harman/kardon

AVR144

5 X 30W 5.1 CHANNEL A/V RECEIVER

SERVICE MANUAL

CONTENTS

Rev 0   2/2007

ELECTROSTATICALLY SENSITIVE (ES) DEVICES

Some semiconductor (solid state) devices can be damaged easily by static electricity. Such components commonly are called Electrostatically Sensitive (ES) Devices. Examples of typical ES devices are integrated circuits and some field effect transistors and semiconductor "chip" components.

The following techniques should be used to help reduce the incidence of component damage caused by static electricity.

1. Immediately before handling any semiconductor component or semiconductor-equipped assembly, drain off any electrostatic charge on your body by touching a known earth ground. Alternatively, obtain and wear a commercially available discharging wrist strap device, which should be removed for potential shock reasons prior to applying power to the unit under test.

2. After removing an electrical assembly equipped with ES devices, place the assembly on a conductive surface such as aluminum foil, to prevent electrostatic charge build-up or exposure of the assembly.

3. Use only a grounded-tip soldering iron to solder or unsolder ES devices.

4. Use only an anti-static solder removal device. Some solder removal devices not classified as "anti-static" can generate electrical charges sufficient to damage ES devices.

5. Do not use freon-propelled chemicals. These can generate electrical change sufficient to damage ES devices.

6. Do not remove a replacement ES device from its protective package until immediately before you are ready to install it. (Most replacement ES devices are packaged with leads electrically shorted together by conductive foam, aluminum foil or comparable conductive material.)

7. Immediately before removing the protective material from the leads of a replacement ES device, touch the protective material to the chassis or circuit assembly into which the device will be installed.

    CAUTION : Be sure no power is applied to the chassis or circuit, and observe all other safety precautions.

8. Minimize bodily motions when handling unpackaged replacement ES devices. (Otherwise harmless motion such as the brushing together or your clothes fabric or the lifting of your foot from a carpeted floor can generate static electricity sufficient to damage an ES devices.

PRODUCT SAFETY NOTICE

Each precaution in this manual should be followed during servicing.

Components identified with the IEC symbol ⚠ in the parts list are special significance to safety. When replacing a component identified with ⚠ , use only the replacement parts designated, or parts with the same ratings or resistance, wattage, or voltage that are designated in the parts list in this manual. Leakage-current or resistance measurements must be made to determine that exposed parts are acceptably insulated from the supply circuit before returning the product to the customer.

SAFETY PRECAUTIONS

The following check should be performed for the continued protection of the customer and service technician.

LEAKAGE CURRENT CHECK

Measure leakage current to a known earth ground (water pipe, conduit, etc.) by connecting a leakage current tester between the earth ground and all exposed metal parts of the appliance (input/output terminals, screwheads, metal overlays, control shaft, etc.). Plug the AC line cord of the appliance directly into a 120V AC 60Hz outlet and turn the AC power switch on. Any current measured must not exceed o.5mA.

Reading should
not be above
0.5mA

Leakage
current
tester

Device
under
test

Test all
exposed metal
surfaces

Also test with
plug reversed
(Using AC adapter
plug as required)

Earth
ground
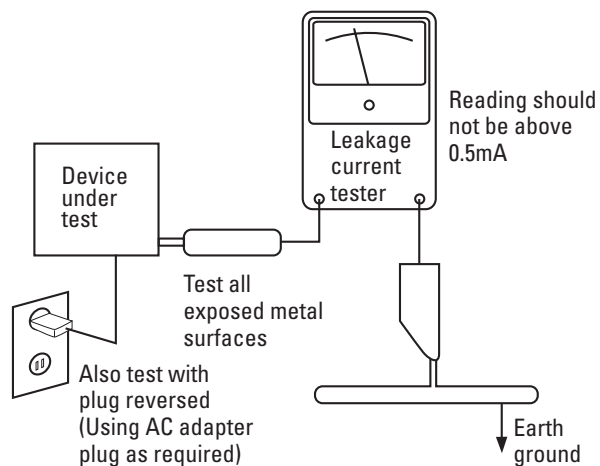
AC Leakage Test

ANY MEASUREMENTS NOT WITHIN THE LIMITS OUTLINED ABOVE ARE INDICATIVE OF A POTENTIAL SHOCK HAZARD AND MUST BE CORRECTED BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

AVR 144 TECHNICAL SPECIFICATIONS

Audio Section

Stereo Mode
Continuous Average Power (FTC)

　　40 Watts per channel, 20Hz–20kHz,
　　@ <0.07% THD, both channels driven into 8 ohms

Five-Channel Surround Modes
Power per Individual Channel

　　Front L&R channels:
　　30 Watts per channel
　　@ <0.07% THD, 20Hz–20kHz into 8 ohms

　　Center channel:
　　30 Watts @ <0.07% THD, 20Hz–20kHz into 8 ohms

　　Surround (L & R Side) channels:
　　30 Watts per channel
　　@ <0.07% THD, 20Hz–20kHz into 8 ohms

Input Sensitivity/Impedance	
Linear (High-Level)	200mV/47k ohms
Signal-to-Noise Ratio (IHF-A)	100dB

Surround System Adjacent Channel Separation

Pro Logic I/II	40dB
Dolby Digital (AC-3)	55dB
DTS	55dB

Frequency Response	
@ 1W (+0dB, –3dB)	10Hz –130kHz
High Instantaneous Current Capability (HCC)	±25 Amps
Transient Intermodulation Distortion (TIM)	Unmeasurable
Slew Rate	40V/µsec

FM Tuner Section

Frequency Range	87.5–108.0MHz
Usable Sensitivity	IHF 1.3µV/13.2dBf
Signal-to-Noise Ratio	Mono/Stereo 70/68dB
Distortion	Mono/Stereo 0.2/0.3%
Stereo Separation	40dB @ 1kHz
Selectivity	±400kHz, 70dB
Image Rejection	80dB
IF Rejection	90dB

AM Tuner Section

Frequency Range	520–1720kHz
Signal-to-Noise Ratio	45dB
Usable Sensitivity	Loop 500µV
Distortion	1kHz, 50% Mod 0.8%
Selectivity	±10kHz, 30dB

Video Section

Television Format	NTSC
Input Level/Impedance	1Vp-p/75 ohms
Output Level/Impedance	1Vp-p/75 ohms
Video Frequency Response (Composite and S-Video)	10Hz–8MHz (–3dB)
Video Frequency Response (Component Video)	10Hz–100MHz (–3dB)

General

Power Requirement	AC 120V/60Hz
Power Consumption	65W idle, 540W maximum (5 channels driven)

Dimensions	(Product)	(Shipping)
Width	17-5/16 inches (440mm)	21-7/8 inches (555mm)
Height	6-1/2 inches (165mm)	10-1/2 inches (266mm)
Depth	15 inches (382mm)	18-5/16 inches (465mm)
	(Product)	(Shipping)
Weight	21.12 lb (9.6kg)	26 lb (11.8kg)

Depth measurement includes knobs, buttons and terminal connections.
Height measurement includes feet and chassis.
All features and specifications are subject to change without notice.

Please register your product on our Web site at www.harmankardon.com. Note: You'll need the product's serial number. At the same time, you can choose to be notified about our new products and/or special promotions.

1. Instruction manual ass'y - Accessories

2. Package Drawing

① POLY BAG

② CARD WARRANTY

③ AM LOOP ANTENNA ASS'Y

④ BATTERY ASS'Y

⑤ MANUAL INSTRUCTION

⑥ FM 1 POLE ANT(UL)

⑦ REMOCON TRANSMITTER ASS'Y

⑧ SHEET GUIDE

⑨ STAPLE

⑩ COVER ASS'Y

⑪ IMAGE BROCHURES
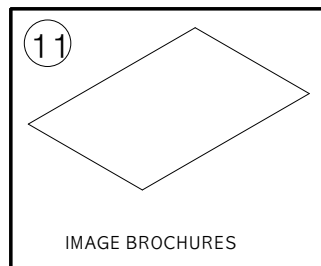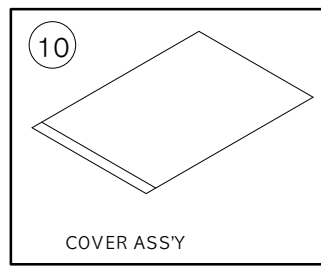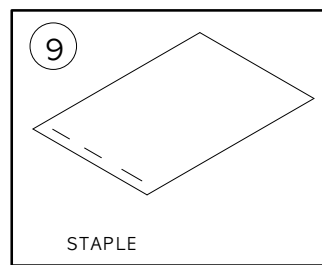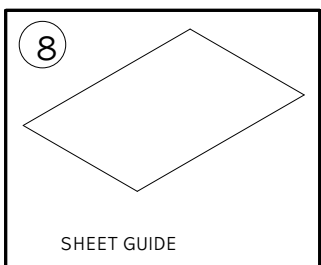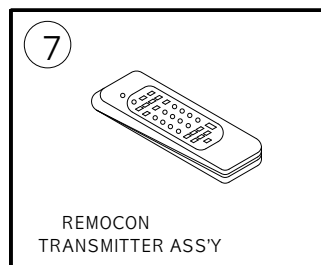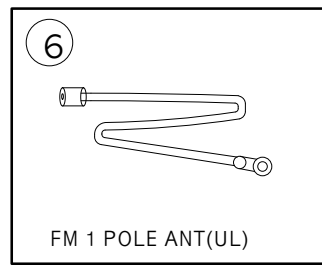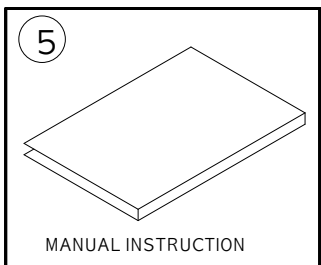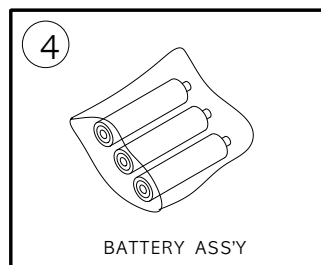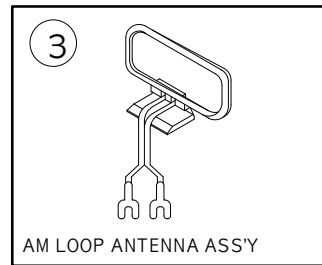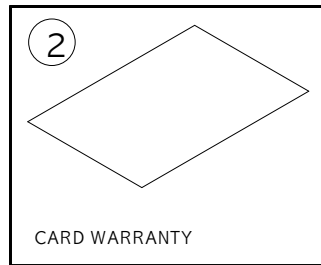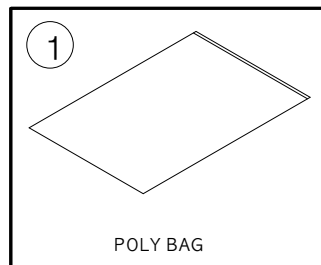
NO		DESCRIPTION	PARTS NO.	Q,ty
1		POLY BAG		1
2		CARD WARRANTY	CQE1A172X	1
3		AM LOOP ANTENNA	CSA1A027Z	1
4		BATTERY		3
5		INSTRUCTION MANUAL	CQX1A1153Z	1
6		FM 1 POL ANT(UL)	CSA1A019Z	1
7		REMOCON TRANSMITTER ASS'Y	CARTAVR144	1
8		SHEET GUIDE(QUICK START GUIDE)	CQE1A305Z	1
9		STAPLE		3
10		**DOOR KIT**	CGRAVR130ZA	1
	1	COVER A	CGR1A331M7H43	1
	2	COVER B	CGR1A332M7H43	1
	3	SHEET,FRONT COVER	CQE1A219Z	1
	4	PAD, COVER	CPS1A676	1
	5	BAG,POLY		1
11		IMAGE BROCHURES		1

① MANUAL ASS'Y

② SNOW PAD (L)

③ SNOW PAD (R)

④ SET
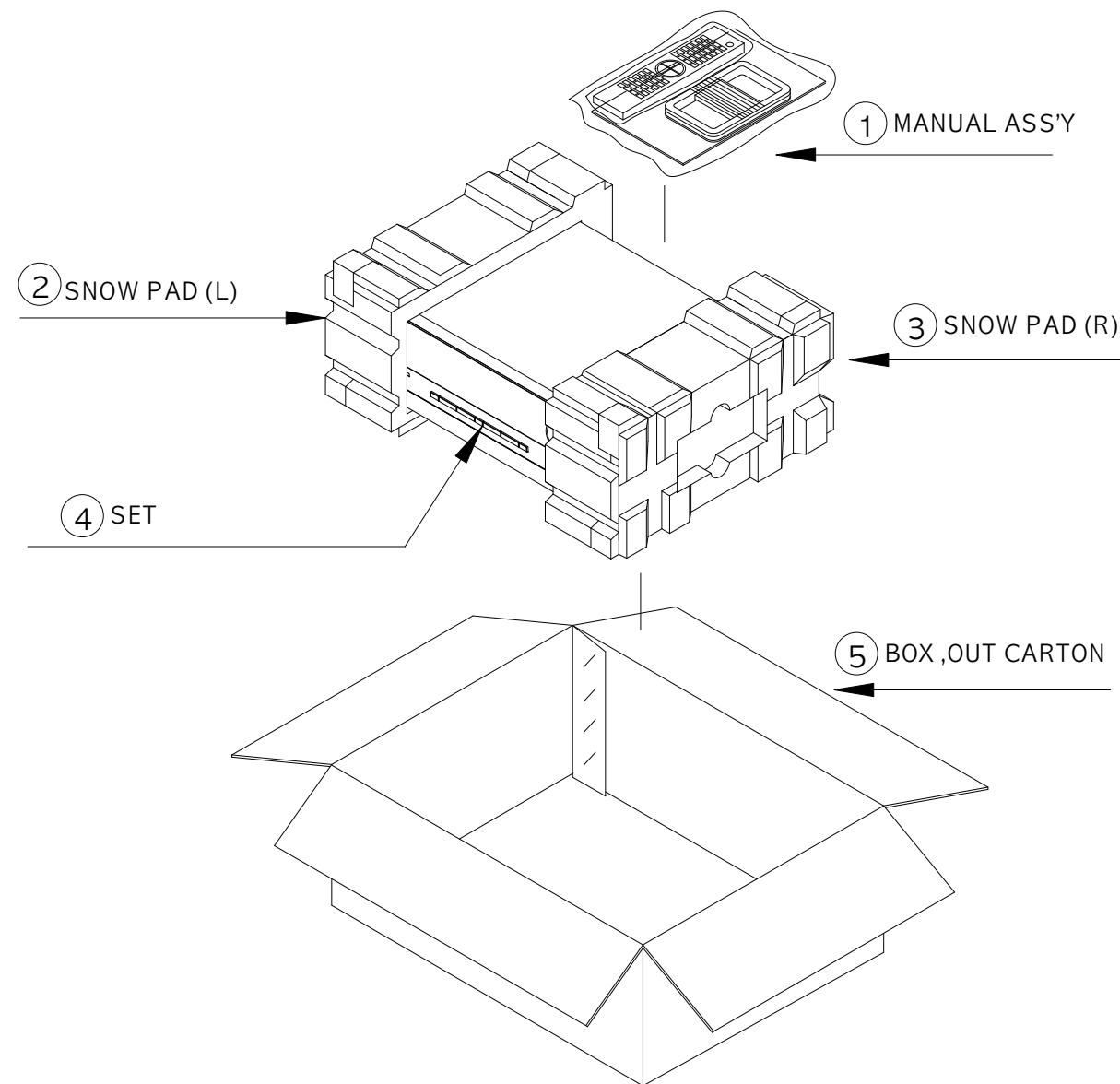
⑤ BOX ,OUT CARTON

NO	DESCRIPTION	PARTS NO.	Q,ty
1	MANUAL ASS'Y		1
2	SNOW,PAD(L)	CPS4A564	1
3	SNOW,PAD(R)	CPS4A565	1
4	AVR144	AVR 144	1
5	BOX,OUT CARTON	CPG1A820S	1

FRONT-PANEL CONTROLS

Main Power Switch: This is a mechanical switch that turns the power supply on or off. It is usually left pressed in (On position) at all times, and cannot be turned on using the remote control.

Standby/On Switch: This is an electrical switch that turns the receiver on for playback, or leaves it in standby mode for quick turn-on using this switch or the remote control.

Power Indicator: This LED has three possible modes. When main power is turned off, the LED is dark and the receiver won't respond to any button presses. When main power is turned on, but before the Standby/On Switch is used, the LED turns amber to indicate that the receiver is in Standby mode and ready to be turned on. When the receiver is turned on, the LED turns blue.

Source Select: Press this button to select a source device, which is a component where a playback signal originates, e.g., DVD, CD, cable TV, satellite or HDTV tuner.

Source Indicators: The name of the current source input lights up. The indicated input changes each time the Source Select Button is pressed.

Volume Knob: Turn this knob to raise or lower the volume, which will be shown in decibels (dB) in the Message Display.

Message Display: Various messages appear in this two-line display in response to commands. When the on-screen display menu system (OSD) is in use, the message OSD ON will appear to remind you to check the video display.

Tuner Band: Press this button to select the tuner as the source, or to switch between the AM and FM bands.

Tuning: Press either side of this button to tune a radio station.

Tuning Mode: This button toggles between manual (one frequency step at a time) and automatic (seeks frequencies with acceptable signal strength) tuning mode. It also toggles between stereo and mono modes when an FM station is tuned.

Preset Stations: Press this button to select a preset radio station.

Headphone Jack: Plug a 1/4" headphone plug into this jack for private listening.

Surround Mode: Press this button to select a type of surround sound (e.g., multichannel) mode. Choose from the Dolby modes, DTS modes, Logic 7 modes, DSP modes or Stereo modes.

Surround Select: After you have selected the desired type of surround mode, press this button to select a specific variant of that type of mode.

Surround Mode Indicators: One or more of these icons may light up as you select different surround modes. The Message Display also indicates the surround mode.

Analog Audio, Video and Digital Audio Inputs: Connect a source component that will only be used temporarily to these jacks, such as a camera or game console. Remember to select only one type of audio and one type of video connection.

Speaker/Channel Input Indicators: The box icons indicate which speaker positions you have configured, and the size (frequency range) of each speaker. When a digital audio input is used, letters will light inside the boxes to indicate which channels are present in the incoming signal.
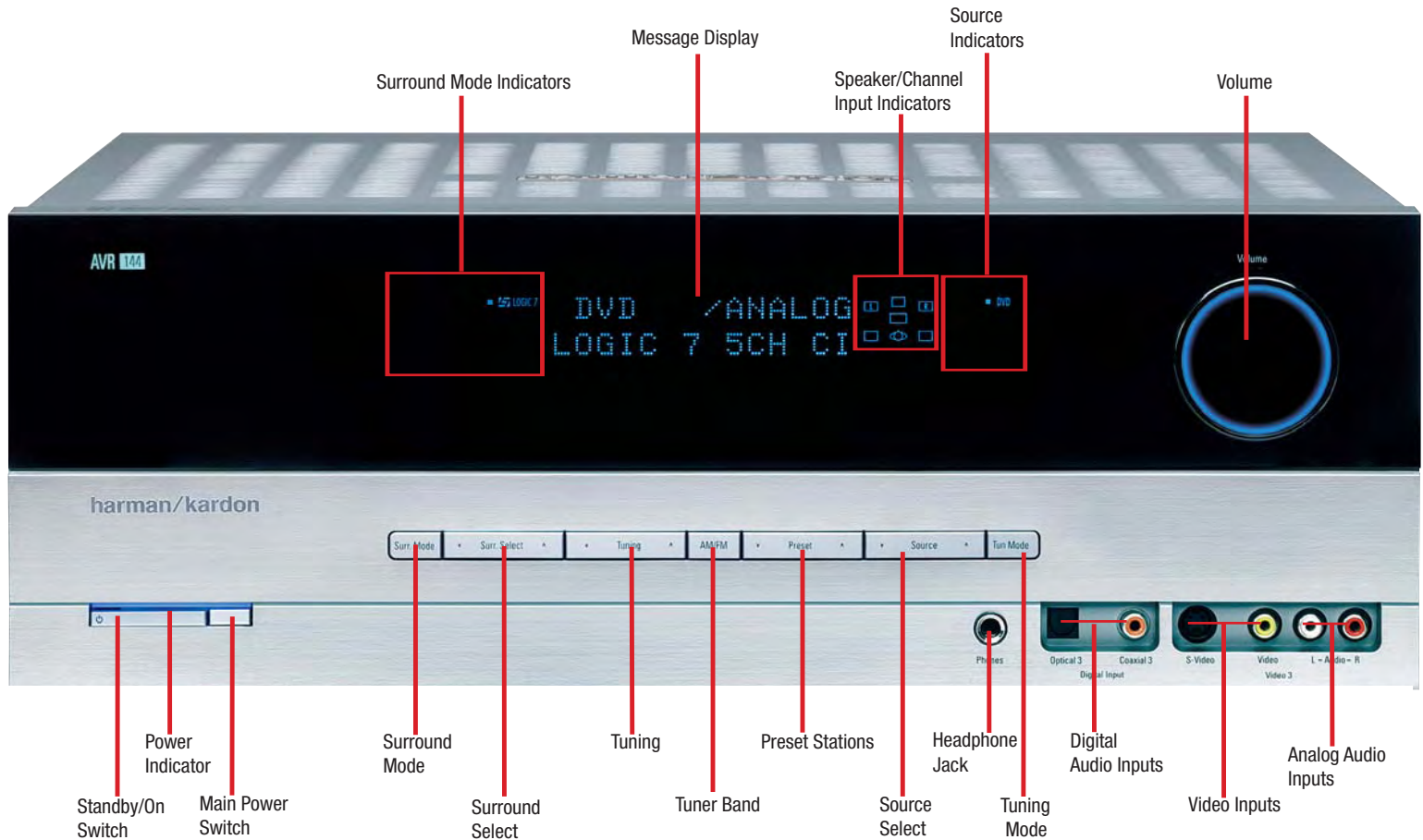
Message Display

Source
Indicators

Surround Mode Indicators

Speaker/Channel
Input Indicators

Volume

AVR 144

DVD   /ANALOG
LOGIC 7 5CH CI

harman/kardon

Surr. Mode   •   Surr. Select   ▲   •   Tuning   ▲   AM/FM   •   Preset   ▲   •   Source   ▲   Tun Mode

Power
Indicator

Surround
Mode

Tuning

Preset Stations

Headphone
Jack

Digital
Audio Inputs

Analog Audio
Inputs

Standby/On
Switch

Main Power
Switch

Surround
Select

Tuner Band

Source
Select

Tuning
Mode

Video Inputs

NOTE: To make it easier to follow the instructions throughout the manual that refer to this illustration, a copy of this page may be downloaded from the Product Support section at www.harmankardon.com.

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REAR-PANEL CONNECTIONS

AM and FM Antenna Terminals: Connect the included AM and FM antennas to their respective terminals for radio reception.

Front, Center and Surround Speaker Outputs: Use two-conductor speaker wire to connect each set of terminals to the correct speaker. Remember to observe the correct polarity (positive and negative connections). Always connect the positive lead to the colored terminal on the receiver and the red terminal on the speaker. Connect the negative lead to the black terminal on both the receiver and the speaker. See the Connections section for more information on connecting your speakers.

Subwoofer Output: If you have a powered subwoofer, connect it to this jack.

Video 1, Video 2 and DVD Audio/Video Inputs: These jacks may be used to connect your video-capable source components (e.g., VCR, DVD player, cable TV box) to the receiver. Remember to use only one type of video connection for each source. See the Connections section for more information on audio and video connection options for each source component.

Video 1 Audio/Video Outputs: These jacks may be used to connect your VCR or another recorder.

Composite and S-Video Monitor Outputs: If some of your sources use composite or S-video connections, then you will need to connect one or both of these monitor outputs to the corresponding inputs on your television or video display in order to view the sources.

CD and Tape Audio Inputs: These jacks may be used to connect your audio-only source components (e.g., CD player, tape deck). Do not connect a turntable to these jacks unless you are using the turntable with a phono preamp.

Tape Outputs: These jacks may be used to connect your CDR or another audio-only recorder.

Coaxial and Optical Digital Audio Inputs: If your source has a compatible digital audio output, connect it to one of these jacks for improved audio performance. Remember to use only one type of digital audio connection for each source.

6-Channel Inputs: Connect the analog audio outputs of a DVD-Audio, SACD™, Blu-ray Disc™ or HD-DVD™ player (or any other external decoder) to these jacks to enjoy these proprietary formats.

Component Video Inputs: If both your video source (e.g., DVD player or HDTV tuner) and your television or video display have analog component video (Y/Pb/Pr) capability, then you may connect the component video outputs of your source to one of the two component video inputs. Do not make any other video connections to that source.

Component Video Monitor Outputs: If you are using one or both of the Component Video Inputs and your television or video display is component-video-capable, you may connect these jacks to the corresponding inputs on your video display. You will also need to connect the composite and/or S-video monitor outputs to your video display if some of your sources use those types of video connections and to view the on-screen menus.

AC Power Cord: After you have made all other connections, plug the AC power cord into an unswitched outlet.

FM Antenna

AM Antenna

Video 2 A/V Inputs

Video 1 A/V Inputs

Video 1 A/V Outputs

Video Monitor Outputs

DVD A/V Inputs

Component Video Inputs (1 & 2)

Component Video Monitor Outputs

Coaxial Digital Audio Inputs (1 & 2)

AC Power Cord

AC INPUT ~120V / 60Hz 235W

FM (75Ω) GND AM
ANTENNA

VIDEO

S-VIDEO

VID 2 VID 1 DVD MONITOR

COMPONENT VIDEO

MONITOR OUT

Y Pb Pr

DIGITAL-INPUT

AUDIO
L
R

CD IN TAPE OUT TAPE IN

VID 2 IN VID 1 OUT VID 1 IN DVD IN

FL/FR SL/SR C/SW
6CH

COAXIAL IN OPTICAL IN

R FRONT L

R SURROUND L CENTER

+

−

R L

R L CENTER

SUB WOOFER PRE-OUT

SPEAKERS (8 Ω)

MODEL NO. AVR 144
harman/kardon
NORTHRIDGE CALIFORNIA, USA
MADE IN CHINA

CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN
AVIS : RISQUE DE CHOC
ÉLECTRIQUE-NE PAS OUVRIR

WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK,
DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.
AVERTISSEMENT: AFIN D'ÉVITER LES DANGERS D'INCENDIE
ET D'ÉLECTROCUTION, NE PAS EXPOSER CET APPAREIL
À LA PLUIE NI À L'HUMIDITÉ.

E218010
c(UL)us
LISTED
9H74
AUDIO
EQUIPMENT

CD Inputs

Tape Inputs

Tape Outputs

Subwoofer Output

Front Speaker Outputs

6-Channel Inputs

Surround Speaker Outputs

Center Speaker Outputs

Optical Digital Audio Inputs (1 & 2)

NOTE: To make it easier to follow the instructions throughout the manual that refer to this illustration, a copy of this page may be downloaded from the Product Support section at www.harmankardon.com.

REMOTE CONTROL FUNCTIONS

The AVR 144 remote is capable of controlling seven devices, including the AVR itself. During the installation process, you may program the codes for each of your source components into the remote. Each time you wish to use the codes for any component, you will need to first press the Selector Button for that component. This changes the button functions to the appropriate codes for that product.

Each Input Selector has been preprogrammed to control certain types of components, with only the codes specific to each brand and model changing, depending on which product code is programmed. The device types programmed into each selector may not be changed.

DVD: Controls DVD players and recorders.

CD: Controls CD players and recorders.

Tape: Controls cassette decks.

Video 1: Controls VCRs, TiVo® and DVRs.

Video 2: Controls cable and satellite television set-top boxes.

Video 3: Controls televisions and other video displays.

For example, if you have inserted a disc in your CD player and you would like to skip ahead three tracks, but you then find that the volume is too loud, you would follow this procedure:

1. Press the CD Input Selector to switch to the codes that control your CD player.

2. Press the Play Button (in the Transport Controls section) if the disc is not already playing.

3. Press the Skip Up Button three times to advance three tracks.

4. Press the AVR Button so that you can access the Volume Controls.

5. Press the Volume Down Button until the volume level is satisfactory.

Any given button may have different functions, depending on which component is being controlled. Some buttons are labeled with these functions. For example, the Sleep and DSP Surround Buttons are labeled for use as Channel Up/Down Buttons when controlling a television or cable box. See Table A8 in the appendix for listings of the different functions for each type of component.

IR Transmitter Lens: As buttons are pressed on the remote, infrared codes are emitted through this lens. Make sure it is pointing toward the component being operated.

Power On Button: Press this button to turn on the AVR or another device. The Master Power Switch on the AVR 144's front panel must first have been switched on.

Mute Button: Press this button to mute the AVR 144's speaker and headphone outputs temporarily. To end the muting, press this button or adjust the volume. Muting is also canceled when the receiver is turned off.

Program Indicator: This LED lights up or flashes in one of three colors as the remote is programmed with codes.

Power Off Button: Press this button to turn off the AVR 144 or another device.

AVR Selector: Press this button to switch the remote to the codes that operate the receiver.

Input Selectors: Press one of these buttons to select a source device, which is a component where a playback signal originates, e.g., DVD, CD, cable TV, satellite or HDTV tuner. This will also turn on the receiver and switch the remote to the codes that operate the source device.

AM/FM Button: Press this button to select the tuner as the source, or to switch between the AM and FM bands.

6-Channel Input Selector: Press this button to select the 6-Channel Inputs as the audio source. The receiver will use the video input and remote control codes for the last-selected video source.

Dim: Press this button to partially or fully dim the front-panel display.

Test Tone: Press this button to activate the test tone for output-level calibration.

TV/Video: This button has no effect on the receiver, but is used to switch video inputs on some video source components.

Sleep Button: Press this button to activate the sleep timer, which shuts off the receiver after a programmed period of time of up to 90 minutes.

Volume Controls: Press these buttons to raise or lower the volume, which will be shown in decibels (dB) in the Message Display.

DSP Surround: Press this button to select a DSP surround mode (Hall 1, Hall 2, Theater).

On-Screen Display (OSD): Press this button to activate the on-screen menu system.

Channel Level: Press this button to set the output levels for each channel so that all speakers sound equally loud at the listening position. Usually this is done while playing an audio selection, such as a favorite CD, as described in the Initial Setup section.

Speaker Setup: Press this button to configure speaker sizes, that is, the low-frequency capability of each speaker. Usually this is done using the on-screen menu system, as described in the Initial Setup section.

