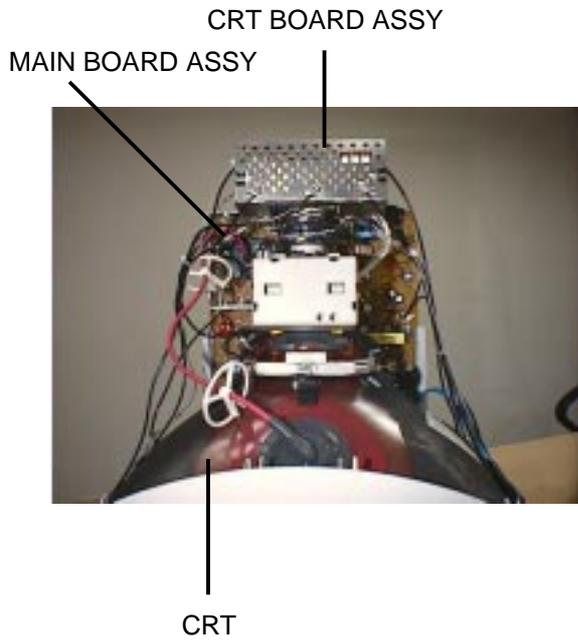
1. Unsolder the GND wire from MAIN BOARD ASSY
2. Disconnect the connector "P201", "P202", "S204" and "S205" from the CRT BOARD ASSY.
3. Disconnect the CRT BOARD ASSY from the CRT
4. Disconnect the connector "S301" and "P102" from the MAIN BOARD ASSY.
5. Remove the Anode Cap from the CRT.
   NOTE:
   Carefully discharge the CRT anode by shorting it to ground before removing Anode Cap.
6. Lift up the MAIN BOARD ASSY from the Cabinet Front ASSY.

ADJUSTMENT SPECIFICATIONS

TABLE OF CONTENTS

(1)   Adjustment & Inspection Tools:

(A) Color Analyzer   (B) Signal Generator CHAROMA 2135
(C) Multi Meter   (D) Hi-Voltage Probe
(E) Convergence Meter   (F) Demagnetizer
(G) Power Meter   (H) Automatic Alignment System
(I) DDC write & inspection system

(2)   TIMING TABLE(Factory Mode –20 MODES)

MODE	RESOLUTION	H-SYNC EREQ.	V-SYNC FREQ	H . POLARITY	V . POLARITY
1	VGA350	31.5KHz	70Hz	+	-
2	VGA400	31.5kHz	70Hz	-	+
3	VGA480	31.5KHz	60Hz	-	-
4	MAC 35K	35.0KHz	66Hz	-	-
5	800*600(56)	35.2KHz	56Hz	+	+
6	8514A	35.5KHz	87Hz	+	+
7	640*480(75)	37.5KHz	75Hz	-	-
8	EVGA400	37.8KHz	84Hz	-	+
9	800*600(60)	37.8KHz	60Hz	+	+
10	640*480	43.3KHz	85Hz	-	-
11	800*600(75)	46.8KHz	75Hz	+	+
12	1024*768(60)	48.3KHz	60Hz	-	-
13	MAC 49K	49.7KHz	74Hz	-	-
14	800*600(85)	53.6KHz	85Hz	+	+
15	1024*768(70)	56.4KHz	70Hz	-	-
16	1024*768(75)	60.0KHz	75Hz	+	+
17	640*480(120)	63.7KHz	120Hz	-	-
18	1280*1024(60)	64.0KHz	60Hz	+	+
19	800*600(100)	64.0KHz	100Hz	+	+
20	1024*768(85)	68.6KHz	85Hz	+	+

(3)   Definition for Normal Condition

(A) Input AC Voltage 110V/60HZ.
(B) Warm up time minimum 30 minutes.
(C) Full White Pattern. See (4) – (C) Aging Mode
(D) ALL VR's Adjust Center Position.
(E) CRT face to the east direction
(F) Color temp 9300K
(G) OSD I-CON [R], [G], [B] gain control bar center position in Factory Mode

(4)   Hot Key Operation

(A) Factory Mode: SELECT Key + UP (+) Key if pressed when the power SW on.
(B) OSD Position Control Mode: DOWN (-) Key if pressed when the power SW on.
(C) Aging mode: Select key if pressed when the power SW on.

(5) B+ Adjustment

    (A) MODE: No. 12.
    (B) Pattern: Full white. (Brightness just cut off)
    (C) Adjust VR101 to make the cathode of D112 has 13.6V.
    (D) Check other power source should be 82 ±2V, 9V ±0.3V, 46V ±1.5V.

(6) X-RAY Test

    (A) Mode: No.12
    (B) Pattern: Normal Crosshatch (Brightness just cut off)
    (C) Test
        1. Use Hi-Voltage probe
        2. Adjust VR102 until X-RAY protector is operated, then check the protection voltage
           should be 31.7KV or less.
        3. After X-RAY protection test, turn back the VR102 position to center.

(7) H. V. Adjustment

    (A)   Mode: No. 12
    (B)   Pattern: Full White(Brightness just cut off)
    (C)   Adjust VR102 to make the cathode of D114 has 103.5V
    (D)   Check the high voltage is 26kV ±0.5kV.

(8) H-Raster Center Adjustment

    (A) Mode: No. 16
    (B) Pattern: Crosshatch Reverse
    (C) Adjust the Brightness Control that the background can be visible.
    (D) Adjust VR302 to make the back ground should be center off the CRT.

(9) Pre-Adjustment

    (A) Mode: No. 12
    (B) Pattern: Crosshatch
    (C) Enter to Factory mode. Adjust H-phase, V-center, H-size, V-size, Pincushion, Trapezoid,
        Bow, Parallelogram, and rotation to make Picture Position Center and Picture Size
        310*232mm.

(10) White Balance Adjustment

    (A) Setting
        Enter Factory Mode,
        Mode: No. 12, Pattern: Full White.
        Warm up 30 min.
        Make External Degauss.
    (B) Cut Off Adjustment
        1. Select the color Mode 9300K
        2. Cut Off Adjustment: Video Signal Off (0.vp-p), Bright Control set to Mex., Adjust the G2,
           at the Brightness 1~1.5FL. (3.4~5.1 cd/m2)
        3. Adjust VR210, VR230 and VR250 to make X=283, Y=297, with readjusting G2 to keep
           the brightness between 1~1.5FL (3.4~5.1 cd/m2).

(C) White Balance Adjustment (Factory Auto Adjustment)

   1. 9300K (Select the color Mode 9300K)

   1) 50*50mm Green block Pattern, Brightness Control set to Max, Contrast Control set to Max, Adjust [G] gain control to Y=45FL. (154 cd/m2)
   2) Change Pattern to Full White, Brightness control set to Min.
   3) Adjust [R] gain control, [B] gain control to X=283, Y=297 at the contrast control is adjusted 15FL (52cd/m2).
   4) Check the color tracking shall be X=283 ǂ15, Y=297 ǂ15 between Y=5~25FT-L (17~86cd/m2) condition.

   2. 7500K (Select the color Mode 7500K)

   1) 50*50mm Green block Pattern, Brightness Control set to Max, Contrast Control set to Max, Adjust [G] gain control to Y=42FL. (144 cd/m2)
   2) Change Pattern to Full White, Brightness control set to Min.
   3) Adjust [R] gain control, [B] gain control to X=300, Y=315 at the contrast control is adjusted 15FL (52cd/m2).

   3. 6500K (Select the color Mode 6500K)

   1) 50*50mm Green block Pattern, Brightness Control set to Max, Contrast Control set to Max, Adjust [G] gain control to Y=39FL. (134 cd/m2)
   2) Change Pattern to Full White, Brightness control set to Min.
   3) Adjust [R] gain control, [B] gain control to X=315, Y=325 at the contrast control is adjusted 15FL (52cd/m2).

(D) Maximum brightness Adjustment

   1. Brightness control set to Max., contrast control set to Max
   2. Adjust VR306 to Y=31FL(105cd/m2)

(11) Focus Adjustment

   (A) Mode: No.20 (VESA1024*768(85))
   (B) Pattern: Green Crosshatch, Brightness just cut off, Contrast maximum.
   (C) Adjust F2 VR of FBT (lower side VR) for the vertical line to become fine line.
   (D) Adjust F1 VR of FBT (higher side VR) for the horizontal line to become fine line.
   (E) Receive Focus adjustment pattern.
   (F) Adjust F2 VR if vertical black line is not fall out.
   (G) Adjust F1 VR if horizontal black line is not fall out.
   (H) Use the video card "Trio64+", and receive Microsoft Excel "Work sheet" (1024*768(75)).
   Make sure that there is no double line for horizontal at the center.

   *Note: Focus adjustment must be finished at F1 VR.

·· Black dot is fall out

F1 VR

F2 VR

Screen VR

The shape of black dot (1 dot)

The shape of black dot (2dots)

FOCUS ADJUSTMENT PATTERN   Focus VR
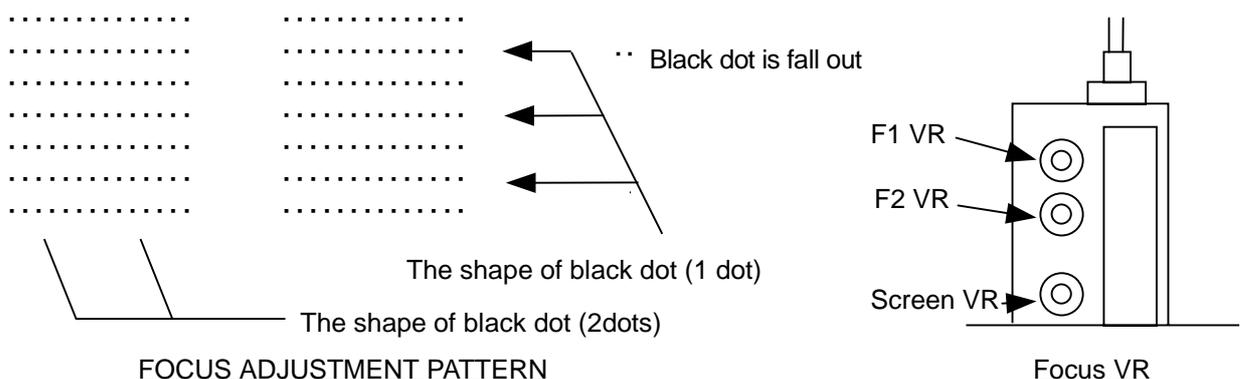
(12) Convergence Adjust

    (A) Mode: No. 12
    (B) Pattern: Crosshatch.
    (C) Use the convergence meter to check whether the convergence is within spec.
        Adjust the CPC Magnet to make the convergence within spec.

(13) Power Saving Function Inspection

    (A) Mode: No. 12
    (B) Pattern: Any Pattern
    (C) Inspection
       1. It should be into suspend Mode when the vertical sync is disable after 4 sec.
          Check the LED color "Yellow" and the power consumption must be less then 15W.
       2. It should be into power off Mode when the both horizontal sync and vertical sync are
          disable after 8 seconds. Check the LED color "Orange" and the power consumption
          must be less than 5W.
       3. It should be recovered the normal Mode when the both horizontal sync and vertical sync
          are enable. Check the picture is normal and LED color "Green".

(14) Geometry Adjustment (Factory Auto Alignment)

    (A) Enter to the Factory Mode.
    (B) Adjust H-size, V-size, H-phase, V-phase, Pincushion, and Trapezoid for all preset signals.
    (C) Adjustment data are automatically stored into the factory-preset memory after 1 sec.
    Note: for the factory auto alignment, Mode No. 2,3,7,9,10,11,12,14,15,16,17,19,20 shall be
    adjusted. Other modes can be used the calculated average value.

(15) DDC 1/2B Writing and Inspection

    (A) Mode: Any Mode, Pattern: Any Pattern.
    (B) Connect the MICON Tech. DDC Read/Write System.
    (C) Scan bar code label and apply serial NO. to EDID Data.

(16) Shipping Condition

   Color Temp 9300K
   OSD Back Ground: Blue
   OSD Position: Center of the screen
   Contrast: Maximum
   Brightness: Preset

(17) Adjustment Magnetic Field

   Vertical: +0.35 Gauss, Horizontal: 0.30 Gauss to North direction.

(18) TIMING SHEET for PN7501-1/PN7701-1/N9501/N9701/N9704

Preset Mode No.		1	2	3	4	5	6
Signal Name		VGA350	VGA400	VGA480	MACII (35K)	800*600 (56)	8514/A XGA
Resolution		640*350	640*400	640*480	640*480	800*600	1024*768
Dot Clock	(MHz)	25.175	25.175	25.175	30.240	36.000	44.900
fh	(kHz)	31.47	31.47	31.47	35.00	35.16	35.52
fv	(Hz)	70.09	70.09	59.94	66.67	56.25	86.96
Total	(dot)	800	800	800	864	1024	1264
	(uS)	31.78	31.78	31.78	28.57	28.44	28.15
Disp	(dot)	640	640	640	640	800	1024
	(uS)	25.42	25.42	25.42	21.16	22.22	22.81
Front	(dot)	16	16	16	64	24	8
	(uS)	0.64	0.64	0.64	2.12	0.67	0.18
Sync Pulse	(dot)	96	96	96	64	72	176
	(uS)	3.18	3.81	3.81	2.12	2.00	3.92
Back	(dot)	48	48	48	96	128	56
	(uS)	1.91	1.91	1.91	3.17	3.56	1.25
Total	(H)	449	449	525	525	625	408.5
	(mS)	14.268	14.268	16.683	15.000	17.778	11.500
Disp	(H)	350	400	480	480	600	384
	(mS)	11.122	12.711	15.253	13.714	17.067	10.810
Front	(H)	37	12	10	3	1	0
	(mS)	1.176	0.381	0.318	0.086	0.028	0.000
Sync Pulse	(H)	2	2	2	3	2	4
	(mS)	0.064	0.064	0.064	0.086	0.057	0.113
Back	(H)	60	35	33	39	22	20
	(mS)	1.907	1.112	1.049	1.114	0.626	0.563
Interlace		NON	NON	NON	NON	NON	YES
Polarity	(H/V)	POS/NEG	NEG/POS	NEG/NEG	NEG/NEG	POS/POS	POS/POS
Composite Sync					NEG		
Composite Video							
Character Font		7*9	7*9	7*9	7*9	7*9	7*9
Serration		OFF	OFF	OFF	ON	OFF	OFF
EQP		OFF	OFF	OFF	OFF	OFF	OFF

Preset Mode No.		7	8	9	10	11	12
Signal Name		640*480 (75)	EVGA400 (VESA)	800*600 (60)	640*480 (85)	800*600 (75)	10*7(60) (VESA)
Resolution		640*480	640*400	800*600	640*480	800*600	1024*768
Dot Clock	(MHz)	31.500	31.5000	40.000	36.000	49.500	65.000
fh	(kHz)	37.50	37.86	37.88	43.27	46.88	48.36
fv	(Hz)	75.00	84.13	60.32	85.01	75.00	60.00
Total	(dot)	840	832	1056	832	1056	1344
	(uS)	26.67	26.41	26.40	23.11	21.33	20.68
Disp	(dot)	640	640	800	640	800	1024
	(uS)	20.32	20.32	20.00	17.78	16.16	15.75
Front	(dot)	16	24	40	56	16	24
	(uS)	0.51	0.76	1.00	1.56	0.32	0.37
Sync Pulse	(dot)	64	40	128	56	80	136
	(uS)	2.03	1.27	3.20	1.56	1.62	2.09
Back	(dot)	120	128	88	80	160	160
	(uS)	3.81	4.06	2.20	2.22	3.23	2.46
Total	(H)	500	450	628	509	625	806
	(mS)	13.333	11.886	16.579	11.76	13.333	16.666
Disp	(H)	480	400	600	480	600	768
	(mS)	12.800	10.565	15.840	11.093	12.800	15.880
Front	(H)	1	9	1	1	1	3
	(mS)	0.027	0.238	0.026	0.023	0.021	0.062
Sync Pulse	(H)	3	3	4	3	3	6
	(mS)	0.080	0.079	0.106	0.069	0.064	0.124
Back	(H)	16	38	23	25	21	29
	(mS)	0.427	1.004	0.607	0.578	0.448	0.600
Interlace		NON	NON	NON	NON	NON	NON
Polarity	(H/V)	NEG/NEG	NEG/POS	POS/POS	NEG/NEG	POS/POS	NEG/NEG
Composite Sync							
Composite Video							
Character Font		7*9	7*9	7*9	7*9	7*9	7*9
Serration		OFF	OFF	OFF	OFF	OFF	OFF
EQP		OFF	OFF	OFF	OFF	OFF	OFF

Preset Mode No.		13	14	15	16	17	18
Signal Name		MACII (49.7K)	800*600 (85)	10*7(70) (VESA)	10*7(75) (VESA)	640*480 (120)	12*10(60) (VESA)
Resolution		832*624	800*600	1024*768	1024*768	640*480	1280*1024
Dot Clock	(MHz)	57.286	56.250	75.000	78.750	55.00	108.000
fh	(kHz)	49.73	53.67	56.48	60.02	63.66	63.98
fv	(Hz)	74.55	85.06	70.07	75.03	120.11	60.02
Total	(dot)	1152	1048	1328	1312	864	1688
	(uS)	20.11	18.63	17.71	16.66	15.71	15.63
Disp	(dot)	832	800	1024	1024	640	1280
	(uS)	14.52	14.22	13.65	13.00	11.645	11.85
Front	(dot)	32	32	24	16	32	48
	(uS)	0.56	0.57	0.32	0.20	0.582	0.44
Sync Pulse	(dot)	64	64	136	96	96	112
	(uS)	1.12	1.14	1.81	1.22	1.745	1.04
Back	(dot)	224	152	144	176	96	248
	(uS)	3.91	2.70	1.92	2.23	1.745	2.30
Total	(H)	667	631	806	800	530	1066
	(mS)	13.413	11.756	14.272	13.328	8.325	16.661
Disp	(H)	624	600	768	768	480	1024
	(mS)	12.548	11.179	13.599	12.795	7.540	16.005
Front	(H)	1	1	3	1	8	1
	(mS)	0.020	0.019	0.053	0.017	0.126	0.016
Sync Pulse	(H)	3	3	6	3	6	3
	(mS)	0.060	0.056	0.106	0.050	0.094	0.047
Back	(H)	39	27	29	28	36	38
	(mS)	0.784	0.503	0.513	0.466	0.566	0.594
Interlace		NON	NON	NON	NON	NON	NON
Polarity	(H/V)	NEG/NEG	POS/POS	NEG/NEG	POS/POS	NEG/NEG	POS/POS
Composite Sync		NEG					
Composite Video							
Character Font		7*9	7*9	7*9	7*9	7*9	7*9
Serration		ON	OFF	OFF	OFF	OFF	OFF
EQP		OFF	OFF	OFF	OFF	OFF	OFF

Preset Mode No.		19	20				
Signal Name		800*600 (100)	1024*768 (85)				
Resolution		800*600	1024*768				
Dot Clock	(MHz)	67.50	94.5				
fh	(kHz)	63.92	68.677				
fv	(Hz)	100.03	85				
Total	(dot)	1056	1376				
	(uS)	15.64	14.561				
Disp	(dot)	800	1024				
	(uS)	11.852	10.836				
Front	(dot)	40	48				
	(uS)	0.593	0.508				
Sync Pulse	(dot)	80	96				
	(uS)	1.185	1.016				
Back	(dot)	136	208				
	(uS)	2.015	2.201				
Total	(H)	639	808				
	(mS)	9.997	11.765				
Disp	(H)	600	768				
	(mS)	9.386	11.183				
Front	(H)	3	1				
	(mS)	0.047	0.015				
Sync Pulse	(H)	4	3				
	(mS)	0.063	0.044				
Back	(H)	32	36				
	(mS)	0.501	0.524				
Interlace		NON	NON				
Polarity	(H/V)	POS/POS	POS/POS				
Composite Sync							
Composite Video							
Character Font		7*9	7*9				
Serration		OFF	OFF				
EQP		OFF	OFF				

Distortion Adjustment

Factory Mode Setting
*After completion of adjustment exit the factory mode and data will be saved.
Signal : All signals   Cross hatch
Perform the adjust for signal No. 14 in step 6-1~3.
Perform the adjust for above all signal in step 6-4,5.

1. Picture Tilt Adjustment
   (1) Receive signal 14 (Cross hatch).
   (2) When OSM MENU is displayed, Select the " " icon.
   (3) Make sure that the picture tilt meets the following standards.

$$X \leq \pm 1.0mm$$
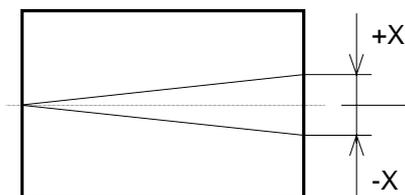
2. Pincushion Balance Adjustment
   (1) When OSM MENU is displayed, Select the " " icon.
   (2) Make sure that the Pincushion Balance meets the following standards.

$$A - B \leq 0.5mm$$

A B
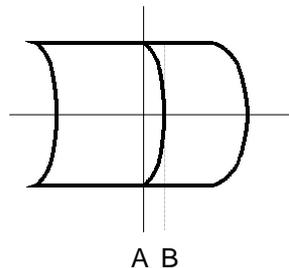
3. Parallelogram distortion Adjustment
   (1) When OSM MENU is displayed, Select the " " icon.
   (2) Adjust "+", "-" SW so that the vertical line and horizontal line at the screen's center fall at right
       angles. (less than 90 ± 0.5 degree)
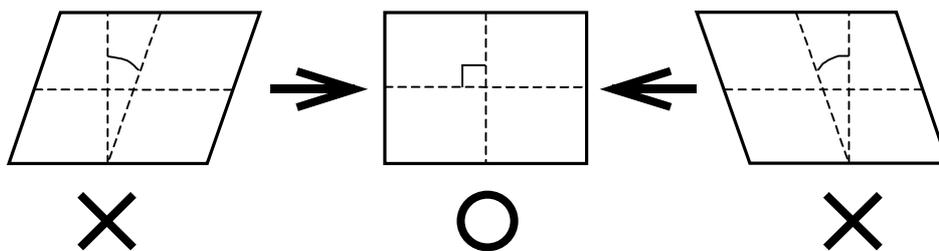
4. Side Pincushion Adjustment

(1) When OSM MENU is displayed, Select the " ⟩⟨ " icon.

(2) Make sure that the side pincushion distortion meets the following standards.
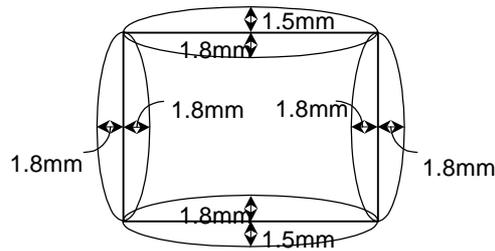
5. Trapezoid Distortion Adjustment

(1) When OSM MENU is displayed, Select the " ⟋⟍ " icon.

(2) Make sure that the trapezoid distortion meets the following standards.

$$|(AB-CD)| \leq 2mm$$
$$|(AC-BD)| \leq 2mm$$
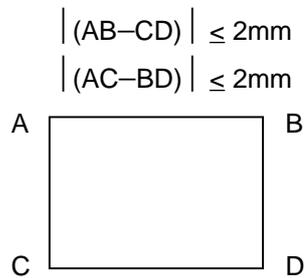
6. Preset Picture Size and Position Adjustment

Factory Mode Setting

Signal: All Signals   Cross hatch

*Perform the Preset Picture Size and Position Adjustment for above all signal.

(1) When OSM MENU is displayed, Select the " ⬭ "," ⬟ "," ↔ "," ↕ " icon.

(2) Adjust the picture size and position as listed below by "−", "+" SW.

Picture size

H : 310 ± 2mm

V : 232 ± 2mm

Picture position

H : $|(X_{TOP}-X_{BOTTOM})| \leq 3mm$

V : $|(X_{LEFT}-X_{RIGHT})| \leq 3mm$
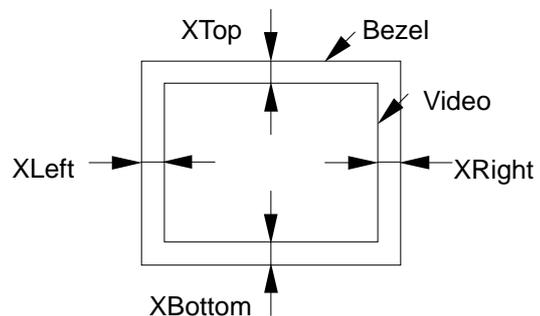
7. Purity
   (1) Receive signal 14(Cross hatch pattern).
   (2) The CRT face should be facing east and degauss the entire unit by external degaussing coil.
   (3) Make sure the single color purity.
       If not, readjust CPC magnet and touch up using correction magnets.

8. Convergence
      C_H : Convergence error of horizontal direction
      C_V : Convergence error of vertical direction
      C_S : Total direction of Convergence error
          (Calculate by "$\sqrt{C_H{}^2 + C_V{}^2}$"
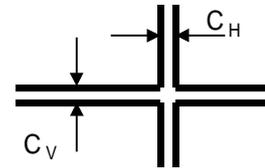
   (1) Receive signal 14(Cross hatch pattern).
   (2) Measure convergence error., If it is out of spec, adjust static convergence by 4-pole magnets and 6-pole magnets.
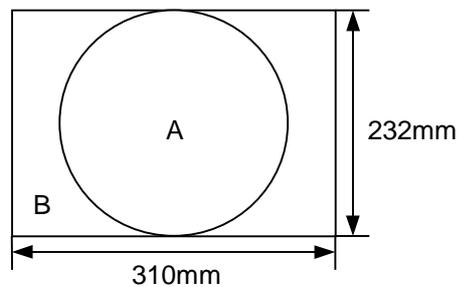
   A Zone (A circle 232 mm in the center of the CRT face center)
           C_H, C_V: Within 0.35 mm
           C_S: No rule
   B Zone (Areas outside of zone A within the rectangle of 310 mm×232 mm)

   Safety with the list below.

	$C_H \leqq 0.35$ mm	0.35 mm $< C_H < 0.40$ mm
$C_V \leqq 0.35$ mm	OK	Calculate C_S and judge Within 0.50 mm $\rightarrow$ OK
0.35 mm $< C_V < 0.40$ mm	Calculate C_S and judge Within 0.50 mm $\rightarrow$ OK	Need to touch up

Write and Inspection for Plug and Play Communication

1. Construction of System

   This system should be connected as shown below.
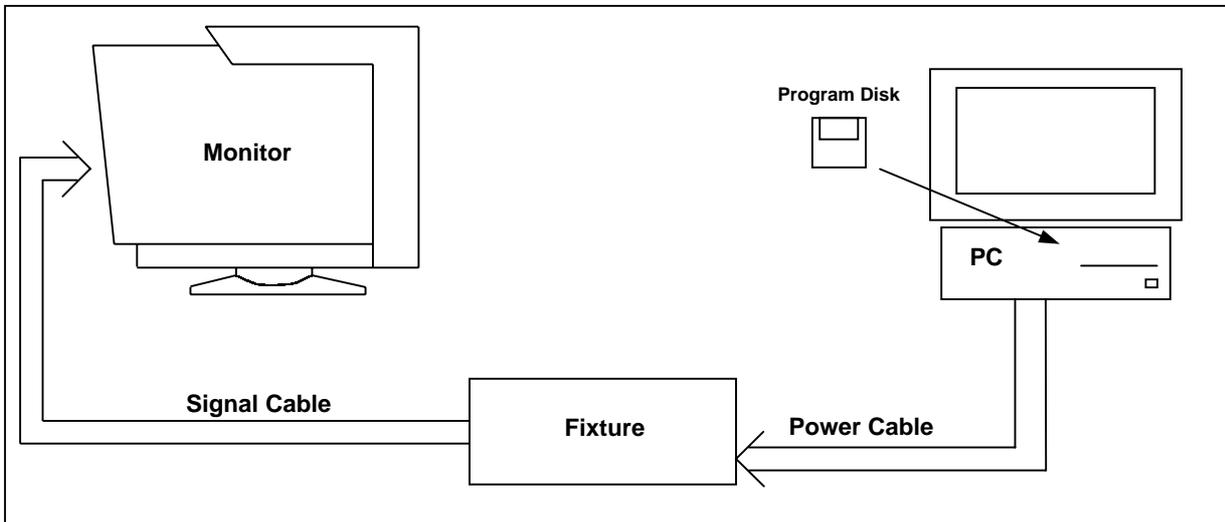
   Note: PC clock speed should be below 266MHz. OS is PC-DOS.
   　　　Fixture Board can be connected directly to PC without Printer Cable.

2. EDID Write and Inspection Method

   1) Run specified EDID write and Inspection program on PC-DOS mode.
      The monitor turns into the self test mode.

   2) Run the specified EDID write and inspection program under PC-DOS mode.

   3) Key in the serial No. or Scan serial No. bar code.

   4) Press "Return" key to write the EDID data.

   5) Press "F1" key to inspect DDC1 communication.

   6) Press "F2" key to inspect DDC2 communication
      EDID DATA Format: Please refer the 3. EDID data File.