Navigation (▲/▼/◄/►) and Set Buttons: These buttons are used together to make selections within the on-screen menu system, or when accessing the functions of the four buttons surrounding this area of the remote – Channel Level, Speaker Setup, Digital Input or Delay.

Digital Input Select: Press this button to select the specific digital audio input (or analog audio input) you used for the current source.

Delay: Press this button to set delay times that compensate for placing the speakers at different distances from the listening position, or to resolve a "lip sync" issue that may be caused by digital video processing.
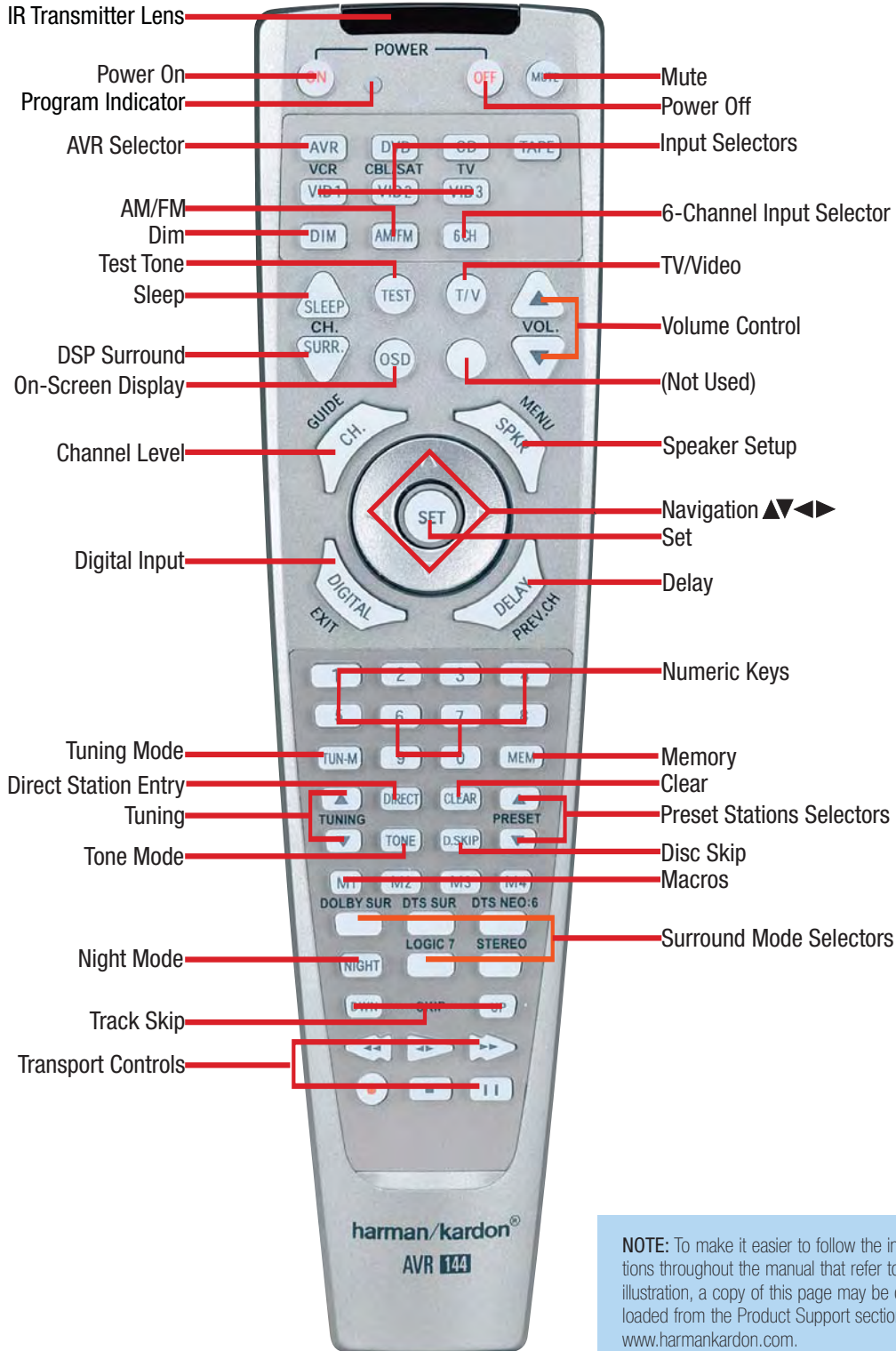
IR Transmitter Lens

POWER

Power On
Program Indicator

Mute
Power Off

AVR Selector

Input Selectors

AM/FM
Dim

6-Channel Input Selector

Test Tone
Sleep

TV/Video

DSP Surround
On-Screen Display

Volume Control

(Not Used)

Channel Level

Speaker Setup

Navigation ▲▼◄►
Set

Digital Input

Delay

Numeric Keys

Tuning Mode
Direct Station Entry
Tuning
Tone Mode

Memory
Clear
Preset Stations Selectors
Disc Skip
Macros

Night Mode

Surround Mode Selectors

Track Skip
Transport Controls

harman/kardon®
AVR 144

NOTE: To make it easier to follow the instructions throughout the manual that refer to this illustration, a copy of this page may be downloaded from the Product Support section at www.harmankardon.com.

REMOTE CONTROL FUNCTIONS

This is done using the on-screen menu system, as described in the Initial Setup section.

Numeric Keys: Use these buttons to enter radio station frequencies when using the tuner (after pressing the Direct Button), or to select station presets.

Tuning Mode: This button toggles between manual (one frequency step at a time) and automatic (seeks frequencies with acceptable signal strength) tuning mode. It also toggles between stereo and mono modes when an FM station is tuned.

Memory: After you have tuned a particular radio station, press this button, then the numeric keys, to save that station as a radio preset.

Tuning: Press these buttons to tune a radio station. Depending on whether the tuning mode has been set to manual or automatic, each press will either change one frequency step at a time, or seek the next frequency with acceptable signal strength.

Direct: Press this button before using the Numeric Keys to directly enter a radio station frequency.

Clear: Press this button to clear a radio station frequency you have started to enter.

Preset Stations Selector: Press these buttons to select a preset radio station.

Tone Mode: Press this button to access the tone controls (bass and treble). Use the Navigation Buttons to make your selections.

Disc Skip: This button has no effect on the receiver, but is used with some optical disc changers to skip to the next disc.

Macros: These buttons may be programmed to execute long command sequences with a single button press. They are useful for programming the command to turn on or off all of your components, or for accessing specialized functions for a different component than you are currently operating.

Surround Mode Selectors: Press any of these buttons to select a type of surround sound (e.g., multichannel) mode. Choose from the Dolby modes, DTS modes, Logic 7 modes or Stereo modes. Each press of a button will cycle to the next available variant of that mode. Not all modes or mode groups are available with all sources.

Night Mode: Press this button to activate Night mode with specially encoded Dolby Digital discs or broadcasts. Night mode compresses the audio so that louder passages are reduced in volume to avoid disturbing others, while dialogue remains intelligible.

Track Skip: These buttons have no effect on the receiver, but are used with many source components to change tracks or chapters.

Transport Controls: These buttons have no effect on the receiver, but are used to control many source components. By default, when the remote is operating the receiver, these buttons will control a DVD player.

CONNECTIONS

There are different types of audio and video connections used to connect the receiver to the speakers and video display, and to connect the source devices to the receiver. To make it easier to keep them all straight, the Consumer Electronics Association (CEA) has established a color-coding standard. Table 1 may be helpful to you as a reference while you set up your system.

Audio Connections		
	Left	Right
Front **(FL/FR)**		
Center **(C)**		
Surround **(SL/SR)**		
Subwoofer **(SUB)**		
Digital Audio Connections		
Coaxial		
Optical	Input	
Video Connections		
Component	Y　　Pb	Pr
Composite		
S-Video		

Table 1– Connection Color Guide

Types of Cables

This section will briefly review different types of cables and connections that you may use to set up your system.

Speaker Connections

Speaker cables carry an amplified signal from the receiver's speaker terminals to each loudspeaker. Speaker cables contain two wire conductors, or leads, inside plastic insulation. The two conductors are usually differentiated in some way, by using different colors, or stripes, or even by adding a ridge to the insulation. Sometimes the actual wires are different, one being copper red and the other silver.

The differentiation is important because each speaker must be connected to the receiver's speaker-output terminals using two wires, one positive (+) and one negative (–). This is called speaker polarity. It's important to maintain the proper polarity for all speakers in the system. If some speakers have their negative terminals connected to the receiver's positive terminals, performance can suffer, especially for the low frequencies.

Always connect the positive terminal on the loudspeaker, which is usually colored red, to the positive terminal on the receiver, which is colored as shown in the Connection Color Guide (Table 1). Similarly, always connect the black negative terminal on the speaker to the black negative terminal on the receiver.
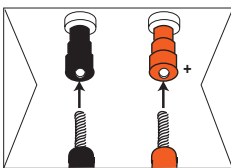
The AVR 144 uses binding-post speaker terminals that can accept banana plugs or bare-wire cables.

Banana plugs are simply plugged into the hole in the middle of the terminal cap. See Figure 1.

Figure 1 – Binding-Post Speaker Terminals With Banana Plugs

Bare wire cables are installed as follows (see Figure 2):

1. Unscrew the terminal cap until the pass-through hole in the collar is revealed.

2. Insert the bare end of the wire into the hole.

3. Screw the cap back into place until the wire is held snugly.
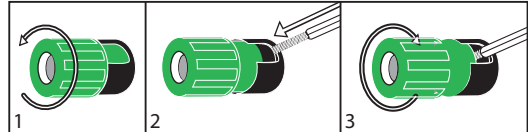
Figure 2 – Binding-Post Speaker Terminals With Bare Wires

Subwoofer

The subwoofer is a specialized type of loudspeaker that is usually connected in a different way. The subwoofer is used to play only the low frequencies (bass), which require much more power than the other speaker channels. In order to obtain the best results, most speaker manufacturers offer powered subwoofers, in which the speaker contains its own amplifier on board. Sometimes the subwoofer is connected to the receiver using the front left and right speaker outputs, and then the front left and right speakers are connected to terminals on the subwoofer. More often, a line-level (nonamplified) connection is made from the receiver's Subwoofer Output to a corresponding jack on the subwoofer, as shown in Figure 3.

Although the subwoofer output looks similar to the analog audio jacks used for the various components, it is filtered and only allows the low frequencies to pass. Don't connect this output to your other devices. Although doing so won't cause any harm, performance will suffer.

Pre-out　Subwoofer

Figure 3 – Subwoofer

Connecting Source Devices to the AVR

The AVR 144 is designed to process audio and video input signals, playing back the audio and displaying the video on a television or monitor connected to the AVR. These signals originate in what are known as "source devices," including your DVD player, CD player, DVR (digital video recorder) or other recorder, tape deck, game console, cable or satellite television box or MP3 player. Although the tuner is built into the AVR, it also counts as a source, even though no external connections are needed, other than the FM and AM antennas.

Separate connections are required for the audio and video portions of the signal. The types of connections used depend upon what's available on the source device, and for video signals, the capabilities of your video display.

CONNECTIONS

Audio Connections

There are two formats for audio connections: digital and analog. Digital audio signals are of higher quality, and are required for listening to sources encoded with digital surround modes, such as Dolby Digital and DTS. There are two types of digital audio connections commonly used: coaxial and optical. Either type of digital audio connection may be used for each source device, but never both simultaneously for the same source. However, it's okay to make both analog and digital audio connections at the same time, to the same source.

Digital Audio

Coaxial digital audio jacks are usually color-coded in orange. Although they look similar to analog jacks, they should not be confused, and you should not connect coaxial digital audio outputs to analog inputs or vice versa. See Figure 4.

Figure 4 – Coaxial Digital Audio

Optical digital audio connectors are normally covered by a shutter to protect them from dust. The shutter opens as the cable is inserted. Input connectors are color-coded using a black shutter. See Figure 5.

Figure 5 – Optical Digital Audio

Due to the nature of digital signals as binary bits, they aren't subject to signal degradation the way analog signals are. Therefore, the quality of coaxial and optical digital audio connections should be the same, although it is important to limit the length of the cable. Whichever type of connection you choose, Harman Kardon recommends that you always select the highest quality cables available within your budget.

Analog Audio

Analog connections require two cables, one for the left channel (white) and one for the right channel (red). These two cables are often attached to each other for most of their length. See Figure 6.

Most sources that have digital audio jacks also have analog audio jacks, although some older types of sources, such as tape decks, have only analog jacks. For sources that are capable of both digital and analog audio, you may wish to make both connections. If you wish to record materials from DVDs or other copy-protected sources, you will only be able to do so using analog connections. Remember to comply with all laws regarding copyright, if you choose to make a copy for your own personal use.
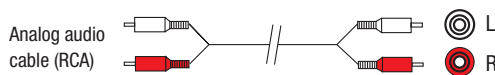
Figure 6 – Analog Audio

Multichannel analog connections are used with advanced sources where the digital content is copy-protected and all surround processing is performed inside the source. These types of connections are usually used with DVD-Audio, SACD, Blu-ray Disc, HD-DVD and other advanced players. See Figure 7.
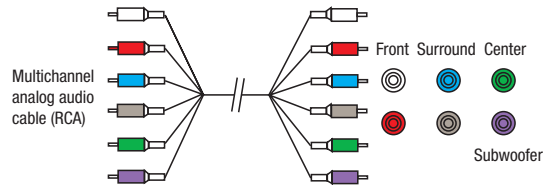
Figure 7 – Multichannel Analog Audio

Video Connections

Although some sources produce an audio signal only (e.g., CD player, tape deck), many sources output both audio and video signals (e.g., DVD player, cable television box, HDTV tuner, satellite box, VCR, DVR). In addition to the audio connection, you will need to connect one type of video connection for each source (never more than one at the same time for any source).

There are three types of analog video connections: composite video, S-video and component video.

Composite video is the basic connection most commonly available. The jack is usually color-coded in yellow, and looks like an analog audio jack, although it is important never to confuse the two. Do not plug a composite video cable into an analog or coaxial digital audio jack, and vice versa. Both the chrominance (color) and luminance (intensity) components of the video signal are transmitted using a single cable. See Figure 8.

Figure 8 – Composite Video

S-video, or "separate" video, transmits the chrominance and luminance components using separate wires contained within a single cable. The plug on an S-video cable contains four metal pins, plus a plastic guide pin. Be careful to line up the plug correctly when you insert it into the jack on the receiver, source or video display. See Figure 9.

Figure 9 – S-Video

Component video separates the video signal into three components – one luminance ("Y") and two subsampled color signals ("Pb" and "Pr") – that are transmitted using three separate cables. The "Y" cable is color-coded green, the "Pb" cable is colored blue and the "Pr" cable is colored red. See Figure 10.

CONNECTIONS
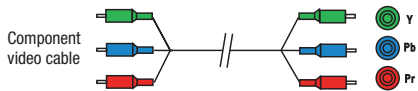
Figure 10 – Component Video

If it's available on your video display, component video is recommended as the best quality connection, followed by S-video and then composite video.

Antennas

The AVR 144 uses separate terminals for the included FM and AM antennas that provide proper reception for the tuner.

The FM antenna uses a 75-ohm F-connector. See Figure 11.

Figure 11 – FM Antenna

The AM loop antenna needs to be assembled. Then connect the two leads to the screw terminals on the receiver. See Figure 12.
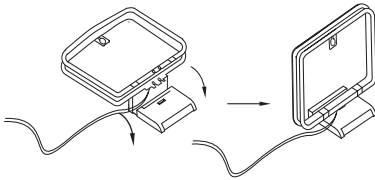
Figure 12 – AM Antenna

INSTALLATION

You are now ready to connect your various components to your receiver. Before beginning, make sure that all components, including the AVR 144, are turned completely off and their power cords are unplugged. **Don't plug any of the power cords back in until you have finished making all of your connections.**

Remember that your receiver generates heat while it is playing. Select a location that leaves several inches of space on all sides of the receiver. It is preferable to avoid completely enclosing the receiver inside a cabinet. It is also preferable to stack components on separate shelves rather than directly on top of the receiver. Some surface finishes are delicate. Try to select a location with a sturdy surface finish.

Step One – Connect the Speakers

If you have not yet done so, place your speakers in the listening room as described in the Speaker Placement section above.

Connect the center, front left, front right, surround left and surround right loudspeakers to the corresponding speaker terminals on the AVR 144. Remember to maintain the proper polarity by always connecting the positive and negative terminals on each speaker to the positive and negative terminals on the receiver. Use the Connection Color Guide on page 16 as a reference. See Figure 14.
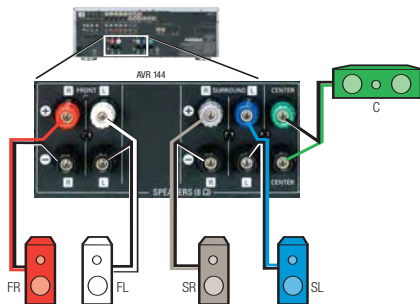
Figure 14 – Speaker Connections

Step Two – Connect the Subwoofer

Connect the Subwoofer Output on the AVR 144 to the line-level input on your subwoofer. See Figure 15. Consult the manufacturer's guide for the subwoofer for additional information.
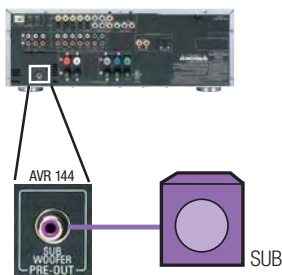
Figure 15 – Subwoofer Connection

Step Three – Connect the Antennas

Connect the FM and AM antennas to their terminals. See Figure 16.
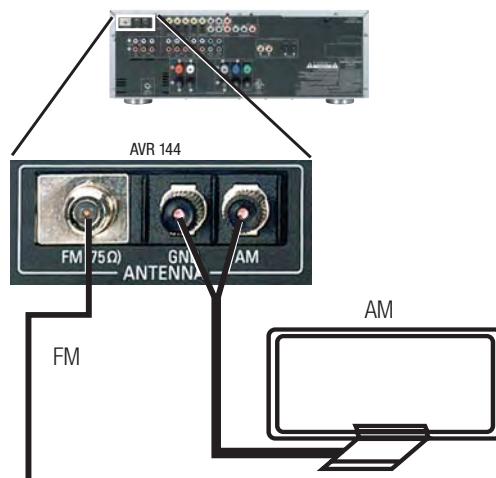
Figure 16 – Antenna Connections

Step Four – Connect the Source Components

Use the worksheets in the Appendix to note which connections you will use for each of your source devices.

For each source, select a source input (Video 1, Video 2, Video 3, etc.). In Table 2 we recommend connecting certain types of sources to certain source inputs to make it easier to program and use the remote control.

Decide which audio connections you will use. If your source device has them, use *either* the coaxial digital or the optical digital audio connection. Referring to Table 2, we recommend you connect the DVD source to the Coaxial 1 input jack, and the source designated Video 2 to the Optical 1 input jack. However, you may make whatever connections are best for your system.

In addition to the digital audio connections, we recommend that you connect the analog audio connections for each source, as a backup to the digital connections. For sources that don't have digital audio outputs, you must use the analog audio connections.

For each video source, select one type of video connection. Component video is preferred, but both your source device and your video display must have this type of video capability. If either device does not, then use S-video. Again, if either your source device or your video display doesn't have S-video connections, then use composite video.

Referring to Table 2, we recommend that you connect the DVD source to the Component Video 1 inputs, and any one source designated as Video 1, Video 2 or Video 3 to the Component Video 2 inputs. However, you may make whatever video connections are best for your system.

INSTALLATION

NOTE: It's possible for a source to use none of the connections named for that source. For example, you might connect your DVD player to the Component Video 1 inputs and the Coax 1 digital audio input. However, we will refer to this source as "DVD", and in Step Five of the Initial Setup section you will program the receiver so that these connections are assigned to the DVD source. When you select "DVD" as your source using the front panel or the remote, the correct connections for your DVD player will be used.

We recommend connecting your various sources using the connections shown in Table 2 below in order to simplify programming your receiver and remote control. However, you may connect any device to any source input.

Device Type	AVR 144 Source Input	Audio Connections	Video Connections
VCR, DVR, PVR, TiVo or other audio/video recorder	Video 1	• Video 1 Analog (inputs and outputs) **and** • Any one available coaxial or optical digital audio input	• *One* of component Video 2, Video 1 S-video or Video 1 composite video • For recording, use Video 1 S-video or composite video output, and do not use component video connections at all
Cable TV, satellite, HDTV or other device that delivers television programs	Video 2	• Video 2 Analog **and** • Optical 1	• *One* of component Video 2, Video 2 S-video, Video 2 composite video
TV, game console, camera or other audio/video device	Video 3 (front-panel jacks)	• Video 3 Analog **and** • *Either* Coax 3 or Optical 3	• *One* of component Video 2, Video 3 S-video *or* Video 3 composite video
DVD Audio/Video, SACD, HD-DVD, Blu-ray Disc	DVD	• DVD Analog • 6-Channel inputs (optional) **and** • Coax 1	• Component Video 1
CD player	CD	• CD Analog **and** • Any one available coaxial or optical digital audio input	• Not required
CDR, MiniDisc, cassette	Tape	• Tape Analog (inputs and outputs) **and** • Any one available coaxial or optical digital audio input	• Not required

Table 2 – Recommended Source Component Connections

Video 1 Source

Since this source includes audio and video recording output jacks, it is best suited to a video recorder, such as your VCR or DVR.

Referring to Table 2, connect your recorder to the Video 1 Analog Audio inputs and outputs **and** to any available Coax or Optical digital audio input. See Figure 17. Use either the Video 1 S-video or composite video input and output if you wish to make recordings. If you don't plan on recording, you may use the Component Video 2 inputs.

Figure 17 – Video 1 A/V Inputs and Outputs, and Digital Audio Inputs

Remember to connect the audio and video *output* jacks on your recorder to the Video 1 or digital audio *input* jacks on the AVR, and the audio and video *input* jacks on your recorder to the Video 1 *output* jacks on the AVR.

INSTALLATION

Video 2 Source

The Video 2 source is used only for playback, never recording. The AVR 144 remote control is programmed to operate many brands and models of cable and satellite television devices, and we recommend connecting your cable or satellite set-top box to this source.

Referring to Table 2, connect your set-top box to the Video 2 Analog Audio inputs **and** to the Optical 1 Digital Audio input. If possible, use the Component Video 2 inputs. Otherwise, connect the set-top box's S-video or composite video output to the matching Video 2 video input. See Figure 18.

Figure 18 – Video 2 A/V, Digital Audio and Component Video Inputs

NOTE: If you receive your television programming using your TV with an antenna or direct cable connection, then you will need to connect the analog audio (if available on your TV) outputs to the Video 2 Analog Audio inputs. Do not connect any video output on the television set to any video input on the receiver. See Step Five for information on connecting the receiver's video monitor outputs to the television.

Video 3 Source

The Video 3 source is used only for playback, never recording. It is also generally reserved for components that are only temporarily connected to the receiver, such as cameras and game consoles. When not in use, you may place the supplied covers over the front-panel Video 3 jacks for a cleaner appearance. Simply snap the covers in place. When you wish to use the jacks, gently press on the left side of each cover to pivot it out for removal.

Referring to Table 2, connect your camera or game console to the Video 3 Analog Audio inputs **and** to either the Coaxial 3 or Optical 3 digital audio input. If possible, use the Component Video 2 inputs. Otherwise, connect the component's S-video or composite video output to the matching Video 3 video input. See Figure 19.

Figure 19 – Video 3 A/V and Digital Audio Inputs

DVD

The DVD source is used for a DVD player. If you have a more advanced multichannel device, such as a Blu-ray Disc or HD-DVD player, connect it to the DVD source.

Referring to Table 2, connect your DVD player to the DVD Analog Audio inputs **and** to the Coaxial 1 Digital Audio input. If possible, use the Component Video 1 inputs. Otherwise, connect the DVD player's S-video or composite video output to the matching DVD video input. See Figure 20.

Figure 20 – DVD A/V, Digital Audio and Component Video Inputs

If your DVD player plays multichannel lossless discs, such as SACD or DVD-Audio, you will also need to connect the 6-channel analog audio outputs on the DVD player to the 6-channel analog audio inputs on the receiver in order to enjoy these discs to their fullest. See Figure 21.

Figure 21 – 6-Channel Analog Audio Inputs

CD

The CD source is used for a strictly audio device, such as a CD player.

Referring to Table 2, connect your CD player to the CD Analog Audio inputs **and** to the Coaxial 2 or Optical 2 Digital Audio input. See Figure 22.

Figure 22 – CD Audio Inputs and Digital Audio Inputs

No video connections are made, although if your system has unusual requirements, you may connect a video device using component video outputs to the Component Video 2 inputs on the receiver, if those jacks are not in use by another device.

INSTALLATION

Tape

The Tape source is used for audio-only recorders, such as a CDR, MiniDisc or cassette deck.

Referring to Table 2, connect your recorder to the Tape Analog Audio inputs and outputs, and to any available digital audio input. See Figure 23.

Figure 23 – Tape Audio Inputs and Outputs, and Digital Audio Inputs

> **NOTE:** You will not be able to make digital audio recordings using the AVR 144. Make sure your source is connected to any of the AVR 144's analog audio inputs, and connect your recorder to either the Video 1 or Tape Analog Audio Outputs. The AVR 144 will not convert a digital audio input signal to analog.

Remember to connect the *output* jacks on your recorder to the Tape or digital audio *input* jacks on the AVR, and the *input* jacks on your recorder to the Tape *output* jacks on the AVR.

No video connections are made.

Step Five – Connect Video Display

Only video connections should be made between the receiver and your video display (TV), unless your TV is the source for your television programming (see note above).

You will need to make a video connection for each type of video used for your sources. In addition, even if you didn't use S-video or composite video for any of your sources, you will still need to use one of these two video monitor connections in order to view the AVR 144's on-screen menus and displays.

First, determine what types of video your display is capable of handling. Remember that component video is preferred, followed by S-video and then composite video. Ideally, this guided you in selecting the video connections for your sources.

Next, note which types of video connections you used for your source devices. Make sure you didn't use a better type of video connection for a source than your video display can handle. If so, you will need to disconnect the source and use a video connection that's compatible with your display.

If you used component video for any sources, connect the Component Video Monitor outputs on the receiver to one set of component video inputs on your display. Make a note of how these inputs are labeled on the display. See Figure 24.

Figure 24 – Component Video Monitor Outputs

If you used S-video for any sources, or if all of your sources used component video, connect the S-video Monitor output on the receiver to an S-video input on your display. Make a note of how the input is labeled. See Figure 25.

If you used composite video for any sources, connect the composite video Monitor output on the receiver to a composite video input on the display. Again, make a note of how this input is labeled on the display. See Figure 25.

Figure 25 – S-Video and Composite Video Monitor Outputs

Consult the manual for your TV to make sure you understand how to select each video input. As you play different source devices that use different types of video connections, you will need to remember to select the correct video input on your video display.

Step Six – Plug in AC Power

Having made all of your wiring connections, it is now time to plug each component's AC power cord into a working outlet.

Before plugging the AVR 144's AC Power Cord into an electrical outlet, make sure that the Master Power Switch on the front panel is popped out so that the word OFF appears on its top. Gently press the button to turn the switch off. This will prevent the possibility of damaging the AVR in case of a transient power surge.

Step Seven – Insert Batteries in Remote

The AVR 144 remote control uses three AAA batteries, which are included.

To remove the battery cover located on the back of the remote, firmly press the ridged depression and slide the cover towards the top of the remote.

Insert the batteries as shown in the diagram, making sure to observe the correct polarity. See Figure 26.
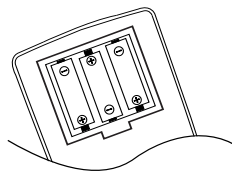
Figure 26 – Remote Battery Compartment

When using the remote, remember to point the lens toward the front panel of the AVR 144. Make sure no objects, such as furniture, are blocking the remote's path to the receiver. Bright lights, fluorescent lights and plasma video displays may interfere with the remote's functioning. The remote has a range of about 20 feet, depending on the lighting conditions. It may be used at an angle of up to 30 degrees to either side of the AVR.

INSTALLATION

If the remote seems to operate intermittently, or if pressing a button on the remote does not cause the AVR Selector or one of the Input Selectors to light up, then make sure the batteries have been inserted correctly, or replace all three batteries with fresh ones.

Step Eight – Program Sources Into the Remote

The AVR 144 remote is capable of controlling not only the receiver, but it may also be programmed to control many brands and models of VCRs, DVD players, CD players, cable boxes, satellite receivers, cassette decks and TVs.

It may help to think of the remote as a book with pages. Each page represents the button functions for a different device. In order to access the functions for a particular device, you first need to turn to that page. This is done by pressing the AVR Button to access the codes that control the receiver, or the Input Selector buttons to access the codes for the devices programmed into the remote.

At the factory, the AVR 144's codes and the codes to control many Harman Kardon DVD and CD players are preprogrammed. If you have other source devices in your system, follow these steps to program the correct codes into the remote.

1. Using the codes in Tables A9–A15 of the Appendix, look up the product type (e.g., DVD, cable TV box) and the brand name of your source. The number(s) listed are potential candidates for the correct code set for your particular device.

2. Turn on your source device.

3. Put the remote into Program mode by pressing and holding the Input Selector and the Mute button simultaneously until the LED on the remote starts to flash, and then releasing the buttons. See Figure 27.

Figure 27 – Input Selectors

4. Enter a code from Step 1 above.

   a) If the device turns off, then press the Input Selector again to accept the code, which will flash. The remote will exit the Program mode.

   b) If the device does not turn off, try entering another code. If you run out of codes, you may search through all of the codes in the remote's library for that product type by pressing the ▲ or ▼ button repeatedly until the device turns off. When the device turns off, enter the code by pressing the Input Selector, which will flash. The remote then exits Program mode.

5. Once you have accepted a code, it's a good idea to try using some other functions to control the device. Sometimes manufacturers

use the same Power code for several different models, while other codes will vary. You may wish to repeat this process until you've programmed a satisfactory code set that operates most of the functions you frequently use.

6. You may find out which code number you have programmed by pressing and holding the Input Selector and Mute Button simultaneously to enter the Program mode. Then press the Set Button, and the LED will blink in the code sequence. One blink represents "1", two blinks for "2", and so forth. A series of many fast blinks represents "0". Record the codes programmed for each device here.

Source Input	Product Type (circle one)	Remote Control Code
Video 1	VCR, PVR	
Video 2	Cable, Satellite	
Video 3	TV	
DVD	DVD	
CD	CD, CDR	
Tape	Cassette	

Table 3 – Remote Control Codes

If you are unable to locate a code set that correctly operates your source device, it will not be possible to use the AVR remote to control that device. However, you may still connect the source to the AVR 144 and operate it using the device's original remote control. Alternatively, you may wish to consider purchasing Harman Kardon's optional TC 30 activity-based remote, which is programmed by accessing a large database of product codes on the Internet. The TC 30 is also capable of "learning" codes from your device's original remote.

Most of the button labels on the remote describe the button's function when used to control the AVR 144. However, the button may perform a very different function when used to control another device. Refer to the Remote Control Function List, Table A8 in the Appendix, for a list of each button's functions with the various product types.

If you wish, you may program Macros, which are preprogrammed code sequences that execute many code commands with a single button press. You may also program "punch-through" codes, which allow the remote to operate the volume, channel or transport controls of another device without having to switch the remote to the mode for that device. See pages 42 – 43 for instructions on these advanced programming functions.

NOTE: The AVR 144 remote is preprogrammed to operate the transport controls of Harman Kardon DVD players when the AVR or the Video 2 (cable/satellite) or Video 3 (TV) source is selected. The volume and mute controls operate the AVR when any device except Tape has been selected. You may change this punch-through programming at any time.

INSTALLATION

Step Nine – Turn On the AVR 144

Two steps are required the first time you turn on the AVR 144.

1. Gently press the Master Power Switch until the word OFF is no longer visible. The Power Indicator above the two power switches should light up in amber, indicating that the AVR is in Standby mode and is ready to be turned on. See Figure 28. Normally, you may leave the Master Power Switch in the ON position, even when the receiver is not being used.

Figure 28 – Power Switches

2. There are several ways in which the AVR 144 may be turned on from Standby mode.

a) Press the Standby/On Switch on the front panel. See Figure 28.

b) Press the Source Select Button on the front panel. See Figure 29.

Figure 29 – Source Select Button

c) Using the remote, press any one of these buttons: AVR, DVD, CD, TAPE, VID1, VID2, VID3, AM/FM or 6CH. See Figure 30.

Figure 30 – AVR and Input Selectors

> **NOTE:** Any time you press one of the Input Selectors on the remote (i.e., DVD, CD, TAPE, VID1, VID2 or VID3), the remote will switch modes so that it will only transmit the codes programmed to operate that device. In order to control the receiver, you will need to press the AVR Button to return the remote to AVR mode.

You are now ready for Initial Setup, in which you will make a few adjustments to ensure that your new AVR 144 receiver performs at its best.

OPERATION

Now that you have installed your system components and completed at least a basic configuration of your receiver, you are ready to begin enjoying your home theater system.

Turning On the AVR 144

Gently press the Master Power Switch until the word OFF is no longer visible. The Power Indicator above the two power switches should light up in amber. This indicates that the AVR is in Standby mode and is ready to be turned on. Normally, you may leave the Master Power Switch in the ON position, even when the receiver is not being used. See Figure 41.

Figure 41 – Power Switches

There are several ways in which the AVR 144 may be turned on:

a) Press the Standby/On Switch on the front panel. See Figure 41.

b) Press the Source Select Button on the front panel. See Figure 42.

Figure 42 – Source Select Button

c) Using the remote, press any one of these buttons: AVR, DVD, CD, TAPE, VID1, VID2, VID3, AM/FM or 6CH. See Figure 43.

Figure 43 – AVR and Input Selectors

NOTE: Any time you press one of the remote's Input Selectors (i.e., DVD, CD, TAPE, VID1, VID2 or VID3), the remote will switch modes so that it will only transmit the codes programmed to operate that device. In order to control the receiver, you will need to press the AVR Button to return the remote to AVR mode.

To turn the receiver off, press either the Standby/On Switch on the front panel, or press the AVR Button and the OFF Button on the remote. Unless the receiver will not be used for an extended period of time (for example, if you will be on vacation), it is not necessary to turn off the Master Power Switch. When the Master Power Switch is turned off, any settings you have programmed, including system configuration and preset radio stations, will be preserved for up to four weeks.

Sleep Timer

You may program the AVR to play for up to 90 minutes and then turn off automatically using the sleep timer.

Press the Sleep Button on the remote, and the time until turn-off will be displayed. Each additional press of the Sleep Button will reduce the time until turn-off by 10 minutes, until the OFF setting is reached, which disables the sleep timer. See Figure 44.

Figure 44 – Sleep Button

When the sleep timer has been set, the front-panel display will automatically dim to half-brightness. If you press any button on the remote or front panel, the display will return to full-brightness. The display will dim again several seconds after your last command.

If you press the Sleep Button after the timer has been set, the remaining time until turn-off will be displayed. You may press the Sleep Button to change the time until turn-off. Pressing and holding the Sleep Button will disable the sleep timer, and the SLEEP OFF message will appear.

Volume Control

The volume may be adjusted either by turning the knob on the front panel (clockwise to increase volume or counterclockwise to decrease volume), or by pressing the Volume Control Buttons on the remote. See Figure 45. The volume is displayed as a negative number of decibels (dB) below the 0dB reference point, and may be changed in 0.5dB increments. Unlike some volume controls on other products, 0dB is the maximum volume for the AVR 144. Although it's physically possible to turn the volume to a higher level, doing so may damage your hearing and your speakers. For certain more dynamic audio materials, even 0dB may be too high, allowing for damage to equipment.

Figure 45 – Volume Controls

OPERATION

Remember that the AVR 144 is designed to reproduce audio with a minimum amount of distortion. This clarity may lead you to believe that your hearing and the equipment can handle higher volumes. We urge caution with regard to volume levels.

Mute Function

To temporarily mute all speakers and the headphones, press the Mute Button on the remote. See Figure 46. Any recording in progress will not be affected. The MUTE message will flash in the display as a reminder. To restore normal audio, either press the Mute Button again, or adjust the volume. Turning off the AVR will also end muting.

Figure 46 – Mute Button

Tone Controls

You may boost or cut either the treble or the bass frequencies by up to 10dB in 2dB increments.

Using the remote, press the Tone Mode Button once. See Figure 47. This will indicate whether the tone controls are in or out of the circuitry. If you wish to return the tone controls to 0, or "flat" response, press the ▲/▼ Buttons until the TONE OUT message appears, which preserves any changes you have made to the bass or treble settings for later use. To reactivate your changes, the tone control must again be set to TONE IN.

With the TONE IN message displayed, press the Tone Mode Button repeatedly to access TREBLE MODE and BASS MODE. Use the ▲/▼ Buttons to change the treble or bass settings, as desired. The display will return to normal a few seconds after your last command.

Figure 47 – Tone Button

You may alternatively adjust the tone controls using the full-OSD menu system. Press the OSD Button on the remote to view the Master Menu. The cursor will be pointing to the INPUT SETUP line; press the Set Button to display that menu. You will be able to view the tone settings. If you wish to make any changes to the TONE, BASS or TREBLE settings, use the arrow keys on the remote to move the cursor to the line you wish to change. Once you have changed the setting using the ◀/▶ Buttons, simply move the cursor up or down to a different line; it isn't necessary to press the Set Button to enter the new setting. When you have finished, either wait until the display times out and disappears,

press the OSD Button to clear the display, or move the cursor to the BACK TO MASTER MENU line if you wish to make other changes using the menu system.

> **NOTE:** The AVR 144 does not have any conventional balance control. The output level calibration process compensates for any characteristics of your room or speakers, and we recommend that you leave the settings as they are after the speakers have been calibrated. However, you may manually adjust the levels of the left and right channels – decreasing one and increasing the other by the same amount – using the Channel Adjust submenu. This achieves the same effect as a balance control.

Headphones

Plug the 1/4" plug on a pair of headphones into the headphone jack on the front of the receiver for private listening. See Figure 48. The first time you use the headphones, the DOLBY H:BP message will be displayed, indicating that Dolby Headphone surround processing is in the bypass mode, which delivers a conventional 2-channel signal to the headphones.

Figure 48 – Headphone Jack

Press the Surround Select Button on the front panel, or the Dolby Button on the remote, to switch to Dolby Headphone virtual surround processing, indicated by the DOLBY H:DH message. Dolby Headphone delivers an enhanced sound field that emulates a 5.1-channel speaker system. No other surround modes are available for the headphones.

Source Selection

Press the front-panel Source Select Button to scroll through the sources. The left side of the button scrolls down the list that appears in the display; the right side scrolls upward. For direct access to the tuner, press the Tuner Band Button, which switches to the last-used band and frequency. See Figure 49. For direct access to any source, press its Input Selector on the remote (see Figure 43).
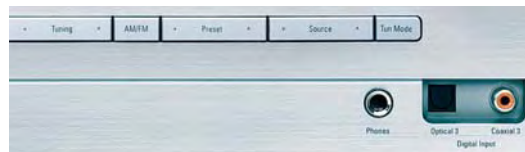
Figure 49 – Source Select and Tuner Band Buttons

The AVR 144 will switch to the audio and video inputs assigned to that source. If you set the BASS MGR setting in the Speaker X-Over menu to INDEPENDENT, the AVR 144 will change the speaker size configuration to the one you programmed for the source. If you selected a surround mode for the source, the AVR 144 will switch to that mode.

OPERATION

The source name will appear in the upper line of the front-panel display. If you retitled the source, only the new title will appear. Otherwise, the audio input assigned to the source (analog or one of the digital audio inputs) will also appear. The surround mode will be displayed on the lower line. The same information will also appear on screen in the semi-OSD, unless you have set the semi-OSD to OFF in the System Setup menu (see Advanced Functions section).

Audio Input Selection

The AVR 144 is programmed at the factory to use the analog audio inputs for each source (except for the DVD and Video 2 sources, which default to Coax 1 and Optical 1). To assign a digital audio input to a source (if you have not done so using the Input Setup menu during Initial Setup), press the Digital Button on the remote. The current audio input selection will flash in the display, and you may press the ▲/▼ Buttons to scroll through the audio inputs. When the desired input appears, press the Set Button to select it. See Figure 50.

Figure 50 – Digital Input Selection

If the Auto Poll feature has been left ON in the Input Setup menu, and if a digital audio input has been assigned to the source, the AVR 144 will first check the digital audio input for a signal. If a signal is present, the AVR 144 will select the digital audio input. If no signal is present, the AVR 144 will switch to the analog audio inputs for the source.

Video Input Selection

When a source is selected, the AVR 144 switches to a video input as follows:

The COMPONENT IN line of the Input Setup menu indicates which of the two component video inputs on the AVR 144 is assigned to each source. All of the sources listed in the left column of the Source Indicators display on the front panel are assigned to the Component Video 2 inputs by default, and the sources listed in the right column default to the Component Video 1 sources. This list appears in Figure 51.
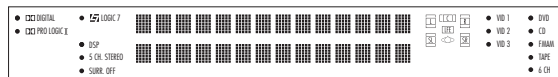
Figure 51 – Front-Panel Input Indicators

You may reassign either component video input to another source, but there is no option to disable the component video inputs for any source. If a signal is present at the component video input assigned to that source, it will be selected. If your device is not using component video, make sure that other devices connected to the component video inputs are turned off.

If no signal is present at the component video input, then the S-video or composite video input for the source will be selected. It is not possible to reassign the S-video or composite video inputs to other sources.

For audio-only sources, such as the tuner or CD inputs, when no component video signal is present, the last-used video source will be selected.

6-Channel Direct Inputs

If you wish to hear audio through the 6-Channel Direct Inputs together with video, then connect your multichannel player to the Component Video 1 Inputs, and connect the player's 6-channel analog audio outputs to the 6-Channel Inputs on the AVR. Assign the Component Video 1 input to the 6-Channel Input source. The AVR will automatically select the correct component video and audio inputs when you select this source.

If you need to use composite or S-video for your multichannel player, e.g., if your video display does not have component video inputs, then you will need to use the video inputs for another source. Since the AVR automatically selects the last-used video inputs for audio sources, first select the source you connected the video cables to, and then the 6-Channel Inputs for the audio.

Example: You would like to connect a DVD-Audio player to the AVR 144. You plan on playing a variety of discs using this player, including conventional DVDs and even CDs as well as multichannel discs. When playing DVDs and CDs, it is preferable to use a digital audio connection to obtain the best sound quality and the benefit of any digital surround formats contained on the DVD. However, when playing DVD-Audio discs, you will need to use the 6-channel analog audio connections. In addition, some of these discs contain video materials.

We recommend you connect this player as follows:

a) Connect the player's coaxial digital audio output to the Coaxial 1 input on the AVR. This input is assigned by default to the DVD source.

b) Connect the player's component video outputs to the Component Video 1 inputs on the AVR, which are assigned by default to the DVD and 6-Channel Input sources. If your video display doesn't have component video inputs, then connect the player's composite or S-video output to the DVD's corresponding video input.

c) Connect the player's 6-channel analog audio outputs to the AVR's 6-Channel Inputs.

d) Program the player's remote control codes into the DVD Input Selector. Note that not all commands will necessarily be available.

When you wish to view a DVD, simply select the DVD source.

When you wish to listen to a DVD-Audio disc and view the menus and other still images on the disc, first select DVD, and then select the 6-/8-Channel Inputs as the source. See Figure 52.

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Figure 52 – 6-Channel Input Selector

> **NOTE:** The 6-Channel Inputs pass the incoming signals directly to the volume control, without digitizing or processing them. Therefore, you will need to configure bass management settings (i.e., speaker size, delay and output level) on your source device so that they match the settings you programmed using the Manual Setup menu. Consult the owner's guide for your multi-channel player for more information.

Using the Tuner

The AVR 144's built-in tuner may be selected in one of three ways (see Figure 53):

1. Press the Source Selector Button on the front panel repeatedly until the tuner is selected. The last-used band (AM or FM) will be active.

2. Press the Tuner Band Button (marked AM/FM). Press this button again to switch bands.

3. Press the Tuner Input Selector (marked AM/FM) on the remote. Press this button again to switch bands.

Figure 53 – Tuner Input Selection

Radio stations may be selected in one of four ways (see Figure 54):

1. If you know the frequency number, enter it directly by first pressing the Direct Button on the remote, and then using the Numeric Keys.

2. After you have programmed Preset stations (see below), either enter the Preset number (1 through 30) using the remote or use the front-panel Preset Stations Button to scroll through the list of presets.

3. In Auto tuning mode, with each press of the Tuning Buttons (front-panel or remote) the AVR 144 will scan in the chosen direction until a station with acceptable signal strength is detected. Press the Tuning Button again to stop scanning.

4. In Manual tuning mode, with each press of the Tuning Buttons the AVR 144 will tune the next frequency increment (0.1MHz for FM, or 10kHz for AM) in the selected direction. Press and hold the Tuning Button for faster scanning.

Figure 54 – Tuning a Station

Press the Tuning Mode Button (TUN-M on the remote) to switch between Auto and Manual tuning modes. When an FM station has been tuned, pressing the Tuning Mode Button will switch between stereo and mono tuning, which may improve reception of weaker stations. See Figure 55.

Figure 55 – Tuning Mode

To store a station in one of the 30 presets (see Figure 56):

1. Tune the desired station.

2. Press the Memory Button on the remote.

3. Use the Numeric Keys to enter the desired preset number.

Figure 56 – Storing a Preset Station

Recording

Two-channel analog audio signals, as well as composite and S-video signals, are normally available at the appropriate recording outputs. Thus, to make a recording, you need only make sure to connect your audio or video recorder to the appropriate output jacks, as described in the Installation section, insert blank media and make sure the recorder is turned on and recording while the source is playing.

> **NOTES:**
> 1. Analog audio signals are not converted to digital form, and digital audio signals are not converted to analog audio form.
>
> 2. The AVR 144 is not designed to make digital audio recordings. Make sure your source device is connected to one of the AVR 144's analog audio inputs, and connect your recorder to either the Video 1 or Tape analog audio outputs.
>
> 3. Component video sources are not available for recording.
>
> 4. Please make certain that you are aware of any copyright restrictions on any material you record. Unauthorized duplication of copyrighted materials is prohibited by federal law.

OPERATION

Selecting a Surround Mode

Surround mode selection can be as simple or sophisticated as your individual system and tastes. Feel free to experiment with the many available surround modes on the AVR 144, and you may find a few that become your favorites for certain sources or program types. Although more detailed information on surround modes may be found in the Advanced Functions section, it is easy to select any of the modes available at a given time:

To select a surround mode using the front-panel controls, press the Surround Mode Button repeatedly until the desired group of modes is selected: Logic 7, Dolby, DTS, DSP or Stereo. Then press the Surround Select Button repeatedly to select the desired mode within the group. See Figure 57.

Figure 57 – Select a Surround Mode (Front Panel)

To select a surround mode using the remote control, locate the button dedicated to the desired group of modes: Logic 7, Dolby Sur, DTS Sur, DTS Neo:6, Surr (DSP) or Stereo. Press that button repeatedly to select the desired mode. See Figure 58.

Figure 58 – Select a Surround Mode (Remote)

To select a surround mode using the full-OSD menu system, press the OSD Button to display the Master Menu. Navigate to the SURROUND SELECT line and press the Set Button to view the Surround Select menu. Each of the major surround mode groups is listed here. Select that group to access the MODE setting for selection of an individual mode. As explained in the Advanced Functions section, there are also some additional settings that may be made.

You are now ready to enjoy the best in home theater entertainment, using your AVR 144. As you become more familiar with the receiver, you may wish to explore some of its advanced functions, which are described in the following section.

TROUBLESHOOTING GUIDE

SYMPTOM	CAUSE	SOLUTION
Unit does not function when Main Power Switch is pushed	• No AC Power	• Make certain AC power cord is plugged into a live outlet • Check to see whether outlet is switch-controlled
Display lights, but no sound or picture	• Intermittent input connections • **Mute** is on • Volume control is down	• Make certain that all input and speaker connections are secure • Press **Mute Button** • Turn up volume control
No sound from any speaker; light around power switch is red	• Amplifier is in protection mode due to possible short • Amplifier is in protection mode due to internal problems	• Check speaker wire connections for shorts at receiver and speaker ends • Contact your local Harman Kardon service center
No sound from surround or center speakers	• Incorrect surround mode • Input is monaural • Incorrect configuration • Stereo or Mono program material	• Select a mode other than Stereo • There is no surround information from mono sources • Check speaker mode configuration • The surround decoder may not create center- or rear-channel information from nonencoded programs
Unit does not respond to remote commands	• Weak batteries in remote • Wrong device selected • Remote sensor is obscured	• Change remote batteries • Press the AVR selector • Make certain front panel sensor is visible to remote or connect an optional remote sensor
Intermittent buzzing in tuner	• Local interference	• Move unit or antenna away from computers, fluorescent lights, motors or other electrical appliances
Letters flash in the channel indicator display and digital audio stops	• Digital audio feed paused	• Resume play for DVD • Check that Digital Input is selected

In addition to the items shown above, additional information on troubleshooting possible problems with your AVR 145, or installation-related issues, may be found in the list of "Frequently Asked Questions" which is located in the Product Support section of our Web site at www.harmankardon.com.

Erasing Macros

It isn't possible to "edit" a command within a macro. However, you may erase the macro as follows:
1. Simultaneously press and hold the Mute Button and the Macro Button containing the macro until the LED flashes.
2. Press the Surround Button to erase the macro.

Resetting the Remote

To reset the remote to its factory defaults, enter Program mode by simultaneously pressing and holding any Input Selector and the Mute Button. When the LED flashes, enter the code "333". When the LED goes out, the remote will have been fully reset.

Processor Reset

There may be instances where you wish to fully reset the AVR 145 to its factory defaults, or the unit may behave erratically after a power surge.
For erratic behavior, we recommend you try turning the Master Power Switch off and unplugging the AC Power Cord for at least three minutes. Try plugging the cord back in and turning the receiver back on. If this
doesn't work, you may want to try a system reset. NOTE: A system reset erases all user configurations, including speaker and level settings and tuner presets. After a reset, you will need to re-enter all of these settings.
To reset the AVR 145, place the receiver in Standby mode (press the front-panel Standby/On Switch so that the Power Indicator turns amber). Then press and hold the front-panel Tone Mode Button for at least five
seconds until the RESET message appears in the display. If the receiver still does not function correctly after a processor reset, contact an authorized Harman Kardon service center for assistance.
Service centers may be located by visiting our Web site at www.harmankardon.com.

Memory

If the AVR 145 is unplugged or experiences a power outage, it will retain user settings for up to four weeks.

1. Removing the Top Cabinet
Remove the Screws ① ~ ⑬
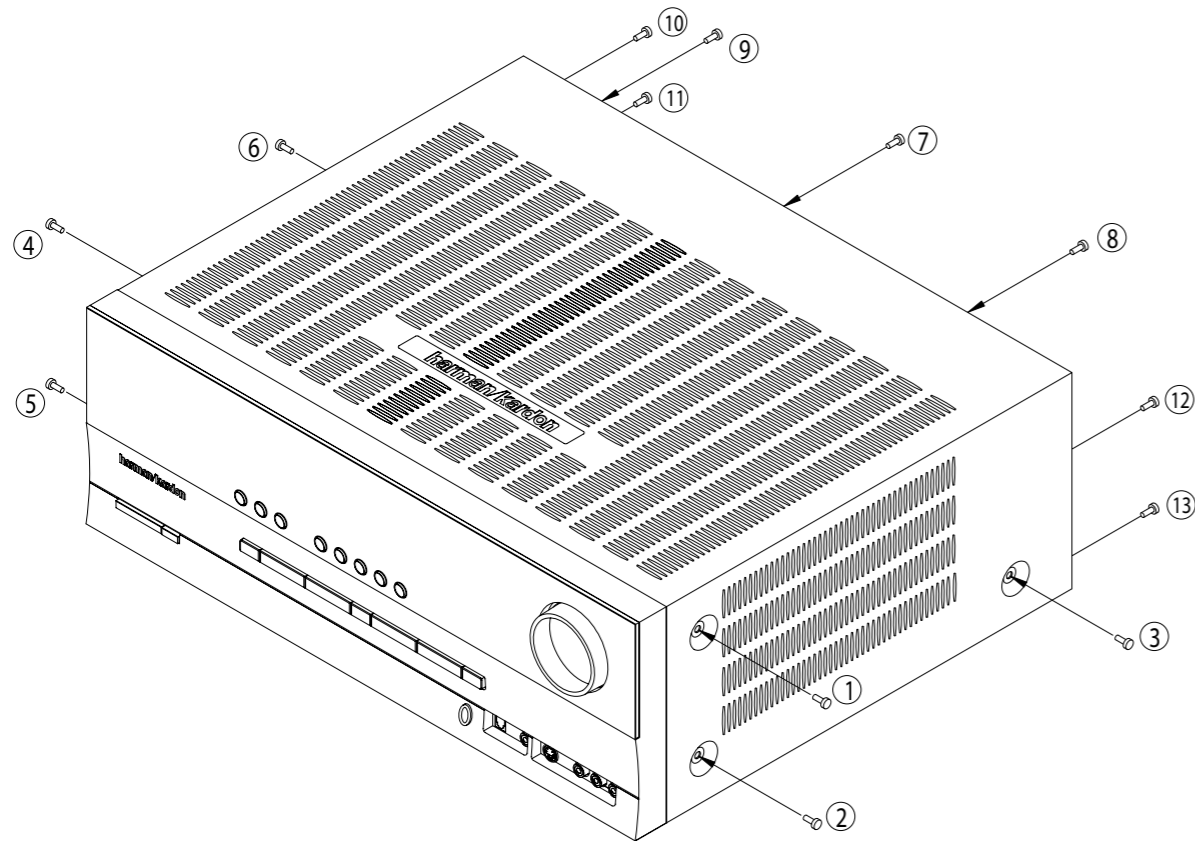
2. Removing the Front Panel
Remove the Screws ① ~ ⑨
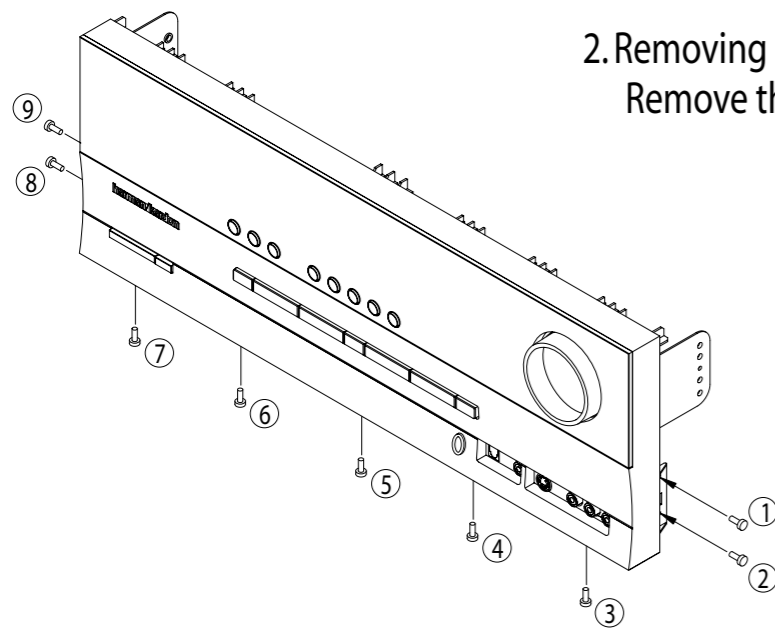
3. Removing the Rear Panel
Remove the Screws ① ~ ⑱
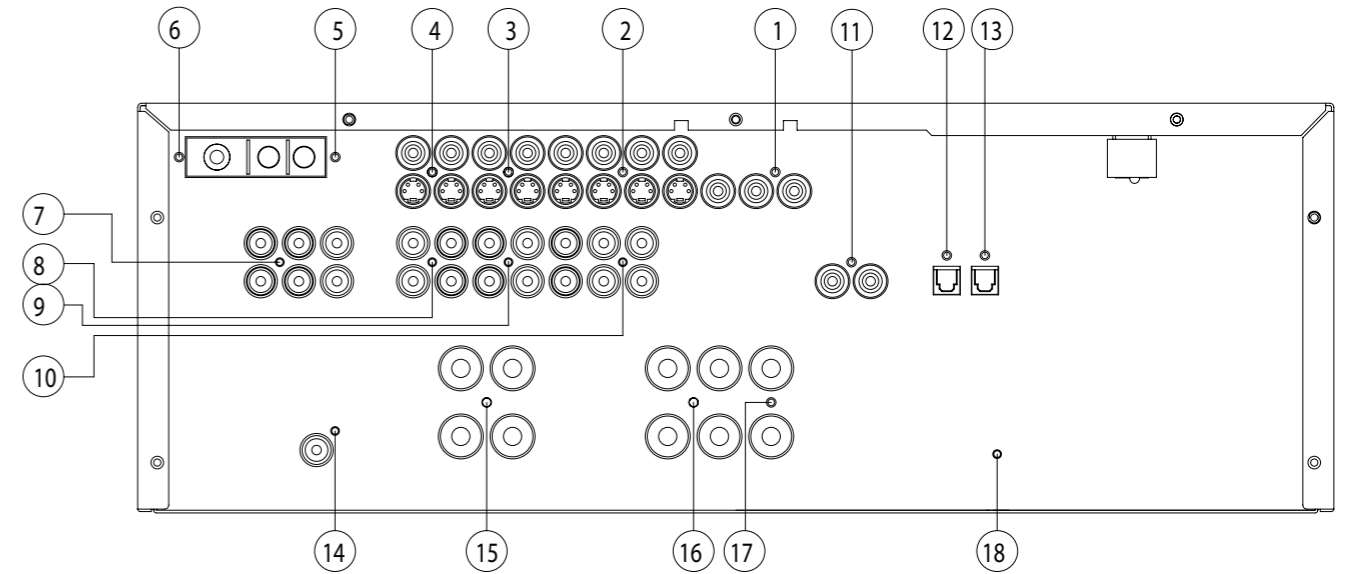
4. Removing the Main PCB
Remove the Screws ① ~ ⑦
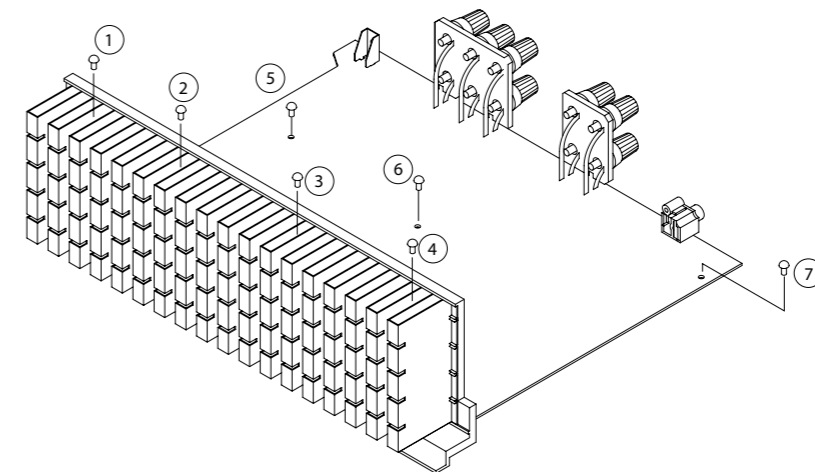
AVR144 DISASSEMBLY PROCEDURES

1   TOP-CABINET (21) REMOVAL

1. Remove 13 screws (S1,S7) and then remove the Top-cabinet.

2   FRONT PANEL ASS'Y REMOVAL

1. Remove the Top-cabinet, referring to the previous step1.
2. Disconnect the card cable between connector (CN72-17p) on the Fip PCB (37-1) and connector (CN72) on the Input PCB (39-1).
3. Disconnect the lead wire (BN81-8P) on the Fip PCB (37-1) from connector (CN81) on the Trans PCB (40-4).
4. Disconnect the lead wire (BN22-6P) on the Phone PCB (37-5) from connector (CN22) on the Input PCB (39-1).
5. Disconnect the lead wire (BN18-5P) on the Phone PCB (37-5) from connector (CN18) on the Input PCB (39-1)
6. Disconnect the lead wire (BN10-4P) on the Volume PCB (37-6) from connector (CN10) on the Input PCB (39-1)
7. Disconnect the lead wire (BN41-6P) on the Volume PCB (37-6) from connector (CN41) on the Video PCB (41)
8. Remove 1 screw (S10) and then lead wire (JW82-1P,JW83-1P) on the Phone PCB (37-5).
9 .Remove 1screw (S10) and then lead wire (JW84-1P) on the Volume PCB (37-3).
10. Remove 10 screws (S1) and then remove the Front Panel ASS'Y.