3. EDID DATA FILE

MS75F EDID Serial No. Format

Week of Manufacture (Month*4)
Year of Manufacture

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00	00	FF	FF	FF	FF	FF	FF	00	38	A3	D1	5D	01	01	01	01
10	0A	0A	01	02	0C	21	18	78	EA	57	98	A4	52	46	97	24
20	11	48	4C	FF	EE	00	31	59	45	59	61	59	71	4A	81	40
30	01	01	01	01	01	01	EA	24	00	60	41	00	28	30	30	60
40	13	00	36	E8	10	00	00	1E	00	00	00	FD	00	37	78	1F
50	46	0B	00	0A	20	20	20	20	20	20	00	00	00	FC	00	4D
60	75	6C	74	69	53	79	6E	63	20	37	35	46	00	00	00	FF
70	00	30	33	30	30	30	30	31	59	41	0A	20	20	20	00	B6

Serial No Area 9bytes   Check Sum

AS75F EDID Serial No. Format

Week of Manufacture (Month*4)
Year of Manufacture

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00	00	FF	FF	FF	FF	FF	FF	00	38	A3	CF	5D	01	01	01	01
10	0A	0A	01	02	0C	21	18	78	EA	57	98	A4	52	46	97	24
20	11	48	4C	FF	EE	00	31	59	45	59	61	59	71	4A	81	40
30	01	01	01	01	01	01	EA	24	00	60	41	00	28	30	30	60
40	13	00	36	E8	10	00	00	1E	00	00	00	FD	00	37	78	1F
50	46	0B	00	0A	20	20	20	20	20	20	00	00	00	FC	00	41
60	63	63	75	53	79	6E	63	20	37	35	46	0A	00	00	00	FF
70	00	30	33	30	30	30	30	31	59	41	0A	20	20	20	00	3D

Serial No Area 9bytes   Check Sum

Bar Code Format(code39)

Digit		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Format	*	N	N	N	N	N	N	N	N	_	_	_	Y	M	S	S	S	S	S	F	R	*
Example	*	N	A	7	0	0	1	0	T	_	_	_	9	6	0	0	0	0	1	Y	A	*

    *+Model Code + 3 spaces + Serial No. + *

Serial No. Descriptions;

Y: Manufactured Year (Last digit) ex. 9 → 1999
M: Manufactured Month 1 ~ 9, X(October),
   Y(Novenber), Z(December)
S: Serial No. (5digits) 00001 ~ onward
  (restart when month is changed)
F: Factory Code: Y is NPG China Factory
R: Product Revision code: start from A

EDID Code Input Procedure   ex.
  1) Scan Bar code (20 digits)   NA70010T_ _9600001YA
  2) Skip 11 digits then find the Serial No. 9600001YA
  3) Make Year hex Code from Year digit   9 → 09h
  4) Make Week hex Code from Month digit 6*4 = 24 → 18h
  5) Change Serial No. to ASCII code   38h 36h 30h 30h 30h 30h 31h 59h 41h
  6) Apply Serial No. Information to the default EDID code.
  7) Download EDID from PC to Monitor.
  8) DDC1 Inspection
  9) DDC2B Inspection   28

TROUBLE SHOOTING

Refer to User's Manual trouble shooting section before using this chart.

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Page

1. NO OPERATION, POWER LED FLASH

```
┌─────────────────────────┐
│     POWER LED FLASH      │
└─────────────────────────┘
             │
             ▼
          ◇ POWER SW ◇
            TURN OFF
             │
             ▼
     ◇ MULTIMETER TEST ◇
         Q307, Q102
    D110,D111,D112,D113
             │
             ▼
          ◇ CHECK ◇ ─────── 1.   DC P/S O/P VOLTAGE SET AT 17V,CURRENT
            U102              SET AT 600MA. POSITIVE CONNECT TO C130"+".
             │               NEGATIVE CONNECT TO U105-pin 5.
             │              2.   SCOPE SET AT 10V/DIV, 10US/DIV, PROBE
             │               CONNECT TO Q102-GATE AND U103pin 5.
             ▼
       ◇ U102 PIN6 ◇ ──NO──▶ ┌──────────────────┐
          PULSE O/P           │      CHECK        │
             │                │  U102 PIN 7 VCC   │
             │                │  PIN 4 SAWTOOTH   │
             │                │     PIN 8 5V      │
             ▼                └──────────────────┘
   ┌──────────────┐                   │
   │  POWER SW    │                   ▼
   │  TURN OFF    │          ┌──────────────────┐
   └──────────────┘          │     FAILURE       │
                             │    R136, ZD103    │
                             └──────────────────┘
```

2. NO OPERATION, POWER LED OFF

```
        ┌─────────────────┐
        │   POWER SW       │
        │   TURN OFF       │
        └────────┬─────────┘
                 │
                 ▼
            ◇ CHECK ◇
            ◇ F101  ◇
                 │
                 ▼
            ◇ CHECK ◇
            ◇ Q101  ◇
                 │
                 ▼
            ◇ CHECK ◇──────  1. DC P/S O/P VOLTAGE SET AT 17V,CURRENT SET
            ◇ U101  ◇            AT 200MA. POSITIVE CONNECT TO C112"+".
                 │                NEGATIVE CONNECT TO C105"-".
                 │             2. SCOPE SET AT 10V/DIV, 10US/DIV, PROBE
                 ▼                CONNECT TO Q101-GATE AND C105"-".
            ◇ U101 PIN6 ◇       ┌──────────────────┐
            ◇ PULSE O/P ◇──NO──▶│     CHECK        │
                 │              │ U101 PIN 7 VCC   │
                 │              │ PIN 4 SAWTOOTH   │
                 │              │ PIN 8 5V         │
                 ▼              └────────┬─────────┘
        ┌─────────────────┐             │
        │   POWER SW       │            ▼
        │   TURN ON        │   ┌──────────────────┐
        └─────────────────┘   │    FAILURE       │
                              │   R111, ZD101    │
                              └──────────────────┘
```

3. VIDEO NOISE, UNSYNCHRONOUS

```
                    ┌─────────────────────┐
                    │       CHECK         │
                    │ Q101 G-S FREQUENCY  │
                    └─────────────────────┘
                              │
                             YES
                              │
                              ▼
┌──────────────────┐    ◇─────────────◇    ┌──────────────────────┐
│ CHECK C114, R116 │◄─NO│  SYNCRONIZE   │NO─►│ CHECK HORIZONTAL     │
│ D109, R115, R117 │    │ WITH H-SYNC   │    │ FREQUENCY C114 TO GND│
└──────────────────┘    ◇─────────────◇    └──────────────────────┘
                              │
                             YES
                              │
                              ▼
                         ◇─────────────◇
                         │    CHECK      │
                         │ Q102 G-S FREQUENCY │
                         ◇─────────────◇
                              │
                              ▼
┌──────────────────┐    ◇─────────────◇    ┌──────────────────────┐
│ CHECK C132, R139,│◄─NO│  SYNCRONIZE   │NO─►│ CHECK HORIZONTAL     │
│ D115, R138, R140 │    │ WITH H-SYNC   │    │ FREQUENCY C132 TO GND│
└──────────────────┘    ◇─────────────◇    └──────────────────────┘
                              │
                              ▼
                    ┌─────────────────────┐
                    │  NORMAL OPERATION   │
                    └─────────────────────┘
```

4. NO VIDEO

```
        ┌─────────────────┐
        │    NO VIDEO     │
        └─────────────────┘
                 │ YES
                 ▼
              ╱╲
            ╱    ╲              NO        ┌─────────────────┐
          ╱ CHECK  ╲──────────────────▶ │   REFER TO      │
          ╲ SCREEN ╱                     │  "NO RASTER"    │
          ╲CONTROL ╱                     │   ON PAGE       │
          ╲CLOCKWISE╱                    └─────────────────┘
              ╲╱
                 │ YES
                 ▼
              ╱╲
            ╱    ╲              NO        ┌─────────────────┐
          ╱ CHECK  ╲──────────────────▶ │   TROUBLE IN    │
          ╲U201 PIN╱                     │  R/G/B SIGNAL,  │
          ╲5, 8, 11╱                     │  SIGNAL CABLE   │
          ╲SIGNAL  ╱                     └─────────────────┘
          ╲LEVEL ╱
              ╲╱
                 │ YES
                 ▼
              ╱╲
            ╱    ╲              NO        ┌─────────────────┐
          ╱ CHECK  ╲──────────────────▶ │ PROBLEM IN U201 │
          ╲U201 PIN╱                     │  CLAMP(PIN 15)  │
          ╲18,20,23╱                     │ U201 12V VOLTAGE│
          ╲SIGNAL  ╱                     └─────────────────┘
          ╲LEVEL ╱
              ╲╱
                 │ YES
                 ▼
              ╱╲
            ╱    ╲              NO        ┌─────────────────┐
          ╱ CHECK  ╲──────────────────▶ │ PROBLEM IN U203 │
          ╲U203 PIN╱                     │  12V, 77V VOLTAGE│
          ╲1, 3, 5 ╱                     └─────────────────┘
          ╲SIGNAL  ╱
          ╲LEVEL ╱
              ╲╱
                 │ YES
                 ▼
              ╱╲
            ╱    ╲              NO        ┌─────────────────┐
          ╱ CHECK  ╲──────────────────▶ │   PROBLEM IN    │
          ╲CATHODE ╱                     │ R220, R240, R260│
          ╲VIDEO   ╱                     └─────────────────┘
          ╲LEVEL ╱
              ╲╱
                 │ YES
                 ▼
        ┌─────────────────┐
        │ PROBLEM IN CRT  │
        └─────────────────┘
```

- NO VIDEO
  - → YES → CHECK SCREEN CONTROL CLOCKWISE
    - NO → REFER TO "NO RASTER" ON PAGE
    - YES → CHECK U201 PIN 5, 8, 11 SIGNAL LEVEL
      - NO → TROUBLE IN R/G/B SIGNAL, SIGNAL CABLE
      - YES → CHECK U201 PIN 18, 20, 23 SIGNAL LEVEL
        - NO → PROBLEM IN U201 CLAMP(PIN 15) U201 12V VOLTAGE
        - YES → CHECK U203 PIN 1, 3, 5 SIGNAL LEVEL
          - NO → PROBLEM IN U203 12V, 77V VOLTAGE
          - YES → CHECK CATHODE VIDEO LEVEL
            - NO → PROBLEM IN R220, R240, R260
            - YES → PROBLEM IN CRT

5. NO RASTER

```
                    ┌─────────────────┐
                    │   NO RASTER     │
                    └─────────────────┘
                            │ YES
                            ▼
                        ╱CHECK╲                    ┌──────────────────┐
                       ╱  B+   ╲────── NO ────────▶│  POWER SUPPLY    │
                       ╲       ╱                    │     CHECK        │
                        ╲─────╱                     └──────────────────┘
                            │ YES
                            ▼
                    ╱  CHECK         ╲              ┌──────────────────┐
                   ╱ U301 PIN 3, U402 ╲──── NO ────▶│   PROBLEM IN     │
                   ╲ PIN 4 H/V SYNC   ╱             │    MCU U701      │
                    ╲────────────────╱              └──────────────────┘
                            │ YES
                            ▼
                   ╱   CHECK          ╲             ┌──────────────────┐
                  ╱ U301 PIN 7, U402   ╲─── NO ────▶│   PROBLEM IN     │
                  ╲ PIN 23,24 H/V SYNC ╱            │   U301, U402     │
                   ╲──────────────────╱             └──────────────────┘
                            │ YES
                            ▼
                  ╱   CHECK              ╲          ┌──────────────────────────┐
                 ╱ T301 PIN 3 VOLTAGE     ╲─ NO ──▶│   PROBLEM IN             │
                 ╲ 56V, 68V(AT H-FREQ.    ╱        │ U102,Q102,D114,D111,L102 │
                  ╲ 31.5KHz)            ╱          │ OR DEFLECTION YOKE       │
                   ╲──────────────────╱            └──────────────────────────┘
                            │ YES
                            ▼
                  ╱  CHECK Q307        ╲            ┌──────────────────┐
                 ╱ COLLECTOR ABOUT      ╲─── NO ──▶│   PROBLEM IN     │
                 ╲  1050Vp-p           ╱           │ Q307, Q308,T302, │
                  ╲──────────────────╱             │ D307, D308, Q309,│
                            │ YES                   │ Q325             │
                            ▼                       └──────────────────┘
                  ╱  CHECK G1          ╲            ┌──────────────────┐
                 ╱ VOLTAGE ABOUT        ╲── NO ───▶│   PROBLEM IN     │
                 ╲  -45~65V            ╱           │ Q305, Q306, ZD303│
                  ╲──────────────────╱             │ D318, T301, C344 │
                            │ YES                   └──────────────────┘
                            ▼
                    ┌─────────────────┐
                    │   PROBLEM IN    │
                    │   G2 VOLTAGE    │
                    └─────────────────┘
```

6. TROUBLE IN H. V SYNC

```
                    ┌─────────────────────┐
                    │    PROBLEM IN       │
                    │  HOR. OR VER. SYNC  │
                    └─────────────────────┘
                               │ YES
                               ▼
                   ╱╲
                  ╱  ╲        CHECK                    ┌──────────────────┐
                 ╱    ╲   CONNECTOR S702      NO       │   PROBLEM IN     │
                 ╲    ╱   (PIN3,4), SIGNAL  ────────▶  │  SIGNAL CABLE    │
                  ╲  ╱                                 └──────────────────┘
                   ╲╱
                    │ YES
                    ▼
                   ╱╲         CHECK                    ┌──────────────────┐
                  ╱  ╲    U701(PIN 40,39)    NO        │   PROBLEM IN     │
                 ╱    ╲     H/V SYNC.     ────────▶    │ H/V SYNC LINE &  │
                 ╲    ╱      SIGNAL                    │   Q301, Q401     │
                  ╲  ╱                                 └──────────────────┘
                   ╲╱
                    │ YES
                    ▼
         ╱╲                       ╱╲                  ┌──────────────────┐
        ╱  ╲    CHECK            ╱  ╲    CHECK         │   PROBLEM IN     │
       ╱    ╲ U701(PIN 32,33) NO╱    ╲ U701(PIN 5) NO │    5V LINE       │
       ╲    ╱  H/V SYNC.  ────▶ ╲    ╱  VOLTAGE  ────▶ └──────────────────┘
        ╲  ╱   SIGNAL            ╲  ╱    5V?
         ╲╱                       ╲╱
          │ YES                    │ YES
          ▼                        ▼
         ╱╲                       ╱╲                  ┌──────────────────┐
        ╱  ╲    CHECK            ╱  ╲    CHECK         │ PROBLEM IN U203  │
       ╱    ╲  U301(PIN 3)  NO  ╱    ╲ U701(PIN 8) NO │ 12V, 77V VOLTAGE │
       ╲    ╱  U402(PIN 4) ───▶ ╲    ╱ FREQ.4MHz ───▶ └──────────────────┘
        ╲  ╱                     ╲  ╱
         ╲╱                       ╲╱
          │ YES                    │ YES
          ▼                        ▼
  ┌──────────────┐          ┌──────────────┐
  │  PROBLEM IN  │          │  PROBLEM IN  │
  │  U301, U402  │          │    U701      │
  └──────────────┘          └──────────────┘
```

7. POOR PINCUSHION

```
┌──────────────────┐
│      POOR        │
│   PINCUSHION     │
└──────────────────┘
          │
          ▼
      ╱────────╲                          ┌──────────────────────┐
    ╱  PARABOLA  ╲        YES              │ CHECK Q314~Q316,     │
    ╲   WAVE     ╱ ──────────────────────▶ │ D308                 │
      ╲────────╱                           └──────────────────────┘
          │
          │ NO
          ▼
      ╱──────────╲                        ┌──────────────────────┐
    ╱   CHECK     ╲       YES              │ CHECK C431, R432     │
    ╲ U402 PIN 9  ╱ ──────────────────────▶ └──────────────────────┘
    ╲  PARABOLA  ╱
      ╲────────╱
          │
          │ NO
          ▼
      ╱──────────╲                        ┌──────────────────────┐
    ╱   CHECK     ╲       YES              │ CHECK 12V & U402     │
    ╲ U401 PIN 4  ╱ ──────────────────────▶ └──────────────────────┘
    ╲ SYNC INPUT ╱
      ╲────────╱
          │
          │ NO
          ▼
┌──────────────────────┐
│ CHECK U701 (PIN 32)  │
│ OUTPUT               │
└──────────────────────┘
```

CIRCUIT DESCRIPTION

TABLE OF CONTENTS

1. Power supply circuit

① Outline

This power supply unit adopts the switching mode technology, and is an off-line mode type unit that provided several different DC outputs. The scanning frequency is available in different values ranging from 31 kHz to 69 kHz. Moreover, it is capable to operate at an AC input voltage of 100V ~ 240V and an AC frequency of 50/60 Hz±3Hz.

The block diagram is the functional construction schematics, that shows the major functions of this power supply unit.

② Harmonics (OPTION)

L107 is a harmonic choke circuit that reduces the harmonic peak currents, for the purpose of fulfilling the requirement items of IEC 1000-3-2.

③ EMI

The EMI circuit has a 2-stage construction, with the first stage consisting of the common mode choke unit and one X-capacitor, and the second stage consisting of the common mode choke unit and four Y-capacitors.

R101 is the bleed resistor of the X-capacitor. When the power supply switch is turned OFF, this resistor carries out the emergency charging of the capacitor C101.

The EMI is the circuit that prevents the monitor switching noise from being generated, there by minimizing the negative influence on the other electronic equipment.

④ AC rectifier and smoothing capacitor

The AC input is rectified by means of the full-bridge rectifier, that consists of the diodes D101 to D104. The AC voltage is converted into the DC voltage by passing through the next stage, that consists of the smoothing capacitor C105.

TH101 is a NTC thermistor for the power supply at the in-rush current limit.

⑤ Degaussing circuit

The degaussing circuit consists of the PTC thermistor TH102, the degaussing coil and the relay RL101. The relay is controlled by means of the +12V control signal coming from the CPU.

⑥ Transformer and energy induction

1) When the PWM controls IC KA3842A chip, a driving pulse is generated at the gate of the transistor Q101, and Q101 turns ON. The current returns from the "plus" (+) side of the energy-supplying capacitor C105 to the "minus" (-) side of the same capacitor C105, passing through the transformer Q101 D-S. During the ON cycle, the energy is stored in the transformer T101. The transistor Q101 turns OFF when the driving pulse disappears from Q101. As a result, all voltages of the dot ends of the winding flow to the positive direction and reach the fly-back rectifier. At that point of time, the diodes of the rectifier of the secondary side turn ON, a temporary energy is induced at the secondary side, and the ON cycle of the driving pulse is repeated.

2) The power supply MOS FET Q101 carries out the ON/OFF operation of the control unit, by means of U101 KA3842A. KA3842A is a PWM (pulse width modulation) IC chip, with 16 V starting voltage and 10 V cut-off voltage.

The following list shows the pin layout of KA3842A pulse width modulation IC chip.

          Pin 1:   Feedback   Pin 2: Compensation

          Pin 3:   Current sensor   Pin 4: Oscillator

          Pin 5:   Ground (GND)   Pin 6: Pulse output

          Pin 7:   VCC Pin 8: VREF (5.1 V)

3) Overcurrent protection

R111 is a sensor resistor, and it has the function of increasing the current of this loop when the output of the secondary side is either in the overloaded state or is insufficient.

Since the current passing through the R111 sensor resistor has voltage dropping effect, the operation of the output pulse is stopped when a voltage lower than 1 Volt is detected at the pin number 3 of the KA3842A 3chip, and the switch of the power supply MOS FET is kept in the "break" state until the VCC voltage is charged up to 16 Volts, and the operation of U101 KA3842A is resumed. When it is not clearly known whether there is voltage shortage or not, however, this circuit repeats the ON/OFF switching, and the power supply LED lights up.

4) Starting circuit

The resistor R123 and R148 and the transistor Q112 and diode D119 and resistor R131, R149 and zener diode ZD105 are for the starting operation. When the circuit starts its operation, the power supply transformer T101 supplies the auxiliary 12 Volt power to the control IC chip U101 via pins 6 and 7 of the winding transformer T101.

5) Synchronization circuit

The synchronization signal is induced from the fly-back transformer (FBT), and carries out the synchronization with the power supply frequency. The frequency range is from 31 kHz to 70 kHz, and the component elements of the synchronization circuit are C114, R116, D109, R115 and R117.

6) Feedback circuit

The feedback circuit loop induces the 12 V voltage through the pin 6 and the pin 7 of the power supply transformer. That voltage is connected with the pin 3 of the IC chip U101 by passing through D108, C113 and passing next through R122, VR101 and R120. This is a regular loop.

7) Snubber circuit

The snubber circuit has the function of clamping the ON/OFF spikes of the power supply MOS-FET, and its component elements D105, C106, R106 make up a snubber that turns OFF the power supply MOS-FET.

8) Secondary rectifier and smoothing rectifier

The secondary rectifier is a harmonic rectifier consisting of D111, C124 and R128, and it works as a snubber circuit as well. The capacitors C120 and C138 are the smoothing rectifier working on the 45 Volt DC output. There are also other DC outputs, such as 80 Volt (D110), 13.5 Volt (D112) and 6.3 Volt (D113).

⑦ Power saving

    Suspend mode   : Every DC voltage operation of the CRT is turned OFF.

                                    The color of the power LED101 switches from green to orange.

    OFF mode   : This is the mode in which the CPU control unit turns OFF the power supply, but the power turns ON when the user touches the keyboard.

                                    The power LED switches to dark orange color.

1) When the power switch is turned ON when there is nothing being entered in the video cable. At that time, if the video is shifted from the free-run mode to the suspend mode, the transistor Q107 turns OFF and the operation returns to the OFF mode within a few seconds.

2) As for the sequence of steps that turn the operation to the OFF mode, if the keyboard is not touched for a given period of time that a preset in advance, the CPU outputs the LOW level signal to the transistor Q107, then Q105 turns OFF, the transistor Q108 and Q104 turns OFF. As a result the power is shut out at that state.

3) When the user touches the keyboard in the OFF mode, the operation is resumed, the video signals V-SYNC and H-SYNC turn ON the CPU via resistor R129 and R159, then the transistor Q105 and Q107 turn ON, the transistors Q104 and Q108 turn ON. As a result the operation returns to the ON state.

⑧ DC/DC

  The DC/DC voltage is DC 45 volts, and since the set-up voltage is variable from 62 volts to 160 volts, it is variable depending on the horizontal synchronism. The frequency band is variable from 31 kHz to 69 kHz. The voltage is fed back from the fly-back transformer (FBT). The DC/DC output voltage is used as high-voltage input of FBT T301.

1) DC/DC is a step-up circuit, and consists mainly of the choke L106, the transistor Q102, the diode D114 and U102.

2) When the PWM controls U102 IC KA3843, a driving pulse is generated at the gate of the transistor Q102, and the transistor Q102 turns ON. During the ON cycle, the energy is stored in the choke L106. The transistor Q102 turns OFF when the driving pulse disappears from the gate of the transistor Q102. As a result, the voltage at the dot terminal of the winding flows in the positive direction and goes to the fly-back rectifier. The energy stored in the choke L106 is entered in the FBT, passing through the choke L106, the diode D114 and the capacitor C129.

3) The feedback is detected by the FBT via diode D130, the capacitor C145, the resistor R145 the variable resistor VR102 and the fixed resistor R146, and is connected to the U102-2 pin.
    This is loop is the regular type one.

4) The frequency of the synchronization signal coming from video H-SYNC is variable from 31 kHz to 69 kHz. The circuit consists of the capacitor C132, the resistor R139, the diode D115, the resistor R138 and the resistor R140.

5) The soft start circuit consists of the resistor R178, the capacitor C164, the diode D133 and the diode D117.

2. MCU

Monitor MCU Specification for Model N9705

Frequency Specification

 H-freq.   : 29.5K – 70KHz
 V-freq.   : 43 – 160Hz
 Judge polarity only when frequency is 31.5 KHz and 37.8 KHz
 Support composite sync detection

System Architecture

1. MCU – Weltrend WT6016, 16K bytes ROM size
2. EEPROM – 24C04 series, 4K bit, with ID code for identify initialization.
3. OSD – Myson MTV016N-12

Input

1. Sync input   – 2 pins for H-sync & V-sync frequency inverted input.
2. Key input   – 2 pins for A/D key input (SELECT. UP, DOWN and RECALL).
3. Burn-in ID input – 1 pins for Burn-in ID input.
4. Reset input   – low pulse for reset MCU
5. Crystal input – 2 pins using 8MHz crystal.

Output – MCU digital pin

1. Degauss – Active high pulse for 2.5 sec when in degauss. MCU will activate degauss while power on.
2. CS output – 3 pins (CS2, CS1, CS0) for CS control

H-sync	CS2	CS1	CS0
H-sync $<$ 33.25KHz	0	0	0
33.25KHz$<$H-sync$<$36.50KHz	0	1	0
36.50KHz$<$H-sync$<$40.50KHz	0	1	1
40.50KHz$<$H-sync$<$45.10KHz	1	0	0
45.10KHz$<$H-sync$<$51.60KHz	1	0	1
51.60KHz$<$H-sync$<$55.10KHz	1	1	0
55.10KHz$<$H-sync$<$62.15KHz	1	1	0
62.15KHz$<$H-sync	1	1	1
Mode change	0	0	0

3. Power saving – 2 pins (PMUS, PMUO) for power saving control

        – if Hf > 70KHz or Hf < 23KHz, enter power saving mode (suspend).

        – enter power saving mode after 3 sec when condition met.

        – enter suspend mode first for 3 sec before enter off mode if off mode condition met.

Mode	H-sync freq.	V-sync freq.	Burn-in ID	PMUS	PMUO
Normal	Yes	Yes	---	1	1
Stand By	No	Yes	---	0	1
Suspend	Yes	No	---	0	1
Off	No	No	Low	0	0
Burn-in	No	No	High	1	1

4. Mute – 2 pins for screen mute

  Mute1 – active low pulse for about 0.6 sec when mode change.

  Mute2 – active low pulse for about 1.0 sec when mode change, active with mute 1 simultaneously.

5. D/A – 14 pins (PWM output) are Brightness, Contrast, H-phase, H-size, V-center, V-size, Pincushion, Trapezoid, Rotation, Parallel, Pin-balance, R-gain, G-gain and B-gain.

    – DAC value 255 means the maximum output volts except Parallel PWM.

    – All D/A except Rotation, Brightness, Contrast, R-gain G-gain B-gain are mode dependent functions.

    – Parallel is voltage inverter function.

6. Sync output – 2 pins for H-sync and V-sync negative output, normal high.

7. DDC – 2 pins (DDC SDA/DDC SCL) for DDC1/DDC2B or auto alignment control.

    – In auto alignment mode, all keys and OSD are disabled.

8. SDA/SCL – 2 pins for EEPROM and OSD control.

9. WP – 1 pin, high for EEPROM write protect.

Control Panel Operation

SELECT (RESET)   **POWER**
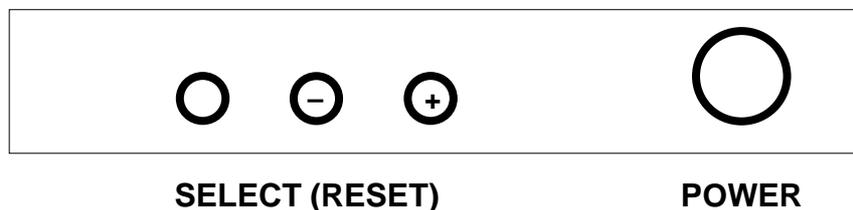
1. Key arrangement – 3 keys for OSD control.

2. Hot key operation

  A. Factory Mode: SELECT Key + UP (+) Key if pressed when the power SW on.

  B. OSD Position Control Mode: DOWN (-) Key if pressed when the power SW on.

  C. Aging mode: Select key if pressed when the power SW on.

<u>IIC interface</u>

  1. DDC1/DDC2B – VESA DDC1/DDC2B is supported.

  2. Auto alignment – I²C auto alignment protocol is supported.

Timing Table

Total 24 modes.

1. Factory mode – 20 modes'*' indicate do not care.

Mode	Resolution	H-sync.	V-sync.	H polarity	V polarity
1	VGA 350	31.5KHz	70Hz	+	-
2	VGA 400	31.5KHz	70Hz	-	+
3	VGA 480	31.5KHz	60Hz	-	-
4	MACII 35k	35.0KHz	66Hz	*	*
5	800*600(56)	35.2KHz	56Hz	*	*
6	8514A	35.5KHz	87Hz	*	*
7	640*480(75)	37.5KHz	75Hz	*	*
8	EVGA 400	37.8KHz	84Hz	-	+
9	800*600(60)	37.8KHz	60Hz	*	*
10	640*480(85)	43.3KHz	85Hz	*	*
11	800*600(75)	46.8KHz	75Hz	*	*
12	1024*768(60)	48.3KHz	60Hz	*	*
13	MACII 49k	49.7KHz	74Hz	*	*
14	800*600(85)	53.6KHz	85Hz	*	*
15	1024*768(70)	56.4KHz	70Hz	*	*
16	1024*768(75)	60.0KHz	75Hz	*	*
17	640*480(120)	63.7KHz	120Hz	*	*
18	1280*1024(60)	64.0KHz	60Hz	*	*
19	800*600(100)	64.0KHz	100Hz	*	*
20	1024*768(85)	68.6KHz	85Hz	*	*

'*' indicate do not care.