3   VOLUME PCB (37-6) REMOVAL

1. Remove the Top-cabinet, referring to the previous step1.
2. Remove the Front Panel ASS'Y, referring to the previous step 2.
3. Pull out the Volume Knob ASS'Y.
4. Disconnect   connector (CN84) on the Volume PCB (37-6) from the lead wire (BN84-5P) on the Fip PCB (37-1).
5. Remove 8 screws (S2,S14), and then remove the Volume PCB (37-6).

4   PHONE PCB (37-5) REMOVAL

1. Remove the Top-cabinet, referring to the previous step 1.
2. Remove the Front Panel ASS'Y, referring to the previous step 2.
3.. Disconnect   connector (CN85)on the Phone PCB (37-5) from the lead wire (BN85-2P) on the Fip PCB (37-1).
4. Remove 2 screws (S2) and then remove the Phone PCB (37-5).
.

5   POWER LED PCB (37-3) REMOVAL

1. Remove the Top-cabinet, referring to the previous step1.
2. Remove the Front Panel ASS'Y, referring to the previous step 2.
3. Disconnect connector (CN88) on the Power Led PCB (37-3) from the lead wire (BN88-4P) on the Fip PCB (37-1) .
4. Remove 2 screws (S2) and then remove the Power led PCB (37-3).

6   FIP PCB (37-1) REMOVAL

1. Remove the Top-cabinet, referring to the previous step 1.
2. Remove the Front Panel ASS'Y, referring to the previous step 2.
3. Disconnect the lead wire (BN84-5P) on the Fip PCB (37-1) from connector (CN84) on the Volume PCB (37-6).
4. Disconnect the lead wire (BN85-2P) on the Fip PCB (37-1) from connector (CN85) on the Phone PCB (37-5).
5. Disconnect the lead wire (BN88-4P) on the Fip PCB (37-1) from connector (CN88) on the Power Led PCB (37-3).
6. Remove 3 screws (S2) and then remove the Guide PCB (37-8) & the Fip PCB (37-1).

7   TUNER MODULE (42) REMOVAL

1. Remove the Top-cabinet, referring to the previous step 1.
2. Disconnect the card cable between connector (CON1-13p) on Tuner module (42)and connector (CN13) on the Input PCB (39-1).
3. Remove 2 screws (S8) and then remove the Tuner Module (42).

8   VIDEO PCB (41) REMOVAL

1. Remove the Top-cabinet, referring to the previous step 1.
2. Disconnect the card cable between connector (BN14-13p) on the Video PCB (41) and connector (CN14) on the Input PCB (39-1).
3. Disconnect connector (CN43) on the Video PCB (41) from the lead wire (BN43-4P) on the Regulator PCB (A)(40-2).
4. Disconnect connector (CN41) on the Video PCB (41) from the lead wire (BN41-6P) on the Volume PCB (37-6).
5. Remove 6 screws (S8) and then remove the Video PCB (41).

9   INPUT PCB (39-1) REMOVAL

1. Remove the Top-cabinet, referring to the previous step 1.
2. Remove the Tuner module (42), referring to the previous step 7
3. Remove the Video PCB (41), referring to the previous step 8
4. Disconnect connector (CN20) on the the Input PCB (39-1) from the lead wire (BN20-5P) on the Regulator PCB (B)(40-5).
5. Disconnect connector (CN22) on the Input PCB (39-1) from the lead wire (BN22-6P) on the Phone PCB (37-5).
6. Disconnect connector (CN18) on the Input PCB (39-1) from the lead wire (BN18-5P) on the Phone PCB (37-5)
7. Disconnect connector (CN10) on the Input PCB (39-1) from the lead wire (BN10-4P) on the Volume PCB (37-6).
8. Disconnect the card cable between connector (CN14) on the Input PCB (39-1) and connector (BN14-13p) on the Video PCB (41).
9. Disconnect the card cable between connector (CN12-21p) on Input PCB (39-1)and connector (CN12-21p) on the main PCB (38-1)
10. Disconnect card cable between connector (CN11-13p) on Input PCB (39-1) and connector (CN11-13p) on the main PCB (38-1)
11. Remove 11 screws (S8,S15) and then remove the Input PCB (39-1).

10   POWER TRANS (36) & POWER PCB ASS'Y(40) REMOVAL

1. Remove the Top-cabinet, referring to the previous step 1.
2. Disconnect lead wire of the Power Trans (36) from connector (CN91-3P) on the Main PCB (38-1)
3. Disconnect connector (CN19-3P,CN20-4P) on TRANS PCB (40-3) from the lead wire (BN19-3P,BN20-4P) on the Main PCB (38-1).
4. Disconnect the lead wire (BN96-8P) on the Power PCB (40-4) from connector (CN96) on the Regulator PCB (B)(40-5).
5. Disconnect the lead wire (BN99-8P) on the Power PCB (40-4) from connector (CN99) on the Regulator PCB (A)(40-2).
6. Disconnect connector (CN81) on the Trans PCB (40-4) from the lead wire (BN81-8P) on the Fip PCB (37-1).
7. Remove 4 Trans screws (S9) and then remove the Power Trans (36)& Power PCB ASS'Y(40) REMOVAL .

11   MAIN PCB ASS'Y(38-1) REMOVAL

1. Remove the Top-cabinet, referring to the previous step1.
2. Remove the Tuner module (42), referring to the previous step7.
3. Remove the Video PCB (41) referring to the previous step8.
5. Remove the Input PCB (39-1), referring to the previous step9.
6. Remove the AC Cord(35) on the Main PCB (38-1)
7. Disconnect   the lead wire (BN90-2P) on the Main PCB (38-1) from connector (CN86) on Moms PCB (37-4).
8. Disconnect connector (CN91-3P) on the Main PCB (38-1) from lead wire of the Power Trans (36)
9. Disconnect the lead wire (BN89-2P) on the Main PCB (38-1) from connector (CN89) on Regulator PCB (A)(40-2).
10. Disconnect the lead wire (BN19-3P,BN20-4P) on Main PCB (38-1) from connector (CN19-3P,CN20-4P) on TRANS PCB (40-4).
11. Remove 11screws (S13-1EA, S4-2EA, S6-2EA, S8-6EA) and then remove the Main PCB ASS'Y(38-1).

AVR144 EXPLODED VIEW
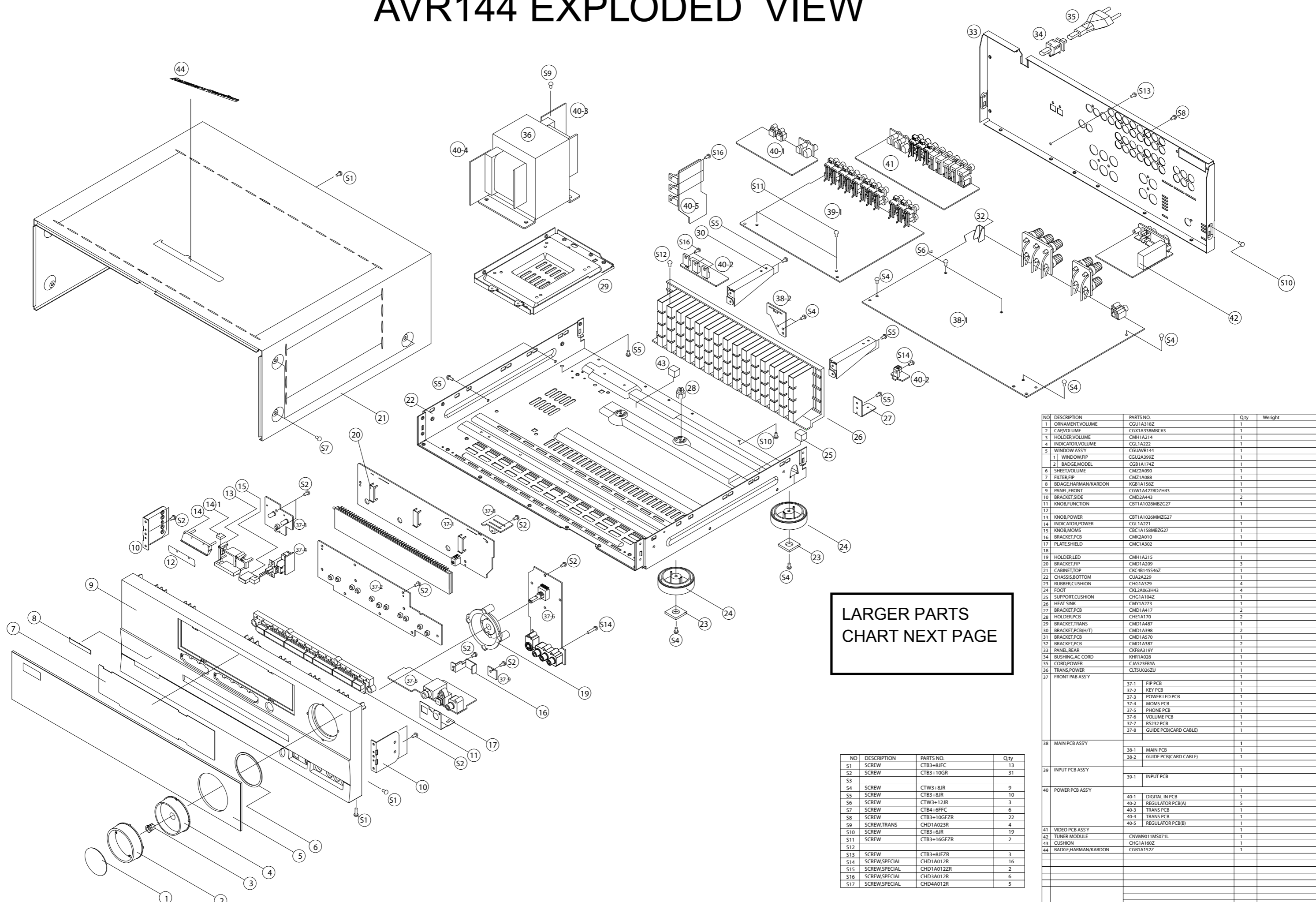
LARGER PARTS
CHART NEXT PAGE

NO	DESCRIPTION	PARTS NO.	Q.ty	Weright
1	ORNAMENT,VOLUME	CGU1A318Z	1	
2	CAP,VOLUME	CGX1A338MMBC63	1	
3	HOLDER,VOLUME	CMH1A214	1	
4	INDICATOR,VOLUME	CGL1A222	1	
5	WINDOW ASS'Y	CGUAVR144	1	
1	WINDOW,FIP	CGU2A399Z	1	
2	BADGE,MODEL	CGB1A174Z	1	
6	SHEET,VOLUME	CM2A090	1	
7	FILTER,FIP	CMZ1A088	1	
8	BDAGE,HARMAN/KARDON	KGB1A158Z	1	
9	PANEL,FRONT	CGW1A427RDZH43	1	
10	BRACKET,SIDE	CMD2A443	2	
11	KNOB,FUNCTION	CBT1A1028MBZG27	1	
12				
13	KNOB,POWER	CBT1A1026MMZG27	1	
14	INDICATOR,POWER	CGL1A221	1	
15	KNOB,MOMS	CBC1A158MBZG27	1	
16	BRACKET,PCB	CMK2A010	1	
17	PLATE,SHIELD	CMC1A302	1	
18				
19	HOLDER,LED	CMH1A215	1	
20	BRACKET,FIP	CMD1A209	3	
21	CABINET,TOP	CKC4B145S46Z	1	
22	CHASSIS,BOTTOM	CUA2A229	1	
23	RUBBER,CUSHION	CHG1A329	4	
24	FOOT	CKL2A063H43	4	
25	SUPPORT,CUSHION	CHG1A104Z	1	
26	HEAT SINK	CMY1A273	1	
27	BRACKET,PCB	CME1A417	2	
28	HOLDER,PCB	CME1A170	2	
29	BRACKET,TRANS	CMD1A487	1	
30	BRACKET,PCB(H/T)	CMD1A398	2	
31	BRACKET,PCB	CMD1A570	1	
32	BRACKET,PCB	CMD1A387	2	
33	PANEL,REAR	CKF8A319Y	1	
34	BUSHING,AC CORD	KHR1A028	1	
35	CORD,POWER	CJAS23FBYA	1	
36	TRANS,POWER	CLT5U026ZU	1	
37	FRONT PAB ASS'Y		1	
		37-1 FIP PCB	1	
		37-2 KEY PCB	1	
		37-3 POWER LED PCB	1	
		37-4 MOMS PCB	1	
		37-5 PHONE PCB	1	
		37-6 VOLUME PCB	1	
		37-7 RS232 PCB	1	
		37-8 GUIDE PCB(CARD CABLE)	1	
38	MAIN PCB ASS'Y		1	
		38-1 MAIN PCB	1	
		38-2 GUIDE PCB(CARD CABLE)	1	
39	INPUT PCB ASS'Y		1	
		39-1 INPUT PCB	1	
40	POWER PCB ASS'Y		1	
		40-1 DIGITAL IN PCB	1	
		40-2 REGULATOR PCB(A)	5	
		40-3 TRANS PCB	1	
		40-4 TRANS PCB	1	
		40-5 REGULATOR PCB(B)	1	
41	VIDEO PCB ASS'Y		1	
42	TUNER MODULE	CNVM9011MS071L	1	
43	CUSHION	CHG1A160Z	1	
44	BADGE,HARMAN/KARDON	CGB1A152Z	1	

NO	DESCRIPTION	PARTS NO.	Q.ty
S1	SCREW	CTB3+8JFC	13
S2	SCREW	CTB3+10GR	31
S3			
S4	SCREW	CTW3+8JR	9
S5	SCREW	CTB3+8JR	10
S6	SCREW	CTW3+12JR	3
S7	SCREW	CTB4+6FFC	6
S8	SCREW	CTB3+10GFZR	22
S9	SCREW,TRANS	CHD1A023R	4
S10	SCREW	CTB3+6JR	19
S11	SCREW	CTB3+16GFZR	2
S12			
S13	SCREW	CTB3+8JFZR	3
S14	SCREW,SPECIAL	CHD1A012R	16
S15	SCREW,SPECIAL	CHD1A012ZR	2
S16	SCREW,SPECIAL	CHD3A012R	6
S17	SCREW,SPECIAL	CHD4A012R	5

NO	DESCRIPTION			PARTS NO.	Q,ty
1	ORNAMENT,VOLUME			CGU1A318Z	1
2	CAP,VOLUME			CGX1A338MBC63	1
3	HOLDER,VOLUME			CMH1A214	1
4	INDICATOR,VOLUME			CGL1A222	1
5	WINDOW ASS'Y			CGUAVR144	1
		1	WINDOW,FIP	CGU2A399Z	1
		2	BADGE,MODEL	CGB1A174Z	1
6	SHEET,VOLUME			CMZ2A090	1
7	FILTER,FIP			CMZ1A088	1
8	BADGE,HARMAN/KARDON			KGB1A158Z	1
9	PANEL,FRONT			CGW1A427RDZH43	1
10	BRACKET,SIDE			CMD2A443	2
11	KNOB,FUNCTION			CBT1A1028MBZG27	1
12					
13	KNOB,POWER			CBT1A1026MMZG27	1
14	INDICATOR,POWER			CGL1A221	1
15	KNOB,MOMS			CBC1A158MBZG27	1
16	BRACKET,PCB			CMK2A010	1
17	PLATE,SHIELD			CMC1A302	1
18					
19	HOLDER,LED			CMH1A215	1
20	BRACKET,FIP			CMD1A209	3
21	CABINET,TOP			CKC4B145S46Z	1
22	CHASSIS,BOTTOM			CUA2A229	1
23	RUBBER,CUSHION			CHG1A329	4
24	FOOT			CKL2A063H43	4
25	SUPPORT,CUSHION			CHG1A104Z	1
26	HEAT SINK			CMY1A273	1
27	BRACKET,PCB			CMD1A417	2
28	HOLDER,PCB			CHE1A170	2
29	BRACKET,TRANS			CMD1A487	1
30	BRACKET,PCB(H/T)			CMD1A398	2
31	BRACKET,PCB			CMD1A570	1
32	BRACKET,PCB			CMD1A387	2
33	PANEL,REAR			CKF8A319Y	1
34	BUSHING,AC CORD			KHR1A028	1
35	CORD,POWER			CJA523FBYA	1
36	TRANS,POWER			CLT5U026ZU	1
37	FRONT PCB ASS'Y				1
		37-1	FIP PCB		1
		37-2	KEY PCB		1
		37-3	POWER LED PCB		1
		37-4	MOMS PCB		1
		37-5	PHONE PCB		1
		37-6	VOLUME PCB		1
		37-7	RS232 PCB		1
		37-8	GUIDE PCB(CARD CABLE)		1
38	MAIN PCB ASS'Y				1
		38-1	MAIN PCB		1
		38-2	GUIDE PCB(CARD CABLE)		1
39	INPUT PCB ASS'Y				1
		39-1	INPUT PCB		1
40	POWER PCB ASS'Y				1
		40-1	DIGITAL IN PCB		1
		40-2	REGULATOR PCB(A)		5
		40-3	TRANS PCB		1
		40-4	TRANS PCB		1
		40-5	REGULATOR PCB(B)		1
41	VIDEO PCB ASS'Y				1
42	TUNER MODULE			CNVM9011MS071L	1
43	CUSHION			CHG1A160Z	1
44	BADGE,HARMAN/KARDON			CGB1A152Z	1

AMPLIFIER SECTION BIAS ADJUSTMENT

Measurement condition
.No input signal or volume position is minimum.

Standard value
.Ideal current = 48mA (± 5%)
.Ideal DC Voltage = 25.92mV (± 5%)
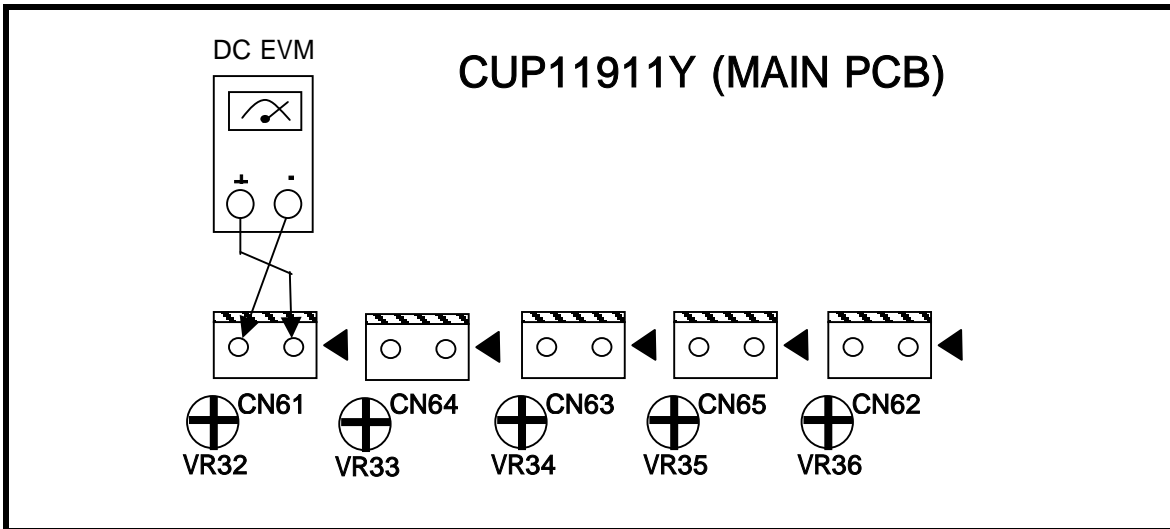
DC VOLTMETER ; Connect to
  CN66(SL),CN61(CEN),CN64(SR),CN63(FL),CN65(SBL/SL(AVR132,144,145)),CN62(FR),CN67(SBR)

NO.	Channel	Adjust for	Adjustment
1	Front Left	25.92mV (± 5%)	CN63
2	Front Right	25.92mV (± 5%)	CN62
3	Center	25.92mV (± 5%)	CN61
4	Surround Left	25.92mV (± 5%)	CN65
5	Surround Right	25.92mV (± 5%)	CN64

harman/kardon

AVR145/245/132/144 BLOCK DIAGRAM
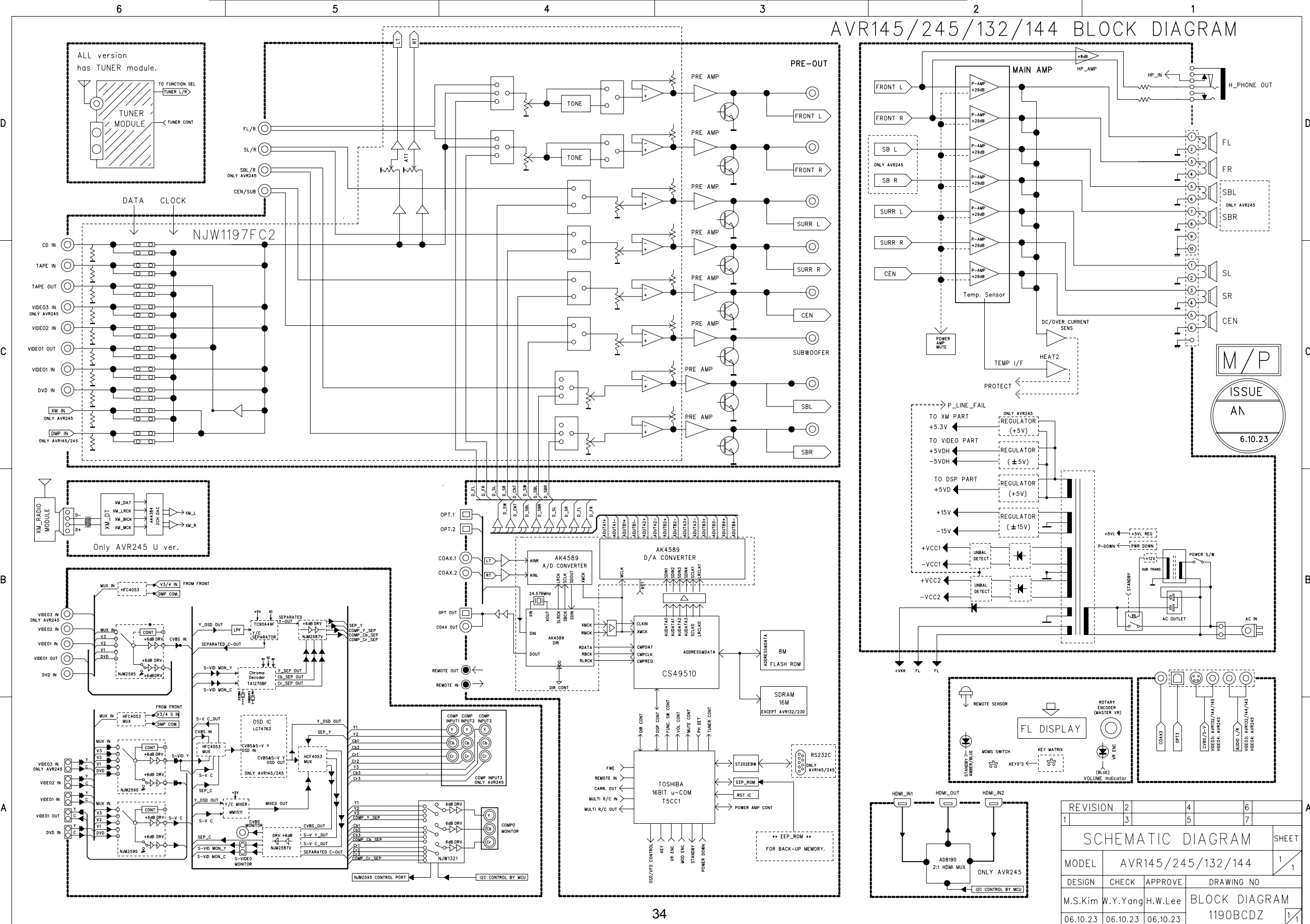
SCHEMATIC DIAGRAM

REVISION					
	2		4		6
1		3		5	7

MODEL	AVR145/245/132/144		SHEET
DESIGN	CHECK	APPROVE	DRAWING NO
M.S.Kim	W.Y.Yang	H.W.Lee	BLOCK DIAGRAM
06.10.23	06.10.23	06.10.23	1190BCDZ

AVR*45 FIP PCB
CUP11910-1

harman/kardon

harman/kardon CUP11910-7
AVR*45 DOWNLOAD JACK PCB

harman/kardon
AVR*45 VR/PHONE/VID3 OR 4(ANALOG)JACK PCB
CUP11910-6

AVR*45 KEY PCB
CUP11910-2

harman/kardon

CENTER BAR

CENTER BAR

AVR*45 STAND BY PCB
CUP11910-3

harman/kardon
PWR.SW PCB
CUP11910-4

CUP11910-8
harman/kardon
BLACKET PCB

FOR CARD CABLE

AVR*45 PHONE/VID3 OR 4(DIGITAL)JACK PCB
CUP11910-5

harman/kardon　　CUP11910 ⚠

AVR145/245/345/144/132
FRONT PART 2006.09.15

| IC | ICT | ADJ1 | ADJ2 | RP | DIPPING |

AVRx45 FRONT(20060915). — Thu Oct 12 18:49:32 2006

CUP11931 ⚠

| IC | ICT | ADJ1 | ADJ2 | RP |

harman/kardon

CENTER BAR

DIPPING

CUP11931-2
EUR ONLY

AVR-145/144/132
No Need

AVR-145/144/132
No Need

AVR-145/144/132
No Need

AVR-145/144/132
No Need

1.8mm
1.7mm
1.2mm

UPDATED 2006.05.27
ISSUED 2006.05.27

Pb

A30C5
C5

CUP11931 ⚠

A7808A
IC36

A7908A
IC37

SBR-CH

SBL-CH

SR-CH

SL-CH

SW-CH

C-CH

FR-CH

FL-CH

ABUS_IR_R2
MULTI_MUTE2
1159_DATA
1159_CLK
1159_LATCH
-12V
+12V
GND
Multi_Rout
GND
Multi_Lout
GND

CN16

CN10 GND
VIDEO4-R

VIDEO4-L

AVR145/144/132
No Need

CN11

CN12

CN13

CN19

CN49_EUR_ONLY

CN14

CN72

CN22

CN17

CN18

CN20

J102　J101

harman/kardon®

CUP11931-1

AVR145 VIDEO(20060928)P – Thu Oct 12 17:02:43 2006

AVR145 VIDEO(20060928)P - Wed Oct 11 21:55:23 2006

AVR132 INPUT(20060929)P — Fri Oct 13 11:59:06 2006

247.0mm

168.0mm

CENTER BAR CUP11916

CUP11916

CUP11916-2

SL/CEN CH ONLY

DIPPING

AVR245
AVR145
AVR144
AVR132

AVR245
AVR145
AVR144
AVR132

AVR245
AVR145

AVR144
AVR132

AVR245
AVR145
AVR144
AVR132

AVR345　AVR345　AVR345　AVR345　AVR345　AVR345　AVR345

IC ICT ADJ1 ADJ2 RP

CENTER BAR

CUP11916-1

• IC95 Option
AVR145/245/345
: L7812CP

AVR132/230, 144
: NJM7809

harman/kardon®

CUP11916

CENTER BAR

L7805CP   L7805CP   L7905CP   L7812CP

CN85:
From XM PCB

CN89:
From Main PCB

CUP11916-6

CUP11916

CENTER BAR

L7815CP   L7915CP   L7805CP

CUP11916

CUP11916-5

AVR345 ONLY

CUP11916-3

CUP11916-4

BN22_1

IC ICT ADJ1 ADJ2 RP

CUP11916-7

CUP11916

CAUTION:
REPLACE FUSIBLE RESISTOR WITH SAME TYPE AND
RATING FUSIBLE RESISTOR.