2. User mode – 4 modes

   – FIFO replacement is applied.

Pin	Name	Description	I/O
1	DA2	Pin-balance PWM	O
2	DA1	H Position PWM	O
3	DA0	H size PWM	O
4	Reset	Low reset	I
5	Vdd	+5V	I
6	Vss	Ground	I
7	Osc O	8MHz Crystal out	O
8	Osc I	Crystal in	I
9	PB5	EEPROM/OSD SDA	I/O
10	PB4	EEPROM/OSD SCL	O
11	PB3	Test Pattern	O
12	PB2	CS1	O
13	PB1	CS0	O
14	PB0	PMU OFF	O
15	IRQ	CS2	O
16	PC7	MUTE2	O
17	PC6	Degauss out	O
18	PC5	MUTE1	O
19	PC4	PMU suspend	O
20	PC3	Burn-in ID	I

GENERAL DESCRIPTION

The WT6016 is a member of WT60XX microcontroller family. It is specially designed for digital controlled multi-sync monitor. It contains 8-bit CPU, 16K bytes ROM, 288 bytes RAM, 14 PWMs, parallel I/O, SYNC processor, timer, one DDC interface (slave mode I²C interface with DDC1), one master/slave I²C interface, two 4-bit A/D converters and watch-dog timer.

FEATURES

* 8-bit 6502 compatible CPU, 4MHz operating frequency
* 16384 bytes ROM, 288 bytes SRAM
* 8MHz crystal oscillator
* 14 channels 8-bit/62.5kHz PWM outputs (8 open drain outputs & 6 CMOS outputs)
* Sync signal processor with H+V separation, frequency calculation, H/V polarity detection/control
* Three free-running sync signal outputs for burn-in test (64kHz/62.5Hz, 48kHz/75Hz, 31kHz/60Hz)
* Self-test pattern generator generates cross hatch picture
* DDC interface supports VESA DDC1/DDC2B standard
* Master/slave I²C interface
* Watch-dog timer (0.524 second)
* Maximum 25 programmable I/O pins
* One 8-bit programmable timer
* Two 4-bit A/D converter
* One external interrupt request
* Built-in low V_{DD} voltage reset
* +5V power supply

PIN ASSIGNMENT

40 Pin

Left	Pin		Pin	Right
DA2	1		40	VSYNC
DA1	2		39	HSYNC
DA0	3		38	DA3
RESET	4		37	DA4
VDD	5		36	DA5
GUD	6		35	DA6
OSCO	7		34	DA7
OSCI	8		33	PA7/HSO
PB5/SDA2	9		32	PA6/VSO
PB4/SCL2	10	WT6016	31	PA5/DA13
PB3/PAT	11		30	PA4/DA12
PB2	12		29	PA3/DA11
PB1	13		28	PA2/DA10
PB0	14		27	PA1/DA9
PB6/IRQ	15		26	PA0/DA8
PC7	16		25	SCL1/PD0
PC6	17		24	SDA1/PD0
PC5	18		23	PC0/AD0
PC4	19		22	PC1/AD1
PC3	20		21	PC2

42 Pin SDIP

Left	Pin		Pin	Right
DA2	1		42	VSYNC
DA1	2		41	HSYNC
DA0	3		40	DA3
RESET	4		39	DA4
VDD	5		38	DA5
NC	6		37	NC
GUD	7		36	DA6
OSCO	8		35	DA7
OSCI	9		34	PA7/HSO
PB5/SDA2	10	WT6016	33	PA6/VSO
PB4/SCL2	11		32	PA5/DA13
PB3/PAT	12		31	PA4/DA12
PB2	13		30	PA3/DA11
PB1	14		29	PA2/DA10
PB0	15		28	DA1/DA9
PB6/IRQ	16		27	PA0/DA8
PC7	17		26	SCL1/PD0
PC6	18		25	SDA1/PD1
PC5	19		24	PC0/AD0
PC4	20		23	PC1/AD1
PC3	21		22	PC2

* I²C is a trademark of Philips Corporation.
* DDC is a trademark of video Electronics Standard Association (VESA).

PIN DESCRIPTION

Pin No. 40	42	Pin Name	I/O	Descriptions
1	1	DA2	O	**D/A converter 2.** Open-drain output. External applied voltage can up to 10V.
2	2	DA1	O	**D/A converter 1.** Open-drain output. External applied voltage can up to 10V.
3	3	DA0	O	**D/A converter 0.** Open-drain output. External applied voltage can up to 10V.
4	4	/RESET	I	**Reset.** Active low. Schmitt trigger input, Internal pull high.
5	5	VDD		**Power supply (+5V).**
6	7	GND		**Ground (0V).**
7	8	OSCO	O	**Oscillator Output.** Connects a 8MHz crystal.
8	9	OSCI	I	**Oscillator Input.** Connects a 8MHz crystal.
9	10	PB5/SDA2	I/O	**I/O Port B5 or I²C data pin.** This pin can be an I/O port or I²C serial data pin.
10	11	PB4/SCL2	I/O	**I/O Port B4 or I²C data pin.** This pin can be I/O port or I²C clock pin.
11	12	PB3/PAT	I/O	**I/O Port B3 or self-test pattern output.** When as an I/O port, it is same as PB5. When it is configured to test pattern output, a video signal is output.
12	13	PB2	I/O	**I/O Port B2. Same as PB0.**
13	14	PB1	I/O	**I/O Port B1. Same as PB0.**
14	15	PB0	I/O	**I/O Port B0.** When it is an input pin, it has an internal pull-up resistor. When it is an output pin, the source/sink current is 5mA.
15	16	PB6/IRQ	I/O	**I/O Port B6 or Interrupt Request.** When as interrupt request input, it has an internal pull high resistor. When as an I/O port, it is same as PB3.
16	17	PC7	I/O	**I/O Port C7.** When it is an input pin, it has an internal pull-up resistor. When it is an output pin, the sink current is 10mA and the source current is 5mA.
17	18	PC6	I/O	**I/O Port C6.** Same as PC7.
18	19	PC5	I/O	**I/O Port C5.** Same as PC7.
19	20	PC4	I/O	**I/O Port C4.** Same as PC7.
20	21	PC3	I/O	**I/O Port C3.** Same as PC7.
21	22	PC2	I/O	**I/O Port C2.** Same as PC7.
22	23	PC1/AD1	I/O	**I/O Port C1 or A/D converter input 0.**
23	24	PC0/AD0	I/O	**I/O Port C0 or A/D converter input 1.**
24	25	SDA1/PD1	I/O	**DDC serial clock or I/O Port D1.** When it is a DDC interface pin, It is an open-drain output. When as an I/O port, it is same as Port B.
25	26	SCLI/PD0	I/O	**DDC serial clock or I/O Port D0.** When it is a DDC interface pin, It is an open-drain output. When as an I/O port, it is same as Port B.
26	27	PA0/DA8	I/O	**I/O Port A0 or D/A converter 8.** This pin can be the output of D/A converter 8 (source /sink = 5mA) or an I/O pin (source = -100uA, sink = 5mA).
27	28	PA1/DA9	I/O	**I/O Port A1 or D/A converter 9.** Same as PA0/DA8.
28	29	PA2/DA10	I/O	**I/O Port A2 or D/A converter 10.** Same as PA0/DA8.
29	30	PA3/DA11	I/O	**I/O Port A3 or D/A converter 11.** Same as PA0/DA8.
30	31	PA4/DA12	I/O	**I/O Port A4 or D/A converter 12.** Same as PA0/DA8.
31	32	PA5/DA13	I/O	**I/O Port A5 or D/A converter 13.** Same as PA0/DA8.
32	33	PA6/VSO	I/O	**I/O Port A6 / VSYNC OUT.** This pin can be the output of VSYNC or an I/O pin. When as an I/O pin, it is same as PA0.
33	34	PA7/HSO	I/O	**I/O Port A7 / HSYNC OUT.** This pin can be the output of HSYNC or an I/O pin. When as an I/O pin, it is same as PA0.
34	35	DA7	O	**D/A converter 7.** Open-drain output. External applied voltage can up to 10V.
35	36	DA6	O	**D/A converter 6.** Open-drain output. External applied voltage can up to 10V.
36	38	DA5	O	**D/A converter 5.** Open-drain output. External applied voltage can up to 10V.
37	39	DA4	O	**D/A converter 4.** Open-drain output. External applied voltage can up to 10V.
38	40	DA3	O	**D/A converter 3.** Open-drain output. External applied voltage can up to 10V.
39	41	HSYNC	I	**HSYNC input.** Schmitt trigger input.
40	42	VSYNC	I	**VSYNC input.** Schmitt trigger input.

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SYNC Processor

The SYNC processor can : (1) separate the composite sync signal; (2) calculate HSYNC and VSYNC frequencies; (3) detect polarities of HSYNC and VSYNC input; (4) control the output polarities of HSO and VSO pin; (5) generate free-running horizontal and vertical sync signals for burn-in test; (6) generate self-test pattern signal.
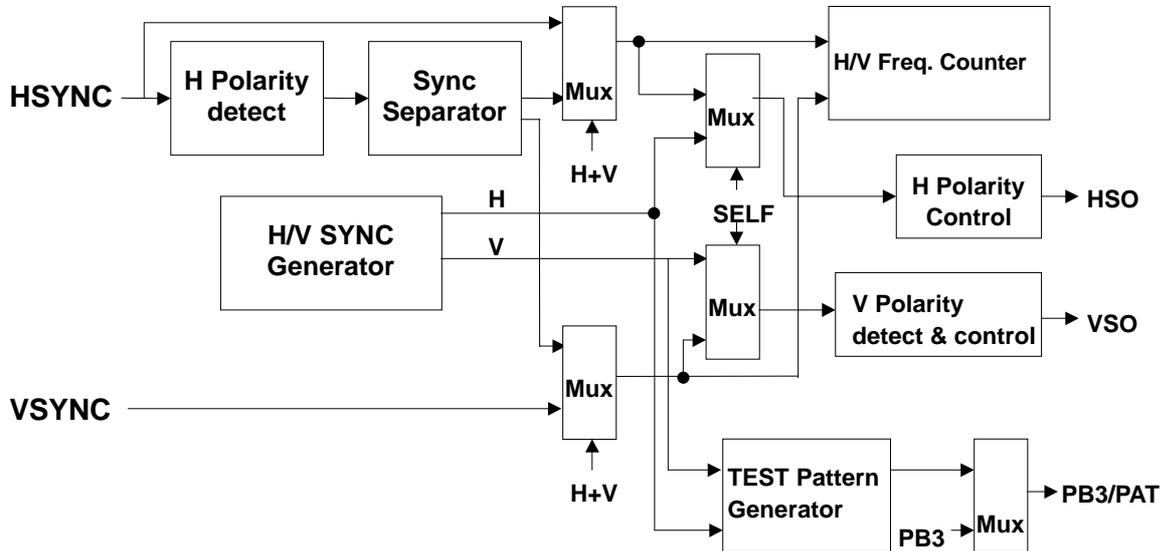
Composite Sync Signal Separation

The composite sync signal comes from HSYNC pin and is separated by the sync separator.
The operations of sync separator are:
- detect the polarity and covert composite sync signal to positive polarity.
- extract Vsync
  Pulse width less than 8us will be filtered, but the Vsync will be widened about 8us.
- count the pulses during the separated Vsync is low and save the counter value (N_H).
- bypass the composite sync pulses before the counter equals to N_H.
- start inserting Hsync pulses after the counter equals to N_H until the separated Vsync is low.
- the period of inserted Hsync is decided by the last two bypassed Hsync.
- the pulse width of the inserted Hsync is 2us.
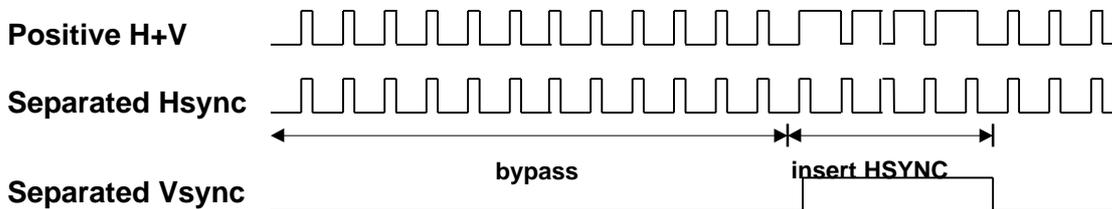
To decide whether the HSYNC input is a composite sync signal or not, program should check the frequency of VSYNC first (reset H+V bit to "0"). If the VSYNC frequency is lower than 15.25Hz (OVF2=1), set H+V bit to "1" and check VSYNC frequency again. If VSYNC still has no frequency, that is power saving condition, program should reset H+V bit. If it has a valid frequency, the HSYNC input is composite signal.

Frequency Calculation

Horizontal frequency and vertical frequencies calculation are done by using one 10-bit up counter. After power is on, the SYNC processor calculates the vertical frequency first (H/V bit = "0"). A 31.25KHz clock counts the time interval between two VSYNC pulses, then sets the FRDY bit and generates an INT1 interrupt (if IEN_S bit is "1"). The software can either use interrupt or polling the FRDY bit to read the correct vertical frequency. After reading the REG#16H, the FRDY bit is cleared to "0", counter is reset and H/V bit is set. The SYNC processor starts to count horizontal frequency. The horizontal frequency calculation is done by counting the HSYNC pulses in 8.192 ms. Like the vertical frequency, the horizontal frequency can be read when the FRDY bit is set or INT1 occurs. After reading the REG#16H, the FRDY, INT_S and H/V bits are cleared. The SYNC processor starts to calculate the vertical frequency again, and so on.

The relationships between counter value and frequency are:

Hfreq = (counter value $\times$ 122.07) Hz

Vfreq = (31250 / counter value) Hz

The frequency range:

Hfreq range: 122.07 Hz to 124.8 kHz; Resolution: 122.07Hz

Vfreq range: 30.5 Hz to 31.25 kHz

If counter overflowed, the OVF1 bit will be set to "1". The counter keeps on counting until it overflowed again. The OVF2 bit and FRDY bit will be set when counter overflowed twice. This is designed for finding the vertical frequency bellows 15.25Hz. The program should check REG#17H before reading REG#16H.

Polarity Detect/Control

The polarities of HSYNC and VSYNC are automatically detected and are shown in the H_POL and V_POL bits. The polarities of HSO and VSO are controlled by the HOP and VOP bits. For example, set HOP bit to "1", the HSO pin always outputs positive horizontal sync signal, whatever the HSYNC input's polarity is.

Free-running Sync Signal

The self-generated sync signals are output from HSO and VSO pins if SELF bit is "1". Three kinds of frequencies are provided:
(1) Hfreq = 8MHz/125 = 64.0kHz, Vfreq = Hfreq/1024 = 62.5Hz.
(2) Hfreq = 8MHz/167 = 47.9kHz, Vfreq = Hfreq/640 = 74.9Hz.
(3) Hfreq = 8MHz/257 = 31.1kHz, Vfreq = Hfreq/512 = 60.8Hz.

The output polarities are controlled by the HOP and VOP bits.

The pulse width of HSO is 2us and VSO is four HSO cycles. The timing relationship is shown in the following:
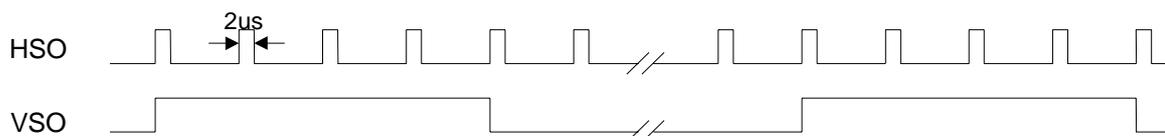
Test Pattern Generation

A self-test pattern signal comes out from pin PB3/PAT. It can generate a cross hatch picture, a inverted cross hatch picture, a whit epicture or a black picture.
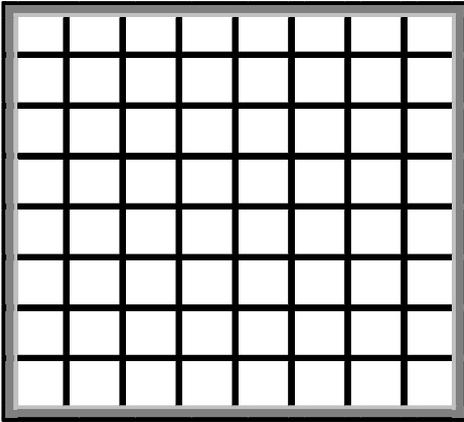
8 × 8 cross hatch
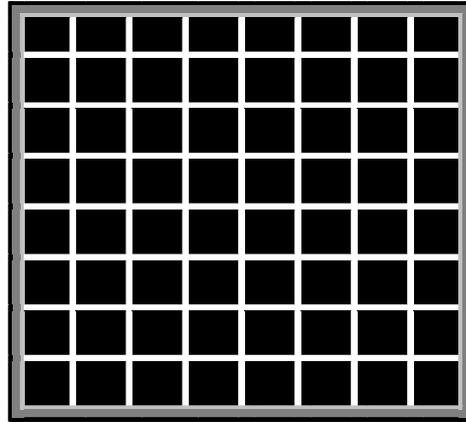
Inverted 8 × 8 cross hatch

White Picture
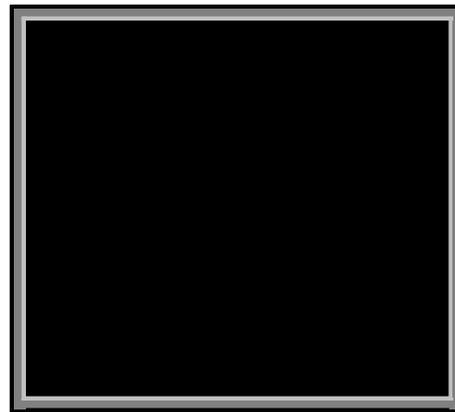
Black Picture

The test pattern signal is generated when SELF and ENPAT are both set to "1". This video signal will synchronize to the free-running Hsync and Vsync, no matter which frequency is chosen. The following diagram shows the timing relationship of cross hatch picture.
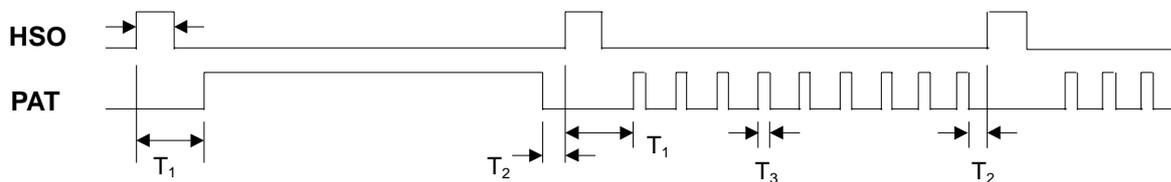
HSO	VSO	T_1	T_2	T_3
31.1kHz	60.8Hz	6us	1us	62.5ns
47.9kHz	74.9Hz	5.125us	0.625us	62.5ns
64kHz	62.5Hz	3.625us	0.875us	62.5ns

DDC Interface

The DDC interface is a slave mode I²C interface with DDC1 function. It is fully compatible with VESA DDC1/2B standard. The functional block diagram is shown in the below.
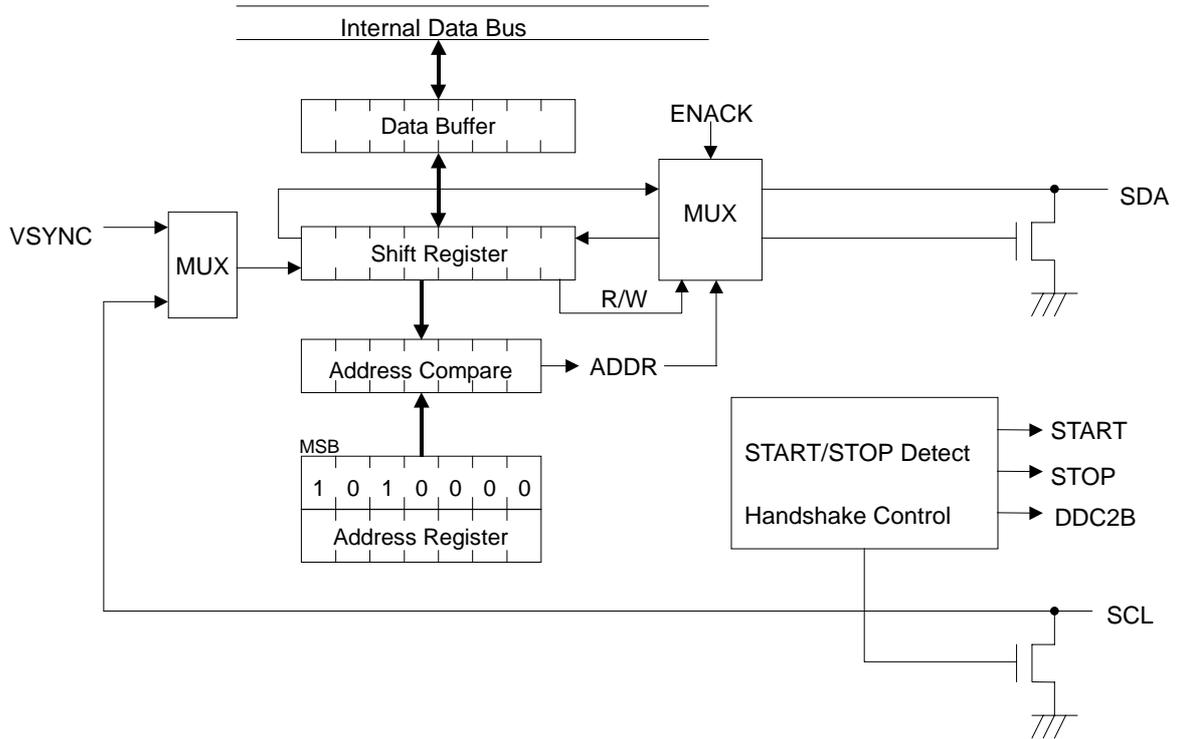
After power on or reset the DDC interface, it is in DDC1 state. The shift register shilfts out data to SDA pin on the rising edge of VSYNC clock. Data format is an 8-bit byte followed by a null bit. Most significant bit (MSB) is transmitted first. Every time when the ninth bit has been transmitted, the shift register will load a data byte from data buffer (REG#18H). After loading data to the shift register, the data buffer becomes empty and generates and INT0 interrupt. So the program must write one data byte into REG#18 every nine VSYNC clocks.

Since the default values of data buffer (REG#22) and shift register are FFH, the SDA pin outputs high level if no data had been written into data buffer after power on reset. When program finished initialization and set the IEN_D bit to "1", the INT0 will occur because the data buffer is empty. The INT0 service routine should check the DDC2B bit is "0" and then writes the first EDID data byte into data buffer. When the second INT0 occurs, the INT0 service routine writes the second EDID data byte into data buffer and so on.
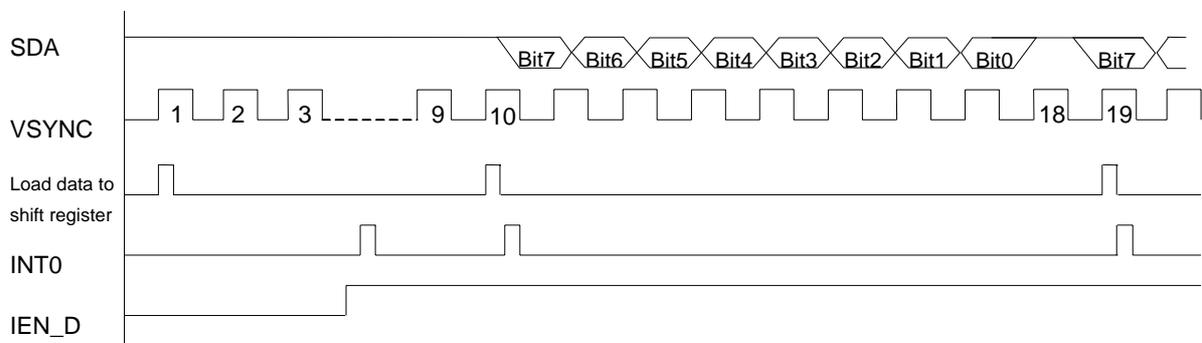
If a low level occurs on the SCL pin in DDC state, the DDC interface will switch to DDC2B state immediately and set the DDC2B bit to "1". No interrupt will be generated. But, if there is no valid device address and it receives 128 VSYNC pulses while the SCL is high level, it will lock into DDC2B state and disregard VSYNC.

In some case, program wants to go back DDC1 state, set RDDC bit in REG#1AH and reset it again. This operation resets the DDC interface to the initial condition.

When it is in DDC2B state, the VSYNC clock is disregarded and the communication protocol follows the DDC standard. The data format on SDA pin is:

S	Address	R/W	A	D7, D6,..., D0	A		D7, D6,..., D0	A	P

S: Start condition. A falling edge occurs when SCL is high level.
P: Stop condition. A rising edge occurs when SCL is high level.
A: Acknowledge bit. "0" means acknowledge and "1" means non-ackonwledge.
Address: 7-bit device address.
R/W: Read/Write control bit, "1" is read and "0" is write.
D7, D6, …, D0: data byte.

The hardware operations in DDC2B state are:

(1) START/STOP detection

When the START condition is detected, the DDC interface Is enabled and set START bit to "1'.
When the STOP condition is detected, the DDC interface is disabled, set STOP bit to "1" and generate INT0 interrupt.
The START bit is cleared when the following data byte received.
The STOP bit is cleared after writing REG#19H.

(2) Address Recognition
It contains two device addresses in WT6018. On fixed address ('1010000') is for EDID reading and one programmable address (REG#19H) is for external control, such as auto alignment.
If the address is equal to "1010000", set ADDR bit to"0".
If the address is equal to the bit A6 to bit A0 (REG#19H), set ADDR bit to"1".
If the address is not equal to anyone above, the DDC interface will not response acknowledge.
The ADDR bit is updated when a new device address is received.

(3) Store R/W bit and decide the direction of SDA pin
The R/W bit on the SDA pin will be stored in the RW bit.

(4) Acknowledge bit control/detection
Acknowledge bit control in receive direction:
If ENACK=1 and address compare is true, response acknowledge (Acknowledge bit ="0").
If ENACK=0 or address compare is false, response non-acknowledge (Acknowledge bit ="1").

Acknowledge bit detect in transmit direction:
If the acknowledge bit is "1", the DDC interface will be disabled and release the SDA pin.
If the acknowledge bit is "0", the DDC interface keeps on communicating.

(5) Data bytes transmit/receive

If the RW bit is "1", the shift register will load data from the data buffer (REG#18H) before the data byte is transmitted and shift out data to the SDA pin before the rising edge of the SCL clock.

If the RW bit is "0", the shift register will shift in data on the rising edge of the SCL clock and the whole data byte is latched to the data buffer (REG#18H).

(6) Handshaking procedure

The handshaking is done on the byte level. The DDC interface will hold the SCL pin low after the acknowledge bit automatically. The bus master will be forced to wait until the WT6018 is ready for the next byte transfer. To release the SCL pin, write REG#19H will release clear the wait state.

(7) Interrupt INT0

The DDC interface interrupt is enabled by setting the IEN_D bit in the REG#1AH.

Interrupt INT0 occurs when:

- Transmit buffer empty in DDC1 state.

  The INT0 occurs when the shift register load data from data buffer.

  Write REG#18H will clear the transmit buffer empty condition.

- Acknowledge is detected in DDC2B state.

  The INT0 occurs on the falling edge of the SCL clock after the acknowledge had been detected.

  The SCL pin will be pulled low to force the bus master to wait until the service routine write REG#19H.

- STOP condition occurs in DDC2B mode

Address	R/W	Initial	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0018H	R/W	FFH	D7	D6	D5	D4	D3	D2	D1	D0
0019H	R	40H	DDC2B	ADDR	R/W	START	STOP	--	--	--
0019H	W	A0H	A6	A5	A4	A3	A2	A1	A0	ENACK

Bit Name	Bit value = "1"	Bit value = "0"
DDC2B	DDC2B state.	DDC1 state.
ADDR	Received address equals to the address in REG#19H(W).	Received address equals to '1010000'
RW	Received R/W bit is '1'	Received R/W bit is '0'
START	START condition is detected.	No START condition is detected.
STOP	STOP condition is detected.	No STOP condition is detected.
ENACK	Enable acknowledge.	Disable acknowledge.
A6, A5, … , A0	7-bit slave address	
D7, D6, … , D0	Data to be transmitted or received data.	

First Diagram

Pull low SCL   Pull low SCL   Pull low SCL

SCL

SDA In   1 0 1 0 0 0 0 0   Data Byte   Data Byte

SDA Out   A   A   A

Write REG#19H to release

Shift register to data buffer

INTO

DDC2B=1	DDC2B=1	DDC2B=1	DDC2B=1
ADDR=0	ADDR=0	ADDR=0	ADDR=0
R/W=0	R/W=0	R/W=0	R/W=0
START=1	START=0	START=0	START=0
STOP=0	STOP=0	STOP=0	STOP=1

DDC2B state write timing

Second Diagram

Pull low SCL   Pull low SCL

SCL

SDA In   1 0 1 0 0 0 0 1   A   N

SDA Out   A   Data Byte   Data Byte

Write REG#19H to release

Data buffer to shift reg

INTO

DDC2B=1	DDC2B=1	DDC2B=1
ADDR=0	ADDR=0	ADDR=0
R/W=1	R/W=1	R/W=1
START=1	START=0	START=0
STOP=0	STOP=0	STOP=1

DDC2B state write timing

3. 2-wire serial CMOS EEROPM

Features

- Low Voltage and Standard Voltage Operation
    - 5.1 (Vcc = 4.5 V to 5.5 V)
    - 3.0 (Vcc = 2.7 V to 5.5 V)
    - 2.5 (Vcc = 2.5 V to 5.5 V)
    - 2.0 (Vcc = 1.8 V to 5.5 V)
- Internally Organized 128 x 8 (1K), 256 x 8 (2K), 512 x 8 (4K), 1024 x 8 (8K) or 2048 x 8 (16K)
- Two-wire Serial Interface
- Bldirectional Data Transfer Protocol
- Wire Protect Pin for Hardware Data Protection
- Eight-byte Page (1K, 2K), 16-byte Page (4K, 8K, 16K) Write Modes
- Partial Page Write Cycle (10 ms max)
- High Reliability
    - Endurance: 100,00 Cycles
    - Extended Endurance Devices Available
    - Data Retention: 100 years
- Automotive Grade and Extended Temperature Device Available
- Eight-Pin and 14-Pin JEDEC SOIC and Eight-Pin PDIP Packages

Description

The AT24C01A/02/04/08/16 provides 1024/2048/4096/8192/16384 bits of serial electrically erasable and programmable read only memory (EEPROM) organized as 128/256/512/1024/2048 words of 8 bits each. The device is optimized for use in many industrial and commercial applications where low power and low voltage operation are essential. The AT24C01A/02/04/08/16 is available in space saving eight-pin PDIP, eight-pin and fourteen-pin SOIC packages and is accessed via a two-wire serial interface. The AT24C01A/02/04/08/16 is guaranteed for 100,000 erase/wire cycles and 100 year data retention. In addition, the entire family is available in 5.0 V (4.5 V to 5.5 V), 3.0 V (2.7 V to 5.5 V), 2.5 V (2.5 V to 5.5 V) and 2.0 V (1.8 V to 5.5 V) versions.

Pin Configurations

Pin Name	Function
A_0 to A_2	Address Inputs
SDA	Serial Data
SCL	Serial Clock Input
WP	Write Protect
NC	No Connect

14-PIN PDIP

Left pin	No.	No.	Right pin
NC	1	14	NC
A0	2	13	Vcc
A1	3	12	WP
NC	4	11	NC
A2	5	10	SCL
GND	6	9	SDA
NC	7	8	NC

8-PIN PDIP

Left pin	No.	No.	Right pin
A0	1	5	Vcc
A1	2	6	WP
A2	3	7	SCL
GND	4	8	SDA

8-PIN PDIP

| Left pin	No.	No.	Right pin
A0	1	5	Vcc
A1	2	6	WP
A2	3	7	SCL
GND	4	8	SDA
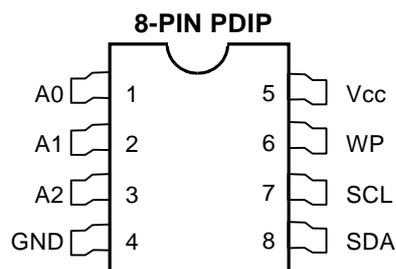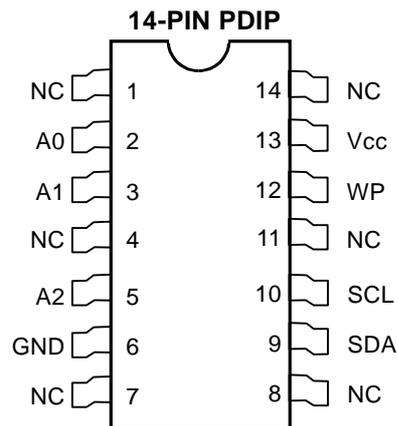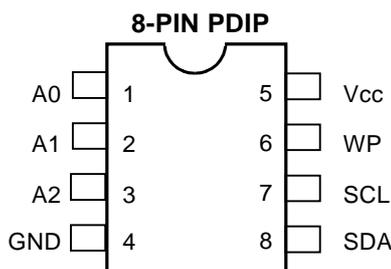
4. Horizontal deflection signal processing

LM1290:

1. Full-automatic synchronization from 22 kHz to 90 kHz. No component changeover nor external adjustment is required.
2. DC control H phase and duty cycle.
3. The resistance corresponds to the frequency programmable down to VCO.
4. X-ray input invalid.
5. H-drive invalid due to low VCC (when VCC<9.5V). The H OUT transistor is protected as a result.
6. The capacitor protects the H output transistor during the change of the scanning mode, by means of the programmable frequency ramming H VO/dt.

**System Block Diagram**
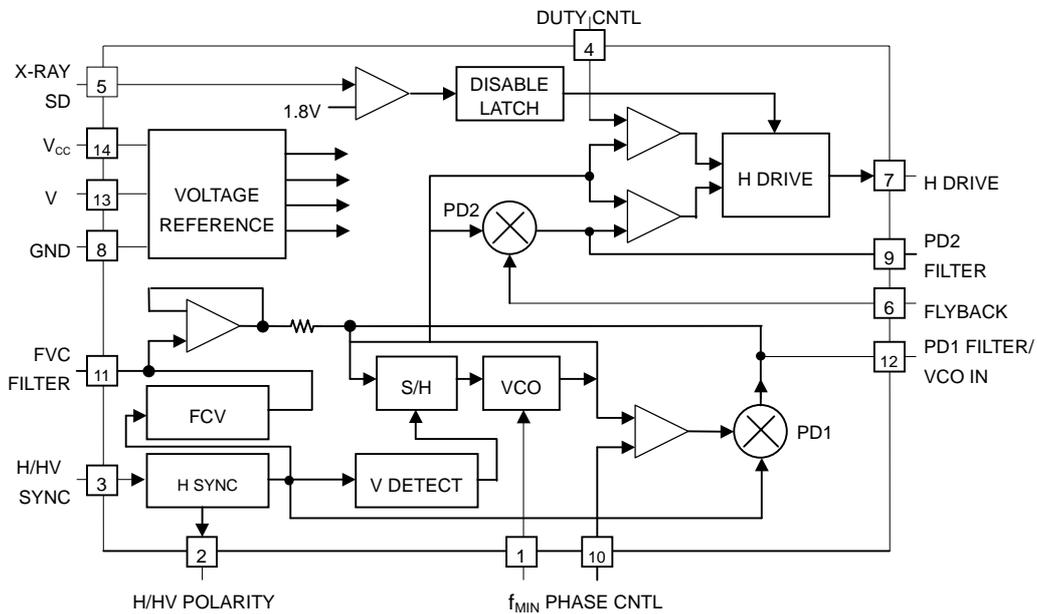
Typical Application LM1290
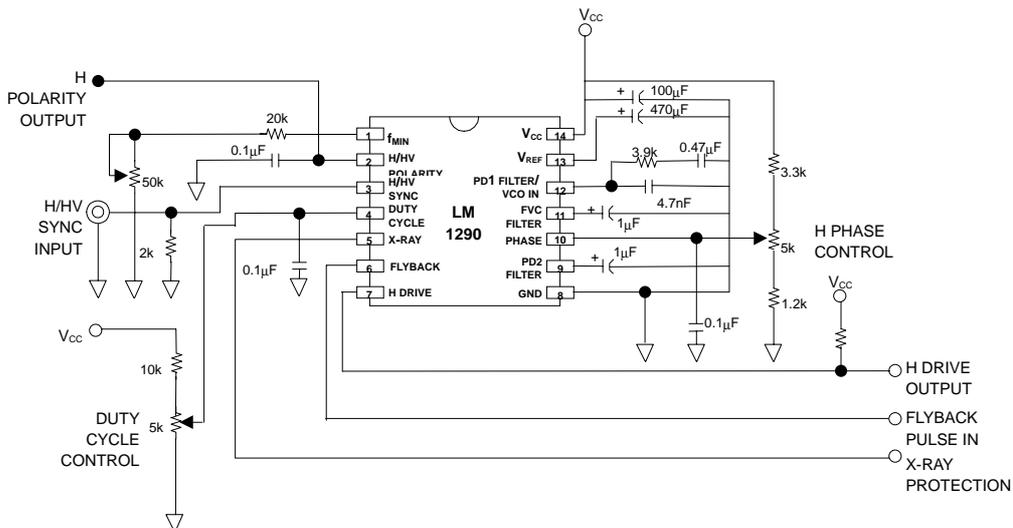
1. PIN 1. fmin: lower limit frequency of this setting. fmin = 5.6×10^8/ (Rmin*500)

   fmin = 29.1 kHz, Rmin = 18.7KΩ (When the frequency is 30kHz or more)

   fmin = 22.8 kHz, Rmin =24KΩ (When the frequency is 24kHz or more)

2. PIN 2. Polarity of H/HV:

   C_{POL} = 0.1uf, Io = ±1uA , Vo = 1-e-t/RC

3. H/HV synchronous input:

   When there is compatibility between TTL and CMOS, the H/HV synchronous input is within the 0.35 to 1.85 V range, and the polarity is negative.

4. Power factor control:

   V4 = 0~4V = 70 to 30%, 10%/V

   V4 = (Vref*R1)/R2 = 2.17V

   Duty = (2.17*10%/V) + 30% = 51.7 to 56.7%

5. X-ray shutdown:

   Specification: 1.65 to 1.8V shutdown

   When B+ HV=25 kV, we have Vout = 25 V_{DC}, therefore, when shutdown HV = 27.5 kV, we have Vout = 30.8 V_{DC}.

   When R1 = 10.7KΩ and R2=10KΩ, we have shutdown VOL = 26.8 to 28.2KV.

6. Fly-back input threshold voltage:

   10 Vp-p < Vin, Vcc (12V) R484 = 24KΩ, Vin = 11 Vp-p.

7. Horizontal drive:

   Low level current: Minimum 100mA

   Low level voltage: Maximum 0.4V

   48.36KHz: Ton = 11.01 us, Toff = 9.66 us : 53.28%

8. Pin 10 H-PHASE control:

   Control gain = 8.89% TH/V

   Minimum control ROMGE = ± 22%TN

   V10 = 3.8~6.8V   f = 31.5 kHz, Range = ± 7.9 us

                      f = 64 kHz, Range = ± 3.9 us

9. Vref: Vref specification = 8.2 V_{DC}

10.   FVC filter:

   FVC = 0.052 V/kHz   V11 31.5KHz to 64KHz =1.734 to 3.53V

5.   Vertical compensation and geometrical compensation of the raster

LM1295:

1. Vertical scanning frequency : 50 to 100Hz.
2. DC control compensation amplitude
3. Temperature stability of the vertical amplitude : 1%.
4. Dynamic vertical deflection compensation corresponding to the secondary anode voltage drop.
5. Positive and negative compensation signals.

Block Diagram
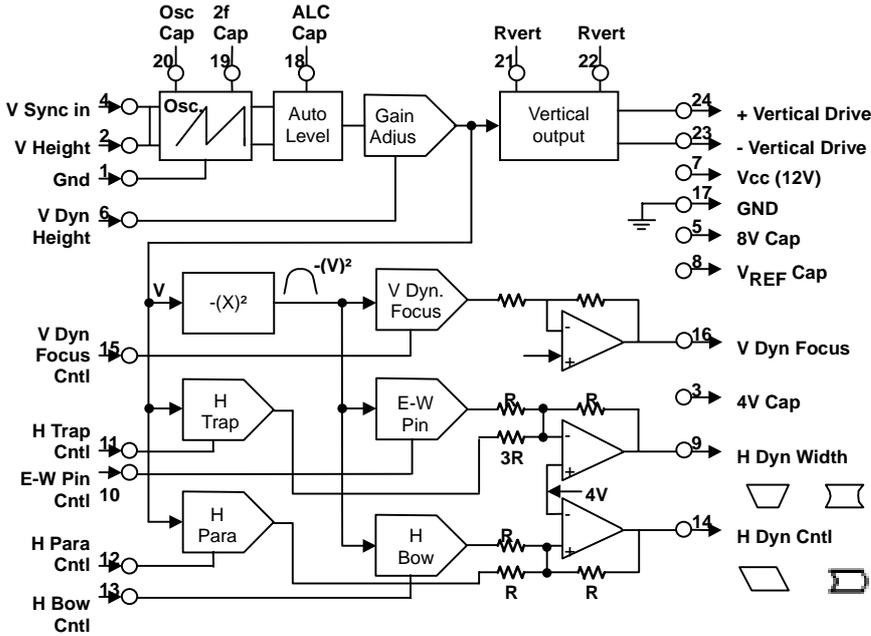
LM1295 Application
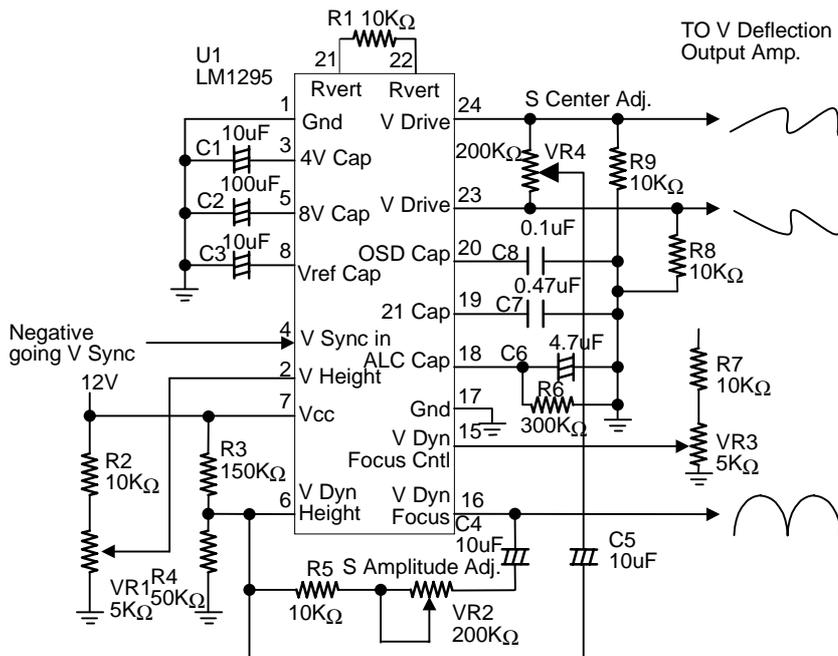
1. V-Height (Pin-2):

   The amplitudes of the +V and –V drive currents are controlled by means of the 0V to 4V voltage of this pin. The current can be raised by raising by raising the voltage. The control range is approximately 1.8 to 1.

2. 4V CAP (Pin 3):

   4 V CAP (capacitor), 10 uF capacitor.

3. V-Sync in:

   The vertical synchronization input is a negative TTL level pulse, and it has the function of locking the vertical oscillator. The pulse has a minimum width of approximately 200 nS.

4. 8V CAP (Pin 5):

   8V CAP (capacitor), 100uF capacitor.

5. V-Dyn Height (Pin 6):

   The amplitude of the driving currents of the voltages +V and –V are controlled by means of the 3V to 4V voltage of this pin.

6. H-Dyn Height (Pin 9):

   This output is expressed by the sum of the vertical ramp and the parabola resulting from that ramp. The amplitude and the polarity of the ramp signal is controlled by H TRAP CNTRL (Pin 11), and the amplitude and polarity of the parabola is controlled by E-W PIN CNTRL (PIN 10), both in the DC-control mode.

7. E-W PIN CNTRL (Pin 10):

   This is the E-W direction pincushion deformation control function, and the voltage range is within the 0V-4V range. When the voltage falls within the 2V-4V range, the amplitude increases, and the parabola becomes positive. On the other hand, when the voltage falls within the 2V-0V range, the parabola becomes negative.

8. TRAP CNTRL (Pin 11):

   This is the trapezoid control function, and the voltage is within the 0V-4V range. When the voltage falls within the 2V-4V range, the amplitude increases, and the ramp becomes positive. On the other hand, when the voltage falls within the 0V-2V range, the ramp becomes negative.

9. Parallelogram control (Pin 12):

   The voltage is within the 0V to 4V range. When the voltage falls within the 2V-4V range, the ramp, the ramp becomes positive.

   One the other hand, when the voltage falls within the 0V-2V range, the ramp becomes negative.

10. Bow shape control (Pin 13):

    The voltage is within the 0V-4V range. When the voltage falls within the 2V-4V range, the parabola becomes positive. On the other hand, when the voltage falls within the 0V-2V range, the parabola becomes negative.

11. Output of the parabola and bow-shaped parabola (Pin 14):

    The amplitude and the polarity of the ramp signal are controlled by means of the PARA CNTRL (Pin 12), and the amplitude and polarity of the parabola are controlled by the BOW CNTRL (PIN 13).

    In both cases, the control is carried out in the DC mode.

12. V Dyn Focus control (Pin 15):

    The voltage is within the 0V to 4V range. When the voltage falls within the 2V-4V range, the parabola becomes positive. On the other hand when the voltage falls within the 0V-2V range, the parabola becomes negative.

13. V Dyn Focus (Pin 16)

14. ALC Cap (Pin 18):

    This is the Automatic level Controller (ALC) capacitor, and the recommended value is 4.7 uF.

15. Frequency doubling capacitor:

    This is the vertical oscillator that locks at a frequency twice as high as the vertical synchronization frequency. Its capacitance is 0.47 uF.

16. OSC Cap (Pin 20):

    The value of the capacitance is 0.1 uF.

17. Rvert (Pin 21/22):

    The vertical resistor has the function of determining the gain of the vertical ramp current generator.

18. –V drive (Pin 23) and +V drive (PIN 24):

    –V is the negative portion of the vertical ramp output current of the object of the operation.

    The ramp current waveform is superimposed on the DC current of the approximately 315 uA.

    The voltage corresponding to the output (typically 10 kΩ) is typically 6V.

6. Horizontal drive and power supply output

Circuit Diagram
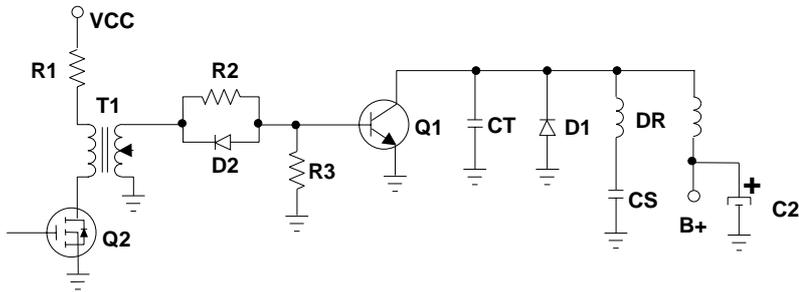
Description of the circuit:

1) R1, T1 and Q2 compose the horizontal driving circuit, and the transistor Q1 generates a horizontal output through the driving signal.

$$IB1 = I_{CPMAX} / Q1h_{feMIN}$$
$$I_{B2} \gtrless 3I_{B1}$$
$$di/dt \gtrless 3.3 \text{ A/us}$$

2) The resistor R2 corrects the current IB1, the resistor R3 works as a damping resistor and leak resistor, and the diode D2 works as a discharging device and polar body.
As long as the transistor Q1 is OFF, the discharge is accelerated and the storage time (Tstg) is shortened.

3)H-OUT circuit waveform

Time 5uS/div

60
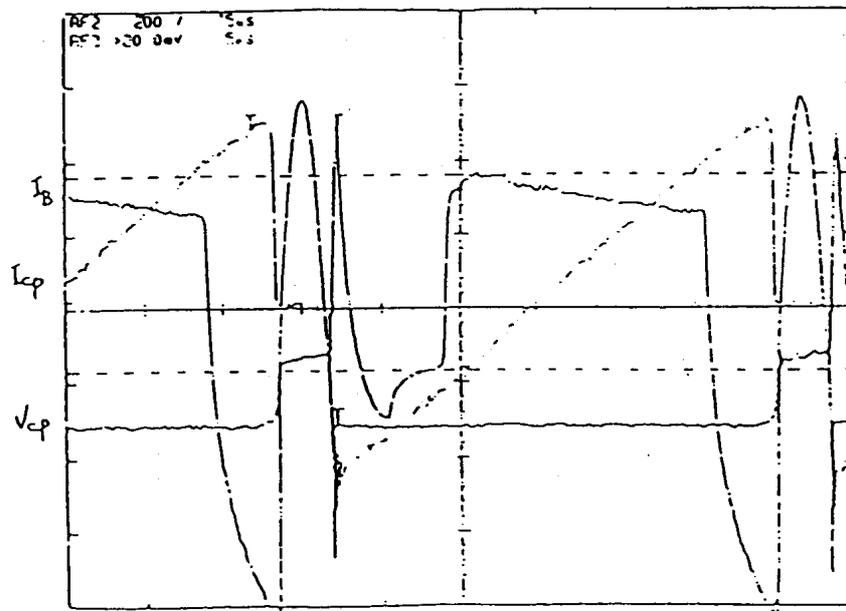
7. Horizontal amplitude control

Circuit Diagram
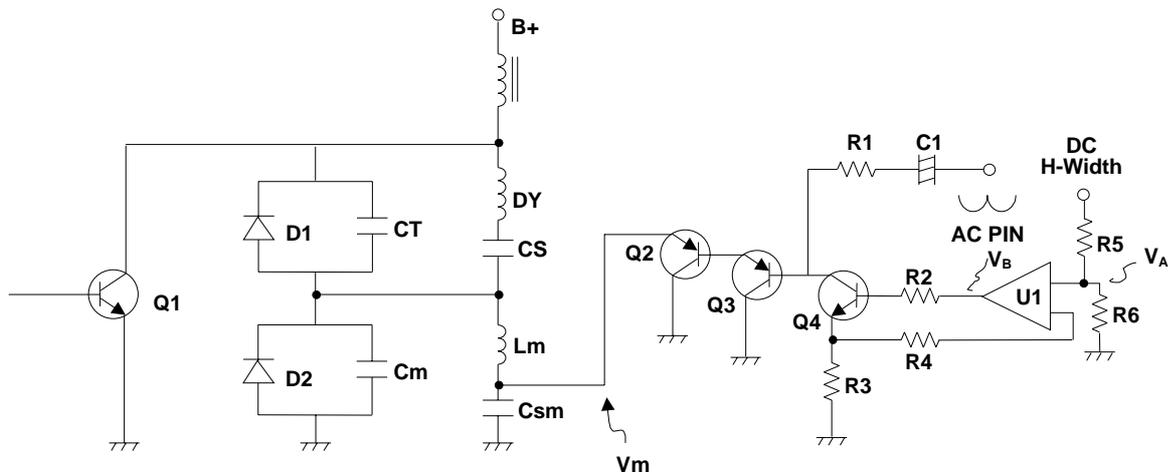
Description of the circuit:

1) The diodes D1 and D2 compose the bipolar modulation circuit, and have the function of controlling the currents of the oils DY(lpp) and Lm(lm) through voltage modulation carried out by utilizing VM.

B+ = Vm +Vcs   Therefore, Vcs = (ly * Ly)/ts $\rightarrow$ ly = (Vcs * ts)/Ly, with B+ fixed.

Such being the case, the horizontal width decreases when Vm $\uparrow$ $\rightarrow$ Vc $\downarrow$ $\rightarrow$ ly $\downarrow$

Inversely, the horizontal width decreases when Vm $\downarrow$ $\rightarrow$ Vcs $\uparrow$ $\rightarrow$ ly $\uparrow$

(B+ = (Vp*2Tr)/(π*Ts), Tr = $_{\|}$ôLyCt, Tm = $_{\|}$ôLmCm)

2) Q2, Q3, Q4 and U1 compose the control circuit of H-WIDTH. Of those devices, the transistor Q1 and Q2 compose the Darlington current amplifier, and on the other hand the transistor Q4 and the operational amplifier U1 compose the emitter-coupled circuit, that stabilize the voltage and control the current.

3) The horizontal width broadens when Va $\uparrow$ $\rightarrow$ Vbl $\uparrow$ $\rightarrow$ I1 $\uparrow$ $\rightarrow$ I2 $\uparrow$ $\rightarrow$ Vm $\downarrow$ $\rightarrow$. An inference in the opposite sense is also possible.

Test points for maintenance:

1) C_T = 31 to 37 kHz = 3.2 us

   48 to 64 kHz = 3.0 us

   Cm $\div$ 2.8 us

2) V_ACENTER: 31 to 64 kHz $_{\|}$ʊ1.91 to 4.06V

   V_MCENTER: 31 to 64 kHz $_{\|}$ʊ11.6 to 27.4V

8.   Blanking and spot killer
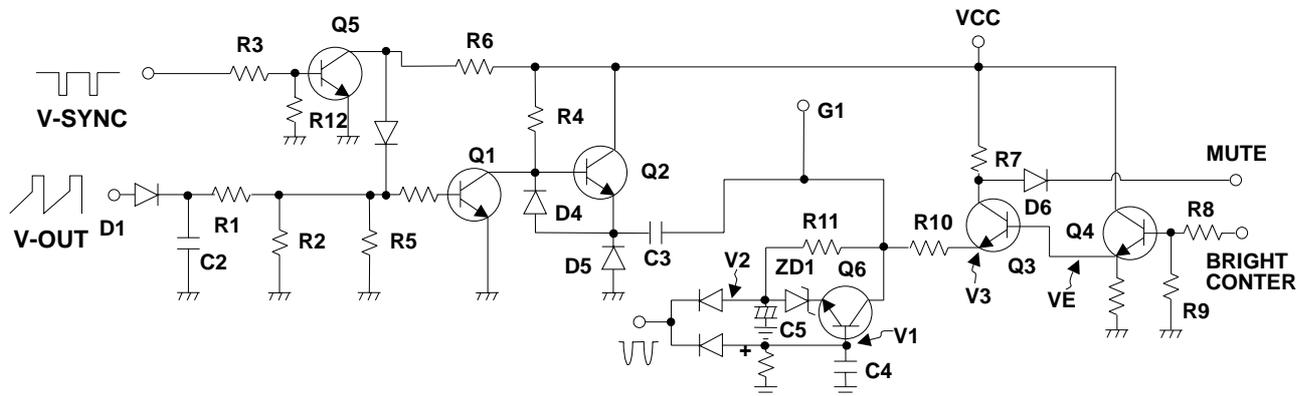
Circuit Diagram
Description of the circuit:

1) The vertical blanking circuit completes by Q1, Q2, Q3 and peripheral circuit.
   The vertical sync pulse applied to R3, R12 connected to Q5 base. Q5 is invert amplifier, then
   mixer with Q1 base together for compensate vertical retrace time of the blanking pulse.

2) The vertical amplifier output waveform through D1, C2, R1, R2 make waveform forming and
   clamp. Then applied to Q1 base, the vertical blanking amplifier of the Q1, the output connected
   to buffer Q2, through C3 coupling to G1 control circuit. D4, D5 for over voltage protect.

3) The Q6 is spot killer protect circuit, in normal power on stage.
   V1 = V2 and ZD1, so Q6 off. The CRT G1 voltage is fixed at −45 ~ −67V_{DC} with vertical blanking
   pulse 12Vpp VG1 = − (V × R11) / (R10 + R11), (V = V1 − V3).
   When power off the voltage V1 > V2, then Q6 turn on pulling VG1 to −180V to protect CRT.

4) When Mute set to lower the Q3 off G1 = −180V screen cut off no picture display, this mute circuit
   makes active, at power ON/OFF and when mode change stage.

5) Q4 bias set up by MCU to control the V_{CE} bias of Q3, then control G1 voltage output.