AVRx45 POWER(20060929)P – Wed Oct 11 16:56:07 2006

AVR144 Electrical Parts List					
Ref. Designator	Part Number	Description		Qty	
FRONT PCB ASSY		**CUP11910-1**			
Capacitors					
C714	HCBS1H151KBT	CAP , CERAMIC	150UF 50V K	1	EA
C716	CCEA1AH331T	CAP , ELECT	330UF 10V	1	EA
C723	HCBS1H104ZFT	CAP , CERAMIC	0.1UF 50V Z	1	EA
C728	HCBS1H104ZFT	CAP , CERAMIC	0.1UF 50V Z	1	EA
C729	HCBS1H473ZFT	CAP , CERAMIC	0.047UF 50V Z	1	EA
C731	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C735	CCEA1CKS100T	CAP , ELECT	10UF 16V	1	EA
C742	HCBS1H223ZFT	CAP , CERAMIC	0.02UF 50V Z	1	EA
C793	HCBS1H104ZFT	CAP , CERAMIC	0.1UF 50V Z	1	EA
C794	HCBS1C222MXT	CAP , CERAMIC	2200PF 16V	1	EA
C795	HCBS1H102KBT	CAP , CERAMIC	1000PF 50V K	1	EA
C796	HCBS1H102KBT	CAP , CERAMIC	1000PF 50V K	1	EA
C882	HCBS1H104ZFT	CAP , CERAMIC	0.1UF 50V Z	1	EA
C891	HCBS1H223ZFT	CAP , CERAMIC	0.023UF 50V Z	1	EA
C892	HCBS1H223ZFT	CAP , CERAMIC	0.023UF 50V Z	1	EA
C893	HCBS1H223ZFT	CAP , CERAMIC	0.023UF 50V Z	1	EA
C894	CCEA1CKS100T	CAP , ELECT	100UF 16V	1	EA
C896	HCBS1H223ZFT	CAP , CERAMIC	0.023UF 50V Z	1	EA
C897	CCEA1AH471T	CAP , ELECT	470UF 10V	1	EA
C901	HCBS1H390JT	CAP , CERAMIC	39PF 50V Z	1	EA
C903	CCEA1HKS2R2T	CAP , ELECT	2.2UF 50V SMALL SIZE	1	EA
C905	CCEA1HKS2R2T	CAP , ELECT	2.2UF 50V SMALL SIZE	1	EA
Semiconductors					
D730	CVD1SS133MT	DIODE	1SS133	1	EA
D778	HVD1N5819T	DIODE , SCHOTTKY	1N5819	1	EA
IC73	HRVNJL34H380A	SENSOR , REMOTE	SENSOR	1	EA
IC75	HVI74ACT04MTR	I.C , HEX	FAIRCHILD	1	EA
Q701	HVTKRC107MT	TRANSISTOR NPN	KRC107M	1	EA
Q722	HVTKRA107MT	TRANSISTOR PNP	KRA107M	1	EA
Q724	HVTKRC107MT	TRANSISTOR NPN	KRC107M	1	EA
Q725	HVTKRC107MT	TRANSISTOR NPN	KRC107M	1	EA
Q738	HVTKRC107MT	TRANSISTOR PNP	KRC107M	1	EA
Q739	HVTKTA1271YT	TRANSISTOR PNP	KTA1271Y	1	EA
Resistors					
R701	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R704	CRD20TJ100T	RES , CARBON	10 OHM 1/5W J	1	EA
R709	CRD20TJ470T	RES , CARBON	47 OHM 1/5W J	1	EA
R710	CRD20TJ470T	RES , CARBON	47 OHM 1/5W J	1	EA
R711	CRD20TJ470T	RES , CARBON	47 OHM 1/5W J	1	EA
R718	CRD20TJ222T	RES , CARBON	2.2K OHM 1/5W J	1	EA
R737	CRD20TJ100T	RES , CARBON	10 OHM 1/5W J	1	EA
R747	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R781	CRD20TJ102T	RES , CARBON	1K OHM 1/5W J	1	EA
R783	CRD20TJ102T	RES , CARBON	1K OHM 1/5W J	1	EA
R784	CRD20TJ102T	RES , CARBON	1K OHM 1/5W J	1	EA
R786	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R787	CRD20TJ101T	RES , CARBON	100 OHM 1/5W J	1	EA
R791	CRD20TJ822T	RES , CARBON	8.2K OHM 1/5W J	1	EA
R892	CRD20TJ222T	RES , CARBON	2.2K OHM 1/5W J	1	EA
R893	CRD20TJ333T	RES , CARBON	33K OHM 1/5W J	1	EA
R913	CRD20TJ102T	RES , CARBON	1K OHM 1/5W J	1	EA
R915	CRD20TJ473T	RES , CARBON	47K OHM 1/5W J	1	EA
Miscellaneous					
FIP1	HFLHCA18ML03	F.I.P	F.I.P	1	EA
BN81	CWB2C908200BM	WIRE ASS'Y	WIRE	1	EA

Ref. Designator	Part Number	Description		Qty	
FRONT PCB ASSY		**CUP11910-1**			
BN84	CWB2B905080EN	WIRE ASS'Y	WIRE	1	EA
BN85	CWB2B902100EW	WIRE ASS'Y (ANGLE)	WIRE	1	EA
BN88	CWB2B904100EN	WIRE ASS'Y	WIRE	1	EA
	CMC3A111	PLATE , EARTH	PLATE	1	EA
L702	HLQ02C100KT	COIL , AXAIL	COIL	1	EA
CN72	CJP17GA193ZY	WAFER, CARD CABLE (SMD)	WAFER	1	EA
CN89	CJP04GB46ZY	WAFER	WAFER	1	EA
PCB , FRONT STAND BY		**CUP11910-3**			
CN88	CJP04GB46ZY	WAFER	WAFER	1	EA
R824	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R825	CRD20TJ681T	RES , CARBON	680 OHM 1/5W J	1	EA
R828	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R829	CRD20TJ681T	RES , CARBON	680 OHM 1/5W J	1	EA
S701	HST1A020ZT	SW , TACT	1A020	1	EA
D723	CVD50BOBBWGA	L.E.D , 2 COLOR (ORG , BLUE)	L.E.D	1	EA
D727	CVD50BOBBWGA	L.E.D , 2 COLOR (ORG , BLUE)	L.E.D	1	EA
PCB , FRONT POWER (MOMS) SW		**CUP11910-4**			
CN86	CJP02GA89ZM	WAFER	WAFER	1	EA
SW1	CSH1A008ZV	SW , PUSH (MOMS)	MOMS SWITCH	1	EA
PCB , FRONT PANEL KEY		**CUP11910-2**			
Capacitors					
C719	HCBS1H102KBT	CAP , CERAMIC	1000PF 50V K	1	EA
C720	HCBS1H102KBT	CAP , CERAMIC	1000PF 50V K	1	EA
C721	HCBS1H102KBT	CAP , CERAMIC	1000PF 50V K	1	EA
Resistors					
R753	CRD20TF1001T	RES , CARBON	1K /1/5W /F	1	EA
R754	CRD20TF1501T	RES , CARBON	1.5K /1/5W /F	1	EA
R755	CRD20TF1801T	RES , CARBON	1.8K /1/5W /F	1	EA
R756	CRD20TF2701T	RES , CARBON	2.7K /1/5W/F	1	EA
R757	CRD20TF3301T	RES ,CARBON	3.3K /1/5W/F	1	EA
R758	CRD20TF5601T	RES ,CARBON(5.6K/F)	5.6K/1/5W/F	1	EA
R759	CRD20TF1001T	RES , CARBON	1K /1/5W /F	1	EA
R760	CRD20TF1501T	RES , CARBON	1.5K /1/5W /F	1	EA
R761	CRD20TF1801T	RES , CARBON	1.8K /1/5W /F	1	EA
R762	CRD20TF2701T	RES , CARBON	2.7K /1/5W/F	1	EA
R763	CRD20TF3301T	RES ,CARBON	3.3K /1/5W/F	1	EA
R764	CRD20TF5601T	RES ,CARBON(5.6K/F)	5.6K/1/5W/F	1	EA
R765	CRD20TF7501T	RES , CARBON (7.5K/F)	7.5K/1/5W/F	1	EA
R766	CRD20TF1001T	RES , CARBON	1K /1/5W /F	1	EA
R767	CRD20TF1501T	RES , CARBON	1.5K /1/5W /F	1	EA
R768	CRD20TF1801T	RES , CARBON	1.8K /1/5W /F	1	EA
R769	CRD20TF2701T	RES , CARBON	2.7K /1/5W/F	1	EA
Miscellaneous					
S701	HST1A020ZT	SW , TACT	1A020	1	EA
S702	HST1A020ZT	SW , TACT	1A020	1	EA
S703	HST1A020ZT	SW , TACT	1A020	1	EA
S704	HST1A020ZT	SW , TACT	1A020	1	EA
S705	HST1A020ZT	SW , TACT	1A020	1	EA
S706	HST1A020ZT	SW , TACT	1A020	1	EA
S707	HST1A020ZT	SW , TACT	1A020	1	EA
S711	HST1A020ZT	SW , TACT	1A020	1	EA
S712	HST1A020ZT	SW , TACT	1A020	1	EA
S713	HST1A020ZT	SW , TACT	1A020	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , FRONT PANEL KEY		**CUP11910-2**			
S714	HST1A020ZT	SW , TACT	1A020	1	EA
S715	HST1A020ZT	SW , TACT	1A020	1	EA
BN89	CWB2B904100EN	WIRE ASS'Y	WIRE	1	EA
PCB , VR JACK		**CUP11910-6**			
Capacitors					
C805	HCBS1H223ZFT	CAP , CERAMIC	0.022UF 50V Z	1	EA
C806	HCBS1H223ZFT	CAP , CERAMIC	0.022UF 50V Z	1	EA
C841	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C842	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C843	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C855	HCBS1H101KBT	CAP , CERAMIC	100PF 50V K	1	EA
C856	HCBS1H101KBT	CAP , CERAMIC	100PF 50V K	1	EA
C857	HCBS1H104ZFT	CAP , CERAMIC	0.1UF 50V Z	1	EA
C862	HCBS1H101KBT	CAP , CERAMIC	100PF 50V K	1	EA
C863	HCBS1H101KBT	CAP , CERAMIC	100PF 50V K	1	EA
C874	HCBS1H101KBT	CAP , CERAMIC	100PF 50V K	1	EA
Semiconductors					
D774	CVD1SS133MT	DIODE	1SS133	1	EA
D701	CVD52CSBBCEAB2	BLUE L.E.D	L.E.D	1	EA
D703	CVD52CSBBCEAB2	BLUE L.E.D	L.E.D	1	EA
D705	CVD52CSBBCEAB2	BLUE L.E.D	L.E.D	1	EA
Resistors					
R705	CRD20TJ820T	RES , CARBON	82 OHM 1/5W J	1	EA
R706	CRD20TJ820T	RES , CARBON	82 OHM 1/5W J	1	EA
R708	CRD20TJ820T	RES , CARBON	82 OHM 1/5W J	1	EA
R864	CRD20TJ272T	RES , CARBON	2.7K OHM 1/5W J	1	EA
R865	CRD20TJ101T	RES , CARBON	100 OHM 1/5W J	1	EA
R866	CRD20TJ272T	RES , CARBON	2.7K OHM 1/5W J	1	EA
R871	CRD20TJ104T	RES , CARBON	100K OHM 1/5W J	1	EA
R872	CRD20TJ104T	RES , CARBON	100K OHM 1/5W J	1	EA
R873	CRD20TJ471T	RES , CARBON	470 OHM 1/5W J	1	EA
R874	CRD20TJ471T	RES , CARBON	470 OHM 1/5W J	1	EA
R876	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R877	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R878	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R881	C3A206	WIRE , COPPER	SN95/PB5 , 0.6		
R882	C3A206	WIRE , COPPER	SN95/PB5 , 0.6		
VR74	CSR2A037Z	ENCODER	ENCODER	1	EA
Miscellaneous					
CN84	CJP05GB46ZY	WAFER	WAFER	1	EA
BN10	CWZAVR230BN10	WIRE ASS'Y (SHIELD)	WIRE	1	EA
BN41	CWZAVR130BN41	WIRE ASS'Y (SHIELD)	WIRE	1	EA
JK85	CJJ9M003Z	JACK , S-VIDEO	S-VIDEO JACK	1	EA
JK86	CJJ4S023Y	JACK , BOARD	BOARD	1	EA
JW84	CWE8202110RV	WIRE ASS'Y	WIRE	1	EA
PCB , PHONE JACK		**CUP11910-5**			
Capacitors					
C807	HCBS1H104ZFT	CAP , CERAMIC	0.1UF 50V Z	1	EA
C808	HCBS1H181KBT	CAP , CERAMIC	180PF 50V Z	1	EA
C809	CCEA1AH471T	CAP , ELECT	470UF 10V	1	EA
C812	HCBS1H104ZFT	CAP , CERAMIC	0.1UF 50V Z	1	EA
C817	HCBS1H100JCT	CAP , CERAMIC	10PF 50V	1	EA
C850	HCBS1H471KBT	CAP , CERAMIC	470PF 50V	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , PHONE JACK		**CUP11910-5**			
C851	HCBS1H471KBT	CAP , CERAMIC	470PF 50V	1	EA
C852	HCBS1H104ZFT	CAP , CERAMIC	0.1UF 50V Z	1	EA
C866	CCEA1HKS100T	CAP , ELECT	10UF 50V	1	EA
C867	CCEA1HKS100T	CAP , ELECT	10UF 50V	1	EA
C868	CCEA1EKS470T	CAP , ELECT	47UF 25V	1	EA
C869	CCEA1EKS470T	CAP , ELECT	47UF 25V	1	EA
C870	HCBS1H681KBT	CAP , CERAMIC	680PF 50V K	1	EA
C871	HCBS1H681KBT	CAP , CERAMIC	680PF 50V K	1	EA
C872	CCEA1CH331T	CAP , ELECT	330UF 16V	1	EA
C873	CCEA1CH331T	CAP , ELECT	330UF 16V	1	EA
C889	HCBS1H104ZFT	CAP , CERAMIC	0.1UF 50V Z	1	EA
Semiconductors					
D784	CVD1SS133MT	DIODE	1SS133	1	EA
D785	CVD1SS133MT	DIODE	1SS133	1	EA
Q734	HVTKTC2874BT	TRANSISTOR , MUTE NPN	KTC2874B	1	EA
Q735	HVTKTC2874BT	TRANSISTOR , MUTE NPN	KTC2874B	1	EA
Q736	HVTKTC2874BT	TRANSISTOR , MUTE NPN	KTC2874B	1	EA
Q737	HVTKTC2874BT	TRANSISTOR , MUTE NPN	KTC2874B	1	EA
IC76	HVI74HCU04AFNG	I.C , INVERTER	TOSHIBA	1	EA
IC86	HVINJM4556AL	I.C , HEADPHONE	JRC	1	EA
Resistors					
R456	C3A206	WIRE , COPPER	SN95/PB5 , 0.6		
R457	C3A206	WIRE , COPPER	SN95/PB5 , 0.6		
R805	CRD20TJ104T	RES , CARBON	100K OHM 1/5W J	1	EA
R806	CRD20TJ472T	RES , CARBON	4.7K OHM 1/5W J	1	EA
R869	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R875	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R895	CRD20TJ101T	RES , CARBON	100 OHM 1/5W J	1	EA
R896	CRD20TJ101T	RES , CARBON	100 OHM 1/5W J	1	EA
R897	CRD20TJ101T	RES , CARBON	100 OHM 1/5W J	1	EA
R898	CRD20TJ101T	RES , CARBON	100 OHM 1/5W J	1	EA
R899	CRD20TJ104T	RES , CARBON	100K OHM 1/5W J	1	EA
R900	CRD20TJ104T	RES , CARBON	100K OHM 1/5W J	1	EA
R901	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R902	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R903	CRD20TJ102T	RES , CARBON	1K OHM 1/5W J	1	EA
R904	CRD20TJ102T	RES , CARBON	1K OHM 1/5W J	1	EA
R905	CRD20TJ104T	RES , CARBON	100K OHM 1/5W J	1	EA
R906	CRD20TJ104T	RES , CARBON	100K OHM 1/5W J	1	EA
R907	CRD20TJ472T	RES , CARBON	4.7K OHM 1/5W J	1	EA
R908	CRD20TJ472T	RES , CARBON	4.7K OHM 1/5W J	1	EA
R909	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R910	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R911	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R912	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R918	CRD20TJ472T	RES , CARBON	4.7K OHM 1/5W J	1	EA
R919	CRD20TJ472T	RES , CARBON	4.7K OHM 1/5W J	1	EA
Miscellaneous					
CN85	CJP02GA19ZY	WAFER, 2PIN	WAFER	1	EA
BN18	CWZAVR125BN18	WIRE ASS'Y (SHIELD)	WIRE	1	EA
BN22	CWZAVR145BN22	WIRE ASS'Y (SHIELD)	WIRE	1	EA
JK81	CJJ4M043Y	JACK,BOARD	BOARD	1	EA
JK82	HJSTORX177L	MODULE , OPTICAL(RX)	OPTICAL JACK	1	EA
JK83	CJJ2E026Z	JACK , HEADPHONE(SILVER PLATE)	HDEAPHONE JACK	1	EA
JW82	CWE8202300RV	WIRE ASS'Y	WIRE	1	EA
JW83	CWE8202150RV	WIRE ASS'Y	WIRE	1	EA

Ref. Designator	Part Number	Description		Qty	
MAIN PCB/HEATSINK		**(CUP11911Z)**			
Capacitors					
C501	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C502	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C503	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C504	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C505	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C506	CCKT1H331KB	CAP , CERAMIC	330PF 50V	1	EA
C507	HCBS1H331KBT	CAP , CERAMIC	330PF 50V	1	EA
C508	HCBS1H331KBT	CAP , CERAMIC	330PF 50V	1	EA
C509	CCKT1H331KB	CAP , CERAMIC	330PF 50V	1	EA
C510	HCBS1H331KBT	CAP , CERAMIC	330PF 50V	1	EA
C561	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C562	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C563	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C564	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C565	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C566	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C567	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C568	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C569	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C570	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C571	HCBS1H681KBT	CAP , CERAMIC	680PF 50V	1	EA
C572	HCBS1H681KBT	CAP , CERAMIC	680PF 50V	1	EA
C573	HCBS1H681KBT	CAP , CERAMIC	680PF 50V	1	EA
C574	HCBS1H681KBT	CAP , CERAMIC	680PF 50V	1	EA
C575	HCBS1H681KBT	CAP , CERAMIC	680PF 50V	1	EA
C601	CCCT1H120JC	CAP , CERAMIC	12PF 50V	1	EA
C602	CCCT1H120JC	CAP , CERAMIC	12PF 50V	1	EA
C603	CCCT1H120JC	CAP , CERAMIC	12PF 50V	1	EA
C604	CCCT1H120JC	CAP , CERAMIC	12PF 50V	1	EA
C605	CCCT1H120JC	CAP , CERAMIC	12PF 50V	1	EA
C606	CCCT1H330JC	CAP , CERAMIC	33PF 50V	1	EA
C607	CCCT1H330JC	CAP , CERAMIC	33PF 50V	1	EA
C608	CCCT1H330JC	CAP , CERAMIC	33PF 50V	1	EA
C609	CCCT1H330JC	CAP , CERAMIC	33PF 50V	1	EA
C610	CCCT1H330JC	CAP , CERAMIC	33PF 50V	1	EA
C681	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C682	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C683	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C684	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C685	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C726	CCKT1H221KB	CAP , CERAMIC	220PF 50V	1	EA
C900	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V	1	EA
C901	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V	1	EA
C905	CCFT1H223ZF	CAP, CERAMIC	0.022UP 50V	1	EA
C907	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C908	CCFT1H223ZF	CAP, CERAMIC	0.022UP 50V	1	EA
C910	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V	1	EA
C911	CCEA1CH471T	CAP , ELECT	470UF 16V	1	EA
C912	CCEA1CH221T	CAP , ELECT	220UF 16V	1	EA
C913	CCFT1H104ZF	CAP , SEMICONDUCTOR	0.1UF 50V ZF	1	EA
C914	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V J	1	EA
C917	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V J	1	EA
C924	CCFT1H104ZF	CAP , SEMICONDUCTOR	0.1UF 50V ZF	1	EA
C939	CCEA1HH4R7T	CAP , ELECT	4.7UF 50V	1	EA
C940	CCEA1AH471T	CAP , ELECT	470UF 10V	1	EA
C948	CCFT1H104ZF	CAP , SEMICONDUCTOR	0.1UF 50V ZF	1	EA
C949	CCEA1HH220T	CAP , ELECT	22UF 50V	1	EA
C972	HCQI1H562JZT	CAP , MYLAR	5600PF 50V	1	EA
C973	HCQI1H562JZT	CAP , MYLAR	5600PF 50V	1	EA
C980	HCQI1H562JZT	CAP , MYLAR	5600PF 50V	1	EA
C981	HCQI1H562JZT	CAP , MYLAR	5600PF 50V	1	EA
C990	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V J	1	EA
C991	CCEA1HH1R0T	CAP , ELECT	1UF 50V	1	EA

Ref. Designator	Part Number	Description		Qty	
MAIN PCB/HEATSINK		**(CUP11911Z)**			
C992	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V J	1	EA
C993	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V J	1	EA
C995	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V J	1	EA
C997	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V J	1	EA
C999	CCFT1H223ZF	CAP, CERAMIC	0.022UP 50V	1	EA
C631	CCEA1JH101E	CAP , ELECT	100UF 63V	1	EA
C632	CCEA1JH101E	CAP , ELECT	100UF 63V	1	EA
C633	CCEA1JH101E	CAP , ELECT	100UF 63V	1	EA
C634	CCEA1JH101E	CAP , ELECT	100UF 63V	1	EA
C635	CCEA1JH101E	CAP , ELECT	100UF 63V	1	EA
C636	CCEA1JH101E	CAP , ELECT	100UF 63V	1	EA
C637	CCEA1JH101E	CAP , ELECT	100UF 63V	1	EA
C638	CCEA1JH101E	CAP , ELECT	100UF 63V	1	EA
C639	CCEA1JH101E	CAP , ELECT	100UF 63V	1	EA
C640	CCEA1JH101E	CAP , ELECT	100UF 63V	1	EA
C902	CCET50VKL4682NK	CAP , ELECT	6800UF/50V	1	EA
C904	KCKDKS472ME	CAP , CERAMIC(X1/Y2/SC)	0.0047UF/2.5KV	1	EA
C906	CCEA1EH102E	CAP , ELECT	1000UF 25V	1	EA
C909	CCET50VKL4682NK	CAP , ELECT	6800UF/50V	1	EA
C915	CCET50VKL4682NK	CAP , ELECT	6800UF/50V	1	EA
C916	CCET50VKL4682NK	CAP , ELECT	6800UF/50V	1	EA
Semiconductors					
D501	CVD1SS133MT	DIODE	1SS133	1	EA
D502	CVD1SS133MT	DIODE	1SS133	1	EA
D503	CVD1SS133MT	DIODE	1SS133	1	EA
D504	CVD1SS133MT	DIODE	1SS133	1	EA
D505	CVD1SS133MT	DIODE	1SS133	1	EA
D581	CVD1SS133MT	DIODE	1SS133	1	EA
D582	CVD1SS133MT	DIODE	1SS133	1	EA
D583	CVD1SS133MT	DIODE	1SS133	1	EA
D584	CVD1SS133MT	DIODE	1SS133	1	EA
D585	CVD1SS133MT	DIODE	1SS133	1	EA
D901	CVD1N4003SRT	RECT , DIODE	1N4003	1	EA
D902	CVD1SS133MT	DIODE	1SS133	1	EA
D911	CVD1SS133MT	DIODE	1SS133	1	EA
D912	CVD1SS133MT	DIODE	1SS133	1	EA
D914	CVD1SS133MT	DIODE	1SS133	1	EA
D917	CVD1SS133MT	DIODE	1SS133	1	EA
D953	CVD1SS133MT	DIODE	1SS133	1	EA
D954	CVD1N4003SRT	RECT , DIODE	1N4003	1	EA
D955	CVD1N4003SRT	RECT , DIODE	1N4003	1	EA
D956	CVD1N4003SRT	RECT , DIODE	1N4003	1	EA
D957	CVD1N4003SRT	RECT , DIODE	1N4003	1	EA
D961	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D962	CVD1N4003SRT	RECT , DIODE	1N4003	1	EA
D963	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D973	CVD1SS133MT	DIODE	1SS133	1	EA
D974	CVD1SS133MT	DIODE	1SS133	1	EA
D979	HVDMTZJ6.2BT	DIODE , ZENER	MTZJ6.2B	1	EA
D980	CVD1SS133MT	DIODE	1SS133	1	EA
Q501	HVTKTA1268GRT	TRANSISTOR PNP	KTA1268GR	1	EA
Q502	HVTKTA1268GRT	TRANSISTOR PNP	KTA1268GR	1	EA
Q503	HVTKTA1268GRT	TRANSISTOR PNP	KTA1268GR	1	EA
Q504	HVTKTA1268GRT	TRANSISTOR PNP	KTA1268GR	1	EA
Q505	HVTKTA1268GRT	TRANSISTOR PNP	KTA1268GR	1	EA
Q511	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q512	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q513	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q514	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q515	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q516	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q517	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q518	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA

Ref. Designator	Part Number	Description		Qty	
MAIN PCB/HEATSINK		**(CUP11911Z)**			
Q519	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q520	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q541	HVTKTC3198YT	TRANSISTOR NPN	KTC3198Y	1	EA
Q542	HVTKTC3198YT	TRANSISTOR NPN	KTC3198Y	1	EA
Q543	HVTKTC3198YT	TRANSISTOR NPN	KTC3198Y	1	EA
Q544	HVTKTC3198YT	TRANSISTOR NPN	KTC3198Y	1	EA
Q545	HVTKTC3198YT	TRANSISTOR NPN	KTC3198Y	1	EA
Q556	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q557	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q558	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q559	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q560	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q561	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q562	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q563	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q564	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q565	HVTKTC3200GRT	TRANSISTOR NPN	KTC3200GR	1	EA
Q601	HVTKTA1268GRT	TRANSISTOR PNP	KTA1268GR	1	EA
Q602	HVTKTA1268GRT	TRANSISTOR PNP	KTA1268GR	1	EA
Q603	HVTKTA1268GRT	TRANSISTOR PNP	KTA1268GR	1	EA
Q604	HVTKTA1268GRT	TRANSISTOR PNP	KTA1268GR	1	EA
Q605	HVTKTA1268GRT	TRANSISTOR PNP	KTA1268GR	1	EA
Q681	HVTKSC2785YT	TRANSISTOR NPN	KSC2785Y	1	EA
Q682	HVTKSC2785YT	TRANSISTOR NPN	KSC2785Y	1	EA
Q683	HVTKSC2785YT	TRANSISTOR NPN	KSC2785Y	1	EA
Q684	HVTKSC2785YT	TRANSISTOR NPN	KSC2785Y	1	EA
Q685	HVTKSC2785YT	TRANSISTOR NPN	KSC2785Y	1	EA
Q901	HVTKSC2785YT	TRANSISTOR NPN	KSC2785Y	1	EA
Q938	HVTKRA107MT	TRANSISTOR PNP	KRA107M	1	EA
Q939	HVTKRA107MT	TRANSISTOR PNP	KRA107M	1	EA
Q942	HVTKSC2785YT	TRANSISTOR NPN	KSC2785Y	1	EA
Q943	HVTKSC2785YT	TRANSISTOR NPN	KSC2785Y	1	EA
Q951	HVTKRC107MT	TRANSISTOR NPN	KRC107M	1	EA
Q952	HVTKRA107MT	TRANSISTOR PNP	KRA107M	1	EA
Q960	HVTKRC107MT	TRANSISTOR NPN	KRC107M	1	EA
Q961	HVTKTA1024YT	TRANSISTOR PNP	KTA1024YT	1	EA
Q991	HVTKRC107MT	TRANSISTOR NPN	KRC107M	1	EA
Q992	HVTKRA107MT	TRANSISTOR PNP	KRA107M	1	EA
Q652	HVT2SB1559P-OKM	TR , POWER (DARLINGTON TYPE) PNP	2SB1559	1	EA
Q653	HVT2SB1559P-OKM	TR , POWER (DARLINGTON TYPE) PNP	2SB1559	1	EA
Q654	HVT2SB1559P-OKM	TR , POWER (DARLINGTON TYPE) PNP	2SB1559	1	EA
Q655	HVT2SB1559P-OKM	TR , POWER (DARLINGTON TYPE) PNP	2SB1559	1	EA
Q657	HVT2SD2389P-OKM	TR , POWER (DARLINGTON TYPE) NPN	2SD2389	1	EA
Q658	HVT2SD2389P-OKM	TR , POWER (DARLINGTON TYPE) NPN	2SD2389	1	EA
Q659	HVT2SD2389P-OKM	TR , POWER (DARLINGTON TYPE) NPN	2SD2389	1	EA
Q660	HVT2SD2389P-OKM	TR , POWER (DARLINGTON TYPE) NPN	2SD2389	1	EA
Q661	HVT2SB1559P-OKM	TR , POWER (DARLINGTON TYPE) PNP	2SB1559	1	EA
Q670	HVT2SD2389P-OKM	TR , POWER (DARLINGTON TYPE) NPN	2SD2389	1	EA
IC94	HVIMC7805C	I.C, REGULATOR +5v	KA7805-ABTU	1	EA
IC97	HVIS-80842CNY-X	I.C RESET	S-80842CNY-X	1	EA
Q858	HVT2SA1360O	TRANSISTOR PNP POWER	2SA13600	1	EA
Q871	HVT2SA1360O	TRANSISTOR PNP POWER	2SA13600	1	EA
Q872	HVT2SA1360O	TRANSISTOR PNP POWER	2SA13600	1	EA
Q874	HVT2SA1360O	TRANSISTOR PNP POWER	2SA13600	1	EA
Q875	HVT2SA1360O	TRANSISTOR PNP POWER	2SA13600	1	EA
Q881	HVT2SC3423O	TRANSISTOR NPN POWER	2SC34230	1	EA
Q882	HVT2SC3423O	TRANSISTOR NPN POWER	2SC34230	1	EA
Q883	HVT2SC3423O	TRANSISTOR NPN POWER	2SC34230	1	EA
Q884	HVT2SC3423O	TRANSISTOR NPN POWER	2SC34230	1	EA
Q885	HVT2SC3423O	TRANSISTOR NPN POWER	2SC34230	1	EA
Resistors					
R501	CRD20TJ433T	RES , CARBON	43K OHM 1/5W J	1	EA
R502	CRD20TJ433T	RES , CARBON	43K OHM 1/5W J	1	EA

Ref. Designator	Part Number	Description		Qty	
MAIN PCB/HEATSINK		**(CUP11911Z)**			
R503	CRD20TJ433T	RES , CARBON	43K OHM 1/5W J	1	EA
R504	CRD20TJ433T	RES , CARBON	43K OHM 1/5W J	1	EA
R505	CRD20TJ433T	RES , CARBON	43K OHM 1/5W J	1	EA
R506	CRD20TJ333T	RES , CARBON	33K OHM 1/5W J	1	EA
R507	CRD20TJ333T	RES , CARBON	33K OHM 1/5W J	1	EA
R508	CRD20TJ333T	RES , CARBON	33K OHM 1/5W J	1	EA
R509	CRD20TJ333T	RES , CARBON	33K OHM 1/5W J	1	EA
R510	CRD20TJ333T	RES , CARBON	33K OHM 1/5W J	1	EA
R511	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R512	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R513	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R514	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R515	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R516	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R517	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R518	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R519	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R520	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R521	CRD20TJ471T	RES , CARBON	470 OHM 1/5W J	1	EA
R522	CRD20TJ471T	RES , CARBON	470 OHM 1/5W J	1	EA
R523	CRD20TJ471T	RES , CARBON	470 OHM 1/5W J	1	EA
R524	CRD20TJ471T	RES , CARBON	470 OHM 1/5W J	1	EA
R525	CRD20TJ471T	RES , CARBON	470 OHM 1/5W J	1	EA
R531	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R532	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R533	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R534	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R535	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R536	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R537	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R538	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R539	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R540	CRD20TJ221T	RES , CARBON	220 OHM 1/5W J	1	EA
R541	CRD20TJ271T	RES , CARBON	270 OHM 1/5W J	1	EA
R542	CRD20TJ271T	RES , CARBON	270 OHM 1/5W J	1	EA
R543	CRD20TJ271T	RES , CARBON	270 OHM 1/5W J	1	EA
R544	CRD20TJ271T	RES , CARBON	270 OHM 1/5W J	1	EA
R545	CRD20TJ271T	RES , CARBON	270 OHM 1/5W J	1	EA
R556	CRD20TJ273T	RES , CARBON	27K OHM 1/5W J	1	EA
R557	CRD20TJ273T	RES , CARBON	27K OHM 1/5W J	1	EA
R558	CRD20TJ273T	RES , CARBON	27K OHM 1/5W J	1	EA
R559	CRD20TJ273T	RES , CARBON	27K OHM 1/5W J	1	EA
R560	CRD20TJ273T	RES , CARBON	27K OHM 1/5W J	1	EA
R561	CRD20TJ182T	RES , CARBON	1.8K OHM 1/5W J	1	EA
R562	CRD20TJ182T	RES , CARBON	1.8K OHM 1/5W J	1	EA
R563	CRD20TJ182T	RES , CARBON	1.8K OHM 1/5W J	1	EA
R564	CRD20TJ182T	RES , CARBON	1.8K OHM 1/5W J	1	EA
R565	CRD20TJ182T	RES , CARBON	1.8K OHM 1/5W J	1	EA
R566	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R567	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R568	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R569	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R570	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R571	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R572	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R573	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R574	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R575	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R576	CRD20TJ100T	RES , CARBON	10 OHM 1/5W J	1	EA
R577	CRD20TJ100T	RES , CARBON	10 OHM 1/5W J	1	EA
R578	CRD20TJ100T	RES , CARBON	10 OHM 1/5W J	1	EA
R579	CRD20TJ100T	RES , CARBON	10 OHM 1/5W J	1	EA
R580	CRD20TJ100T	RES , CARBON	10 OHM 1/5W J	1	EA
R581	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R582	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA

Ref. Designator	Part Number	Description		Qty	
MAIN PCB/HEATSINK		**(CUP11911Z)**			
R583	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R584	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R585	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R586	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R587	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R588	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R589	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R590	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R591	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R592	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R593	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R594	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R595	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R596	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R597	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R598	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R599	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R600	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R601	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R602	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R603	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R604	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R605	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R606	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R607	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R608	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R609	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R610	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R631	CRD25FJ180T	RES , CARBON	18 OHM 1/4W	1	EA
R632	CRD25FJ180T	RES , CARBON	18 OHM 1/4W	1	EA
R633	CRD25FJ180T	RES , CARBON	18 OHM 1/4W	1	EA
R634	CRD25FJ180T	RES , CARBON	18 OHM 1/4W	1	EA
R635	CRD25FJ180T	RES , CARBON	18 OHM 1/4W	1	EA
R636	CRD25FJ180T	RES , CARBON	18 OHM 1/4W	1	EA
R637	CRD25FJ180T	RES , CARBON	18 OHM 1/4W	1	EA
R638	CRD25FJ180T	RES , CARBON	18 OHM 1/4W	1	EA
R639	CRD25FJ180T	RES , CARBON	18 OHM 1/4W	1	EA
R640	CRD25FJ180T	RES , CARBON	18 OHM 1/4W	1	EA
R646	CRD25FJ3R3T	RES , CARBON	3.3 OHM 1/4W J	1	EA
R647	CRD25FJ3R3T	RES , CARBON	3.3 OHM 1/4W J	1	EA
R648	CRD25FJ3R3T	RES , CARBON	3.3 OHM 1/4W J	1	EA
R649	CRD25FJ3R3T	RES , CARBON	3.3 OHM 1/4W J	1	EA
R650	CRD25FJ3R3T	RES , CARBON	3.3 OHM 1/4W J	1	EA
R651	CRD25FJ3R3T	RES , CARBON	3.3 OHM 1/4W J	1	EA
R652	CRD25FJ3R3T	RES , CARBON	3.3 OHM 1/4W J	1	EA
R653	CRD25FJ3R3T	RES , CARBON	3.3 OHM 1/4W J	1	EA
R654	CRD25FJ3R3T	RES , CARBON	3.3 OHM 1/4W J	1	EA
R655	CRD25FJ3R3T	RES , CARBON	3.3 OHM 1/4W J	1	EA
R666	CRD25TJ470T	RES , CARBON	47 OHM 1/4W	1	EA
R667	CRD25TJ470T	RES , CARBON	47 OHM 1/4W	1	EA
R668	CRD25TJ470T	RES , CARBON	47 OHM 1/4W	1	EA
R669	CRD25TJ470T	RES , CARBON	47 OHM 1/4W	1	EA
R670	CRD25TJ470T	RES , CARBON	47 OHM 1/4W	1	EA
R671	CRD20TJ911T	RES , CARBON	910 OHM 1/5W J	1	EA
R672	CRD20TJ911T	RES , CARBON	910 OHM 1/5W J	1	EA
R673	CRD20TJ911T	RES , CARBON	910 OHM 1/5W J	1	EA
R674	CRD20TJ911T	RES , CARBON	910 OHM 1/5W J	1	EA
R675	CRD20TJ911T	RES , CARBON	910 OHM 1/5W J	1	EA
R676	CRD20TJ182T	RES , CARBON	1.8K OHM 1/5W J	1	EA
R677	CRD20TJ182T	RES , CARBON	1.8K OHM 1/5W J	1	EA
R678	CRD20TJ182T	RES , CARBON	1.8K OHM 1/5W J	1	EA
R679	CRD20TJ182T	RES , CARBON	1.8K OHM 1/5W J	1	EA
R680	CRD20TJ182T	RES , CARBON	1.8K OHM 1/5W J	1	EA
R681	CRD20TJ562T	RES , CARBON	5.6K OHM 1/5W J	1	EA
R682	CRD20TJ562T	RES , CARBON	5.6K OHM 1/5W J	1	EA

Ref. Designator	Part Number	Description		Qty	
MAIN PCB/HEATSINK		**(CUP11911Z)**			
R683	CRD20TJ562T	RES , CARBON	5.6K OHM 1/5W J	1	EA
R684	CRD20TJ562T	RES , CARBON	5.6K OHM 1/5W J	1	EA
R685	CRD20TJ562T	RES , CARBON	5.6K OHM 1/5W J	1	EA
R686	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R687	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R688	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R689	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R690	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R696	CRD25TJ470T	RES , CARBON	47 OHM 1/4W	1	EA
R697	CRD25TJ470T	RES , CARBON	47 OHM 1/4W	1	EA
R698	CRD25TJ470T	RES , CARBON	47 OHM 1/4W	1	EA
R699	CRD25TJ470T	RES , CARBON	47 OHM 1/4W	1	EA
R700	CRD25TJ470T	RES , CARBON	47 OHM 1/4W	1	EA
R706	C3A206	WIRE , COPPER	SN95/PB5 , 0.6		
R771	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R772	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R773	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R774	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R775	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R781	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R782	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R783	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R784	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R785	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R900	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R901	CRD25TJ393T	RES , CARBON	39K OHM 1/4W	1	EA
R902	CRD25TJ393T	RES , CARBON	39K OHM 1/4W	1	EA
R903	CRD25TJ393T	RES , CARBON	39K OHM 1/4W	1	EA
R906	CRD25TJ393T	RES , CARBON	39K OHM 1/4W	1	EA
R907	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R910	CRD20TJ105T	RES , CARBON	1M OHM 1/5W J	1	EA
R911	CRD25TJ680T	RES , CARBON	68 OHM 1/4W J	1	EA
R912	CRD20TJ332T	RES , CARBON	3.3K OHM 1/5W J	1	EA
R917	CRD25TJ393T	RES , CARBON	39K OHM 1/4W	1	EA
R918	CRD25TJ393T	RES , CARBON	39K OHM 1/4W	1	EA
R919	CRD25TJ393T	RES , CARBON	39K OHM 1/4W	1	EA
R920	CRD25TJ393T	RES , CARBON	39K OHM 1/4W	1	EA
R932	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R939	CRD20TJ472T	RES , CARBON	4.7K OHM 1/5W J	1	EA
R940	CRD20TJ152T	RES , CARBON	1.5K OHM 1/5W J	1	EA
R941	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R942	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R944	CRD25TJ223T	RES , CARBON	22K OHM 1/4W J	1	EA
R946	CRD25TJ223T	RES , CARBON	22K OHM 1/4W J	1	EA
R947	CRD20TJ223T	RES , CARBON	22K OHM 1/5W J	1	EA
R948	CRD25TJ222T	RES , CARBON	2.2K OHM 1/4W J	1	EA
R949	CRD20TJ822T	RES , CARBON	8.2K OHM 1/5W J	1	EA
R955	CRD20TJ393T	RES , CARBON	39K OHM 1/5W J	1	EA
R956	CRD20TJ394T	RES , CARBON	390K OHM 1/5W J	1	EA
R957	CRD20TJ153T	RES , CARBON	15K OHM 1/5W J	1	EA
R960	CRD20TJ332T	RES , CARBON	3.3K OHM 1/5W J	1	EA
R961	CRD20TJ331T	RES , CARBON	330 OHM 1/5W J	1	EA
R962	CRD20TJ273T	RES , CARBON	27K OHM 1/5W J	1	EA
R963	CRD20TJ105T	RES , CARBON	1M OHM 1/5W J	1	EA
R966	CRD20TJ472T	RES , CARBON	4.7K OHM 1/5W J	1	EA
R980	CRD20TJ473T	RES , CARBON	47K OHM 1/5W J	1	EA
R986	CRD20TJ102T	RES , CARBON	1K OHM 1/5W J	1	EA
R987	CRD20TJ561T	RES , CARBON	560 OHM 1/5W J	1	EA
R988	CRD20TJ562T	RES , CARBON	5.6K OHM 1/5W J	1	EA
R989	CRD20TJ302T	RES , CARBON	3K OHM 1/5W J	1	EA
R991	CRD20TJ822T	RES , CARBON	8.2K OHM 1/5W J	1	EA
R992	CRD20TJ562T	RES , CARBON	5.6K OHM 1/5W J	1	EA
R998	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R656	CRF5EKR27HX2K	RES , CEMENT	0.27ohm X 2	1	EA
R657	CRF5EKR27HX2K	RES , CEMENT	0.27ohm X 2	1	EA