Test points for maintenance:

1) Check D1, R3 and Q1 collector
2) G1 voltage control range= −45 ~ −67VDC
   G1 off momentary voltage 约−180VAC

9. Video amplifier system with on-screen display

LM1281 (U201)

Outstanding features:
* Three-channel video amplifier bandwidth 85 MHz @ -3 dB (4 Vp-p output)
* OSD TTL input, bandwidth 50 MHz
* High-speed video/OSD changeover
* High impedance DC contrast control above the 0-4V, 40dB range
* High impedance DC OSD contrast control above the 0-4V, 40dB range

BLOCK AND CONNECTION DIAGRAM
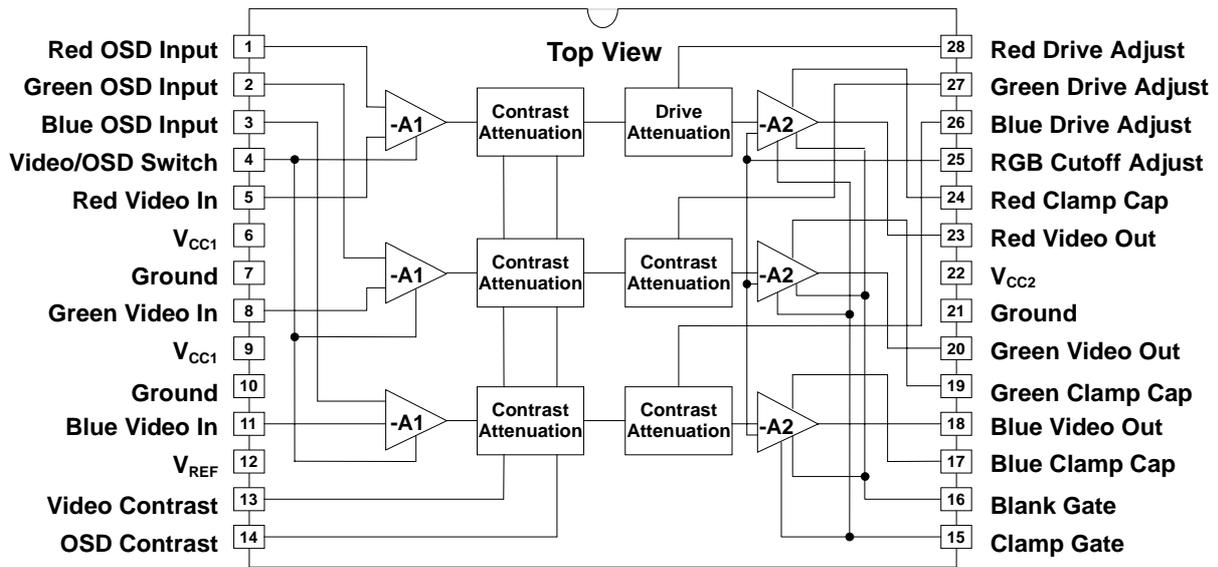
Description of the functions

   Figure 1 shows the block diagram of LM1281, in conformity with the pin layout of the IC.
   Every channel accepts both the video signal and the OSD signal at the input anplifier (A1).
   Also the video/OSD changeover signal passes either the video signal or the OSD signal through
   LM1281, or is connected with the input amplifier for control purposes. The next contrast adjustment
   block is a drive adjustment type one.
   The reference level for the DC return circuit is set by means of the RGB cutoff adjustment pin (PIN 25).
   Attention must be paid to the fact that the blank clamp gate is active when it is stuck at the LOW state.
   Under ordinary circumstances, these pins are controlled by means of the standard TTL signal.

Test Circuits
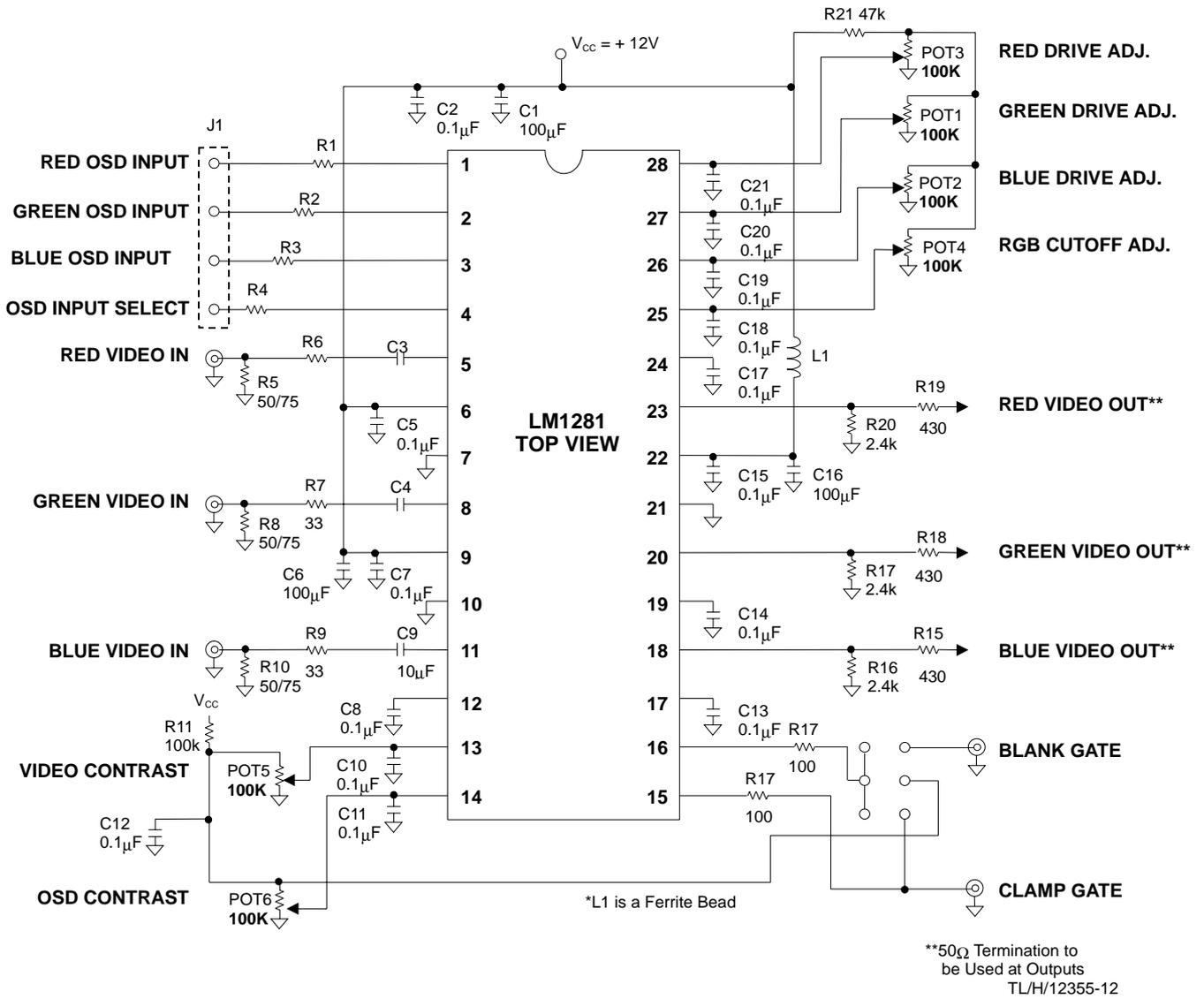
FIGURE 2 LM1281 OSD Video Preamp Demonstration Board Schematic

National Semiconductor
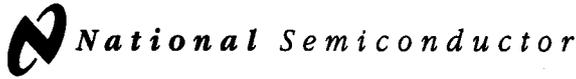
August 1999

LM2438
Monolithic Triple 13.5 ns CRT Driver

General Description

The LM2438 is an integrated high voltage CRT driver circuit designed for use in color monitor applications. The IC contains three high input impedance, wide band amplifiers which directly drive the RGB cathodes of a CRT. Each channel has its gain internally set to −14 and can drive CRT capacitive loads as well as resistive loads present in other applications, limited only by the package's power dissipation.

The IC is packaged in an industry standard 9-lead TO-220 molded plastic power package. See Thermal Considerations section.

Features

- Well matched with LM1279 video preamp
- 0V to 5V input range
- Stable with 0–20 pF capacitive loads and inductive peaking networks
- Convenient TO-220 staggered lead package style
- Standard LM243X Family Pinout which is designed for easy PCB layout

Applications

- 1024 x 768 displays up to 60 Hz refresh
- Pixel clock frequencies up to 60 MHz
- Monitors using video blanking

Schematic and Connection Diagrams
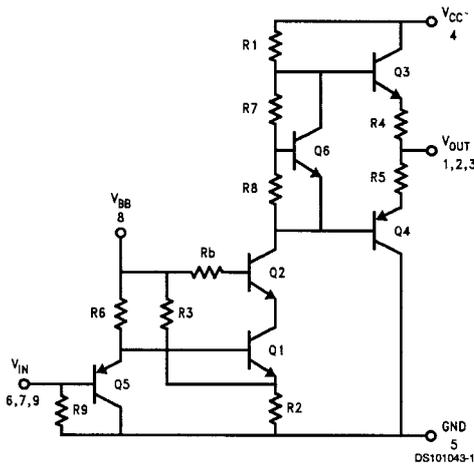
FIGURE 1. Simplified Schematic Diagram (One Channel)
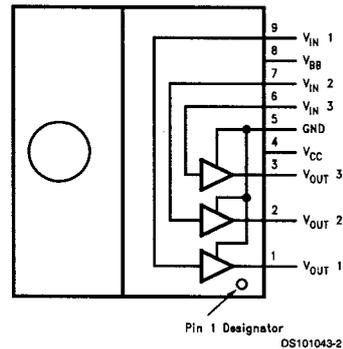
Note: Tab is at GND

Top View
Order Number LM2438T

Text on right margin: LM2438 Monolithic Triple 13.5 ns CRT Driver

www.national.com

Theory of Operation

The LM2438 is a high voltage monolithic three channel CRT driver suitable for high resolution display applications. The LM2438 operates with 80V and 12V power supplies. The part is housed in the industry standard 9-lead TO-220 molded plastic power package.

The circuit diagram of the LM2438 is shown in *Figure 1*. The PNP emitter follower, Q5, provides input buffering. Q1 and Q2 form a fixed gain cascode amplifier with resistors R1 and R2 setting the gain at –14. Emitter followers Q3 and Q4 isolate the high output impedance of the cascode stage from the capacitance of the CRT cathode which decreases the sensitivity of the device to load capacitance. Q6 provides biasing to the output emitter follower stage to reduce crossover distortion at low signal levels.

Figure 2 shows a typical test circuit for evaluation of the LM2438. This circuit is designed to allow testing of the LM2438 in a 50Ω environment without the use of an expensive FET probe. In this test circuit, the two 2.49 kΩ resistors form a 200:1 wideband, low capacitance probe when connected to a 50Ω coaxial cable and a 50Ω load (such as a 50Ω oscilloscope input). The input signal from the generator is ac coupled to the base of Q5.

Application Hints

INTRODUCTION

National Semiconductor (NSC) is committed to provide application information that assists our customers in obtaining the best performance possible from our products. The following information is provided in order to support this commitment. The reader should be aware that the optimization of performance was done using a specific printed circuit board designed at NSC. Variations in performance can be realized due to physical changes in the printed circuit board and the application. Therefore, the designer should know that component value changes may be required in order to optimize performance in a given application. The values shown in this document can be used as a starting point for evaluation purposes. When working with high bandwidth circuits, good layout practices are also critical to achieving maximum performance.

IMPORTANT INFORMATION

The LM2438 performance is targeted for the XGA (1024 x 768, 60 Hz refresh) resolution market. The application circuits shown in this document to optimize performance and to protect against damage from CRT arcover are designed specifically for the LM2438. If another member of the LM243X family is used, please refer to its datasheet.

POWER SUPPLY BYPASS

Since the LM2438 is a wide bandwidth amplifier, proper power supply bypassing is critical for optimum performance. Improper power supply bypassing can result in large overshoot, ringing or oscillation. 0.1 µF capacitors should be connected from the supply pins, V_{CC} and V_{BB}, to ground, as close to the LM2438 as is practical. Additionally, a 47 µF or larger electrolytic capacitor should be connected from both supply pins to ground reasonably close to the LM2438.

ARC PROTECTION

During normal CRT operation, internal arcing may occasionally occur. Spark gaps, in the range of 200V, connected from the CRT cathodes to CRT ground will limit the maximum voltage, but to a value that is much higher than allowable on the LM2438. This fast, high voltage, high energy pulse can damage the LM2438 output stage. The application circuit shown in *Figure 9* is designed to help clamp the voltage at the output of the LM2438 to a safe level. The clamp diodes, D1 and D2, should have a fast transient response, high peak current rating, low series impedance and low shunt capacitance. FDH400 or equivalent diodes are recommended. Do not use 1N4148 diodes for the clamp diodes. D1 and D2 should have short, low impedance connections to V_{CC} and ground respectively. The cathode of D1 should be located very close to a separately decoupled bypass capacitor (C3 in *Figure 9*). The ground connection of D2 and the decoupling capacitor should be very close to the LM2438 ground. This will significantly reduce the high frequency voltage transients that the LM2438 would be subjected to during an arcover condition. Resistor R2 limits the arcover current that is seen by the diodes while R1 limits the current into the LM2438 as well as the voltage stress at the outputs of the device. R2 should be a ½W solid carbon type resistor. R1 can be a ¼W metal or carbon film type resistor. Having large value resistors for R1 and R2 would be desirable, but this has the effect of increasing rise and fall times. Inductor L1 is critical to reduce the initial high frequency voltage levels that the LM2438 would be subjected to. The inductor will not only help protect the device but it will also help minimize rise and fall times as well as minimize EMI. For proper arc protection, it is important to not omit any of the components shown in *Figure 9*.

Application Hints (Continued)
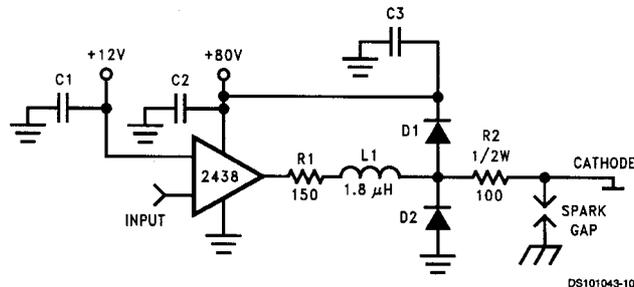
FIGURE 9. One Channel of the LM2438 with the Recommended Application Circuit

DS101043-10

OPTIMIZING TRANSIENT RESPONSE

Referring to *Figure 9*, there are three components (R1, R2 and L1) that can be adjusted to optimize the transient response of the application circuit. Increasing the values of R1 and R2 will slow the circuit down while decreasing overshoot. Increasing the value of L1 will speed up the circuit as well as increase overshoot. It is very important to use inductors with very high self-resonant frequencies, preferably above 300 MHz. Ferrite core inductors from J.W. Miller Magnetics (part #78F1R8K) were used for optimizing the performance of the device in the NSC application board. The values shown in *Figure 9* can be used as a good starting point for the evaluation of the LM2438. Using a variable resistor for R1 will simplify finding the value needed for optimum performance in a given application. Once the optimum value is determined the variable resistor can be replaced with a fixed value.

EFFECT OF LOAD CAPACITANCE

Figure 8 shows the effect of increased load capacitance on the speed of the device. This demonstrates the importance of knowing the load capacitance in the application. *Figure 8* also shows the effect inductance has on the rise and fall times.

EFFECT OF OFFSET

Figure 7 shows the variation in rise and fall times when the output offset of the device is varied from 40 to 50 V_{DC}. The rise time shows a maximum variation relative to the center data point (45 V_{DC}) of about 2%. The fall time shows a variation of about 2% relative to the center data point.

THERMAL CONSIDERATIONS

Figure 4 shows the performance of the LM2438 in the test circuit shown in *Figure 2* as a function of case temperature. The figure shows that the rise time of the LM2438 increases by approximately 5% as the case temperature increases from 50°C to 100°C. This corresponds to a speed degradation of 1% for every 10°C rise in case temperature. The fall time increases by approximately 7.5% as the case temperature increases from 50°C to 100°C. This corresponds to a speed degradation of 1.5% for every 10°C rise in case temperature.

Figure 6 shows the maximum power dissipation of the LM2438 vs. Frequency when all three channels of the device are driving an 8 pF load with a 40 V_{p-p} alternating one pixel on, one pixel off signal. The graph assumes a 72% active time (device operating at the specified frequency) which is typical in a monitor application. The other 28% of the time

the device is assumed to be sitting at the black level (65V in this case). This graph gives the designer the information needed to determine the heat sink requirement for his application. The designer should note that if the load capacitance is increased the AC component of the total power dissipation will also increase.

The LM2438 case temperature must be maintained below 100°C. If the maximum expected ambient temperature is 70°C and the maximum power dissipation is 2.6W (from *Figure 6*, 30 MHz bandwidth) then a maximum heat sink thermal resistance can be calculated:

$$R_{TH} = \frac{100°C - 70°C}{2.6W} = 11.5°C/W$$

This example assumes a capacitive load of 8 pF and no resistive load.

TYPICAL APPLICATION

A typical application of the LM2438 is shown in *Figure 11*. Used in conjunction with an LM1279, a complete video channel from monitor input to CRT cathode can be achieved. Performance is ideal for 1024 x 768 resolution displays with pixel clock frequencies up to 60 MHz. *Figure 11* is the schematic for the NSC demonstration board that can be used to evaluate the LM1279/2438 combination in a monitor.

PC BOARD LAYOUT CONSIDERATIONS

For optimum performance, an adequate ground plane, isolation between channels, good supply bypassing and minimizing unwanted feedback are necessary. Also, the length of the signal traces from the preamplifier to the LM2438 and from the LM2438 to the CRT cathode should be as short as possible. The following references are recommended:

Ott, Henry W., "Noise Reduction Techniques in Electronic Systems", John Wiley & Sons, New York, 1976.

"Video Amplifier Design for Computer Monitors", National Semiconductor Application Note 1013.

Pease, Robert A., "Troubleshooting Analog Circuits", Butterworth-Heinemann, 1991.

Because of its high small signal bandwidth, the part may oscillate in a monitor if feedback occurs around the video channel through the chassis wiring. To prevent this, leads to the video amplifier input circuit should be shielded, and input circuit wiring should be spaced as far as possible from output circuit wiring.

Application Hints (Continued)

NSC DEMONSTRATION BOARD

Figure 12 shows the routing and component placement on the NSC LM1279/2438 demonstration board. The schematic of the board is shown in *Figure 11*. This board provides a good example of a layout that can be used as a guide for future layouts. Note the location of the following components:

- C54, C56 — V_{CC} bypass capacitor, located very close to pin 4 and ground pins

- C43, C44 — V_{BB} bypass capacitors, located close to pin 8 and ground

- C53, C55 — Additional V_{CC} bypass capacitors, near LM2438 and V_{CC} clamp diodes. Very important for arc protection.

The routing of the LM2438 outputs to the CRT is very critical to achieving optimum performance. *Figure 13* shows the routing and component placement from pin 1 of the LM2438 to the red cathode. Note that the components are placed so that they almost line up from the output pin of the LM2438 to the red cathode pin of the CRT connector. This is done to minimize the length of the video path between these two components. Note also that D16, D17, R21 and D9 are placed to minimize the size of the video nodes that they are attached to. This minimizes parasitic capacitance in the video path and also enhances the effectiveness of the protection diodes. The anode of protection diode D17 is connected directly to a section of the the ground plane that has a short and direct path to the LM2438 ground pins. The cathode of D16 is connected to V_{CC} very close to decoupling capacitor C53 (see *Figure 13*) which is connected to the same section of the ground plane as D17. The diode placement and routing is very important for minimizing the voltage stress on the LM2438 during an arcover event. Lastly, notice that S1 is placed very close to the red cathode and is tied directly to CRT ground.
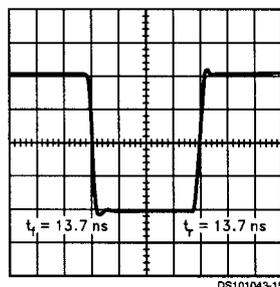
FIGURE 10. Waveform at Cathode with LM1279/243X Demo Board

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11. On Screen Display

FEATURES

- Horizontal sync input may be up to 100 kHz.
- On-chip PLL circuitry up to 90MHz pixel rate for multi-sync operation.
- Programmable horizontal resolutions up to 1524 dots per display row.
- 538 bytes display registers to control full screen display.
- Full screen display consists of 10 (rows) by 24 (columns) characters.
- 12×18 dot matrix per character.
- 128 built-in characters and graphic symbols and character by character color selection.
- Maximum 8 color selectable per display row.
- Double character height and/or width control.
- Programmable positioning for display screen center.
- Bordering and shadowing effect for display.
- Programmable vertical character height (18 to 71 lines) for multi-sync operation.
- 4 programmable background windows with multi-level windowing effect.
- Software clear function for display frame buffer.
- Hsync and Vsync input polarity selectable.
- Auto detection for input edge distortion between Hsync and Vsync inputs.
- Half tone and fast blanking output.
- Software force blank function for display frame.
- Compatible with both SPI bus and I²C interface through pin selection.
- 16 pins PDIP package.

GENERAL DESCRIPTION

MTV016 is designed for use in monitor applications to display the built-in characters or symbols onto monitor screen. The display operation is by transferring data and control information in micro controller to RAM through a serial data interface. It can execute full screen display automatically and specific functions such as character bordering, shadowing, double height and width, font by font color control, frame positioning, frame size control by character height and horizontal display resolution, and windowing effect.

BLOCK DIAGRAM
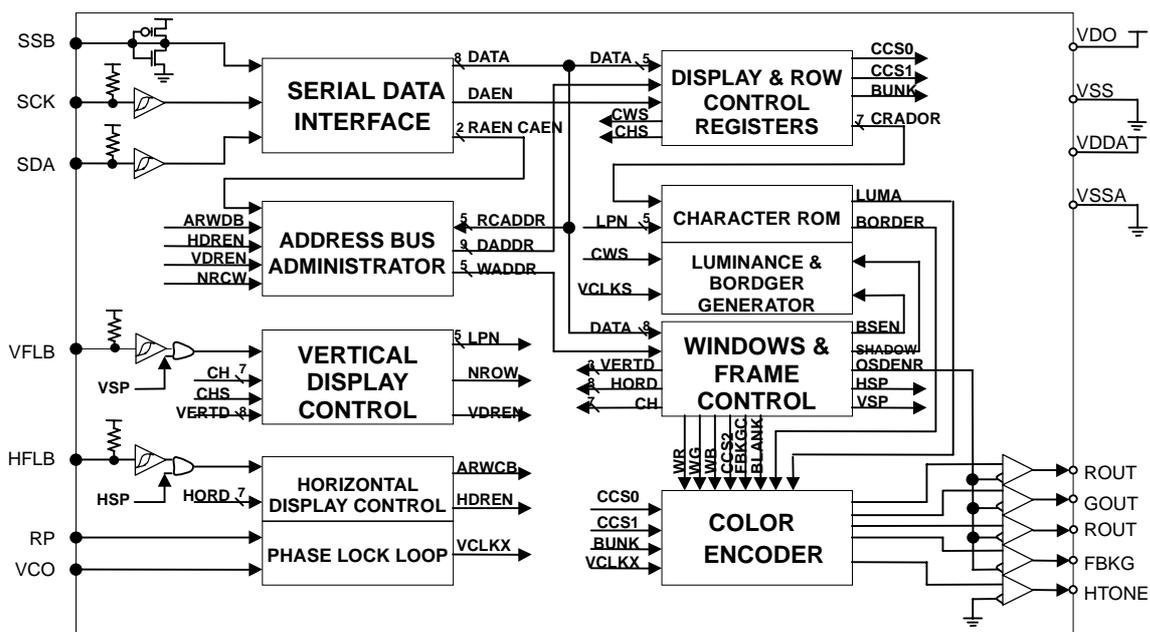
1.0 CONNECTION DIAGRAM

(16 PINS PDIP 300 MIL PACKAGE)

```
          ┌───────⌒───────┐
   VSSA ─┤ 1           16 ├─ VSS
    VCO ─┤ 2           15 ├─ ROUT
     RP ─┤ 3           14 ├─ GOUT
   VDDA ─┤ 4           13 ├─ BOUT
         │   MTV016-N     │
   HFLB ─┤ 5           12 ├─ FBKG
    SSB ─┤ 6           11 ├─ HTONE
    SDA ─┤ 7           10 ├─ VFLB
    SCK ─┤ 8            9 ├─ VDD
          └───────────────┘
```
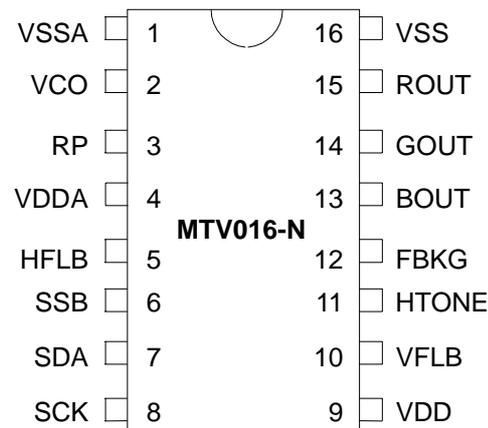
2.0 PIN DESCRIPTIONS

Name	I/O	Pin#	Function
VSSA	-	1	**Analog ground.** This ground pin is used to internal analog circuitry.
VCO	I/O	2	**Voltage Control Oscillator.** This pin is used to control the internal oscillator frequency by DC voltage input from external low pass filter.
RP	I/O	3	**Bias Resistor.** The bias resistor is used to regulate the appropriate bias current for internal oscillator to resonate at specific dot frequency.
VDDA	-	4	**Analog power supply.** Positive 5 V DC supply for internal analog circuitry. And a 0.1uF decoupling capacitor should be connected across to VDDA and VSSA.
HFLB	I	5	**Horizontal input.** This pin is used to input the horizontal synchronizing signal. It has an internal 100 kΩ pull-up resistor.
SSB	I	6	**Serial interface enable.** It is used to enable the serial data interface and is also used to select I²C or SPI bus operation. If this pin is left floating, I²C bus is enable. Otherwise the SPI bus is enabled.
SDA	I	7	**Serial data input.** The external data transfer through this pin to internal display registers and control registers. It has an internal 100 kΩ pull-up resistor.
SCK	I	8	**Serial clock input.** The clock input pin is used to synchronize the data transfer. It has an internal 100 kΩ pull-up resistor.
VDD	-	9	**Digital power supply.** Positive 5 V DC supply for internal digital circuitry and a 0.1uF decoupling capacitor should be connected across to VDD and VSS.
VFLB	I	10	**Vertical input.** This pin is used to input the vertical synchronizing signal. It has an internal pull-up resistor.
HTONE	O	11	**Half tone output.** This pin is used to attenuate the external R, G, B amplifiers gain for the transparent windowing effect.
FBKG	O	12	**Fast Blanking output.** It is used to cut off the external R, G, B signals while this chip is displaying characters or windows.
BOUT	O	13	**Blue color output.** It is a blue color video signal output.
GOUT	O	14	**Green color output.** It is a green color video signal output.
ROUT	O	15	**Red color output.** It is a red color video signal output.
VSS	-	16	**Digital ground.** This ground pin of internal digital circuitry.

Replacement Parts List

A: U.S.A, B: Asia

	ASSY CODE	PART NO	DESCRIPTION	LOCATION	Q'TY	ALT	REMARK
1	CABINET FRONT ASSY	10101321	CABINET FRONT		1		A
2	CABINET FRONT ASSY	10101491	CABINET FRONT(PC+ABS)		1		B
3	CABINET FRONT ASSY	11300661	PUSH BUTTON(CONTROL)		1		
4	CABINET FRONT ASSY	11300591	PUSH BUTTON(SW)		1		
5	CABINET FRONT ASSY	11600211	LENS		1		
6	CABINET FRONT ASSY	13000081	COIL SPRING		1		
7	CRT BOARD A/I	80000561	BEAD 3.5x6x0.8/T	B201	1		
8	CRT BOARD A/I	80000561	BEAD 3.5x6x0.8/T	B208	1		
9	CRT BOARD A/I	72000281	N9501 CRT BOARD(29D NECK)	BOARD	1		
10	CRT BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C201	1		
11	CRT BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C202	1		
12	CRT BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C203	1		
13	CRT BOARD A/I	GB210458	CERAMIC Y5V/T 0.1u/50V Z	C204	1		
14	CRT BOARD A/I	GB210458	CERAMIC Y5V/T 0.1u/50V Z	C205	1		
15	CRT BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C206	1		
16	CRT BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C207	1		
17	CRT BOARD A/I	GA322725	ELECT 85oC/T 220u/16V M	C209	1		
18	CRT BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C210	1		
19	CRT BOARD A/I	GA410575	ELECT NP/T 1u/100V M	C213	1		
20	CRT BOARD A/I	GA210575	ELECT 105oC/T 1u/100V M	C214	1		
21	CRT BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C230	1		
22	CRT BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C231	1		
23	CRT BOARD A/I	GA410575	ELECT NP/T 1u/100V M	C233	1		
24	CRT BOARD A/I	GA210575	ELECT 105oC/T 1u/100V M	C234	1		
25	CRT BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C250	1		
26	CRT BOARD A/I	GA410575	ELECT NP/T 1u/100V M	C253	1		
27	CRT BOARD A/I	GA210575	ELECT 105oC/T 1u/100V M	C254	1		
28	CRT BOARD A/I	GB210458	CERAMIC Y5V/T 0.1u/50V Z	C267	1		
29	CRT BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C270	1		
30	CRT BOARD A/I	GE210252	PLASTIC PEI/T 0.001u/50V J	C271	1		
31	CRT BOARD A/I	GB7471F3	CERAMIC Y5P(B)/T 470P/500V K	C272	1		
32	CRT BOARD A/I	GB7102F3	CERAMIC Y5P(B)/T 1000P/500V K	C275	1		
33	CRT BOARD A/I	GB7102H3	CERAMIC Y5P(B)/T 1000P/1KV K	C276	1		
34	CRT BOARD A/I	GB7102F3	CERAMIC Y5P(B)/T 1000P/500V K	C278	1		
35	CRT BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C280	1		
36	CRT BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C281	1		
37	CRT BOARD A/I	GB210458	CERAMIC Y5V/T 0.1u/50V Z	C282	1		
38	CRT BOARD A/I	GB210458	CERAMIC Y5V/T 0.1u/50V Z	C283	1		
39	CRT BOARD A/I	GB210458	CERAMIC Y5V/T 0.1u/50V Z	C284	1		
40	CRT BOARD A/I	GA347625	ELECT 85oC/T 47u/16V M	C285	1		
41	CRT BOARD A/I	GB7102F3	CERAMIC Y5P(B)/T 1000P/500V K	C287	1		
42	CRT BOARD A/I	GA347625	ELECT 85oC/T 47u/16V M	C289	1		
43	CRT BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C291	1		
44	CRT BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C292	1		
45	CRT BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C293	1		
46	CRT BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C294	1		
47	CRT BOARD A/I	GE210352	PLASTIC PEI/T 0.01u/50V J	C295	1		
48	CRT BOARD A/I	GE210352	PLASTIC PEI/T 0.01u/50V J	C296	1		
49	CRT BOARD A/I	GB7102F3	CERAMIC Y5P(B)/T 1000P/500V K	C297	1		
50	CRT BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C299	1		
51	CRT BOARD A/I	EJAC0018	DIODE/T 1A 1N4937	D201	1		
52	CRT BOARD A/I	EJ044148	DIODE "T" 1N4148	D202	1		
53	CRT BOARD A/I	EJ044148	DIODE "T" 1N4148	D203	1		
54	CRT BOARD A/I	EJ044148	DIODE "T" 1N4148	D204	1		

55	CRT BOARD A/I	EJ044148	DIODE "T" 1N4148	D205	1		
56	CRT BOARD A/I	EJ044148	DIODE "T" 1N4148	D210	1		
57	CRT BOARD A/I	EJ044148	DIODE "T" 1N4148	D211	1		
58	CRT BOARD A/I	80000051	DIODE/T 1/2W 1SS82	D213	OR		
59	CRT BOARD A/I	80000451	DIODE/T 1/2W 1SS83	D213	1		
60	CRT BOARD A/I	80001211	DIODE/T 1/2W BAV21 (PHILIPS)	D213	OR		
61	CRT BOARD A/I	80004711	ROHM DIODE 1SS244	D213	OR		
62	CRT BOARD A/I	80000051	DIODE/T 1/2W 1SS82	D214	OR		
63	CRT BOARD A/I	80000451	DIODE/T 1/2W 1SS83	D214	1		
64	CRT BOARD A/I	80001211	DIODE/T 1/2W BAV21 (PHILIPS)	D214	OR		
65	CRT BOARD A/I	80004711	ROHM DIODE 1SS244	D214	OR		
66	CRT BOARD A/I	EJ044148	DIODE "T" 1N4148	D230	1		
67	CRT BOARD A/I	EJ044148	DIODE "T" 1N4148	D231	1		
68	CRT BOARD A/I	80000051	DIODE/T 1/2W 1SS82	D233	OR		
69	CRT BOARD A/I	80000451	DIODE/T 1/2W 1SS83	D233	1		
70	CRT BOARD A/I	80001211	DIODE/T 1/2W BAV21 (PHILIPS)	D233	OR		
71	CRT BOARD A/I	80004711	ROHM DIODE 1SS244	D233	OR		
72	CRT BOARD A/I	80000051	DIODE/T 1/2W 1SS82	D234	OR		
73	CRT BOARD A/I	80000451	DIODE/T 1/2W 1SS83	D234	1		
74	CRT BOARD A/I	80001211	DIODE/T 1/2W BAV21 (PHILIPS)	D234	OR		
75	CRT BOARD A/I	80004711	ROHM DIODE 1SS244	D234	OR		
76	CRT BOARD A/I	EJ044148	DIODE "T" 1N4148	D250	1		
77	CRT BOARD A/I	EJ044148	DIODE "T" 1N4148	D251	1		
78	CRT BOARD A/I	80000051	DIODE/T 1/2W 1SS82	D253	OR		
79	CRT BOARD A/I	80000451	DIODE/T 1/2W 1SS83	D253	1		
80	CRT BOARD A/I	80001211	DIODE/T 1/2W BAV21 (PHILIPS)	D253	OR		
81	CRT BOARD A/I	80004711	ROHM DIODE 1SS244	D253	OR		
82	CRT BOARD A/I	80000051	DIODE/T 1/2W 1SS82	D254	OR		
83	CRT BOARD A/I	80000451	DIODE/T 1/2W 1SS83	D254	1		
84	CRT BOARD A/I	80001211	DIODE/T 1/2W BAV21 (PHILIPS)	D254	OR		
85	CRT BOARD A/I	80004711	ROHM DIODE 1SS244	D254	OR		
86	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J1	1		
87	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J10	1		
88	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J19	1		
89	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J2	1		
90	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J20	1		
91	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J22	1		
92	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J24	1		
93	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J26	1		
94	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J27	1		
95	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J28	1		
96	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J29	1		
97	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J3	1		
98	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J30	1		
99	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J32	1		
100	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J35	1		
101	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J37	1		
102	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J4	1		
103	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J5	1		
104	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J6	1		
105	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J7	1		
106	CRT BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J8	1		
107	CRT BOARD A/I	FA040473	CARBON 1/8W(T) 5% 47Kohm	JP1	1		
108	CRT BOARD A/I	HB013828	PACKING COIL/T 0.82uH K(EC24)	L203	1		
109	CRT BOARD A/I	HB013828	PACKING COIL/T 0.82uH K(EC24)	L204	1		
110	CRT BOARD A/I	HB013828	PACKING COIL/T 0.82uH K(EC24)	L205	1		
111	CRT BOARD A/I	HC006002	BEAD 3.5X4.7/T	L206	1		

112	CRT BOARD A/I	EAA12133	TR NPN 2SC1213AC TO-92(T)	Q201	1		
113	CRT BOARD A/I	FA040680	CARBON 1/8W(T) 5% 68ohm	R201	1		
114	CRT BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R202	1		
115	CRT BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R203	1		
116	CRT BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R204	1		
117	CRT BOARD A/I	FA040152	CARBON 1/8W(T) 5% 1.5Kohm	R205	1		
118	CRT BOARD A/I	FA240103	CARBON 1/4W(T) 5% 10Kohm	R206	1		
119	CRT BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R208	1		
120	CRT BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R209	1		
121	CRT BOARD A/I	FB247509	METAL 1/4W(T) 1% 75ohm	R210	1		
122	CRT BOARD A/I	FA040330	CARBON 1/8W(T) 5% 33ohm	R211	1		
123	CRT BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R212	1		
124	CRT BOARD A/I	FA040391	CARBON 1/8W(T) 5% 390ohm	R213	1		
125	CRT BOARD A/I	FA040333	CARBON 1/8W(T) 5% 33Kohm	R219	1		
126	CRT BOARD A/I	FA240151	CARBON 1/4W(T) 5% 150ohm	R220	1		
127	CRT BOARD A/I	FA040111	CARBON 1/8W(T) 5% 110ohm	R221	1		
128	CRT BOARD A/I	FA040224	CARBON 1/8W(T) 5% 220Kohm	R223	1		
129	CRT BOARD A/I	FB247509	METAL 1/4W(T) 1% 75ohm	R230	1		
130	CRT BOARD A/I	FA040330	CARBON 1/8W(T) 5% 33ohm	R231	1		
131	CRT BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R232	1		
132	CRT BOARD A/I	FA040391	CARBON 1/8W(T) 5% 390ohm	R233	1		
133	CRT BOARD A/I	FA040333	CARBON 1/8W(T) 5% 33Kohm	R239	1		
134	CRT BOARD A/I	FA240151	CARBON 1/4W(T) 5% 150ohm	R240	1		
135	CRT BOARD A/I	FA040111	CARBON 1/8W(T) 5% 110ohm	R241	1		
136	CRT BOARD A/I	FA040224	CARBON 1/8W(T) 5% 220Kohm	R243	1		
137	CRT BOARD A/I	FB247509	METAL 1/4W(T) 1% 75ohm	R250	1		
138	CRT BOARD A/I	FA040330	CARBON 1/8W(T) 5% 33ohm	R251	1		
139	CRT BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R252	1		
140	CRT BOARD A/I	FA040391	CARBON 1/8W(T) 5% 390ohm	R253	1		
141	CRT BOARD A/I	FA040333	CARBON 1/8W(T) 5% 33Kohm	R259	1		
142	CRT BOARD A/I	FA240151	CARBON 1/4W(T) 5% 150ohm	R260	1		
143	CRT BOARD A/I	FA040111	CARBON 1/8W(T) 5% 110ohm	R261	1		
144	CRT BOARD A/I	FA040224	CARBON 1/8W(T) 5% 220Kohm	R263	1		
145	CRT BOARD A/I	FA040221	CARBON 1/8W(T) 5% 220ohm	R270	1		
146	CRT BOARD A/I	FA240223	CARBON 1/4W(T) 5% 22Kohm	R278	1		
147	CRT BOARD A/I	FA240223	CARBON 1/4W(T) 5% 22Kohm	R280	1		
148	CRT BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R282	1		
149	CRT BOARD A/I	FA040681	CARBON 1/8W(T) 5% 680ohm	R284	1		
150	CRT BOARD A/I	FA240334	CARBON 1/4W(T) 5% 330Kohm	R286	1		
151	CRT BOARD A/I	FA330101	CARBON 1/2W(T) 5% 100ohm	R287	1		
152	CRT BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R288	1		
153	CRT BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R289	1		
154	CRT BOARD A/I	FA240223	CARBON 1/4W(T) 5% 22Kohm	R290	1		
155	CRT BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R291	1		
156	CRT BOARD A/I	FA240101	CARBON 1/4W(T) 5% 100ohm	R292	1		
157	CRT BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R293	1		
158	CRT BOARD A/I	FA040562	CARBON 1/8W(T) 5% 5.6Kohm	R294	1		
159	CRT BOARD A/I	FA040562	CARBON 1/8W(T) 5% 5.6Kohm	R295	1		
160	CRT BOARD A/I	FA040105	CARBON 1/8W(T) 5% 1Mohm	R296	1		
161	CRT BOARD A/I	FA040473	CARBON 1/8W(T) 5% 47Kohm	VR201	1		
162	CRT BOARD A/I	FA040473	CARBON 1/8W(T) 5% 47Kohm	VR202	1		
163	CRT BOARD INSERT	GB9332H8	CERAMIC Z5V(F)/T 3300P/1KV Z	C277	1		
164	CRT BOARD INSERT	GAB22675	ELECT 105oC/T 22u/100V M	C288	1		
165	CRT BOARD INSERT	R0224070	SINGLE PIN 1P L=14mm 2.36mm	CRT GND	1		
166	CRT BOARD INSERT	14000041	SCREW (P-#2CBRITS*3*8*15BF)	FOR U203	1		
167	CRT BOARD INSERT	HB013100	PACKING COIL/T 10uH K(EC24)	J23	1		
168	CRT BOARD INSERT	HB000008	CHOKE COIL 100uH 8X10	L201	1		

169	CRT BOARD INSERT	HB000008	CHOKE COIL 100uH 8X10	L202	1		
170	CRT BOARD INSERT	FB910229	FUSIBLE MF RES 1/4W 2.2ohm J	R297	1		
171	CRT BOARD INSERT	R0224129	BASE PIN 6P+HOUSING P=2.5mm	S201	1		
172	CRT BOARD INSERT	R0224127	XH-BASE PIN 4P	S202	1		
173	CRT BOARD INSERT	R0224129	BASE PIN 6P+HOUSING P=2.5mm	S204	1		
174	CRT BOARD INSERT	R0224130	BASE PIN 7P+HOUSING P=2.5mm	S205	1		
175	CRT BOARD INSERT	80001751	17" 29D NECK CRT SOCKET	SOCKET	1		
176	CRT BOARD INSERT	80000631	IC LM1281	U201	1		
177	CRT BOARD INSERT	80003661	N.S VIDEO DRIVE IC LM2438	U203	1		
178	CRT BOARD INSERT	80001941	OSD IC MTV016N	U204	1		
179	CRT BOARD INSERT	FF300203	VR CARBON 6mm 20K/B	VR210	1		
180	CRT BOARD INSERT	FF300203	VR CARBON 6mm 20K/B	VR230	1		
181	CRT BOARD INSERT	FF300203	VR CARBON 6mm 20K/B	VR250	1		
182	CRT BOARD INSERT	12600112	HEAT SINK (VIDEO)		1		
183	MAIN BOARD A/I	HC006002	BEAD 3.5X4.7/T	B101	1		
184	MAIN BOARD A/I	HC006002	BEAD 3.5X4.7/T	B104	1		
185	MAIN BOARD A/I	HC006002	BEAD 3.5X4.7/T	B105	1		
186	MAIN BOARD A/I	HC006002	BEAD 3.5X4.7/T	B106	1		
187	MAIN BOARD A/I	HC006002	BEAD 3.5X4.7/T	B107	1		
188	MAIN BOARD A/I	HC006002	BEAD 3.5X4.7/T	B301	1		
189	MAIN BOARD A/I	HC006002	BEAD 3.5X4.7/T	B302	1		
190	MAIN BOARD A/I	GA347625	ELECT 85oC/T 47u/16V M	C108	1		
191	MAIN BOARD A/I	GA310735	ELECT 85oC/T 100u/25V M	C109	1		
192	MAIN BOARD A/I	GB747153	CERAMIC Y5P(B)/T 470P/50V K	C110	1		
193	MAIN BOARD A/I	GE210352	PLASTIC PEI/T 0.01u/50V J	C111	1		
194	MAIN BOARD A/I	GA347635	ELECT 85oC/T 47u/25V M	C112	1		
195	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C113	1		
196	MAIN BOARD A/I	GF210452	MEF CAP BOX 0.1u/50V J	C114	OR		
197	MAIN BOARD A/I	GF210462	MEF CAP BOX 0.1u/63V J	C114	1		
198	MAIN BOARD A/I	GF210472	MEF CAP BOX 0.1u/100V J	C114	OR		
199	MAIN BOARD A/I	GF233252	MEF CAP BOX 0.0033u/50V J	C115	OR		
200	MAIN BOARD A/I	GF233262	MEF CAP BOX 0.0033u/63V J	C115	1		
201	MAIN BOARD A/I	GF233272	MEF CAP BOX 0.0033u/100V J	C115	OR		
202	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C116	1		
203	MAIN BOARD A/I	GA310725	ELECT 85oC/T 100u/16V M	C117	1		
204	MAIN BOARD A/I	GB7331H3	CERAMIC Y5P(B)/T 330P/1KV K	C123	1		
205	MAIN BOARD A/I	GB7331H3	CERAMIC Y5P(B)/T 330P/1KV K	C124	1		
206	MAIN BOARD A/I	GB7331H3	CERAMIC Y5P(B)/T 330P/1KV K	C125	1		
207	MAIN BOARD A/I	GB7331H3	CERAMIC Y5P(B)/T 330P/1KV K	C126	1		
208	MAIN BOARD A/I	GA347625	ELECT 85oC/T 47u/16V M	C130	1		
209	MAIN BOARD A/I	GF210462	MEF CAP BOX 0.1u/63V J	C131	1		
210	MAIN BOARD A/I	GF210452	MEF CAP BOX 0.1u/50V J	C131	OR		
211	MAIN BOARD A/I	GF210472	MEF CAP BOX 0.1u/100V J	C131	OR		
212	MAIN BOARD A/I	GE233352	PLASTIC PEI/T 0.033u/50V J	C132	1		
213	MAIN BOARD A/I	GF233262	MEF CAP BOX 0.0033u/63V J	C133	1		
214	MAIN BOARD A/I	GF233252	MEF CAP BOX 0.0033u/50V J	C133	OR		
215	MAIN BOARD A/I	GF233272	MEF CAP BOX 0.0033u/100V J	C133	OR		
216	MAIN BOARD A/I	GB747153	CERAMIC Y5P(B)/T 470P/50V K	C134	1		
217	MAIN BOARD A/I	GA347625	ELECT 85oC/T 47u/16V M	C137	1		
218	MAIN BOARD A/I	GE210352	PLASTIC PEI/T 0.01u/50V J	C140	1		
219	MAIN BOARD A/I	GE210352	PLASTIC PEI/T 0.01u/50V J	C142	1		
220	MAIN BOARD A/I	GA310555	ELECT 85oC/T 1u/50V M	C145	1		
221	MAIN BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C149	1		
222	MAIN BOARD A/I	GA347625	ELECT 85oC/T 47u/16V M	C150	1		
223	MAIN BOARD A/I	GA347625	ELECT 85oC/T 47u/16V M	C151	1		
224	MAIN BOARD A/I	GB7681J3	CERAMIC Y5P(B)/T 680P/2KV K	C152	1		
225	MAIN BOARD A/I	GA347555	ELECT 85oC/T 4.7u/50V M	C156	1		

226	MAIN BOARD A/I	GA310555	ELECT 85oC/T 1u/50V M	C161	1		
227	MAIN BOARD A/I	GE210352	PLASTIC PEI/T 0.01u/50V J	C162	1		
228	MAIN BOARD A/I	GA347555	ELECT 85oC/T 4.7u/50V M	C164	1		
229	MAIN BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C301	1		
230	MAIN BOARD A/I	GF210452	MEF CAP BOX 0.1u/50V J	C302	OR		
231	MAIN BOARD A/I	GF210462	MEF CAP BOX 0.1u/63V J	C302	1		
232	MAIN BOARD A/I	GF210472	MEF CAP BOX 0.1u/100V J	C302	OR		
233	MAIN BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C304	1		
234	MAIN BOARD A/I	GA347625	ELECT 85oC/T 47u/16V M	C305	1		
235	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C306	1		
236	MAIN BOARD A/I	GE210352	PLASTIC PEI/T 0.01u/50V J	C307	1		
237	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C308	1		
238	MAIN BOARD A/I	GA347555	ELECT 85oC/T 4.7u/50V M	C309	1		
239	MAIN BOARD A/I	GA347555	ELECT 85oC/T 4.7u/50V M	C312	1		
240	MAIN BOARD A/I	GA347655	ELECT 85oC/T 47u/50V M	C313	1		
241	MAIN BOARD A/I	GF210452	MEF CAP BOX 0.1u/50V J	C314	1		
242	MAIN BOARD A/I	GF210462	MEF CAP BOX 0.1u/63V J	C314	OR		
243	MAIN BOARD A/I	GF210472	MEF CAP BOX 0.1u/100V J	C314	OR		
244	MAIN BOARD A/I	GF210252	MEF CAP BOX 0.001u/50V J	C315	1		
245	MAIN BOARD A/I	GF210262	MEF CAP BOX 0.001u/63V J	C315	OR		
246	MAIN BOARD A/I	GF210272	MEF CAP BOX 0.001u/100V J	C315	OR		
247	MAIN BOARD A/I	GF247252	MEF CAP BOX 0.0047u/50V J	C316	OR		
248	MAIN BOARD A/I	GF247262	MEF CAP BOX 0.0047u/63V J	C316	1		
249	MAIN BOARD A/I	GF247272	MEF CAP BOX 0.0047/100V J	C316	OR		
250	MAIN BOARD A/I	GA347455	ELECT 85oC/T 0.47u/50V M	C317	1		
251	MAIN BOARD A/I	GA322725	ELECT 85oC/T 220u/16V M	C320	1		
252	MAIN BOARD A/I	GA322735	ELECT 85oC/T 220u/25V M	C323	1		
253	MAIN BOARD A/I	GA322735	ELECT 85oC/T 220u/25V M	C324	1		
254	MAIN BOARD A/I	GF222452	MEF CAP BOX 0.22u/50V J	C326	OR		
255	MAIN BOARD A/I	GF222462	MEF CAP BOX 0.22u/63V J	C326	1		
256	MAIN BOARD A/I	GF222472	MEF CAP BOX 0.22u/100V J	C326	OR		
257	MAIN BOARD A/I	GA347555	ELECT 85oC/T 4.7u/50V M	C328	1		
258	MAIN BOARD A/I	GB9103F8	CERAMIC Z5V(F)/T 0.01u/500V Z	C331	1		
259	MAIN BOARD A/I	GB7102H3	CERAMIC Y5P(B)/T 1000P/1KV K	C334	1		
260	MAIN BOARD A/I	GA347625	ELECT 85oC/T 47u/16V M	C335	1		
261	MAIN BOARD A/I	GA310555	ELECT 85oC/T 1u/50V M	C336	1		
262	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C337	1		
263	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 5mm	C338	1		
264	MAIN BOARD A/I	GA410585	ELECT NP/T 1u/250V M	C339	1		
265	MAIN BOARD A/I	GB210458	CERAMIC Y5V/T 0.1u/50V Z	C340	1		
266	MAIN BOARD A/I	GB7471F3	CERAMIC Y5P(B)/T 470P/500V K	C341	1		
267	MAIN BOARD A/I	GF210452	MEF CAP BOX 0.1u/50V J	C343	OR		
268	MAIN BOARD A/I	GF210462	MEF CAP BOX 0.1u/63V J	C343	1		
269	MAIN BOARD A/I	GF210472	MEF CAP BOX 0.1u/100V J	C343	OR		
270	MAIN BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C350	1		
271	MAIN BOARD A/I	GB210458	CERAMIC Y5V/T 0.1u/50V Z	C352	1		
272	MAIN BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C354	1		
273	MAIN BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C358	1		
274	MAIN BOARD A/I	GE222352	PLASTIC PEI/T 0.022u/50V J	C361	1		
275	MAIN BOARD A/I	GB633152	CERAMIC SL/T 330P/50V J	C362	1		
276	MAIN BOARD A/I	GE233352	PLASTIC PEI/T 0.033u/50V J	C363	1		
277	MAIN BOARD A/I	GE222352	PLASTIC PEI/T 0.022u/50V J	C365	1		
278	MAIN BOARD A/I	GE210252	PLASTIC PEI/T 0.001u/50V J	C401	1		
279	MAIN BOARD A/I	GB210458	CERAMIC Y5V/T 0.1u/50V Z	C403	1		
280	MAIN BOARD A/I	GE210352	PLASTIC PEI/T 0.01u/50V J	C404	1		
281	MAIN BOARD A/I	GE210352	PLASTIC PEI/T 0.01u/50V J	C405	1		
282	MAIN BOARD A/I	GE210352	PLASTIC PEI/T 0.01u/50V J	C417	1		

283	MAIN BOARD A/I	GA310725	ELECT 85oC/T 100u/16V M	C418	1		
284	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C419	1		
285	MAIN BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C420	1		
286	MAIN BOARD A/I	GE233352	PLASTIC PEI/T 0.033u/50V J	C421	1		
287	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C423	1		
288	MAIN BOARD A/I	GA322725	ELECT 85oC/T 220u/16V M	C424	1		
289	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C427	1		
290	MAIN BOARD A/I	GA347485	ELECT 85oC/T 0.47u/250V M	C428	1		
291	MAIN BOARD A/I	GA422625	ELECT NP/T 22u/16V M	C431	1		
292	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C433	1		
293	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C435	1		
294	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C437	1		
295	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C438	1		
296	MAIN BOARD A/I	GA310555	ELECT 85oC/T 1u/50V M	C440	1		
297	MAIN BOARD A/I	GE210352	PLASTIC PEI/T 0.01u/50V J	C442	1		
298	MAIN BOARD A/I	GA347455	ELECT 85oC/T 0.47u/50V M	C447	1		
299	MAIN BOARD A/I	GF210452	MEF CAP BOX 0.1u/50V J	C448	OR		
300	MAIN BOARD A/I	GF210462	MEF CAP BOX 0.1u/63V J	C448	1		
301	MAIN BOARD A/I	GF210472	MEF CAP BOX 0.1u/100V J	C448	OR		
302	MAIN BOARD A/I	GA347555	ELECT 85oC/T 4.7u/50V M	C450	1		
303	MAIN BOARD A/I	GE268252	PLASTIC PEI/T 0.0068u/50V J	C601	1		
304	MAIN BOARD A/I	GE210352	PLASTIC PEI/T 0.01u/50V J	C603	1		
305	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C604	1		
306	MAIN BOARD A/I	GB710253	CERAMIC Y5P(B)/T 1000P/50V K	C605	1		
307	MAIN BOARD A/I	GB210458	CERAMIC Y5V/T 0.1u/50V Z	C702	1		
308	MAIN BOARD A/I	GA310725	ELECT 85oC/T 100u/16V M	C703	1		
309	MAIN BOARD A/I	GA322555	ELECT 85oC/T 2.2u/50V M	C704	1		
310	MAIN BOARD A/I	GB633052	CERAMIC SL/T 33P/50V J	C705	1		
311	MAIN BOARD A/I	GB633052	CERAMIC SL/T 33P/50V J	C706	1		
312	MAIN BOARD A/I	GB610152	CERAMIC SL/T 100P/50V J	C707	1		
313	MAIN BOARD A/I	GB610152	CERAMIC SL/T 100P/50V J	C708	1		
314	MAIN BOARD A/I	GB910358	CERAMIC Z5V(F)/T 0.01u/50V Z	C724	1		
315	MAIN BOARD A/I	GA347625	ELECT 85oC/T 47u/16V M	C725	1		
316	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C726	1		
317	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C727	1		
318	MAIN BOARD A/I	GA310655	ELECT 85oC/T 10u/50V M	C728	1		
319	MAIN BOARD A/I	EJA20003	DIODE/T 1A BA159	D105	1		
320	MAIN BOARD A/I	EJAC0005	DIODE/T 1A 1N4002	D106	1		
321	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D107	1		
322	MAIN BOARD A/I	EJAC0017	DIODE/T 1A 1N4936	D108	1		
323	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D109	1		
324	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D115	1		
325	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D117	1		
326	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D120	1		
327	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D126	1		
328	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D127	1		
329	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D128	1		
330	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D129	1		
331	MAIN BOARD A/I	EJAC0017	DIODE/T 1A 1N4936	D130	1		
332	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D133	1		
333	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D134	1		
334	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D136	1		
335	MAIN BOARD A/I	EJAC0018	DIODE/T 1A 1N4937	D301	1		
336	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D302	1		
337	MAIN BOARD A/I	EJAC0018	DIODE/T 1A 1N4937	D303	1		
338	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D304	1		
339	MAIN BOARD A/I	EJA00160	DIODE STKY/T 1A/60V SB160	D305	1		

340	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D306	1		
341	MAIN BOARD A/I	EJAC0018	DIODE/T 1A 1N4937	D309	1		
342	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D30A	1		
343	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D310	1		
344	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D311	1		
345	MAIN BOARD A/I	EJAC0018	DIODE/T 1A 1N4937	D312	1		
346	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D313	1		
347	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D314	1		
348	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D315	1		
349	MAIN BOARD A/I	EJAC0018	DIODE/T 1A 1N4937	D318	1		
350	MAIN BOARD A/I	EJAC0018	DIODE/T 1A 1N4937	D319	1		
351	MAIN BOARD A/I	EJAC0018	DIODE/T 1A 1N4937	D321	1		
352	MAIN BOARD A/I	EJAC0018	DIODE/T 1A 1N4937	D322	1		
353	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D323	1		
354	MAIN BOARD A/I	EJAC0018	DIODE/T 1A 1N4937	D324	1		
355	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D325	1		
356	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D401	1		
357	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D402	1		
358	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D601	1		
359	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D602	1		
360	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D604	1		
361	MAIN BOARD A/I	EJ044148	DIODE "T" 1N4148	D605	1		
362	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	D701	1		
363	MAIN BOARD A/I	EJA00160	DIODE STKY/T 1A/60V SB160	D702	1		
364	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J1	1		
365	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J10	1		
366	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J100	1		
367	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J101	1		
368	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J102	1		
369	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J103	1		
370	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J104	1		
371	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J105	1		
372	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J106	1		
373	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J107	1		
374	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J108	1		
375	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J109	1		
376	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J11	1		
377	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J110	1		
378	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J111	1		
379	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J112	1		
380	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 20mm	J113	1		
381	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J114	1		
382	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J115	1		
383	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 20mm	J116	1		
384	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J117	1		
385	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J118	1		
386	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J119	1		
387	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J12	1		
388	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J120	1		
389	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J121	1		
390	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J122	1		
391	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J123	1		
392	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J124	1		
393	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J125	1		
394	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J126	1		
395	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J127	1		
396	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J128	1		

397	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 20mm	J130	1		
398	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J132	1		
399	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 20mm	J133	1		
400	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J134	1		
401	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J135	1		
402	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J136	1		
403	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J137	1		
404	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J138	1		
405	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J139	1		
406	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J14	1		
407	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J140	1		
408	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J141	1		
409	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J142	1		
410	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J143	1		
411	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J146	1		
412	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J147	1		
413	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J148	1		
414	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J149	1		
415	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J15	1		
416	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J150	1		
417	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J151	1		
418	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J152	1		
419	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J153	1		
420	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J154	1		
421	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J155	1		
422	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J156	1		
423	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J157	1		
424	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J16	1		
425	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J160	1		
426	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 20mm	J161	1		
427	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J162	1		
428	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J17	1		
429	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J18	1		
430	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J19	1		
431	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J2	1		
432	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J20	1		
433	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J21	1		
434	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J22	1		
435	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J23	1		
436	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J24	1		
437	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J25	1		
438	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J26	1		
439	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J27	1		
440	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J28	1		
441	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J29	1		
442	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J3	1		
443	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J30	1		
444	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J31	1		
445	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J32	1		
446	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 20mm	J33	1		
447	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 20mm	J34	1		
448	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J35	1		
449	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J36	1		
450	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J37	1		
451	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J38	1		
452	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J39	1		
453	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 20mm	J4	1		