Ref. Designator	Part Number	Description		Qty	
MAIN PCB/HEATSINK		**(CUP11911Z)**			
R658	CRF5EKR27HX2K	RES , CEMENT	0.27ohm X 2	1	EA
R659	CRF5EKR27HX2K	RES , CEMENT	0.27ohm X 2	1	EA
R660	CRF5EKR27HX2K	RES , CEMENT	0.27ohm X 2	1	EA
R904	HRDERC12UGK335T	RES , CARBON	ERC12UGK 3.3M OHM	1	EA
R905	CRG1ANJ100H	RES , METAL OXIDE FILM	10 OHM 1W J	1	EA
R990	CRG1ANJ100H	RES , METAL OXIDE FILM	10 OHM 1W J	1	EA
R993	CRG1ANJ100H	RES , METAL OXIDE FILM	10 OHM 1W J	1	EA
R995	CRG1ANJ100H	RES , METAL OXIDE FILM	10 OHM 1W J	1	EA
R997	CRG1ANJ100H	RES , METAL OXIDE FILM	10 OHM 1W J	1	EA
R999	CRG1ANJ100H	RES , METAL OXIDE FILM	10 OHM 1W J	1	EA
Miscellaneous					
	CMYAVR144	HEAT SINK ASS'Y	ASS'Y	1	EA
	CHD1A012R	SCREW , SPECIAL	SCREW	15	EA
	CHD3A012R	SCREW , SPECIAL	SCREW	6	EA
	CMD1A398	BRACKET , PCB	BRACKET	2	EA
	CMD1A417	BRACKET , PCB	BRACKET	2	EA
	CMY1A273	HEAT SINK	HEAT SINK	1	EA
	CTB3+8JR	SCREW	SCREW	6	EA
ET90	HJT1A025	PLATE , EARTH	MET37-0002	1	EA
ET91	HJT1A025	PLATE , EARTH	MET37-0002	1	EA
F901	KJCFC5S	HOLDER , FUSE	FUSE	2	EA
BN19	CWB3FE03250UP	WIRE ASS'Y	WAFER	1	EA
BN20	CWB3FC04280UP	WIRE ASS'Y	WAFER	1	EA
BN82	CWB1C902050EN	WIRE ASS'Y	WAFER	1	EA
BN83	CWB1C902050EN	WIRE ASS'Y	WAFER	1	EA
BN84	CWB1C902050EN	WIRE ASS'Y	WAFER	1	EA
BN85	CWB1C902050EN	WIRE ASS'Y	WAFER	1	EA
BN86	CWB1C902050EN	WIRE ASS'Y	WAFER	1	EA
BN89	CWB1C902250BM	WIRE ASS'Y	WAFER	1	EA
BN90	CWB4F232550PU	WIRE ASS'Y	WAFER	1	EA
BN98	HJP08GA130ZK	WAFER	WAFER	1	EA
CN11	CJP13GA117ZY	WAFER , CARD CABLE	WAFER	1	EA
CN12	CJP21GA115ZY	WAFER , CARD CABLE	WAFER	1	EA
CN61	CJP02GA01ZY	WAFER, STRAIGHT, 2PIN	WAFER	1	EA
CN62	CJP02GA01ZY	WAFER, STRAIGHT, 2PIN	WAFER	1	EA
CN63	CJP02GA01ZY	WAFER, STRAIGHT, 2PIN	WAFER	1	EA
CN64	CJP02GA01ZY	WAFER, STRAIGHT, 2PIN	WAFER	1	EA
CN65	CJP02GA01ZY	WAFER, STRAIGHT, 2PIN	WAFER	1	EA
CN91	CJP02GA89ZY	WAFER	WAFER	1	EA
CN92	KJP02KA060ZY	WAFER	WAFER	1	EA
ET01	CMD1A387	BRACKET , PCB	BRACKET	1	EA
JK90	CJJ4M040Z	JACK , BOARD (SW)	JACK	1	EA
JK91	CJJ5R006Z	TERMINAL , SPEAKER	SPEAKER TERMINAL	1	EA
JK92	CJJ5P020Z	TERMINAL , SPEAKER	SPEAKER TERMINAL	1	EA
JW90	CWE8212120VV	WIRE , RED	WIRE	1	EA
JW91	CWE8212180VV	WIRE ASS'Y	WIRE	1	EA
JW92	CWEE212080VV	WIRE ASS'Y	WIRE	1	EA
JW96	CWE8212180VV	WIRE ASS'Y	WIRE	1	EA
L501	CLEY0R5KAK	COIL , SPEAKER	0.5UH K	1	EA
L502	CLEY0R5KAK	COIL , SPEAKER	0.5UH K	1	EA
L503	CLEY0R5KAK	COIL , SPEAKER	0.5UH K	1	EA
L504	CLEY0R5KAK	COIL , SPEAKER	0.5UH K	1	EA
L505	CLEY0R5KAK	COIL , SPEAKER	0.5UH K	1	EA
RY94	HSL1A008ZE	RELAY	SDT-S-112DMR	1	EA
TH91	KRTP42T7D330B	THERMAL SENSOR , POSISTOR	P42T7D330BW20	1	EA
T902	CLT5J033ZU	TRANS , SUB	SR-68	1	EA
	CTW3+8J	SCREW	SCREW	2	EA
PCB , POWER TRANS		**CUP11916-3,4**			
Capacitors					
C105	HCBS1H103ZFT	CAP , CERAMIC	0.01UF 50V	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , POWER TRANS		**CUP11916-3,4**			
C106	CCFT1H104ZF	CAP , SEMICONDUCTOR	0.1UF 50V ZF	1	EA
C107	HCBS1H103ZFT	CAP , CERAMIC	0.01UF 50V	1	EA
C108	HCBS1H103ZFT	CAP , CERAMIC	0.01UF 50V	1	EA
C109	CCFT1H104ZF	CAP , SEMICONDUCTOR	0.1UF 50V ZF	1	EA
C117	CCEA1HH4R7T	CAP , ELECT	4.7UF 50V	1	EA
C118	HCBS1H103ZFT	CAP , CERAMIC	0.01UF 50V	1	EA
C119	CCEA1JH470TS	CAP , ELECT	63V/47UF/105'C	1	EA
C120	CCEA1JH470TS	CAP , ELECT	63V/47UF/105'C	1	EA
C121	HCBS1H103ZFT	CAP , CERAMIC	0.01UF 50V	1	EA
C122	CCEA1JH101E	CAP , ELECT	100UF 63V	1	EA
C125	CCFT1H473ZF	CAP, CERAMIC	0.047UF 50V ZF	1	EA
C126	CCFT1H473ZF	CAP, CERAMIC	0.047UF 50V ZF	1	EA
C128	CCEA1EH102E	CAP , ELECT	1000UF 25V	1	EA
C129	CCEA1EH222E	CAP , ELECT	2200UF 25V	1	EA
C131	CCEA1HH4R7T	CAP , ELECT	4.7UF 50V	1	EA
C919	CCKT1H102KB	CAP , CERAMIC	1000PF 50V	1	EA
C920	CCEA1HH470T	CAP , ELECT	47UF 50V	1	EA
C921	HCQI1H104JZT	CAP , MYLAR	0.1UF 50V J	1	EA
C922	HCQI1H104JZT	CAP , MYLAR	0.1UF 50V J	1	EA
C923	HCQI1H104JZT	CAP , MYLAR	0.1UF 50V J	1	EA
C924	HCQI1H104JZT	CAP , MYLAR	0.1UF 50V J	1	EA
C925	HCQI1H103JZT	CAP , MYLAR	0.01UF 50V J	1	EA
C926	HCQI1H103JZT	CAP , MYLAR	0.01UF 50V J	1	EA
C927	HCQI1H103JZT	CAP , MYLAR	0.01UF 50V J	1	EA
C928	HCQI1H103JZT	CAP , MYLAR	0.01UF 50V J	1	EA
C931	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V J	1	EA
C932	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V J	1	EA
C933	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V J	1	EA
C934	HCQI1H473JZT	CAP , MYLAR	0.047UF 50V J	1	EA
C104	HCBS1H103ZFT	CAP , CERAMIC	0.01UF 50V	1	EA
Semiconductors					
D101	HVDMTZJ15BT	DIODE , ZENER	15V 1/2W	1	EA
D102	HVDMTZJ27BT	DIODE , ZENER	27V 1/2W	1	EA
D104	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D105	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D108	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D109	HVDMTZJ12BT	DIODE , ZENER	12V 1/2W	1	EA
D111	HVDMTZJ12BT	DIODE , ZENER	12V 1/2W	1	EA
D114	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D115	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D116	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D117	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D118	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D119	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D120	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D121	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D124	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D125	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D991	HVDKBU804F	DIODE , BRIDGE	KBU804F	1	EA
D992	HVDKBU804F	DIODE , BRIDGE	KBU804F	1	EA
Q104	HVTKSC2316YT	TRANSISTOR NPN	KSC2316Y	1	EA
Q911	HVTKTA1267YT	TRANSISTOR PNP	KTA1267Y	1	EA
Q912	HVTKTC3198YT	TRANSISTOR NPN	KTC3198Y	1	EA
Q913	HVTKTC3198YT	TRANSISTOR NPN	KTC3198Y	1	EA
Resistors					
R101	CRD25FJ3R3T	RES , CARBON	3.3 OHM 1/4W J	1	EA
R104	KRQ1AJR47H	RES , FUSE	0.47 OHM 1W J	1	EA
R105	KRQ1AJR47H	RES , FUSE	0.47 OHM 1W J	1	EA
R106	CRQ1AJR33H	RES , FUSE	0.33 OHM 1W J	1	EA
R107	CRQ1AJR33H	RES , FUSE	0.33 OHM 1W J	1	EA
R116	CRQ1AJR33H	RES , FUSE	0.33 OHM 1W J	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , POWER TRANS		**CUP11916-3,4**			
R117	CRQ1AJR33H	RES , FUSE	0.33 OHM 1W J	1	EA
R108	CRD20TJ4R7T	RES , CARBON	4.7 OHM 1/5W J	1	EA
R109	CRD20TJ100T	RES , CARBON	10 OHM 1/5W J	1	EA
R110	CRD20TJ4R7T	RES , CARBON	4.7 OHM 1/5W J	1	EA
R112	CRD20TJ122T	RES , CARBON	1.2K OHM 1/5W J	1	EA
R113	CRD20TJ473T	RES , CARBON	47K OHM 1/5W J	1	EA
R120	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R917	CRD20TJ153T	RES , CARBON	15K OHM 1/5W J	1	EA
R918	CRD20TJ153T	RES , CARBON	15K OHM 1/5W J	1	EA
R919	CRD20TJ153T	RES , CARBON	15K OHM 1/5W J	1	EA
R920	CRD20TJ153T	RES , CARBON	15K OHM 1/5W J	1	EA
R921	CRD20TJ153T	RES , CARBON	15K OHM 1/5W J	1	EA
R922	CRD20TJ153T	RES , CARBON	15K OHM 1/5W J	1	EA
R923	CRD25TJ153T	RES , CARBON	15K OHM 1/5W J	1	EA
R924	CRD20TJ153T	RES , CARBON	15K OHM 1/5W J	1	EA
R925	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R926	CRD25TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R927	CRD20TJ104T	RES , CARBON	100K OHM 1/5W J	1	EA
R928	CRD20TJ333T	RES , CARBON	33K OHM 1/5W J	1	EA
Miscellaneous					
CN13	CJP05GA01ZY	CON WAFER YMW025-05R	WAFER	1	EA
CN19	CJP03GA90ZY	WAFER	WAFER	1	EA
CN20	CJP04GA90ZM	WAFER	WAFER	1	EA
CN81	CJP08GA01ZY	WAFER, STRAIGHT, 8PIN	WAFER	1	EA
BN96	CWB1C909150BM	WIRE ASS'Y	WIRE	1	EA
BN99	CWB1B908270EN	WIRE ASS'Y	WIRE	1	EA
PCB , DIGITAL IN/OUT		**CUP11916-1**			
BN17	KJP12GB143ZP	DIP SOCKET	SOCKET	1	EA
C750	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C751	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C754	HCBS1H181KBT	CAP , CERAMIC	180PF 50V	1	EA
C757	CCFT1H104ZF	CAP , SEMICONDUCTOR	0.1UF 50V ZF	1	EA
C760	CCFT1H473ZF	CAP, CERAMIC	0.047UF 50V ZF	1	EA
C761	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
IC72	HVI74HCU04AFNG	I.C , INVERTER	TOSHIBA	1	EA
JK75	HJSTORX177L	MODULE , OPTICAL(RX)	OPTICAL JACK	1	EA
JK76	HJSTORX177L	MODULE , OPTICAL(RX)	OPTICAL JACK	1	EA
JK78	CJJ4S022Z	JACK , BOARD	JACK	1	EA
JK79	CJJ4N068Z	JACK , BOARD	JACK	1	EA
R750	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R751	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R757	CRD20TJ750T	RES , CARBON	75 OHM 1/5W J	1	EA
R765	CRD20TJ104T	RES , CARBON	100K OHM 1/5W J	1	EA
R766	CRD20TJ472T	RES , CARBON	4.7K OHM 1/5W J	1	EA
R767	CRD20TJ472T	RES , CARBON	4.7K OHM 1/5W J	1	EA
R768	CRD20TJ472T	RES , CARBON	4.7K OHM 1/5W J	1	EA
R770	CRD20TJ104T	RES , CARBON	100K OHM 1/5W J	1	EA
R771	CRD20TJ102T	RES , CARBON	1K OHM 1/5W J	1	EA
R776	CRD20TJ104T	RES , CARBON	100K OHM 1/5W J	1	EA
PCB , BIAS TR		**CUP11916-2**			
Capacitors					
C851	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C852	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C853	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C854	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C855	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , BIAS TR		**CUP11916-2**			
Semiconductors					
Q851	HVTKTD600KGR	TRANSISTOR , BIAS, NPN	KTD600KGR	1	EA
Q852	HVTKTD600KGR	TRANSISTOR , BIAS, NPN	KTD600KGR	1	EA
Q853	HVTKTD600KGR	TRANSISTOR , BIAS, NPN	KTD600KGR	1	EA
Q854	HVTKTD600KGR	TRANSISTOR , BIAS, NPN	KTD600KGR	1	EA
Q855	HVTKTD600KGR	TRANSISTOR , BIAS, NPN	KTD600KGR	1	EA
Resistors					
R874	CRD20TJ331T	RES , CARBON	330 OHM 1/5W J	1	EA
R875	CRD20TJ331T	RES , CARBON	330 OHM 1/5W J	1	EA
R876	CRD20TJ331T	RES , CARBON	330 OHM 1/5W J	1	EA
R877	CRD20TJ331T	RES , CARBON	330 OHM 1/5W J	1	EA
R878	CRD20TJ331T	RES , CARBON	330 OHM 1/5W J	1	EA
R882	CRD20TJ122T	RES , CARBON	1.2K OHM 1/5W J	1	EA
R883	CRD20TJ122T	RES , CARBON	1.2K OHM 1/5W J	1	EA
R884	CRD20TJ122T	RES , CARBON	1.2K OHM 1/5W J	1	EA
R885	CRD20TJ122T	RES , CARBON	1.2K OHM 1/5W J	1	EA
R886	CRD20TJ122T	RES , CARBON	1.2K OHM 1/5W J	1	EA
VR81	HVN1RA221B01T	RES , SEMI FIXED(220 OHM)	RH0615C100221	1	EA
VR82	HVN1RA221B01T	RES , SEMI FIXED(220 OHM)	RH0615C100221	1	EA
VR83	HVN1RA221B01T	RES , SEMI FIXED(220 OHM)	RH0615C100221	1	EA
VR84	HVN1RA221B01T	RES , SEMI FIXED(220 OHM)	RH0615C100221	1	EA
VR85	HVN1RA221B01T	RES , SEMI FIXED(220 OHM)	RH0615C100221	1	EA
Miscellaneous					
CN31	CJP02GA19ZY	WAFER, 2PIN	WAFER	1	EA
CN32	CJP02GA19ZY	WAFER, 2PIN	WAFER	1	EA
CN33	CJP02GA19ZY	WAFER, 2PIN	WAFER	1	EA
CN34	CJP02GA19ZY	WAFER, 2PIN	WAFER	1	EA
CN35	CJP02GA19ZY	WAFER, 2PIN	WAFER	1	EA
PCB , REGULATOR		**CUP11916-5,6**			
Capacitors					
C902	HCBS1H223ZFT	CAP , CERAMIC	0.022UF 50V	1	EA
C903	HCBS1H223ZFT	CAP , CERAMIC	0.022UF 50V	1	EA
C906	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C907	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C908	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C935	HCBS1H223ZFT	CAP , CERAMIC	0.022UF 50V	1	EA
C936	HCBS1H223ZFT	CAP , CERAMIC	0.022UF 50V	1	EA
C937	HCBS1H223ZFT	CAP , CERAMIC	0.022UF 50V	1	EA
C938	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C939	CCEA1EH101T	CAP , ELECT	100UF 25V	1	EA
C940	CCEA1EH101T	CAP , ELECT	100UF 25V	1	EA
C912	CCEA0JKR3222E	CAP , ELECT	2200UF 6.3V	1	EA
C929	CCEA1VH102E	CAP , ELECT	1000UF 35V	1	EA
C930	CCEA1VH102E	CAP , ELECT	1000UF 35V	1	EA
C941	CCEA1CH682E	CAP , ELECT	6800UF 16V	1	EA
Semiconductors					
IC89	HVIL7805CP	I.C, REGULATOR +5V	ST	1	EA
IC90	HVIL7815CP	I.C, REGULATOR +15V	ST	1	EA
IC91	HVIL7915CP	I.C, REGULATOR -15V	ST	1	EA
IC93	HVIL7905CP	I.C, REGULATOR -5V	ST	1	EA
IC94	HVIL7805CP	I.C, REGULATOR +5V	ST	1	EA
IC95	HVINJM7809FA	I.C , REGULATOR +9V	JRC	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , REGULATOR		**CUP11916-5,6**			
Resistors					
R912	CRD20TJ153T	RES , CARBON	15K OHM 1/5W J	1	EA
R913	CRD20TJ153T	RES , CARBON	15K OHM 1/5W J	1	EA
Miscellaneous					
BN20	CWB1C905200BM	WIRE ASS'Y	WIRE	1	EA
BN43	CWB1C904200BM	WIRE ASS'Y	WIRE	1	EA
BN95	CWB1C903080EN	WIRE ASS'Y	WIRE	1	EA
CN89	CJP02GA01ZY	WAFER, STRAIGHT, 2PIN	WAFER	1	EA
CN95	CJP03GA19ZY	WAFER, STRAIGHT, 3PIN	WAFER	1	EA
CN96	CJP09GA01ZY	CON WAFER YMW025-09R	WAFER	1	EA
CN98	HJP08GB131ZK	WAFER	WAFER	1	EA
CN99	CJP08GA19ZY	WAFER, STRAIGHT, 8PIN	WAFER	1	EA
PCB , INPUT		**CUP11912-1**			
Capacitors					
C201	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C202	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C203	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C204	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C205	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C206	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C209	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C210	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C211	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C212	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C213	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C214	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C215	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C216	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C219	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C220	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C221	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C222	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C223	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C224	CCUS1H221JA	CAP , CHIP	220PF	1	EA
C260	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C269	CCUS1A105KC	CAP , CHIP	1UF	1	EA
C274	CCUS1A105KC	CAP , CHIP	1UF	1	EA
C277	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C279	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C280	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C289	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C290	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C291	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C293	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C299	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C301	CCUS1H471JA	CAP , CHIP	470PF	1	EA
C302	CCUS1H471JA	CAP , CHIP	470PF	1	EA
C303	CCUS1H471JA	CAP , CHIP	470PF	1	EA
C304	CCUS1H471JA	CAP , CHIP	470PF	1	EA
C305	CCUS1H471JA	CAP , CHIP	470PF	1	EA
C306	CCUS1H471JA	CAP , CHIP	470PF	1	EA
C309	CCUS1H332KC	CAP , CHIP	3300PF	1	EA
C310	CCUS1H332KC	CAP , CHIP	3300PF	1	EA
C311	CCUS1H332KC	CAP , CHIP	3300PF	1	EA
C312	CCUS1H332KC	CAP , CHIP	3300PF	1	EA
C313	CCUS1H332KC	CAP , CHIP	3300PF	1	EA
C314	CCUS1H332KC	CAP , CHIP	3300PF	1	EA
C317	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C318	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , INPUT		**CUP11912-1**			
C319	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C321	CCUS1H561JA	CAP , CHIP	560PF	1	EA
C322	CCUS1H561JA	CAP , CHIP	560PF	1	EA
C323	CCUS1H561JA	CAP , CHIP	560PF	1	EA
C324	CCUS1H561JA	CAP , CHIP	560PF	1	EA
C325	CCUS1H561JA	CAP , CHIP	560PF	1	EA
C326	CCUS1H561JA	CAP , CHIP	560PF	1	EA
C327	CCUS1H561JA	CAP , CHIP	560PF	1	EA
C328	CCUS1H561JA	CAP , CHIP	560PF	1	EA
C329	CCUS1H561JA	CAP , CHIP	560PF	1	EA
C330	CCUS1H561JA	CAP , CHIP	560PF	1	EA
C331	CCUS1H561JA	CAP , CHIP	560PF	1	EA
C332	CCUS1H561JA	CAP , CHIP	560PF	1	EA
C337	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C338	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C339	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C350	CCUS1H332KC	CAP , CHIP	3300PF	1	EA
C351	CCUS1H332KC	CAP , CHIP	3300PF	1	EA
C352	CCUS1H332KC	CAP , CHIP	3300PF	1	EA
C353	CCUS1H332KC	CAP , CHIP	3300PF	1	EA
C354	CCUS1H332KC	CAP , CHIP	3300PF	1	EA
C355	CCUS1H332KC	CAP , CHIP	3300PF	1	EA
C369	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C370	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C381	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C382	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C383	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C384	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C385	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C386	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C391	CCUS1H151JA	CAP , CHIP	150PF	1	EA
C392	CCUS1H151JA	CAP , CHIP	150PF	1	EA
C393	CCUS1H151JA	CAP , CHIP	150PF	1	EA
C394	CCUS1H102KC	CAP , CHIP	1000PF	1	EA
C395	CCUS1H151JA	CAP , CHIP	150PF	1	EA
C396	CCUS1H151JA	CAP , CHIP	150PF	1	EA
C601	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C603	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C605	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C607	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C609	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C611	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C613	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C615	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C617	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C619	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C621	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C623	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C625	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C627	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C629	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C631	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C701	CCUS1H150JA	CHIP, CAP 15PF/50V/1608	15PF	1	EA
C702	CCUS1H150JA	CHIP, CAP 15PF/50V/1608	15PF	1	EA
C704	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C705	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C707	CCUS1H102KC	CAP , CHIP	1000PF	1	EA
C708	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C718	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C719	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C722	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C723	CCUS1H473KC	CAP , CHIP	0.047UF	1	EA
C725	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C727	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C729	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , INPUT		**CUP11912-1**			
C731	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C733	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C734	CCUS1H102KC	CAP , CHIP	1000PF	1	EA
C735	CCUS1H470JA	CAP , CHIP	47PF	1	EA
C738	CCUS1A105KC	CAP , CHIP	1UF	1	EA
C739	CCUS1H103KC	CAP , CHIP	0.01UF	1	EA
C741	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C742	CCUS1H180JA	CHIP, CAP 18PF/50V/1608	18PF	1	EA
C743	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C744	CCUS1H180JA	CHIP, CAP 18PF/50V/1608	18PF	1	EA
C745	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C746	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C747	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C748	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C751	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C757	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C760	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C761	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C765	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C768	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C769	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C770	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C771	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C772	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C773	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C261	CCEA1EH470T	CAP , ELECT	47UF 25V	1	EA
C262	CCEA1EH470T	CAP , ELECT	47UF 25V	1	EA
C263	CCEA1EH470T	CAP , ELECT	47UF 25V	1	EA
C264	CCEA1EH470T	CAP , ELECT	47UF 25V	1	EA
C265	CCEA1EH470T	CAP , ELECT	47UF 25V	1	EA
C266	CCEA1EH470T	CAP , ELECT	47UF 25V	1	EA
C267	CCEA1EH470T	CAP , ELECT	47UF 25V	1	EA
C268	CCEA1EH470T	CAP , ELECT	47UF 25V	1	EA
C272	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C273	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C275	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C276	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C281	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C282	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C283	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C284	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C285	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C286	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C292	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C294	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C341	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C342	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C343	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C344	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C345	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C346	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C349	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C358	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C359	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C360	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C371	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C372	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C373	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C374	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C375	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C376	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C389	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C390	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C600	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C602	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , INPUT		**CUP11912-1**			
C604	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C606	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C608	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C610	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C612	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C614	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C616	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C618	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C620	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C622	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C624	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C626	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C628	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C630	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C703	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C706	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C717	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C720	CCEA1AH471T	CAP , ELECT	470UF 10V	1	EA
C721	CCEA1AH471T	CAP , ELECT	470UF 10V	1	EA
C724	CCEA1AH471T	CAP , ELECT	470UF 10V	1	EA
C726	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C728	CCEA1AH471T	CAP , ELECT	470UF 10V	1	EA
C730	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C736	CCEA1HH2R2T	CAP , ELECT	2.2UF 50V	1	EA
C737	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C740	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C749	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C764	CCEA0JH102T	CAP , ELECT	1000UF 6.3V	1	EA
C766	CCEA0JH102T	CAP , ELECT	1000UF 6.3V	1	EA
C732	CCEA0JKR3222E	CAP , ELECT	2200UF 6.3V	1	EA
Semiconductors					
D201	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D202	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D203	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D204	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D207	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D208	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D209	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D210	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D211	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D212	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D213	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D214	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D215	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
D216	CVD1SS355T	CHIP , DIODE	1SS355T	1	EA
IC20	CVINJW1197FC2	IC , SW(WITH VOLUME)	JRC	1	EA
IC21	HVINJM2068MDTE1	I.C , DUAL OP AMP	JRC	1	EA
IC22	HVINJM2068MDTE1	I.C , DUAL OP AMP	JRC	1	EA
IC23	HVINJM2068MDTE1	I.C , DUAL OP AMP	JRC	1	EA
IC25	HVINJM2068MDTE1	I.C , DUAL OP AMP	JRC	1	EA
IC31	HVINJM2068MDTE1	I.C , DUAL OP AMP	JRC	1	EA
IC32	HVINJM2068MDTE1	I.C , DUAL OP AMP	JRC	1	EA
IC33	HVINJM2068MDTE1	I.C , DUAL OP AMP	JRC	1	EA
IC72	HVI74HCU04AFNG	I.C , INVERTER	TOSHIBA	1	EA
IC73	HVIAK4589VQ-T	I.C , CODEC + DIR	ASAHI KASEI	1	EA
IC75	CVICS49510-CQ	I.C , DSP	CIRRUS LOGIC	1	EA
IC76	HVIM29W800DT70N	I.C, 4M FLASH MEMORY	ST	1	EA
IC78	HVINJM2391DL133	I.C , CHIP REGULATOR (+3.3V)	JRC	1	EA
IC79	HVILM1117S-1V8	I.C , REGULATOR (1.8V)	ETC	1	EA
IC88	HVILM1117S-3V3	I.C , REGULATOR (3.3V)	ETC	1	EA
IC89	CVIM24C32WMN6TP	I.C , EEPROM (32 Kbit)	ST	1	EA
IC90	CVIT5CC1	I.C , FLASH U-COM	TOSHIBA	1	EA
IC91	HVI74ACT04MTR	I.C , HEX	TOSHIBA	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , INPUT		**CUP11912-1**			
Q729	HVTKRC107S	TR , CHIP NPN	KRC107S	1	EA
Q730	HVTKRC107S	TR , CHIP NPN	KRC107S	1	EA
Q732	HVTKRC107S	TR , CHIP NPN	KRC107S	1	EA
Q734	HVTKRC107S	TR , CHIP NPN	KRC107S	1	EA
D221	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D222	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D703	CVD1N4003ST	RECT , DIODE	1N4003	1	EA
D704	CVD1N4003SRT	RECT , DIODE	1N4003	1	EA
IC87	HVIRE5VT28CATZ	IC , RESET	RICOH	1	EA
Q301	HVTKTC2874BT	TRANSISTOR , MUTE, NPN	KTC2874B	1	EA
Q302	HVTKTC2874BT	TRANSISTOR , MUTE, NPN	KTC2874B	1	EA
Q303	HVTKTC2874BT	TRANSISTOR , MUTE, NPN	KTC2874B	1	EA
Q304	HVTKTC2874BT	TRANSISTOR , MUTE, NPN	KTC2874B	1	EA
Q305	HVTKTC2874BT	TRANSISTOR , MUTE, NPN	KTC2874B	1	EA
Q306	HVTKTC2874BT	TRANSISTOR , MUTE, NPN	KTC2874B	1	EA
Q311	HVTKTC2874BT	TRANSISTOR , MUTE, NPN	KTC2874B	1	EA
IC36	HVIL7808CP	I.C , REGULATOR (+8V)	ST	1	EA
IC37	HVINJM7908FA	I.C REGULATOR -8V	JRC	1	EA
Resistors					
RN61	CRJ104DJ103T	RES, ARRAY, 10K (1608)	10K OHM/1608*4	1	EA
RN62	CRJ104DJ103T	RES, ARRAY, 10K (1608)	10K OHM/1608*4	1	EA
RN63	CRJ104DJ103T	RES, ARRAY, 10K (1608)	10K OHM/1608*4	1	EA
RN64	CRJ104DJ101T	RES, ARRAY, 100R (1608)	100 OHM/1608*4	1	EA
RN65	CRJ104DJ101T	RES, ARRAY, 100R (1608)	100 OHM/1608*4	1	EA
RN66	CRJ104DJ101T	RES, ARRAY, 100R (1608)	100 OHM/1608*4	1	EA
RN71	CRJ104DJ103T	RES, ARRAY, 10K (1608)	10K OHM/1608*4	1	EA
RN72	CRJ104DJ103T	RES, ARRAY, 10K (1608)	10K OHM/1608*4	1	EA
RN73	CRJ104DJ103T	RES, ARRAY, 10K (1608)	10K OHM/1608*4	1	EA
RN74	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN75	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN76	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN77	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN78	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN79	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN80	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN81	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN82	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN83	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN84	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN85	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN86	CRJ104DJ103T	RES, ARRAY, 10K (1608)	10K OHM/1608*4	1	EA
RN87	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN88	CRJ104DJ103T	RES, ARRAY, 10K (1608)	10K OHM/1608*4	1	EA
RN89	CRJ104DJ103T	RES, ARRAY, 10K (1608)	10K OHM/1608*4	1	EA
RN90	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN91	CRJ104DJ330T	RES , 4ARRAY (1608*4)	33 OHM/1608*4	1	EA
RN92	CRJ104DJ101T	RES, ARRAY, 100R (1608)	100 OHM/1608*4	1	EA
R201	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R202	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R203	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R204	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R205	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R206	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R209	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R210	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R211	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R212	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R213	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R214	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R215	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R216	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R219	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R220	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , INPUT		**CUP11912-1**			
R221	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R222	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R223	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R224	CRJ10DJ272T	RES , CHIP	2.7K OHM	1	EA
R227	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R228	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R229	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R230	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R231	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R232	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R235	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R236	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R237	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R238	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R239	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R240	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R241	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R242	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R245	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R246	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R247	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R248	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R249	CRJ10DJ474T	RES , CHIP	470K OHM	1	EA
R250	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R253	CRJ10DJ4R7T	RES , CHIP	4.7 OHM	1	EA
R254	CRJ10DJ4R7T	RES , CHIP	4.7 OHM	1	EA
R256	CRJ10DJ4R7T	RES , CHIP	4.7 OHM	1	EA
R257	CRJ10DJ4R7T	RES , CHIP	4.7 OHM	1	EA
R258	CRJ10DJ4R7T	RES , CHIP	4.7 OHM	1	EA
R259	CRJ10DJ4R7T	RES , CHIP	4.7 OHM	1	EA
R260	CRJ10DJ4R7T	RES , CHIP	4.7 OHM	1	EA
R261	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R262	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R263	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R264	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R265	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R266	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R271	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R272	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R273	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R274	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R275	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R276	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R281	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R282	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R283	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R284	CRJ10DJ912T	RES , CHIP	9.1K OHM	1	EA
R285	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R286	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R291	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R292	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R293	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R294	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R295	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R296	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R301	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R302	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R303	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R304	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R305	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R306	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R307	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R308	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R309	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R310	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , INPUT		**CUP11912-1**			
R311	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R312	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R317	CRJ10DJ561T	RES , CHIP	560 OHM	1	EA
R318	CRJ10DF3920T	RES. CHIP (392R 1%)	392 OHM	1	EA
R321	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R322	CRJ10DJ122T	RES , CHIP	1.2K OHM	1	EA
R323	CRJ10DJ122T	RES , CHIP	1.2K OHM	1	EA
R324	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R325	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R326	CRJ10DJ122T	RES , CHIP	1.2K OHM	1	EA
R327	CRJ10DJ122T	RES , CHIP	1.2K OHM	1	EA
R328	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R329	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R330	CRJ10DJ122T	RES , CHIP	1.2K OHM	1	EA
R331	CRJ10DJ122T	RES , CHIP	1.2K OHM	1	EA
R332	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R341	CRJ10DJ122T	RES , CHIP	1.2K OHM	1	EA
R344	CRJ10DJ122T	RES , CHIP	1.2K OHM	1	EA
R345	CRJ10DJ122T	RES , CHIP	1.2K OHM	1	EA
R348	CRJ10DJ122T	RES , CHIP	1.2K OHM	1	EA
R349	CRJ10DJ122T	RES , CHIP	1.2K OHM	1	EA
R352	CRJ10DJ122T	RES , CHIP	1.2K OHM	1	EA
R361	CRJ10DJ104T	RES , CHIP	100K OHM	1	EA
R362	CRJ10DJ104T	RES , CHIP	100K OHM	1	EA
R363	CRJ10DJ104T	RES , CHIP	100K OHM	1	EA
R364	CRJ10DJ104T	RES , CHIP	100K OHM	1	EA
R365	CRJ10DJ104T	RES , CHIP	100K OHM	1	EA
R366	CRJ10DJ104T	RES , CHIP	100K OHM	1	EA
R371	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R372	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R373	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R374	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R375	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R376	CRJ10DJ512T	RES , CHIP	5.1K OHM	1	EA
R381	CRJ10DJ561T	RES , CHIP	560 OHM	1	EA
R382	CRJ10DJ561T	RES , CHIP	560 OHM	1	EA
R383	CRJ10DJ561T	RES , CHIP	560 OHM	1	EA
R384	CRJ10DJ561T	RES , CHIP	560 OHM	1	EA
R385	CRJ10DJ561T	RES , CHIP	560 OHM	1	EA
R386	CRJ10DJ561T	RES , CHIP	560 OHM	1	EA
R389	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R390	CRJ10DJ184T	RES , CHIP	180K OHM	1	EA
R391	CRJ10DF3920T	RES. CHIP (392R 1%)	392 OHM	1	EA
R392	CRJ10DF3920T	RES. CHIP (392R 1%)	392 OHM	1	EA
R393	CRJ10DF3920T	RES. CHIP (392R 1%)	392 OHM	1	EA
R394	CRJ10DF3920T	RES. CHIP (392R 1%)	392 OHM	1	EA
R395	CRJ10DF3920T	RES. CHIP (392R 1%)	392 OHM	1	EA
R396	CRJ10DF3920T	RES. CHIP (392R 1%)	392 OHM	1	EA
R701	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R702	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R709	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R710	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R714	CRJ10DJ104T	RES , CHIP	100K OHM	1	EA
R715	CRJ10DJ104T	RES , CHIP	100K OHM	1	EA
R716	CRJ10DJ472T	RES , CHIP	4.7K OHM	1	EA
R717	CRJ10DJ3R3T	RES , CHIP	3.3 OHM	1	EA
R718	CRJ10DJ123T	RES , CHIP	12K OHM	1	EA
R719	CRJ10DJ473T	RES , CHIP	47K OHM	1	EA
R720	CRJ10DJ473T	RES , CHIP	47K OHM	1	EA
R721	CRJ10DJ330T	RES , CHIP	33 OHM	1	EA
R723	CRJ10DJ2R7T	RES , CHIP	2.7 OHM	1	EA
R724	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R725	CRJ10DJ473T	RES , CHIP	47K OHM	1	EA
R726	CRJ10DJ473T	RES , CHIP	47K OHM	1	EA
R727	CRJ10DJ473T	RES , CHIP	47K OHM	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , INPUT		**CUP11912-1**			
R728	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R729	CRJ10DJ123T	RES , CHIP	12K OHM	1	EA
R730	CRJ10DJ123T	RES , CHIP	12K OHM	1	EA
R737	CRJ10DJ330T	RES , CHIP	33 OHM	1	EA
R739	CRJ10DJ1R0T	RES , CHIP	1 OHM	1	EA
R740	CRJ10DJ820T	RES , CHIP	820 OHM	1	EA
R741	CRJ10DJ330T	RES , CHIP	820 OHM	1	EA
R742	CRJ10DJ330T	RES , CHIP	33 OHM	1	EA
R743	CRJ10DJ330T	RES , CHIP	33 OHM	1	EA
R744	CRJ10DJ0R0T	RES , CHIP	0 OHM	1	EA
R746	CRJ10DJ0R0T	RES , CHIP	0 OHM	1	EA
R747	CRJ10DJ330T	RES , CHIP	33 OHM	1	EA
R748	CRJ10DJ330T	RES , CHIP	33 OHM	1	EA
R751	CRJ10DJ330T	RES , CHIP	33 OHM	1	EA
R752	CRJ10DJ330T	RES , CHIP	33 OHM	1	EA
R753	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R754	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R756	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R759	CRJ10DJ330T	RES , CHIP	33 OHM	1	EA
R760	CRJ10DJ105T	RES , CHIP	1M OHM	1	EA
R765	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R766	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R767	CRJ10DJ301T	RES , CHIP	300 OHM	1	EA
R768	CRJ10DJ562T	RES , CHIP	5.6K OHM	1	EA
R773	CRJ10DJ332T	RES , CHIP	10 OHM	1	EA
R774	CRJ10DJ332T	RES , CHIP	10K OHM	1	EA
R775	CRJ10DJ332T	RES , CHIP	47K OHM	1	EA
R776	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R777	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R778	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R782	CRJ10DJ272T	RES , CHIP	2.7K OHM	1	EA
R783	CRJ10DJ272T	RES , CHIP	2.7K OHM	1	EA
R784	CRJ10DJ473T	RES , CHIP	47K OHM	1	EA
R785	CRJ10DJ104T	RES , CHIP	100K OHM	1	EA
R786	CRJ10DJ471T	RES , CHIP	470 OHM	1	EA
R787	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R788	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R789	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R790	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R793	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R794	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R795	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R796	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R712	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R732	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
Miscellaneous					
X702	HOX27000E180S	CRYSTAL , CHIP(27MHZ,SMD)	27MHZ	1	EA
L701	HLZ9Z014Z	CHIP , BEAD	HU-1H4516-600JT	1	EA
L702	HLZ9Z014Z	CHIP , BEAD	HU-1H4516-600JT	1	EA
L703	HLZ9Z014Z	CHIP , BEAD	HU-1H4516-600JT	1	EA
L704	HLZ9R005Z	BEAD CHIP 60(1608 SIZE)	HH-1M1608-600	1	EA
L705	HLZ9R005Z	BEAD CHIP 60(1608 SIZE)	HH-1M1608-600	1	EA
CN10	CJP04GB46ZY	WAFER	WAFER	1	EA
CN11	CJP13GA117ZY	WAFER , CARD CABLE	WAFER	1	EA
CN12	CJP21GA115ZY	WAFER , CARD CABLE	WAFER	1	EA
CN13	CJP13GA115ZY	WAFER , CARD CABLE	WAFER	1	EA
CN14	CJP09GA117ZY	WAFER	WAFER	1	EA
CN17	KJP12GB142ZP	PIN HEADER	WAFER	1	EA
CN18	CJP05GA19ZY	WAFER, STRAIGHT, 5PIN	WAFER	1	EA
CN19	CJP09GA117ZY	WAFER	WAFER	1	EA
CN20	CJP05GA01ZY	CON WAFER YMW025-05R	WAFER	1	EA
CN22	CJP06GA19ZY	WAFER, STRAIGHT, 6PIN	WAFER	1	EA
CN72	CJP17GA117ZY	WAFER	WAFER	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , INPUT		**CUP11912-1**			
JK11	CJJ4R019W	TERMINAL , IN/OUT	TERMINAL JACK	1	EA
JK12	CJJ4P014W	JACK , IN/OUT	TERMINAL JACK	1	EA
JK13	CJJ4R019W	TERMINAL , IN/OUT	TERMINAL JACK	1	EA
JK14	CJJ4P043W	JACK IN/OUT	JACK	1	EA
X701	HOX24576E150TF	CRYSTAL	24.576MHZ	1	EA
	CHG1A306	CUSHION	CUSHION	1	EA
PCB , VIDEO		**CUP11917Z**			
Capacitors					
C401	CCUS1H101JA	CAP , CHIP	100PF	1	EA
C402	CCUS1H101JA	CAP , CHIP	100PF	1	EA
C403	CCUS1H101JA	CAP , CHIP	100PF	1	EA
C461	CCUS1H223KC	CAP , CHIP	100PF	1	EA
C463	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C466	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C468	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C471	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C473	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C491	CCUS1H101JA	CAP , CHIP	100PF	1	EA
C492	CCUS1H101JA	CAP , CHIP	100PF	1	EA
C493	CCUS1H101JA	CAP , CHIP	100PF	1	EA
C501	CCUS1H103KC	CAP , CHIP	0.01UF	1	EA
C504	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C511	CCUS1H103KC	CAP , CHIP	0.01UF	1	EA
C521	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C525	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C531	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C535	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C539	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C543	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C548	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C552	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C553	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C554	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C555	CCUS1H272KC	CAP , CHIP	2700PF	1	EA
C559	CCUS1A105KC	CAP , CHIP	1UF	1	EA
C601	CCUS1H220JA	CAP , CHIP	22PF	1	EA
C603	CCUS1H220JA	CAP , CHIP	22PF	1	EA
C605	CCUS1H220JA	CAP , CHIP	22PF	1	EA
C611	CCUS1H220JA	CAP , CHIP	22PF	1	EA
C613	CCUS1H220JA	CAP , CHIP	22PF	1	EA
C615	CCUS1H220JA	CAP , CHIP	22PF	1	EA
C621	CCUS1H220JA	CAP , CHIP	22PF	1	EA
C623	CCUS1H220JA	CAP , CHIP	22PF	1	EA
C625	CCUS1H220JA	CAP , CHIP	22PF	1	EA
C672	CCUS1H104KC	CAP , CHIP	0.1UF	1	EA
C677	CCUS1H473KC	CAP , CHIP	0.047UF	1	EA
C701	CCUS1H330JA	CAP , CHIP	33PF	1	EA
C702	CCUS1H330JA	CAP , CHIP	33PF	1	EA
C705	CCUS1H181JA	CAP , CHIP	180PF	1	EA
C717	CCUS1H220JA	CAP , CHIP	22PF	1	EA
C721	CCUS1H560JA	CAP , CHIP	56PF	1	EA
C722	CCUS1H220JA	CAP , CHIP	22PF	1	EA
C731	CCUS1H220JA	CAP , CHIP	22PF	1	EA
C732	CCUS1H330JA	CAP , CHIP	33PF	1	EA
C733	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C736	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C741	CCUS1H223KC	CAP , CHIP	0.022UF	1	EA
C411	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C412	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C413	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C421	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C422	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , VIDEO		**CUP11917Z**			
C423	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C451	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C452	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C453	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C462	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C464	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C467	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C469	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C472	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C474	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C503	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C505	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C514	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C515	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C522	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C524	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C532	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C533	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C534	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C536	CCEA1AH471T	CAP , ELECT	470UF 10V	1	EA
C537	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C538	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C544	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C549	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C602	CCEA0JH102T	CAP , ELECT	1000UF 6.3V	1	EA
C604	CCEA0JH102T	CAP , ELECT	1000UF 6.3V	1	EA
C606	CCEA0JH102T	CAP , ELECT	1000UF 6.3V	1	EA
C612	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C614	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C616	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C622	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C624	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C626	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C671	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C673	CCEA1HH100T	CAP , ELECT	10UF 50V	1	EA
C676	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C678	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
C708	CCEA1HHR47T	CAP , ELECT	0.47UF 50V	1	EA
C711	CCEA1AH471T	CAP , ELECT	470UF 10V	1	EA
C723	CCEA1HH0R1T	CAP , ELECT	0.1UF 50V	1	EA
C725	HCQI1H682JZT	CAP , MYLAR	6800PF 50V J	1	EA
C726	CCEA1HH1R0T	CAP , ELECT	1UF 50V	1	EA
C734	CCEA1HH1R0T	CAP , ELECT	1UF 50V	1	EA
C737	CCEA1CH101T	CAP , ELECT	100UF 16V	1	EA
Semiconductors					
D502	HVDRLS4148SR	DIODE, SWITCHING, SMD TYPE	RLS4148 TE-11	1	EA
D505	HVDRLS4148SR	DIODE, SWITCHING, SMD TYPE	RLS4148 TE-11	1	EA
D512	HVDRLS4148SR	DIODE, SWITCHING, SMD TYPE	RLS4148 TE-11	1	EA
D514	HVDRLS4148SR	DIODE, SWITCHING, SMD TYPE	RLS4148 TE-11	1	EA
D741	HVDRLS4148SR	DIODE, SWITCHING, SMD TYPE	RLS4148 TE-11	1	EA
IC41	CVINJM2595MTE1	I.C , VIDEO S/W	JRC	1	EA
IC42	CVINJM2595MTE1	I.C , VIDEO S/W	JRC	1	EA
IC43	CVINJM2595MTE1	I.C , VIDEO S/W	JRC	1	EA
IC51	HVIHCF4053M013T	TRIPLE 2 CHANNEL ANALOG MULTIPLEXERS DEMULTIPLEXERS	ST	1	EA
IC52	HVIHCF4053M013T	TRIPLE 2 CHANNEL ANALOG MULTIPLEXERS DEMULTIPLEXERS	ST	1	EA
IC53	CVINJM2587V	NJM2587 (6CH VIDEO AMPLIFIER)	JRC	1	EA
IC54	HVIMM1511XNRE	IC, Y/C-MIX	MITSUMI	1	EA
IC61	CVINJW1321FP1	I.C , VIDEO S/W	JRC	1	EA
IC71	HVILC74763M	I.C , OSD	SANYO	1	EA
IC72	HVI74ACT04MTR	I.C , HEX	FAIRCHILD	1	EA
L551	CRJ10DJ0R0T	RES , CHIP	0 OHM	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , VIDEO		**CUP11917Z**			
Q505	HVTKRA107S	TRANSISTOR, CHIP PNP	KRA107S	1	EA
Q507	HVTKRC107S	TRANSISTOR, CHIP NPN	KRC107S	1	EA
Q512	HVTKRC107S	TRANSISTOR, CHIP NPN	KRC107S	1	EA
Q515	HVTKRA107S	TRANSISTOR, CHIP PNP	KRA107S	1	EA
Q516	HVTKRC107S	TRANSISTOR, CHIP NPN	KRC107S	1	EA
Q517	HVTKRC107S	TRANSISTOR, CHIP NPN	KRC107S	1	EA
Q518	HVTKRC107S	TRANSISTOR, CHIP NPN	KRC107S	1	EA
Q551	HVTKTD1304T	TRANSISTOR , CHIP (MUTE) NPN	KTD1304	1	EA
Q552	HVTKRA104S	TRANSISTOR, CHIP PNP	KRA104S	1	EA
Q555	HVTKTD1304T	TRANSISTOR , CHIP (MUTE) NPN	KTD1304	1	EA
Q556	HVTKRA104S	TRANSISTOR, CHIP PNP	KRA104S	1	EA
Q501	HVTKSA733CYT	TRANSISTOR PNP	KSA733CY	1	EA
Q504	HVTKTC2874BT	TRANSISTOR , MUTE NPN	KTC2874B	1	EA
Q511	HVTKSA733CYT	TRANSISTOR PNP	KSA733CY	1	EA
Q536	HVTKSA1175YT	TRANSISTOR PNP	KSA1175Y(DEAD)	1	EA
Q712	HVTKSA1175YT	TRANSISTOR PNP	KSA1175Y(DEAD)	1	EA
Q716	HVTKSC2785YT	TRANSISTOR NPN	KSC2785Y	1	EA
IC62	C3A206	WIRE , COPPER	WIRE		
Resistors					
R401	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R402	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R403	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R404	CRJ10DJ332T	RES , CHIP	3300 OHM	1	EA
R405	CRJ10DJ332T	RES , CHIP	3300 OHM	1	EA
R411	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R412	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R413	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R421	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R422	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R423	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R451	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R452	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R453	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R461	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R466	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R471	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R481	CRJ10DJ0R0T	RES , CHIP	0 OHM	1	EA
R482	CRJ10DJ0R0T	RES , CHIP	0 OHM	1	EA
R483	CRJ10DJ0R0T	RES , CHIP	0 OHM	1	EA
R491	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R492	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R493	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R501	CRJ10DJ333T	RES , CHIP	33K OHM	1	EA
R502	CRJ10DJ680T	RES , CHIP	68 OHM	1	EA
R503	CRJ10DJ123T	RES , CHIP	12K OHM	1	EA
R504	CRJ10DJ223T	RES , CHIP	22K OHM	1	EA
R505	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R506	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R507	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R511	CRJ10DJ333T	RES , CHIP	33K OHM	1	EA
R512	CRJ10DJ680T	RES , CHIP	68 OHM	1	EA
R513	CRJ10DJ123T	RES , CHIP	12K OHM	1	EA
R514	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R515	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R516	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R517	CRJ10DJ223T	RES , CHIP	22K OHM	1	EA
R518	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R521	CRJ10DJ100T	RES , CHIP	10 OHM	1	EA
R523	CRJ10DJ100T	RES , CHIP	10 OHM	1	EA
R531	CRJ10DJ100T	RES , CHIP	10 OHM	1	EA
R533	CRJ10DJ2R2T	RES , CHIP	2.2 OHM	1	EA
R534	CRJ10DJ100T	RES , CHIP	10 OHM	1	EA
R536	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , VIDEO		**CUP11917Z**			
R537	CRJ10DJ183T	RES , CHIP	18K OHM	1	EA
R539	CRJ10DJ181T	RES , CHIP	180 OHM	1	EA
R540	CRJ10DJ101T	RES , CHIP	100 OHM	1	EA
R541	CRJ10DJ181T	RES , CHIP	180 OHM	1	EA
R542	CRJ10DJ392T	RES . CHIP	3.9K OHM	1	EA
R543	CRJ10DJ1R8T	RES , CHIP	1.8 OHM	1	EA
R545	CRJ10DJ161T	RES , CHIP	160 OHM	1	EA
R546	CRJ10DJ181T	RES , CHIP	180 OHM	1	EA
R547	CRJ10DJ183T	RES , CHIP	18K OHM	1	EA
R548	CRJ10DJ1R0T	RES , CHIP	1 OHM	1	EA
R551	CRJ10DJ105T	RES , CHIP	1M OHM	1	EA
R552	CRJ10DJ223T	RES , CHIP	22K OHM	1	EA
R553	CRJ10DJ332T	RES , CHIP	3.3K OHM	1	EA
R555	CRJ10DJ562T	RES , CHIP	5.6K OHM	1	EA
R556	CRJ10DJ472T	RES , CHIP	4.7K OHM	1	EA
R601	CRJ10DJ680T	RES , CHIP	68 OHM	1	EA
R603	CRJ10DJ560T	RES , CHIP	56 OHM	1	EA
R605	CRJ10DJ620T	RES , CHIP	62 OHM	1	EA
R611	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R613	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R615	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R621	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R623	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R625	CRJ10DJ750T	RES , CHIP	75 OHM	1	EA
R674	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R675	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R701	CRJ10DJ0R0T	RES , CHIP	0 OHM	1	EA
R705	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R706	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R707	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R711	CRJ10DJ104T	RES , CHIP	100K OHM	1	EA
R712	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R713	CRJ10DJ223T	RES , CHIP	22K OHM	1	EA
R714	CRJ10DJ122T	RES , CHIP	2K OHM	1	EA
R715	CRJ10DJ822T	RES , CHIP	8.2K OHM	1	EA
R716	CRJ10DJ103T	RES , CHIP	10K OHM	1	EA
R717	CRJ10DJ271T	RES , CHIP	270 OHM	1	EA
R721	CRJ10DJ222T	RES , CHIP	2.2 OHM	1	EA
R724	CRJ10DJ393T	RES , CHIP	39J OHM	1	EA
R725	CRJ10DJ152T	RES , CHIP	1.5K OHM	1	EA
R726	CRJ10DJ682T	RES , CHIP	6.8K OHM	1	EA
R727	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R728	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R735	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R737	CRJ10DJ104T	RES , CHIP	100K OHM	1	EA
R742	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R743	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R744	CRJ10DJ102T	RES , CHIP	1K OHM	1	EA
R558	CRD20TJ222T	RES , CARBON	2.2K OHM 1/5W J	1	EA
R746	CRD20TJ103T	RES , CARBON	10K OHM 1/5W J	1	EA
R747	CRD20TJ332T	RES , CARBON	3.3K OHM 1/5W J	1	EA
Miscellaneous					
L731	KLQ5R6J405T	COIL, PEAKING(RADIAL)	5.6UH J 4X5	1	EA
L736	HLQ02C101JT	COIL , AXAIL	100UH,J	1	EA
BN14	CJP13GA117ZY	WAFER , CARD CABLE	WAFER	1	EA
CN41	CJP06GA19ZY	WAFER, STRAIGHT, 6PIN	WAFER	1	EA
CN43	CJP04GA01ZY	WAFER, STRAIGHT, 4PIN	WAFER	1	EA
C481	HCBS1H101KBT	CAP , CERAMIC	100PF 50V	1	EA
C483	HCBS1H101KBT	CAP , CERAMIC	100PF 50V	1	EA
C712	CCEA0JKR3222E	CAP , ELECT	2200UF 6.3V	1	EA
JK40	CJJ9P003Z	JACK , (S-VIDEO + CVBS)	KA7809-ABTU	1	EA
JK41	CJJ9R001Z	JACK , (S-VIDEO + CVBS)	JACK	1	EA
JK62	CJJ4R045Z	JACK , BOARD	JACK	1	EA

Ref. Designator	Part Number	Description		Qty	
PCB , VIDEO		**CUP11917Z**			
JK69	CJJ4S030Z	JACK , BOARD	JACK	1	EA
X701	HOX14318E220C	CRYSTAL	14.318Mhz	1	EA
CNVM9011MS071L	**AVR 144 TUNER MODULE**				

JRC

NJM2587

6CH VIDEO AMPLIFIER FOR DVD

■GENERAL DESCRIPTION

The NJM2587 is a dual supply voltage 6ch Video Amplifier. It includes 6dB amplifier and 75Ω driver, Low Pass Filter.