454	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J40	1		
455	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J41	1		
456	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 20mm	J42	1		
457	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J43	1		
458	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 20mm	J44	1		
459	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J45	1		
460	MAIN BOARD A/I	R0319111	JUMPER WIRE AI/T 20mm	J46	1		
461	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J48	1		
462	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J49	1		
463	MAIN BOARD A/I	R0319111	JUMPER WIRE AI/T 10mm	J5	1		
464	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J50	1		
465	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J51	1		
466	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J52	1		
467	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J53	1		
468	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J54	1		
469	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J55	1		
470	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J56	1		
471	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J57	1		
472	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J58	1		
473	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J59	1		
474	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J6	1		
475	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J60	1		
476	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J61	1		
477	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J62	1		
478	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J63	1		
479	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J64	1		
480	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J65	1		
481	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J66	1		
482	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J67	1		
483	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J68	1		
484	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J69	1		
485	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J7	1		
486	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J70	1		
487	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J71	1		
488	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J72	1		
489	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J73	1		
490	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J74	1		
491	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J75	1		
492	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J76	1		
493	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J77	1		
494	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J78	1		
495	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J79	1		
496	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J8	1		
497	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J80	1		
498	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J81	1		
499	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J82	1		
500	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J83	1		
501	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J84	1		
502	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J85	1		
503	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J86	1		
504	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J87	1		
505	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J88	1		
506	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J89	1		
507	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	J9	1		
508	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J91	1		
509	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J92	1		
510	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 20mm	J93	1		

511	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J94	1		
512	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J95	1		
513	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	J96	1		
514	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 15mm	J97	1		
515	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	J98	1		
516	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 17.5mm	J99	1		
517	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	JP2	1		
518	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 5mm	JP5	1		
519	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	JP6	1		
520	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 5mm	L308	1		
521	MAIN BOARD A/I	72000433	PN9501BOARD MAIN PCB-043 246X330	MAIN PCB	1		
522	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q103	1		
523	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q103	OR		
524	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q105	1		
525	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q105	OR		
526	MAIN BOARD A/I	EAA22355	TR NPN 2SC2235Y TO-92(T) (TOSHIBA)	Q106	OR		
527	MAIN BOARD A/I	EAA23281	TR NPN KSC 2328A TO-92(T) (SAMSUNG)	Q106	1		
528	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q107	1		
529	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q107	OR		
530	MAIN BOARD A/I	EBA09281	TR PNP KSA 928A TO-92(T) (SAMSUNG)	Q108	1		
531	MAIN BOARD A/I	EBA10205	TR PNP 2SA1020Y TO-92(T)	Q108	OR		
532	MAIN BOARD A/I	EAA00440	TR NPN KSP44 TO 92(T) (SAMSUNG)	Q109	1		
533	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q110	1		
534	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q110	OR		
535	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q111	1		
536	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q111	OR		
537	MAIN BOARD A/I	EBA04230	TR PNP BF423 TO-92(T)(T.P.)	Q112	1		
538	MAIN BOARD A/I	EAA12133	TR NPN 2SC1213AC TO-92(T)	Q113	1		
539	MAIN BOARD A/I	EAA20015	TR NPN KSC2001Y TO-92(T) (SAMSUNG)	Q113	OR		
540	MAIN BOARD A/I	EAA21200	TR NPN 2SC2120 TO-92(T) (TOSHIBA)	Q113	OR		
541	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q115	1		
542	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q115	OR		
543	MAIN BOARD A/I	EBA07336	TR PNP 2SA733P TO-92(T) (N.P.S.)	Q117	1		
544	MAIN BOARD A/I	EBA10157	TR PNP 2SA1015GR TO-92(T) (T.P.S.)	Q117	OR		
545	MAIN BOARD A/I	EAA23690	TR NPN PH2369 TO-92(T) (PHILIPS)	Q301	1		
546	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q302	1		
547	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q302	OR		
548	MAIN BOARD A/I	EAA40020	TR NPN 2SC4002 TO-92(T) (SANYO)	Q303	1		
549	MAIN BOARD A/I	EAA04220	TR NPN BF422 TO-92(T) (T,P)	Q304	1		
550	MAIN BOARD A/I	EBA04230	TR PNP BF423 TO-92(T)(T.P.)	Q305	1		
551	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q306	1		
552	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q306	OR		
553	MAIN BOARD A/I	EFA29610	TR 2SK2961 FET TOSHIBA	Q308	1		
554	MAIN BOARD A/I	EBA07336	TR PNP 2SA733P TO-92(T) (N.P.S.)	Q310	1		
555	MAIN BOARD A/I	EBA10157	TR PNP 2SA1015GR TO-92(T) (T.P.S.)	Q310	OR		
556	MAIN BOARD A/I	EBA04230	TR PNP BF423 TO-92(T)(T.P.)	Q315	1		
557	MAIN BOARD A/I	EAA06673	TR NPN 2SD667AC TO-92(T) (HITACHI)	Q316	1		
558	MAIN BOARD A/I	EBA09281	TR PNP KSA 928A TO-92(T) (SAMSUNG)	Q317	1		
559	MAIN BOARD A/I	EBA09655	TR PNP 2SA965Y TO-92(T)	Q317	OR		
560	MAIN BOARD A/I	EAA22355	TR NPN 2SC2235Y TO-92(T) (TOSHIBA)	Q318	OR		
561	MAIN BOARD A/I	EAA23281	TR NPN KSC 2328A TO-92(T) (SAMSUNG)	Q318	1		
562	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q320	1		
563	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q320	OR		
564	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q323	1		
565	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q323	OR		
566	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q324	1		
567	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q324	OR		

568	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q401	1		
569	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q401	OR		
570	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q402	1		
571	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q402	OR		
572	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q601	1		
573	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q601	OR		
574	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q603	1		
575	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q603	OR		
576	MAIN BOARD A/I	EBA07336	TR PNP 2SA733P TO-92(T) (N.P.S.)	Q604	1		
577	MAIN BOARD A/I	EBA10157	TR PNP 2SA1015GR TO-92(T) (T.P.S.)	Q604	OR		
578	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q605	1		
579	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q605	OR		
580	MAIN BOARD A/I	EAA09456	TR NPN 2SC945P TO-92(T) (N.P.S.)	Q606	1		
581	MAIN BOARD A/I	EAA18157	TR NPN 2SC1815GR TO-92(T) (T.P.S.)	Q606	OR		
582	MAIN BOARD A/I	FA330684	CARBON 1/2W(T) 5% 680Kohm	R101	1		
583	MAIN BOARD A/I	FA040331	CARBON 1/8W(T) 5% 330ohm	R102	1		
584	MAIN BOARD A/I	FA240564	CARBON 1/4W(T) 5% 560Kohm	R107	1		
585	MAIN BOARD A/I	FA240304	CARBON 1/4W(T) 5% 300Kohm	R108	1		
586	MAIN BOARD A/I	FA040100	CARBON 1/8W(T) 5% 10ohm	R109	1		
587	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R110	1		
588	MAIN BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R112	1		
589	MAIN BOARD A/I	FA040752	CARBON 1/8W(T) 5% 7.5Kohm	R113	1		
590	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R114	1		
591	MAIN BOARD A/I	FA040390	CARBON 1/8W(T) 5% 39ohm	R115	1		
592	MAIN BOARD A/I	FA240271	CARBON 1/4W(T) 5% 270ohm	R116	1		
593	MAIN BOARD A/I	FA240390	CARBON 1/4W(T) 1% 39ohm	R117	1		
594	MAIN BOARD A/I	FA240203	CARBON 1/4W(T) 5% 20Kohm	R118	1		
595	MAIN BOARD A/I	FA040474	CARBON 1/8W(T) 5% 470Kohm	R119	1		
596	MAIN BOARD A/I	FA040273	CARBON 1/8W(T) 5% 27Kohm	R120	1		
597	MAIN BOARD A/I	FA040473	CARBON 1/8W(T) 5% 47Kohm	R121	1		
598	MAIN BOARD A/I	FA040154	CARBON 1/8W(T) 5% 150Kohm	R122	1		
599	MAIN BOARD A/I	FA240561	CARBON 1/4W(T) 5% 560ohm	R123	1		
600	MAIN BOARD A/I	FA040473	CARBON 1/8W(T) 5% 47Kohm	R126	1		
601	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R129	1		
602	MAIN BOARD A/I	FA040223	CARBON 1/8W(T) 5% 22Kohm	R133	1		
603	MAIN BOARD A/I	FA040330	CARBON 1/8W(T) 5% 33ohm	R135	1		
604	MAIN BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R137	1		
605	MAIN BOARD A/I	FA240750	CARBON 1/4W(T) 5% 75ohm	R138	1		
606	MAIN BOARD A/I	FA330561	CARBON 1/2W(T) 5% 560ohm	R139	1		
607	MAIN BOARD A/I	FA040470	CARBON 1/8W(T) 5% 47ohm	R140	1		
608	MAIN BOARD A/I	FA040203	CARBON 1/8W(T) 5% 20Kohm	R141	1		
609	MAIN BOARD A/I	FA040224	CARBON 1/8W(T) 5% 220Kohm	R142	1		
610	MAIN BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R144	1		
611	MAIN BOARD A/I	FA040273	CARBON 1/8W(T) 5% 27Kohm	R145	1		
612	MAIN BOARD A/I	FA040222	CARBON 1/8W(T) 5% 2.2Kohm	R146	1		
613	MAIN BOARD A/I	FA040202	CARBON 1/8W(T) 5% 2Kohm	R147	1		
614	MAIN BOARD A/I	FA240154	CARBON 1/4W(T) 5% 150Kohm	R149	1		
615	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	R150	1		
616	MAIN BOARD A/I	FA040332	CARBON 1/8W(T) 5% 3.3Kohm	R152	1		
617	MAIN BOARD A/I	FA040473	CARBON 1/8W(T) 5% 47Kohm	R153	1		
618	MAIN BOARD A/I	FA040562	CARBON 1/8W(T) 5% 5.6Kohm	R154	1		
619	MAIN BOARD A/I	FA040104	CARBON 1/8W(T) 5% 100Kohm	R155	1		
620	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	R157	1		
621	MAIN BOARD A/I	FA240472	CARBON 1/4W(T) 5% 4.7Kohm	R159	1		
622	MAIN BOARD A/I	FA040202	CARBON 1/8W(T) 5% 2Kohm	R160	1		
623	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R161	1		
624	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 10mm	R162	1		

625	MAIN BOARD A/I	FA240102	CARBON 1/4W(T) 5% 1Kohm	R163	1		
626	MAIN BOARD A/I	FA240154	CARBON 1/4W(T) 5% 150Kohm	R165	1		
627	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R167	1		
628	MAIN BOARD A/I	FA040104	CARBON 1/8W(T) 5% 100Kohm	R168	1		
629	MAIN BOARD A/I	FB910010	METAL 1/4W(T) 5% 1ohm	R169	1		
630	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R177	1		
631	MAIN BOARD A/I	FA040393	CARBON 1/8W(T) 5% 39Kohm	R178	1		
632	MAIN BOARD A/I	FA330102	CARBON 1/2W(T) 5% 1Kohm	R182	1		
633	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R190	1		
634	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R191	1		
635	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R192	1		
636	MAIN BOARD A/I	FA040132	CARBON 1/8W(T) 5% 1.3Kohm	R300	1		
637	MAIN BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R301	1		
638	MAIN BOARD A/I	FA040561	CARBON 1/8W(T) 5% 560ohm	R303	1		
639	MAIN BOARD A/I	FA040105	CARBON 1/8W(T) 5% 1Mohm	R305	1		
640	MAIN BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R306	1		
641	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R307	1		
642	MAIN BOARD A/I	FA330391	CARBON 1/2W(T) 5% 390ohm	R308	1		
643	MAIN BOARD A/I	FA240223	CARBON 1/4W(T) 5% 22Kohm	R30C	1		
644	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R310	1		
645	MAIN BOARD A/I	FB910010	METAL 1/4W(T) 5% 1ohm	R313	1		
646	MAIN BOARD A/I	FB910010	METAL 1/4W(T) 5% 1ohm	R314	1		
647	MAIN BOARD A/I	FA330105	CARBON 1/2W(T) 5% 1Mohm	R315	1		
648	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R318	1		
649	MAIN BOARD A/I	FA040823	CARBON 1/8W(T) 5% 82Kohm	R319	1		
650	MAIN BOARD A/I	FA330479	CARBON 1/2W(T) 5% 4.7ohm	R321	1		
651	MAIN BOARD A/I	FA040122	CARBON 1/8W(T) 5% 1.2Kohm	R322	1		
652	MAIN BOARD A/I	FA040393	CARBON 1/8W(T) 5% 39Kohm	R325	1		
653	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R326	1		
654	MAIN BOARD A/I	FA040104	CARBON 1/8W(T) 5% 100Kohm	R327	1		
655	MAIN BOARD A/I	FA040473	CARBON 1/8W(T) 5% 47Kohm	R328	1		
656	MAIN BOARD A/I	FA040822	CARBON 1/8W(T) 5% 8.2Kohm	R329	1		
657	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R330	1		
658	MAIN BOARD A/I	FA040273	CARBON 1/8W(T) 5% 27Kohm	R331	1		
659	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R332	1		
660	MAIN BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R333	1		
661	MAIN BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R334	1		
662	MAIN BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R336	1		
663	MAIN BOARD A/I	FA040333	CARBON 1/8W(T) 5% 33Kohm	R337	1		
664	MAIN BOARD A/I	FA240243	CARBON 1/4W(T) 5% 24Kohm	R338	1		
665	MAIN BOARD A/I	FA040224	CARBON 1/8W(T) 5% 220Kohm	R339	1		
666	MAIN BOARD A/I	FA040104	CARBON 1/8W(T) 5% 100Kohm	R340	1		
667	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R341	1		
668	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R342	1		
669	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R343	1		
670	MAIN BOARD A/I	FA330102	CARBON 1/2W(T) 5% 1Kohm	R344	1		
671	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R345	1		
672	MAIN BOARD A/I	FB241301	METAL 1/4W(T) 1% 1.3Kohm	R346	1		
673	MAIN BOARD A/I	FB247871	METAL 1/4W(T) 1% 7.87Kohm	R347	1		
674	MAIN BOARD A/I	FA330224	CARBON 1/2W(T) 5% 220Kohm	R348	1		
675	MAIN BOARD A/I	FB245602	METAL 1/4W(T) 1% 56Kohm	R34A	1		
676	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 7.5mm	R350	1		
677	MAIN BOARD A/I	FB910010	METAL 1/4W(T) 5% 1ohm	R351	1		
678	MAIN BOARD A/I	FB241132	METAL 1/4W(T) 1% 11.3Kohm	R352	1		
679	MAIN BOARD A/I	FA040104	CARBON 1/8W(T) 5% 100Kohm	R353	1		
680	MAIN BOARD A/I	FA040224	CARBON 1/8W(T) 5% 220Kohm	R354	1		
681	MAIN BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R355	1		

682	MAIN BOARD A/I	FA330105	CARBON 1/2W(T) 5% 1Mohm	R356	1		
683	MAIN BOARD A/I	FA040153	CARBON 1/8W(T) 5% 15Kohm	R357	1		
684	MAIN BOARD A/I	FA040154	CARBON 1/8W(T) 5% 150Kohm	R358	1		
685	MAIN BOARD A/I	FA040473	CARBON 1/8W(T) 5% 47Kohm	R359	1		
686	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R360	1		
687	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R361	1		
688	MAIN BOARD A/I	FA040154	CARBON 1/8W(T) 5% 150Kohm	R362	1		
689	MAIN BOARD A/I	FA040104	CARBON 1/8W(T) 5% 100Kohm	R363	1		
690	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R364	1		
691	MAIN BOARD A/I	FB242103	METAL 1/4W(T) 1% 210Kohm	R366	1		
692	MAIN BOARD A/I	FB241802	METAL 1/4W(T) 1% 18Kohm	R368	1		
693	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R369	1		
694	MAIN BOARD A/I	FA240224	CARBON 1/4W(T) 5% 220Kohm	R370	1		
695	MAIN BOARD A/I	FA040562	CARBON 1/8W(T) 5% 5.6Kohm	R371	1		
696	MAIN BOARD A/I	FA040222	CARBON 1/8W(T) 5% 2.2Kohm	R372	1		
697	MAIN BOARD A/I	FB243481	METAL 1/4W(T) 1% 3.48Kohm	R373	1		
698	MAIN BOARD A/I	FB241002	METAL 1/4W(T) 1% 10Kohm	R374	1		
699	MAIN BOARD A/I	FA040104	CARBON 1/8W(T) 5% 100Kohm	R375	1		
700	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R376	1		
701	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R377	1		
702	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R378	1		
703	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R379	1		
704	MAIN BOARD A/I	FA240224	CARBON 1/4W(T) 5% 220Kohm	R380	1		
705	MAIN BOARD A/I	FA240224	CARBON 1/4W(T) 5% 220Kohm	R381	1		
706	MAIN BOARD A/I	FA040473	CARBON 1/8W(T) 5% 47Kohm	R382	1		
707	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R383	1		
708	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R384	1		
709	MAIN BOARD A/I	FB241002	METAL 1/4W(T) 1% 10Kohm	R386	1		
710	MAIN BOARD A/I	FB246490	METAL 1/4W(T) 1% 649ohm	R388	1		
711	MAIN BOARD A/I	FB241372	METAL 1/4W(T) 1% 13.7Kohm	R389	1		
712	MAIN BOARD A/I	FA040153	CARBON 1/8W(T) 5% 15Kohm	R390	1		
713	MAIN BOARD A/I	FB241503	METAL 1/4W(T) 1% 150Kohm	R392	1		
714	MAIN BOARD A/I	FA330104	CARBON 1/2W(T) 5% 100Kohm	R393	1		
715	MAIN BOARD A/I	FA040474	CARBON 1/8W(T) 5% 470Kohm	R394	1		
716	MAIN BOARD A/I	FA330563	CARBON 1/2W(T) 5% 56Kohm	R395	1		
717	MAIN BOARD A/I	FB910010	METAL 1/4W(T) 5% 1ohm	R398	1		
718	MAIN BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R401	1		
719	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R402	1		
720	MAIN BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R403	1		
721	MAIN BOARD A/I	FA040471	CARBON 1/8W(T) 5% 470ohm	R408	1		
722	MAIN BOARD A/I	FA040152	CARBON 1/8W(T) 5% 1.5Kohm	R410	1		
723	MAIN BOARD A/I	FA040152	CARBON 1/8W(T) 5% 1.5Kohm	R411	1		
724	MAIN BOARD A/I	FA330109	CARBON 1/2W(T) 5% 1ohm	R412	1		
725	MAIN BOARD A/I	FA040223	CARBON 1/8W(T) 5% 22Kohm	R413	1		
726	MAIN BOARD A/I	FA240222	CARBON 1/4W(T) 5% 2.2Kohm	R414	1		
727	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R416	1		
728	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R418	1		
729	MAIN BOARD A/I	FA040394	CARBON 1/8W(T) 5% 390Kohm	R419	1		
730	MAIN BOARD A/I	FA040134	CARBON 1/8W(T) 5% 130K	R420	1		
731	MAIN BOARD A/I	FA240100	CARBON 1/4W(T) 5% 10ohm	R421	1		
732	MAIN BOARD A/I	FA330221	CARBON 1/2W(T) 5% 220ohm	R422	1		
733	MAIN BOARD A/I	FA040513	CARBON 1/8W(T) 5% 51Kohm	R430	1		
734	MAIN BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R432	1		
735	MAIN BOARD A/I	FA040104	CARBON 1/8W(T) 5% 100Kohm	R433	1		
736	MAIN BOARD A/I	FA040223	CARBON 1/8W(T) 5% 22Kohm	R440	1		
737	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R442	1		
738	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R443	1		

739	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R444	1		
740	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 12.5mm	R445	1		
741	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R447	1		
742	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R449	1		
743	MAIN BOARD A/I	FA040753	CARBON 1/8W(T) 5% 75Kohm	R450	1		
744	MAIN BOARD A/I	FA240103	CARBON 1/4W(T) 5% 10Kohm	R451	1		
745	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R452	1		
746	MAIN BOARD A/I	FA040473	CARBON 1/8W(T) 5% 47Kohm	R454	1		
747	MAIN BOARD A/I	FA040304	CARBON 1/8W(T) 5% 300Kohm	R455	1		
748	MAIN BOARD A/I	FA040822	CARBON 1/8W(T) 5% 8.2Kohm	R456	1		
749	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R457	1		
750	MAIN BOARD A/I	FA040154	CARBON 1/8W(T) 5% 150Kohm	R458	1		
751	MAIN BOARD A/I	FA040104	CARBON 1/8W(T) 5% 100Kohm	R459	1		
752	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R460	1		
753	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R462	1		
754	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R463	1		
755	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R477	1		
756	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R601	1		
757	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R602	1		
758	MAIN BOARD A/I	FA040102	CARBON 1/8W(T) 5% 1Kohm	R603	1		
759	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R604	1		
760	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R605	1		
761	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R608	1		
762	MAIN BOARD A/I	FA040222	CARBON 1/8W(T) 5% 2.2Kohm	R609	1		
763	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R610	1		
764	MAIN BOARD A/I	FA040223	CARBON 1/8W(T) 5% 22Kohm	R611	1		
765	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R612	1		
766	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R613	1		
767	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R701	1		
768	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R702	1		
769	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R703	1		
770	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R704	1		
771	MAIN BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R706	1		
772	MAIN BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R707	1		
773	MAIN BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R708	1		
774	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R709	1		
775	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R710	1		
776	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R711	1		
777	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R712	1		
778	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R713	1		
779	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R714	1		
780	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R715	1		
781	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R716	1		
782	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R717	1		
783	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R718	1		
784	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R719	1		
785	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R720	1		
786	MAIN BOARD A/I	FA240103	CARBON 1/4W(T) 5% 10Kohm	R725	1		
787	MAIN BOARD A/I	FA240103	CARBON 1/4W(T) 5% 10Kohm	R726	1		
788	MAIN BOARD A/I	FA240472	CARBON 1/4W(T) 5% 4.7Kohm	R728	1		
789	MAIN BOARD A/I	FA240472	CARBON 1/4W(T) 5% 4.7Kohm	R729	1		
790	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R731	1		
791	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R732	1		
792	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R733	1		
793	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R734	1		
794	MAIN BOARD A/I	FA040222	CARBON 1/8W(T) 5% 2.2Kohm	R735	1		
795	MAIN BOARD A/I	FA040103	CARBON 1/8W(T) 5% 10Kohm	R736	1		

796	MAIN BOARD A/I	FA040104	CARBON 1/8W(T) 5% 100Kohm	R737	1		
797	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R738	1		
798	MAIN BOARD A/I	FA040471	CARBON 1/8W(T) 5% 470ohm	R739	1		
799	MAIN BOARD A/I	FA040471	CARBON 1/8W(T) 5% 470ohm	R740	1		
800	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R741	1		
801	MAIN BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R742	1		
802	MAIN BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R743	1		
803	MAIN BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R744	1		
804	MAIN BOARD A/I	FA040104	CARBON 1/8W(T) 5% 100Kohm	R745	1		
805	MAIN BOARD A/I	FB041212	METAL 1/8W(T) 1% 12.1Kohm	R746	1		
806	MAIN BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R761	1		
807	MAIN BOARD A/I	FA040101	CARBON 1/8W(T) 5% 100ohm	R762	1		
808	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R768	1		
809	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R769	1		
810	MAIN BOARD A/I	FA040472	CARBON 1/8W(T) 5% 4.7Kohm	R770	1		
811	MAIN BOARD A/I	FA040471	CARBON 1/8W(T) 5% 470ohm	R771	1		
812	MAIN BOARD A/I	R0319110	JUMPER WIRE AI/T 5mm	VR307	1		
813	MAIN BOARD A/I	EKA0180B	ZEN DIODE 1/2W(T) HZS 18-2 (HITACHI)	ZD101	1		
814	MAIN BOARD A/I	EKC0180B	ZEN DIODE 1/2W(T) BZX79F18 (PHILIPS)	ZD101	OR		
815	MAIN BOARD A/I	EKA01201	ZEN DIODE 1/2W(T) HZS12A2 (HITACHI)	ZD102	1		
816	MAIN BOARD A/I	EKC01201	ZEN DIODE 1/2W(T) BZX79F12 (PHLIPS)	ZD102	OR		
817	MAIN BOARD A/I	EKA0180B	ZEN DIODE 1/2W(T) HZS 18-2 (HITACHI)	ZD103	1		
818	MAIN BOARD A/I	EKC0180B	ZEN DIODE 1/2W(T) BZX79F18 (PHILIPS)	ZD103	OR		
819	MAIN BOARD A/I	EKA00507	ZEN DIODE 1/2W(T) HZS5C2 (HITACHI)	ZD104	1		
820	MAIN BOARD A/I	EKC00507	ZEN DIODE 1/2W(T) BZX79F5V1 (PHILIPS)	ZD104	OR		
821	MAIN BOARD A/I	EKA0200B	ZEN DIODE 1/2W(T) HZS 20.2 (HITACHI)	ZD105	1		
822	MAIN BOARD A/I	EKA01201	ZEN DIODE 1/2W(T) HZS12A2 (HITACHI)	ZD301	1		
823	MAIN BOARD A/I	EKC01201	ZEN DIODE 1/2W(T) BZX79F12 (PHLIPS)	ZD301	OR		
824	MAIN BOARD A/I	EKA00507	ZEN DIODE 1/2W(T) HZS5C2 (HITACHI)	ZD303	1		
825	MAIN BOARD A/I	EKC00507	ZEN DIODE 1/2W(T) BZX79F5V1 (PHILIPS)	ZD303	OR		
826	MAIN BOARD A/I	EKA00507	ZEN DIODE 1/2W(T) HZS5C2 (HITACHI)	ZD701	1		
827	MAIN BOARD A/I	EKC00507	ZEN DIODE 1/2W(T) BZX79F5V1 (PHILIPS)	ZD701	OR		
828	MAIN BOARD A/I	EKA00507	ZEN DIODE 1/2W(T) HZS5C2 (HITACHI)	ZD702	1		
829	MAIN BOARD A/I	EKC00507	ZEN DIODE 1/2W(T) BZX79F5V1 (PHILIPS)	ZD702	OR		
830	MAIN BOARD A/I	EKA00507	ZEN DIODE 1/2W(T) HZS5C2 (HITACHI)	ZD703	1		
831	MAIN BOARD A/I	EKC00507	ZEN DIODE 1/2W(T) BZX79F5V1 (PHILIPS)	ZD703	OR		
832	MAIN BOARD A/I	EKA00507	ZEN DIODE 1/2W(T) HZS5C2 (HITACHI)	ZD704	1		
833	MAIN BOARD A/I	EKC00507	ZEN DIODE 1/2W(T) BZX79F5V1 (PHILIPS)	ZD704	OR		
834	MAIN BOARD A/I	EKA00507	ZEN DIODE 1/2W(T) HZS5C2 (HITACHI)	ZD705	1		
835	MAIN BOARD A/I	EKC00507	ZEN DIODE 1/2W(T) BZX79F5V1 (PHILIPS)	ZD705	OR		
836	MAIN BOARD INSERT	14000051	SCREW (#2CBRITS*4*8*15BF)	AC SOCKET	2		
837	MAIN BOARD INSERT	80000991	BEAD WBR6H-3T-R7K-B5	B102	1		
838	MAIN BOARD INSERT	GJ047400	SAFETY X-CAP 0.47u/275V M	C101	1		
839	MAIN BOARD INSERT	GJ047404	SAFETY X-CAP 0.47u/275V M(ISKRA)	C101	OR		
840	MAIN BOARD INSERT	GJ047405	SAFETY X-CAP 0.47u/275V M(PHILIPS)	C101	OR		
841	MAIN BOARD INSERT	GJ047407	SAFETY X-CAP 0.47u/275V M(OKAYA)	C101	OR		
842	MAIN BOARD INSERT	GJ047409	SAFETY X-CAP 0.47u/250V M(PILKOR)	C101	OR		
843	MAIN BOARD INSERT	GJC222E5	SAFETY Y-CAP/D 2200P/400V M	C102	1		
844	MAIN BOARD INSERT	GJH102E5	SAFETY Y-CAP/S 1000P/400V M	C103	1		
845	MAIN BOARD INSERT	GJH102E5	SAFETY Y-CAP/S 1000P/400V M	C104	1		
846	MAIN BOARD INSERT	GKA227E5	POWER ELECT 85oC 220u/400V M	C105	1		
847	MAIN BOARD INSERT	GB7472H3	CERAMIC Y5P(B)/T 4700P/1KV K	C106	1		
848	MAIN BOARD INSERT	GBE103H5	CERAMIC Z5U(E)/T 0.01u/1KV M	C107	1		
849	MAIN BOARD INSERT	GAB10775	ELECT 105oC/A 100u/100V M	C119	1		
850	MAIN BOARD INSERT	GAB22775	ELECT 105oC/A 220u/100V M	C120	1		
851	MAIN BOARD INSERT	GAA10825	ELECT 85oC/A 1000u/16V M	C121	1		
852	MAIN BOARD INSERT	GA347725	ELECT 85oC/T 470u/16V M	C122	1		

853	MAIN BOARD INSERT	GAA47685	ELECT 85oC/A 47u/250V M	C129	1		
854	MAIN BOARD INSERT	GAA10825	ELECT 85oC/A 1000u/16V M	C136	1		
855	MAIN BOARD INSERT	GAB22775	ELECT 105oC/A 220u/100V M	C138	1		
856	MAIN BOARD INSERT	GFA33382	PLASTIC MPE/A 0.033u/250V J	C143	1		
857	MAIN BOARD INSERT	GJH102E5	SAFETY Y-CAP/S 1000P/400V M	C146	1		
858	MAIN BOARD INSERT	GJH102E5	SAFETY Y-CAP/S 1000P/400V M	C154	1		
859	MAIN BOARD INSERT	GB9103F8	CERAMIC Z5V(F)/T 0.01u/500V Z	C310	1		
860	MAIN BOARD INSERT	GFE562J2	PLASTIC PMS/A 5600P/2KV J (MYLAR)	C318	1		
861	MAIN BOARD INSERT	GED472M2	PLASTIC PPN/A 4700P/800V J	C319	1		
862	MAIN BOARD INSERT	GAA47685	ELECT 85oC/A 47u/250V M	C325	1		
863	MAIN BOARD INSERT	GFA47482	PLASTIC MPE/A 0.47u/250V J	C329	1		
864	MAIN BOARD INSERT	GAA10825	ELECT 85oC/A 1000u/16V M	C330	1		
865	MAIN BOARD INSERT	GFD304E2	PLASTIC PMM/T 0.3u/400V J(MYLAR)	C332	1		
866	MAIN BOARD INSERT	GFA10582	PLASTIC MPE/A 1u/250V J	C333	1		
867	MAIN BOARD INSERT	GA347585	ELECT 85oC/T 4.7u/250V M	C344	1		
868	MAIN BOARD INSERT	GFD12482	PLASTIC PMM/A 0.12u/250V J	C351	1		
869	MAIN BOARD INSERT	GFD30482	PLASTIC MPPS/A 0.3u/250V J (MYLAR:PMM)	C356	1		
870	MAIN BOARD INSERT	GFB75482	PLASTIC MPP/A 0.75u/250V J	C357	1		
871	MAIN BOARD INSERT	GAA10825	ELECT 85oC/A 1000u/16V M	C413	1		
872	MAIN BOARD INSERT	GAA22675	ELECT 85oC/A 22u/100V M	C415	1		
873	MAIN BOARD INSERT	GA310655	ELECT 85oC/T 10u/50V M	C416	1		
874	MAIN BOARD INSERT	GA347555	ELECT 85oC/T 4.7u/50V M	C446	1		
875	MAIN BOARD INSERT	EJB20001	DIODE/A 3A 1N5406	D101	1		
876	MAIN BOARD INSERT	EJB20001	DIODE/A 3A 1N5406	D102	1		
877	MAIN BOARD INSERT	EJB20001	DIODE/A 3A 1N5406	D103	1		
878	MAIN BOARD INSERT	EJB20001	DIODE/A 3A 1N5406	D104	1		
879	MAIN BOARD INSERT	80003561	DIODE 600V/1.6A RG2A SANKEN S	D110	1		
880	MAIN BOARD INSERT	80003581	DIODE 600V/2A UF2005 CHENMKO S	D110	OR		
881	MAIN BOARD INSERT	80000691	DIODE/A 3A/600V RG4A ( ) (SANKEN)	D111	1		
882	MAIN BOARD INSERT	12800011	HEAT SINK 22.5*31.5*1.3	D111	1		
883	MAIN BOARD INSERT	80001131	DIODE/A 2A/600V RG4A (S)	D112	1		
884	MAIN BOARD INSERT	80001331	DIODE 3A/200V UF5402(S) (GD)	D113	OR		
885	MAIN BOARD INSERT	80001401	DIODE /A 3A/200V RG4Z (S)	D113	1		
886	MAIN BOARD INSERT	80000691	DIODE/A 3A/600V RG4A ( ) (SANKEN)	D114	1		
887	MAIN BOARD INSERT	80001341	DIODE 3A/400V UF5404( ) (GD)	D114	OR		
888	MAIN BOARD INSERT	12800011	HEAT SINK 22.5*31.5*1.3	D114	1		
889	MAIN BOARD INSERT	80001171	DIODE/A 5TUZ47C (TOSHIBA)	D307	1		
890	MAIN BOARD INSERT	14000041	SCREW (P-#2CBRITS*3*8*15BF)	D307	1		
891	MAIN BOARD INSERT	80000691	DIODE/A 3A/600V RG4A ( ) (SANKEN)	D308	1		
892	MAIN BOARD INSERT	12800021	HEAT SINK 22.5*56.5*1.3	D308	1		
893	MAIN BOARD INSERT	80008741	DIODE SANKEN RP3F S (A)	D316	1		
894	MAIN BOARD INSERT	80008751	DIODE FUJI ERD07-15 S (A)	D316	OR		
895	MAIN BOARD INSERT	80001521	FUSE 3.15A/250V 50T T3.15A	F101	1		
896	MAIN BOARD INSERT	14000021	SCREW (#2CBRITS*4*12*15BF)	FOR FBT	1		FOR M-FBT
897	MAIN BOARD INSERT	14000041	SCREW (P-#2CBRITS*3*8*15BF)	FOR FBT	3		
898	MAIN BOARD INSERT	R0180028	FUSE HOLDER 5X20mm	FOR FUSE	2		
899	MAIN BOARD INSERT	12800341	HEAT SINK 56.2*20*60	FOR HK-FBT	1		
900	MAIN BOARD INSERT	14000041	SCREW (P-#2CBRITS*3*8*15BF)	FOR HK-FBT	3		
901	MAIN BOARD INSERT	80000781	SINGLE PIN L=12.0 D=1.5	FOR TH101	2		
902	MAIN BOARD INSERT	JD010040	IC SOCKET 40P	FOR U701	1		
903	MAIN BOARD INSERT	HA030010	EMI FILTER COIL 20.45X10.2X10	G2,G4 WIRE	2		
904	MAIN BOARD INSERT	R0319110	JUMPER WIRE AI/T 12.5mm	J13	1		
905	MAIN BOARD INSERT	80007031	WIRE GND CHOKE 60mm Y/G 1015 18A 3T	L100	1		
906	MAIN BOARD INSERT	80000111	LINE FILTER ET24 10mH MIN	L101	1		
907	MAIN BOARD INSERT	HB000015	LINE FILTER UU10.5 1mH	L102	1		
908	MAIN BOARD INSERT	80003321	CHOKE 1.3mH DR 16X22X10	L106	1		
909	MAIN BOARD INSERT	80001811	CHOKE COIL 130uH 18X20 + BASE	L303	1		

910	MAIN BOARD INSERT	80003441	H. CENTER CHOKE 5mH 8*20	L305	1		
911	MAIN BOARD INSERT	80006631	LINEARITY COIL 4uH	L306	1		
912	MAIN BOARD INSERT	80006641	LINEARITY COIL 3.2uH	L307	1		
913	MAIN BOARD INSERT	80000131	LED L-59GH/1GYC	LED101	1		
914	MAIN BOARD INSERT	18000331	CABLE CLIP (WC-13T)	LW101	1		
915	MAIN BOARD INSERT	80009031	AC SOCKET 3P R30190 SOLTEAM	P101	OR		
916	MAIN BOARD INSERT	JD512001	AC SOCKET 3P	P101	1		
917	MAIN BOARD INSERT	R0220510	BASE PIN VH-3P NC 2P	P102	1		
918	MAIN BOARD INSERT	80000901	FET N FS7KM-12 600V/7A TO-220F	Q101	OR		
919	MAIN BOARD INSERT	80000981	FET N 2SK2645-01/MR TO-220F	Q101	OR		
920	MAIN BOARD INSERT	EF202500	FET N 2SK2545 TO-220F TOSHIBA	Q101	1		
921	MAIN BOARD INSERT	EF211180	FET N 2SK1118 TO-220F	Q101	OR		
922	MAIN BOARD INSERT	12800351	HEAT SINK 44*12*60	Q101	1		
923	MAIN BOARD INSERT	14000041	SCREW (P-#2CBRITS*3*8*15BF)	Q101	1		
924	MAIN BOARD INSERT	EF206301	FET N YTAF630 TO-220F	Q102	1		
925	MAIN BOARD INSERT	12800321	HEAT SINK 23*17*50	Q102	1		
926	MAIN BOARD INSERT	14000041	SCREW (P-#2CBRITS*3*8*15BF)	Q102	1		
927	MAIN BOARD INSERT	80000201	TR PNP 2SB1273 S/R	Q104	OR		
928	MAIN BOARD INSERT	80002451	TR PNP 2SB1274 S/R (SANYO)	Q104	OR		
929	MAIN BOARD INSERT	EB307720	TRPNP KSB772 TO-126	Q104	1		
930	MAIN BOARD INSERT	12600125	HEAT SINK (FBT)	Q307	1		
931	MAIN BOARD INSERT	80005721	TOSHIBA 2SC5411(hfe)	Q307	1		
932	MAIN BOARD INSERT	R0311D04	SCREW CTTWC M3.0X10	Q307	1		
933	MAIN BOARD INSERT	EF206301	FET N YTAF630 TO-220F	Q313	1		
934	MAIN BOARD INSERT	EB20861A	TR PNP 2SB861C TO-220F	Q314	1		
935	MAIN BOARD INSERT	R0311D04	SCREW CTTWC M3.0X10	Q314	1		
936	MAIN BOARD INSERT	EF206301	FET N YTAF630 TO-220F	Q322	1		
937	MAIN BOARD INSERT	12800201	HEAT SINK 15*11*40	Q322	1		
938	MAIN BOARD INSERT	14000041	SCREW (P-#2CBRITS*3*8*15BF)	Q322	1		
939	MAIN BOARD INSERT	FB480220	MOF 1W/M(B) 5% 22ohm	R103	1		
940	MAIN BOARD INSERT	FB470279	MOF 1W/M(A) 5% 2.7ohm	R104	1		
941	MAIN BOARD INSERT	FB570228	MOF 2W/M(B) 5% 0.22ohm	R105	1		
942	MAIN BOARD INSERT	FCE20223	WOUND RES 5W(B) 5% 22Kohm	R106	1		
943	MAIN BOARD INSERT	FC110158	WOUND RES 2W(A) 5% 0.15ohm	R111	1		
944	MAIN BOARD INSERT	FB480100	MOF 1W/M(B) 5% 10ohm	R127	1		
945	MAIN BOARD INSERT	FB480100	MOF 1W/M(B) 5% 10ohm	R128	1		
946	MAIN BOARD INSERT	FB480100	MOF 1W/M(B) 5% 10ohm	R130	1		
947	MAIN BOARD INSERT	FB570569	MOF 2W/M(B) 5% 5.6ohm	R131	1		
948	MAIN BOARD INSERT	FB480100	MOF 1W/M(B) 5% 10ohm	R132	1		
949	MAIN BOARD INSERT	FB470100	MOF 1W/M(A) 5% 10ohm	R134	1		
950	MAIN BOARD INSERT	FC020508	WOUND RES 1W/(B) 5% 0.5ohm	R136	1		
951	MAIN BOARD INSERT	FB470623	MOF 1W/M(A) 5% 62Kohm	R143	1		
952	MAIN BOARD INSERT	FB470103	MOF 1W/M(A) 5% 10Kohm	R148	1		
953	MAIN BOARD INSERT	FB480471	MOF 1W/M(B) 5% 470ohm	R151	1		
954	MAIN BOARD INSERT	80001491	RESISTOR FUSEABLE 1/2W 1.5 ohm J	R156	1		
955	MAIN BOARD INSERT	80001991	RESISTOR FUSEABLE 1/4W 47 ohm J	R158	1		
956	MAIN BOARD INSERT	FB470103	MOF 1W/M(A) 5% 10Kohm	R164	1		
957	MAIN BOARD INSERT	FB720153	MOF 3W/M(B)5% 15Kohm	R170	1		
958	MAIN BOARD INSERT	80006781	RESISTOR FUSEABLE 1/2W/A 0.47ohm J	R302	1		
959	MAIN BOARD INSERT	FB710339	MOF 3W/M(A) 5% 3.3ohm	R304	1		
960	MAIN BOARD INSERT	FB710569	MOF 3W/M(A) 5% 5.6ohm	R309	1		
961	MAIN BOARD INSERT	FB560828	MOF 2W/M(A) 5% 0.82ohm	R311	1		
962	MAIN BOARD INSERT	FB470270	MOF 1W/M(A) 5% 27ohm	R312	1		
963	MAIN BOARD INSERT	FB470102	MOF 1W/M(A) 5% 1Kohm	R316	1		
964	MAIN BOARD INSERT	FB470220	MOF 1W/M(A) 5% 22ohm	R323	1		
965	MAIN BOARD INSERT	FB470220	MOF 1W/M(A) 5% 22ohm	R324	1		
966	MAIN BOARD INSERT	FB560101	MOF 2W/M(A) 5% 100ohm	R335	1		

967	MAIN BOARD INSERT	FB470273	MOF 1W/M(A) 5% 27Kohm	R349	1		
968	MAIN BOARD INSERT	FB710560	MOF 3W/M(A) 5% 56ohm	R391	1		
969	MAIN BOARD INSERT	FB470331	MOF 1W/M(A) 5% 330ohm	R415	1		
970	MAIN BOARD INSERT	FB480100	MOF 1W/M(B) 5% 10ohm	R606	1		
971	MAIN BOARD INSERT	80003751	RELAY 12V 6P GSA-SS-212DM(GOOD)	RL101	1		
972	MAIN BOARD INSERT	80003761	RELAY 12V 6P OSA-SS-212DM5(DEG)	RL101	OR		
973	MAIN BOARD INSERT	HG040011	RELAY 12V	RL321	1		
974	MAIN BOARD INSERT	R0224308	BASE PIN 2.36mm P=8/10 4P	S301	1		
975	MAIN BOARD INSERT	R0224710	BASE PIN 2P P=2mm	S701	1		
976	MAIN BOARD INSERT	R0224129	BASE PIN 6P+HOUSING P=2.5mm	S702	1		
977	MAIN BOARD INSERT	80002201	SPARK GAP 1.5KV+-500V	SG301	1		
978	MAIN BOARD INSERT	80009071	POWER SW 10A/250V PS-22SPA-P9AZ(SOLTEAM)	SW101	OR		
979	MAIN BOARD INSERT	JC021211	POWER SW	SW101	1		
980	MAIN BOARD INSERT	80000251	TACT SW 1P 100G+-50	SW701	1		
981	MAIN BOARD INSERT	80000251	TACT SW 1P 100G+-50	SW702	1		
982	MAIN BOARD INSERT	80000251	TACT SW 1P 100G+-50	SW703	1		
983	MAIN BOARD INSERT	80006711	POWER X'FM ERL35 500uH(3.3/6.6)	T101	1		
984	MAIN BOARD INSERT	80005651	17" FBT Double Focus	T301	1		
985	MAIN BOARD INSERT	80000281	H.DRIVE X'FM 4.5mH EI-19	T302	1		
986	MAIN BOARD INSERT	80001921	H.DF X'FM EI-19	T303	1		
987	MAIN BOARD INSERT	80000801	THERMISTOR NTCR SCK054 13.3mm	TH101	1		
988	MAIN BOARD INSERT	80005821	THERMISTOR PTCR 4.5ohm	TH102	1		
989	MAIN BOARD INSERT	R0224077	BASE PIN 1P 1.55mm	TPC	1		
990	MAIN BOARD INSERT	80009051	IC LINEAR UC3842A (UNIEX)	U101	OR		
991	MAIN BOARD INSERT	DD002600	IC LINEAR KA3842A 8P	U101	1		
992	MAIN BOARD INSERT	80009041	IC LINEAR UC3843A (UNIEX)	U102	OR		
993	MAIN BOARD INSERT	DD002900	IC LINEAR KA3843B 8P	U102	1		
994	MAIN BOARD INSERT	DD004600	IC LM1290	U301	1		
995	MAIN BOARD INSERT	80000341	IC TDA4866 10P	U401	1		
996	MAIN BOARD INSERT	12800331	HEAT SINK 44*27*60	U401	1		
997	MAIN BOARD INSERT	R0311D04	SCREW CTTWC M3.0X10	U401	2		
998	MAIN BOARD INSERT	80000351	IC LM1295	U402	1		
999	MAIN BOARD INSERT	80007191	N9704 MTP V03 WT6016	U701	1		
1000	MAIN BOARD INSERT	12300121	PLATE SHIELDING (IC)	U701	1		
1001	MAIN BOARD INSERT	80008701	IC KS24C041C(SAMSUNG)	U702	OR		
1002	MAIN BOARD INSERT	BE028000	IC AT24C04 ATMEL	U702	1		
1003	MAIN BOARD INSERT	FF310103	VR CARBON 6mm 10K VZ067TL1	VR101	1		
1004	MAIN BOARD INSERT	FF310102	VR CARBON 6mm 1K	VR102	1		
1005	MAIN BOARD INSERT	FF310103	VR CARBON 6mm 10K VZ067TL1	VR302	1		
1006	MAIN BOARD INSERT	FF300103	VR CARBON 6mm 10K VZ067TH1	VR306	1		
1007	MAIN BOARD INSERT	80000761	WIRE L=110mm BLACK AWG22	WC-C'	1		
1008	MAIN BOARD INSERT	80003491	MS-50 WIRE ASSY	WIRE ASSY	1		
1009	MAIN BOARD INSERT	EM080003	X'TAL 49U 8MHz	X701	1		
1010	MAIN BOARD INSERT	18000321	EDGE SADDLE(SB-31)		1		
1011	MAIN BOARD INSERT	14000071	SCREW (PL-CPTS*3*8*15BF)		2		
1012	PACKING	80001631	POWER CORD 3P 1.8 NON-SHIELD COLOR SG8508	POWER CORD	1		A
1013	PACKING	80008691	POWER CORD 3P 1.8M U.K. N-SHIELD SG8508	POWER CORD	1		U.K.
1014	PACKING	80001651	POWER CORD 3P 1.8M EUROPE N-SHIELD	POWER CORD	1		B
1015	PACKING	13200701	CARTON BOX (MS75 F)		1		A
1016	PACKING	13200751	CARTON BOX (MS75 F-B)		1		B
1017	PACKING	13400411	POLYLON(T)		1		
1018	PACKING	13400421	POLYLON(B)		1		
1019	PACKING	13700021	BAG POLYETHYLENE (270*370)		1		
1020	PACKING	13700031	BAG POLYETHYLENE (150*370)		1		
1021	PACKING	15800051	SAFETY INSTRUCTION SHEET		1		A
1022	PACKING	13700071	PE BAG (500*480*850 + WARNING)		1		
1023	PACKING	15500481	OWNERS MANUAL (MS75 F)		1		A

1024	PACKING	15500511	OWNERS MANUAL (MS75/95 F)		1	B
1025	PACKING	15900023	SALES OFFICE LIST		1	B
1026	PACKING	11000331	REVOLVING STAND ASSY		1	
1027	PACKING	11000381	REVOLVING STAND ASSY		OR	
1028	REVOLVING STAND ASSY	17000291	CUSHION SHEET	FOR BASE	4	
1029	REVOLVING STAND ASSY	17000451	CUSHION SHEET	FOR BASE	4	
1030	REVOLVING STAND ASSY	11000251	REVOLVING STAND(B)(94HB)		1	
1031	REVOLVING STAND ASSY	11000361	REVOLVING STAND(B)(94HB)		1	
1032	REVOLVING STAND ASSY	11000261	REVOLVING STAND(T)(94HB)		1	
1033	SET ASSY	80004721	SIGNAL CABLE BLUE(66C)	CABLE	1	
1034	SET ASSY	80008731	17" SAMSUNG CRT M41QCJ761X172	CRT	1	
1035	SET ASSY	80008781	DEGAUSSING COIL AS75 F	DEGUESSING COIL	1	
1036	SET ASSY	14000011	SCREW (#2CBRITS*4*16*15BF)	FOR BACK	2	
1037	SET ASSY	14600171	SCREW SPECIAL (5*30)	FOR CRT	4	
1038	SET ASSY	17000501	CRT PAD t=5	FOR CRT	4	
1039	SET ASSY	17000521	MAYLAR SHEET (280*30*3t)	FOR CRT	1	
1040	SET ASSY	18000281	LOOKING CABLE CLIP(GL-70A)	FOR DEGUES	4	
1041	SET ASSY	11700211	SUPPORT	FOR FRONT	2	
1042	SET ASSY	14000021	SCREW (#2CBRITS*4*12*15BF)	FOR FRONT	4	
1043	SET ASSY	18000271	SPACER SUPPORT(PS-26GD)	FOR M/B	4	
1044	SET ASSY	17000101	CRT PAD t=2.5	FOR SUPPORT	1	B
1045	SET ASSY	80000031	GND WIRE 18AWG L=130mm	GND WIRE	2	
1046	SET ASSY	80006971	GND WIRE 18AWG L=410mm	GND WIRE	1	
1047	SET ASSY	80008831	17"CRT GND WIRE FOR AS75 F	GND WIRE	1	
1048	SET ASSY	72000372	TCO SHIELD PCB	PCB C	1	B
1049	SET ASSY	17000301	CUSHION PIECE(BACK)	SPONGE	1	
1050	SET ASSY	R0191207	TAPE BLACK L=75mmX3	TAPE	0.015	
1051	SET ASSY	R0315A04	CABLE TIE L=100mm W=2.5mm	TIE	10	A
1052	SET ASSY	R0315A04	CABLE TIE L=100mm W=2.5mm	TIE	11	B
1053	SET ASSY	15000701	NAME PLATE INSTRUCTION (MS75 F)		1	A
1054	SET ASSY	15000751	NAME PLATE INSTRUCTION (MS75 F-B)		1	B
1055	SET ASSY	15200281	LABLE,SERIAL BARCODE(A)		1	A
1056	SET ASSY	15200971	LABEL WARNING (30KV,1000uA)		1	B
1057	SET ASSY	15200331	LABLE,SERIAL BARCODE(B)		1	B
1058	SET ASSY	15200681	LABEL (TCO99)		1	B
1059	SET ASSY	12000551	BRACKET (CABLE)		1	
1060	SET ASSY	80005101	WIRE 1618 24AWG 40mm BLACK		1	B
1061	SET ASSY	80009161	DEGUASSING COIL AS75F/MS75F TCO SSCRT		1	B
1062	SET ASSY	80008761	WIRE 3P-2P		1	
1063	SET ASSY	80005101	WIRE 1618 24AWG 40mm BLACK		1	
1064	SET ASSY	18000261	ANODE CLAMPER(SPA-11G)		2	
1065	SET ASSY	10101311	CABINET FRONT ASSY		1	A
1066	SET ASSY	10101481	CABINET FRONT ASSY(PC+ABS)		1	B
1067	SET ASSY	10100923	CABINET BACK(PC+ABS)		1	B
1068	SET ASSY	10100593	CABINET BACK		1	A
1069	SET ASSY	15200881	LABEL (CRA) (MS75 F)		1	A
1070	SET ASSY	15200961	LABEL WARNING (30KV)		1	
1071	SET ASSY	15200491	LABEL MANUFACTURE (NPG)		1	A
1072	SET ASSY	12000281	BRACKET(PCB)		1	
1073	SET ASSY	14000031	SCREW (#2CBRITS*3*12*15BF)		2	
1074	SET ASSY	12300201	PLATE SHIELDING (VIDEO)		1	
1075	SET ASSY	15200031	LABEL (REV.)		1	
1076	SET ASSY	14300031	SCREW (PL-CPIMS*4*10*15BF)		2	
1077	SET ASSY	18000311	PCB SUPPORT(SS-8)		1	
1078	SET ASSY	18000361	HOLDER PCB FOR TCO(CBS-5C)		4	B
1079	SET ASSY	14000041	SCREW (P-#2CBRITS*3*8*15BF)		1	

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SORT BY ASSY CODE

2) AS75F Different Parts List
A: U.S.A

	ASSY CODE	PART NO	DESCRIPTION	LOCATION	Q'TY	ALT	REMARK
1	CABINET FRONT ASSY	10101341	CABINET FRONT		1		
2	CABINET FRONT ASSY	11300461	PUSH BUTTON(CONTROL)		1		
3	CABINET FRONT ASSY	11300671	PUSH BUTTON(SW)		1		
4	CABINET FRONT ASSY	11600141	LENS		1		
5	CABINET FRONT ASSY	13000061	COIL SPRING		1		
6	CABINET FRONT ASSY	11700251	KEY COVER		1		
7	PACKING	80001631	POWER CORD 3P 1.8 NON-SHIELD COLOR SG8508	POWER CORD	1		A
8	PACKING	80008691	POWER CORD 3P 1.8M U.K. N-SHIELD SG8508	POWER CORD	1		U.K.
9	PACKING	13200711	CARTON BOX (AS75 F)		1		
10	PACKING	13400411	POLYLON(T)		1		
11	PACKING	13400421	POLYLON(B)		1		
12	PACKING	13700021	BAG POLYETHYLENE (270*370)		1		
13	PACKING	13700031	BAG POLYETHYLENE (150*370)		1		
14	PACKING	15800051	SAFETY INSTRUCTION SHEET		1		
15	PACKING	13700071	PE BAG (500*480*850 + WARNING)		1		
16	PACKING	15500491	OWNERS MANUAL (AS75 F)		1		
17	PACKING	11000331	REVOLVING STAND ASSY		1		
18	PACKING	11000381	REVOLVING STAND ASSY		OR		
19	SET ASSY	15000711	NAME PLATE INSTRUCTION (AS75 F)	B/C LABEL	1		
20	SET ASSY	80004721	SIGNAL CABLE BLUE(66C)	CABLE	1		
21	SET ASSY	80008731	17" SAMSUNG CRT M41QCJ761X172	CRT	1		
22	SET ASSY	80008781	DEGAUSSING COIL AS75 F	DEGUESSING COIL	1		
23	SET ASSY	14000011	SCREW (#2CBRITS*4*16*15BF)	FOR BACK	2		
24	SET ASSY	14600171	SCREW SPECIAL (5*30)	FOR CRT	4		
25	SET ASSY	17000501	CRT PAD t=5	FOR CRT	4		
26	SET ASSY	17000521	MAYLAR SHEET(280*30*3t)	FOR CRT	1		
27	SET ASSY	18000281	LOOKING CABLE CLIP(GL-70A)	FOR DEGUES	4		
28	SET ASSY	11700211	SUPPORT	FOR FRONT	2		
29	SET ASSY	14000021	SCREW (#2CBRITS*4*12*15BF)	FOR FRONT	4		
30	SET ASSY	18000271	SPACER SUPPORT(PS-26GD)	FOR M/B	4		
31	SET ASSY	80000031	GND WIRE 18AWG L=130mm	GND WIRE	2		
32	SET ASSY	80006971	GND WIRE 18AWG L=410mm	GND WIRE	1		
33	SET ASSY	80008831	17"CRT GND WIRE FOR AS75 F	GND WIRE	1		
34	SET ASSY	17000301	CUSHION PIECE(BACK)	SPONGE	1		
35	SET ASSY	R0191207	TAPE BLACK L=75mmX3	TAPE	0.02		
36	SET ASSY	R0315A04	CABLE TIE L=100mm W=2.5mm	TIE	10		
37	SET ASSY	12000551	BRACKET (CABLE)		1		
38	SET ASSY	80008761	WIRE 3P-2P		1		
39	SET ASSY	80005101	WIRE 1618 24AWG 40mm BLACK		1		
40	SET ASSY	18000261	ANODE CLAMPER(SPA-11G)		2		
41	SET ASSY	10101331	CABINET FRONT ASSY		1		
42	SET ASSY	10100593	CABINET BACK		1		
43	SET ASSY	15200891	LABEL (CRA) (AS75 F)		1		
44	SET ASSY	15200961	LABEL WARNING (30KV)		1		
45	SET ASSY	15200281	LABLE,SERIAL BARCODE(A)		1		
46	SET ASSY	15200491	LABEL MANUFACTURE (NPG)		1		
47	SET ASSY	12000281	BRACKET(PCB)		1		
48	SET ASSY	14000031	SCREW (#2CBRITS*3*12*15BF)		2		
49	SET ASSY	12300201	PLATE SHIELDING (VIDEO)		1		
50	SET ASSY	15200031	LABEL (REV.)		1		
51	SET ASSY	14300031	SCREW (PL-CPIMS*4*10*15BF)		2		
52	SET ASSY	18000311	PCB SUPPORT(SS-8)		1		
53	SET ASSY	14000041	SCREW (P-#2CBRITS*3*8*15BF)		1		

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N9705(MS75F/AS75F)

SCHEMATIC DIAGRAMS