The input corresponds to the composite signal, the Y/C signal, and the component signal.

The NJM2587 is suitable for the DVD player and DVD recorder corresponding to the progressive video signal.
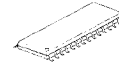
■ FEATURES
● Operating Voltage ±4.5 to ±5.5V
● 6dB amplifier
● Internal LPF
● Internal 75Ω Driver Circuit (2-system drive)
● Power Save Circuit
● Bipolar Technology
● Package Outline   SSOP32

■PACKAGE OUTLINE

NJM2587V

■BLOCK DIAGRAM

JRC
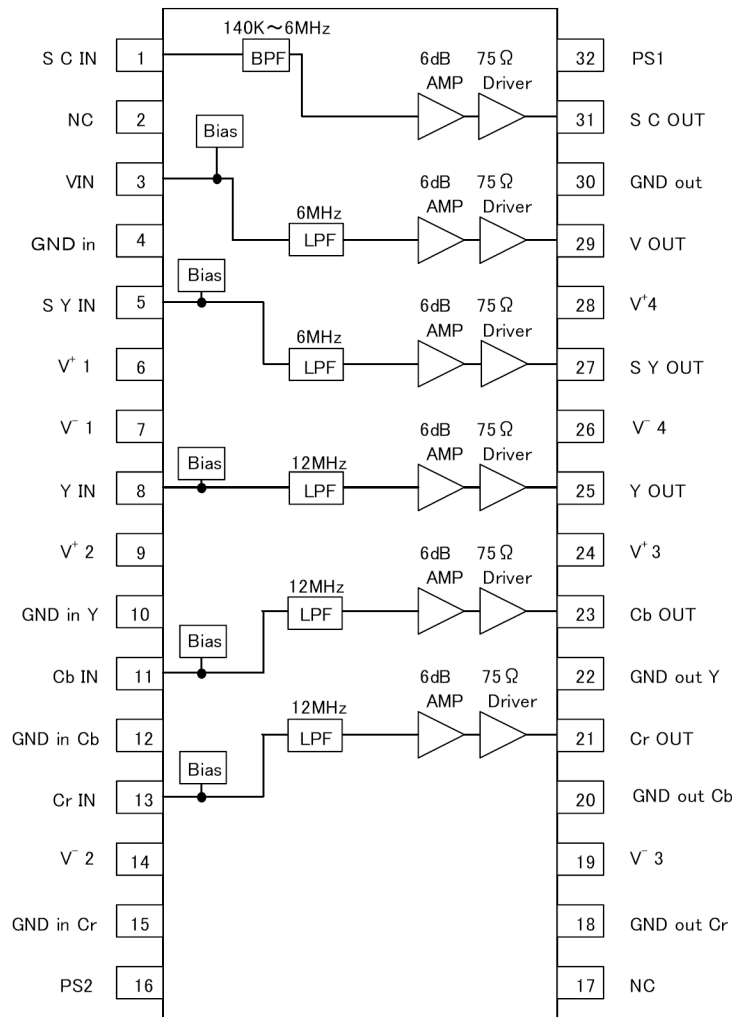
NJM2587

■ TERMINAL DESCRIPTION

No.	SYMBOL	EQUIVALENT CIRCUIT	VOLTAGE	NOTE
1	SCIN		-	
3 5 8 11 13	VIN SYIN YIN CbIN CrIN		0V	
4 10 12 15	GNDIN GNDINY GNDINCb GNDINCr		0V	
18 20 22 30	GNDOUTCr GNDOUTCb GNDOUTY GNDOUT		0V	

JRC   **NJM2587**

No.	SYMBOL	EQUIVALENT CIRCUIT	VOLTAGE	NOTE
25 27 29	YOUT SYOUT VOUT	V+ ... V−	-0.6V	
31	SCOUT	V+ ... V−	0.7V	
16 32	PS2 PS1	60k / 45k / GND	0V	
21 23	CrOUT CbOUT	V+ ... V−	-1.2V	

JRC   # NJW1321

WIDE BAND VIDEO SWITCH WITH I^{2}C BUS

■ GENERAL DESCRIPTION

The NJW1321 is a Wide Band Video Switch with I^{2}C BUS.

The NJW1321 includes switch of 4-input 2-output and 6dB amplifier. It is suitable for RGB or Y, Pb, and Pr signal because frequency range is 100MHz.

The NJW1321 includes external logic control terminals and external logic discernment terminals.

The NJW1321 is suitable for PTV, DTV, PDP and other high quality AV systems.

■ FEATURES
- ● Operating Voltage   +9.0V
- ● I^{2}C BUS Interface
- ● 4-input 2-output 3-Circuits
- ● Wide frequency range   0dB at 100MHz typ.
                                         -3dB at 300MHz typ.
- ● Internal 6dB amplifier (Selectable Bypass or 6dB)
- ● External logic discernment terminal
- ● External logic control terminal
- ● Selectable slave address
- ● Power Save Circuit
- ● Bi-CMOS Technology
- ● Package Outline   QFP48

■ PACKAGE OUTLINE

NJW1321FP1

■ BLOCK DIAGRAM
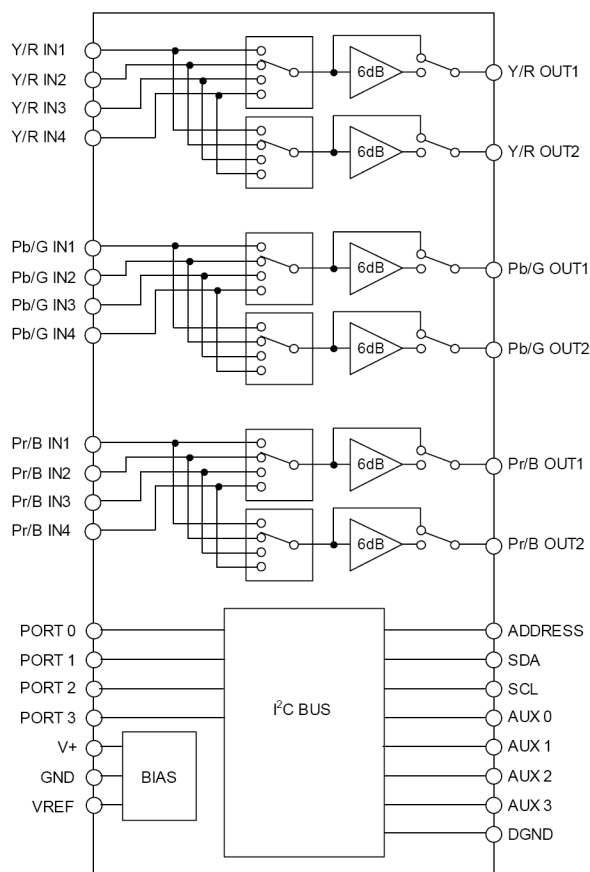
NJW1321

■PIN CONFIGURATION

Top pins (left to right): Pb IN4, V+, Y IN4, V+, Y OUT1, GND, Pb OUT1, GND, Pr OUT1, AUX3, AUX2, Y OUT2, AUX1, AUX0

Left pins (top to bottom): GND (39), Pr IN4, V+, Y IN3, GND, Pb IN3, V+, Pr IN3, GND, Y IN2 (48)

Right pins (top to bottom): Pb OUT2 (24), PORT0, PORT1, Pr OUT2, V+, VREF, DGND, GND, SDA, SCL (15)

Bottom pins (left to right): V+, Pb IN2, GND, Pr IN2, GND, Y IN1, V+, Pb IN1, V+, Pr IN1, GND, PORT3, PORT2, ADR

Corner markers: 38, 25, 1, 14
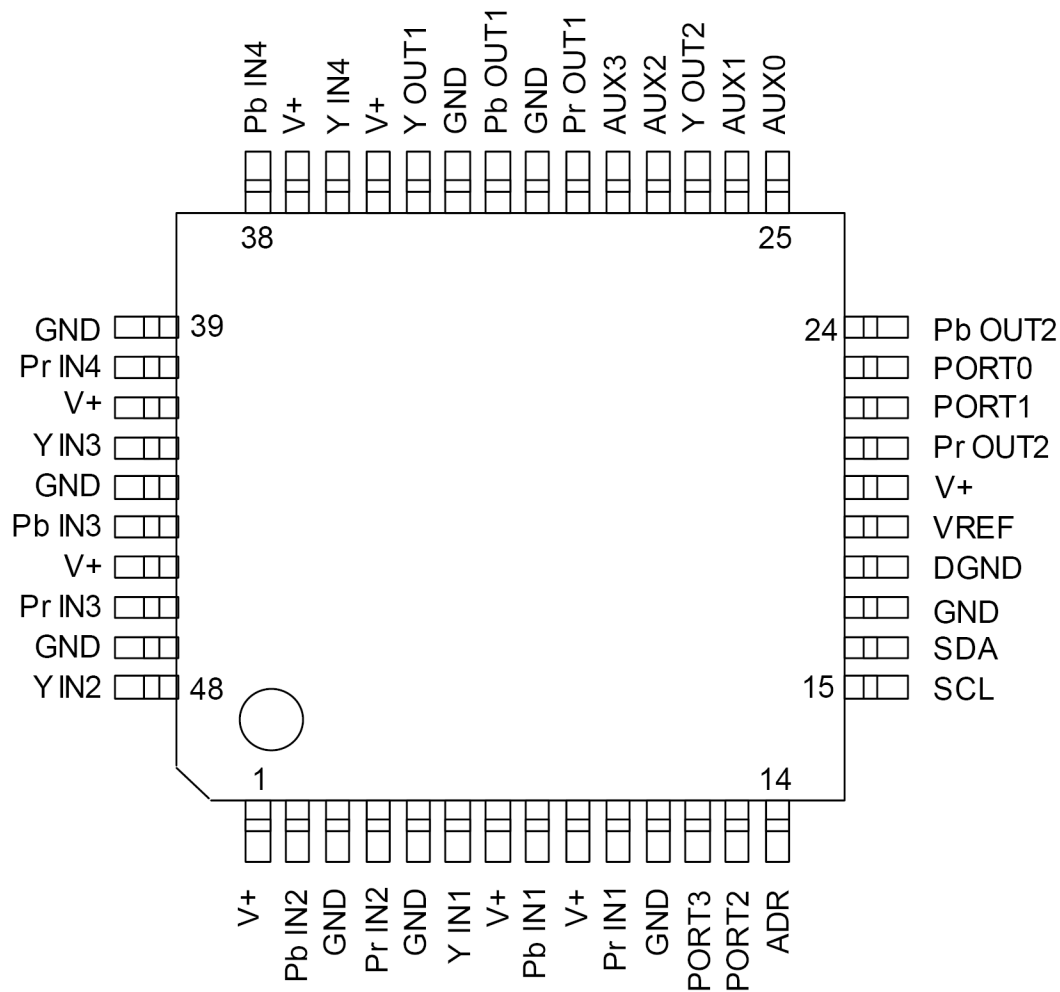
1. V+	13. PORT2	25. AUX0	37. V+
2. Pb IN2	14. ADR	26. AUX1	38. Pb IN4
3. GND	15. SCL	27. Y OUT2	39. GND
4. Pr IN2	16. SDA	28. AUX2	40. Pr IN4
5. GND	17. GND	29. AUX3	41. V+
6. Y IN1	18. DGND	30. Pr OUT1	42. Y IN3
7. V+	19. VREG	31. GND	43. GND
8. Pb IN1	20. V+	32. Pb OUT1	44. Pb IN3
9. V+	21. Pr OUT2	33. GND	45. V+
10. Pr IN1	22. PORT1	34. Y OUT1	46. Pr IN3
11. GND	23. PORT 0	35. V+	47. GND
12. PORT3	24. Pb OUT2	36. Y IN4	48. Y IN2

NJW1321

■EQUIVALENT CIRCUIT

PIN No.	NAME	FUNCTION	INSIDE EQUIVALENT CIRCUIT	VOLTAGE
6 8 10 48 2 4 42 44 46 36 38 40	Y IN1 Pb IN1 Pr IN1 Y IN2 Pb IN2 Pr IN2 Y IN3 Pb IN3 Pr IN3 Y IN4 Pb IN4 Pr IN4	Y,Pb,Pr Input RGB Input	150kΩ 100Ω	4.4V
34 32 30 27 24 21	Y OUT1 Pb OUT1 Pr OUT1 Y OUT2 Pb OUT2 Pr OUT2	Y,Pb,Pr Output RGB Output	50Ω	3.7V
23 22 13 12	PORT0 PORT1 PORT2 PORT3	Logic input terminal	66Ω 100kΩ	-
25 26 28 29	AUX0 AUX1 AUX2 AUX3	Auxiliary 3 values voltage output terminal	1kΩ 66Ω	0V 1.9V 5.0V

NJW1321

PIN No.	NAME	FUNCTION	INSIDE EQUIVALENT CIRCUIT	VOLTAGE
14	ADR	Slave address setting terminal		-
15 16	SCL SDA	I^2C clock terminal I^2C data terminal		-
19	VREF	Reference voltage terminal		4.8V
1 7 9 20 35 37 41 45	V+	Supply voltage terminal		-
3 5 11 17 31 33 39 43 47	GND	Ground terminal		-
18	DGND	Ground terminal		-

Hex inverter

74HCU04

FEATURES

- Output capability: standard
- I_{CC} category: SSI

GENERAL DESCRIPTION

The 74HCU04 is a high-speed Si-gate CMOS device and is pin compatible with low power Schottky TTL (LSTTL).
It is specified in compliance with JEDEC standard no. 7A.
The 74HCU04 is a general purpose hex inverter. Each of the six inverters is a single stage

QUICK REFERENCE DATA

GND = 0 V; T_{amb} = 25 °C; $t_r = t_f$ = 6 ns

SYMBOL	PARAMETER	CONDITIONS	TYP.	UNIT
t_{PHL}/ t_{PLH}	propagation delay nA to nY	C_L = 15 pF; V_{CC} = 5 V	5	ns
C_I	input capacitance		3.5	pF
C_{PD}	power dissipation capacitance per inverter	note 1	10	pF

Note

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_O)$$ where:

   f_i = input frequency in MHz

   f_o = output frequency in MHz

   C_L = output load capacitance in pF

   V_{CC} = supply voltage in V

   $\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs

ORDERING INFORMATION

See *"74HC/HCT/HCU/HCMOS Logic Package Information"*.

FUNCTION TABLE

INPUT	OUTPUT
nA	**nY**
L	H
H	L

Note

1. H = HIGH voltage level
   L = LOW voltage level

Hex inverter 74HCU04

PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
1, 3, 5, 9, 11, 13	1A to 6A	data inputs
2, 4, 6, 8, 10, 12	1Y to 6Y	data outputs
7	GND	ground (0 V)
14	V_{CC}	positive supply voltage
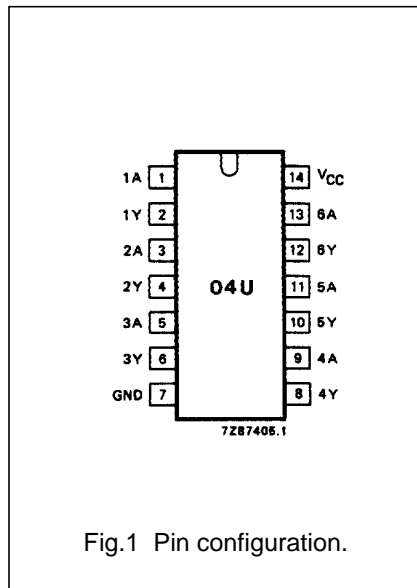
Fig.1 Pin configuration.
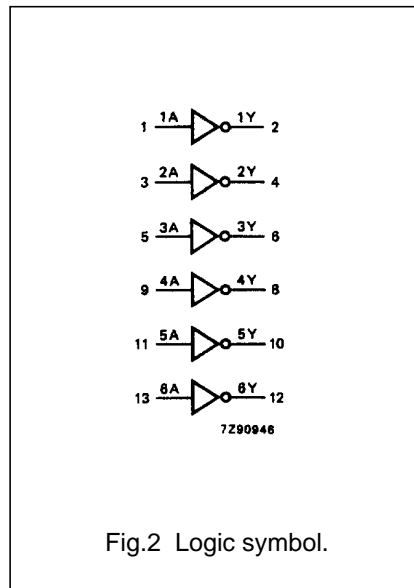
Fig.2 Logic symbol.
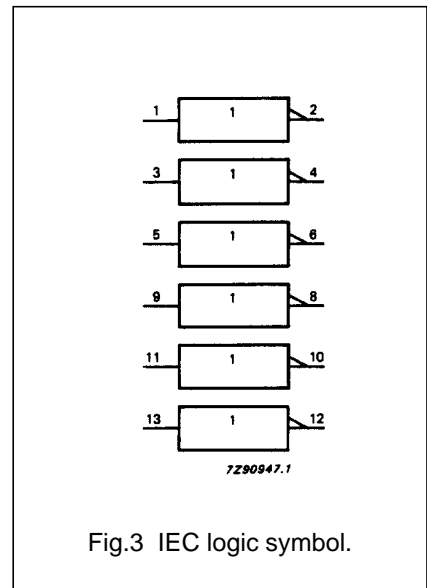
Fig.3 IEC logic symbol.
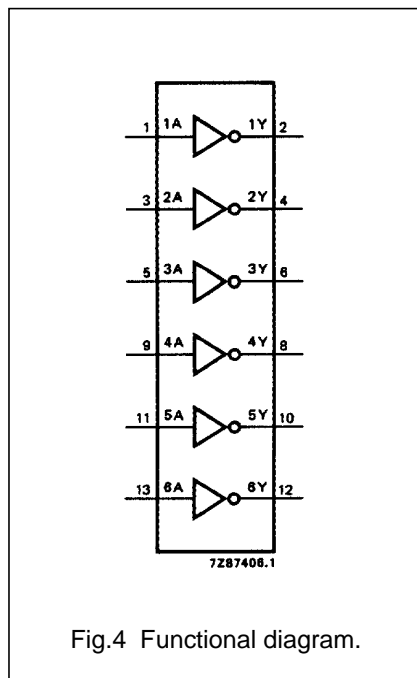
Fig.4 Functional diagram.
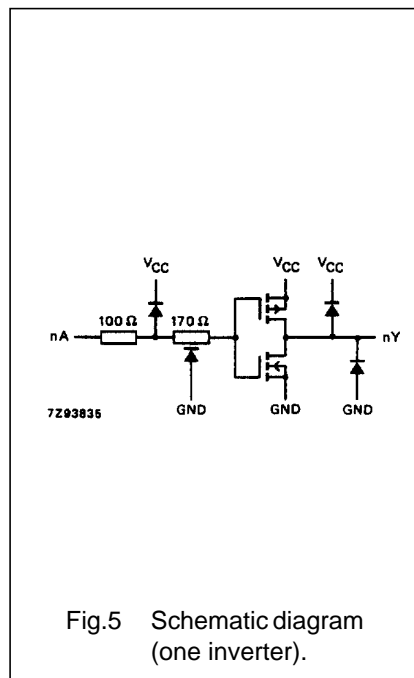
Fig.5   Schematic diagram
(one inverter).

74ACT04

HEX INVERTER

- HIGH SPEED: t_{PD} = 5.0ns (TYP.) at V_{CC} = 5V
- LOW POWER DISSIPATION:
  I_{CC} = 2µA(MAX.) at T_A=25°C
- COMPATIBLE WITH TTL OUTPUTS
  V_{IH} = 2V (MIN.), V_{IL} = 0.8V (MAX.)
- 50Ω TRANSMISSION LINE DRIVING
  CAPABILITY
- SYMMETRICAL OUTPUT IMPEDANCE:
  $|I_{OH}|$ = I_{OL} = 24mA (MIN)
- BALANCED PROPAGATION DELAYS:
  $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:
  V_{CC} (OPR) = 4.5V to 5.5V
- PIN AND FUNCTION COMPATIBLE WITH
  74 SERIES 04
- IMPROVED LATCH-UP IMMUNITY

DESCRIPTION

The 74ACT04 is an advanced high-speed CMOS
HEX INVERTER fabricated with sub-micron
silicon gate and double-layer metal wiring C^{2}MOS
technology.
The internal circuit is composed of 3 stages
including buffer output, which enables high noise
immunity and stable output.

| DIP | SOP | TSSOP |
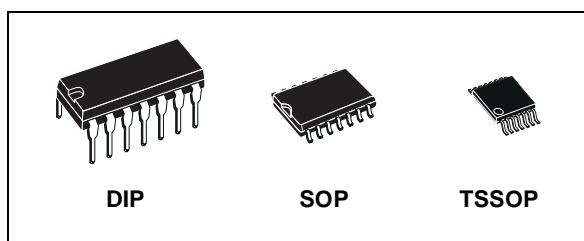
ORDER CODES

PACKAGE	TUBE	T & R
DIP	74ACT04B	
SOP	74ACT04M	74ACT04MTR
TSSOP		74ACT04TTR

The device is designed to interface directly High
Speed CMOS systems with TTL, NMOS and
CMOS output voltage levels.
All inputs and outputs are equipped with
protection circuits against static discharge, giving
them 2KV ESD immunity and transient excess
voltage.

PIN CONNECTION AND IEC LOGIC SYMBOLS

JRC
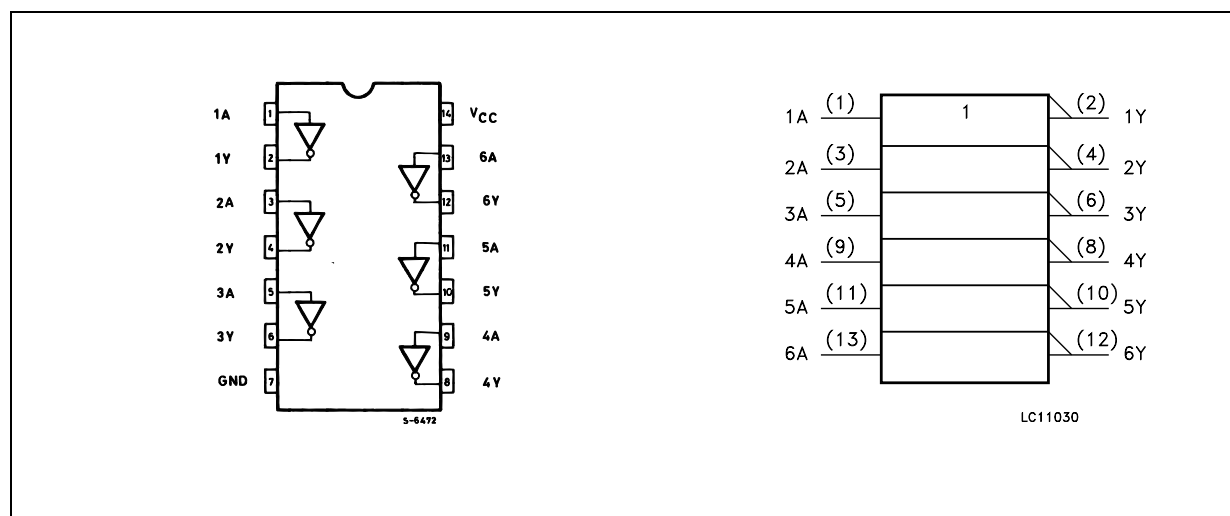
NJM2595

5-INPUT 3-OUTPUT VIDEO SWITCH

■ GENERAL DESCRIPTION

The **NJM2595** is a 5-input 3-output video switch. Its switches select one from five signals received from VTR,TV,DVD, TV-GAME and others.

The NJM2595 is designed for audio items, such as AV amplifier and others.

■ PACKAGE OUTLINE
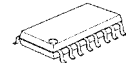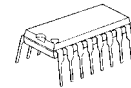
NJM2595D   **NJM2595M**

■ FEATURES
- 5-input 3-output
- Operating Voltage ±4.0 to ±6.5V
- Operating current ±15mAtyp. at Vcc=±5V
- Crosstalk   -65dBtyp.
- Internal 6dB Amplifier
- Internal 75Ω Driver
- Bipolar Technology
- Package Outline   DIP16,DMP16

■ PIN CONFIGURATION and BLOCK DIAGRAM
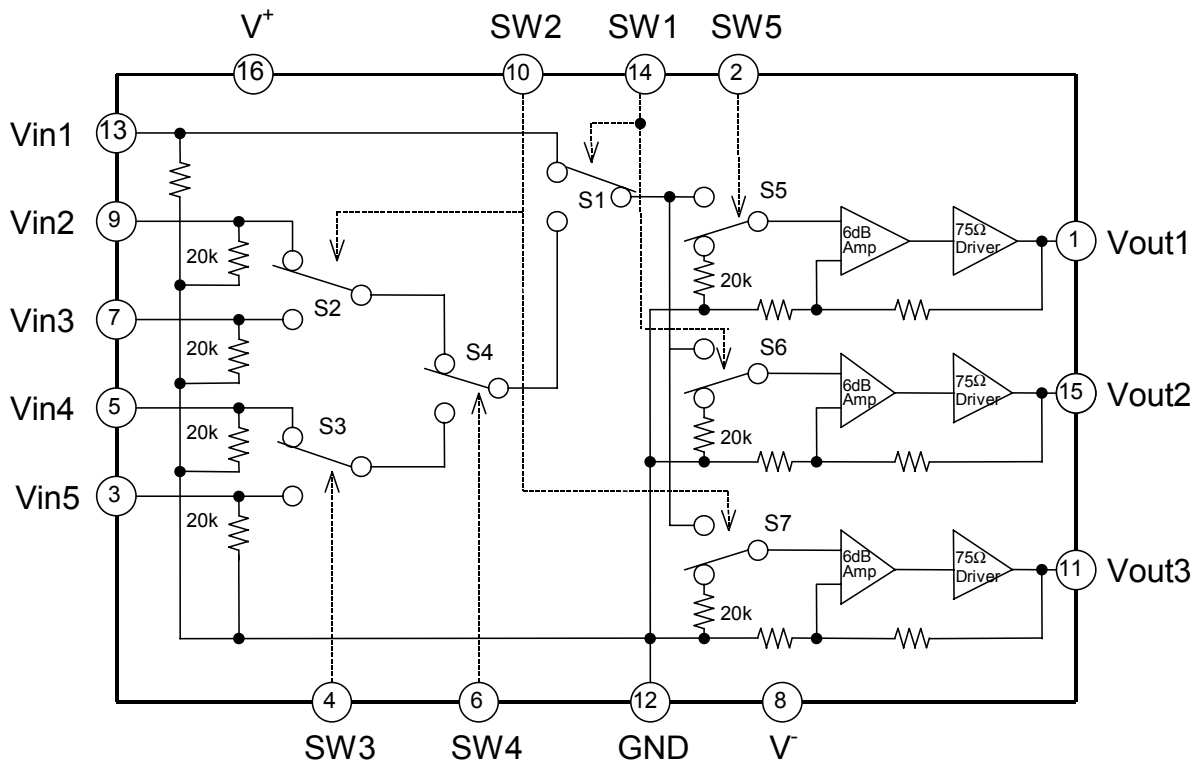
NJM2595

■ **EQUIVALENT CIRCUIT**

PIN No.	PIN NAME	INSIDE EQUIVALENT CIRCUIT	VOLTAGE
16	V$^+$		5V
8	V$^-$		-5V
12	GND		-
13 9 7 5 3	Vin1 Vin2 Vin3 Vin4 Vin5		0V
1 15 11	Vout1 Vout2 Vout3		0V
4 6 2	SW3 SW4 SW5		-

NJM2595

■ EQUIVALENT CIRCUIT

PIN No.	PIN NAME	INSIDE EQUIVALENT CIRCUIT	VOLTAGE
14 10	SW1 SW2		-

■ TEST CIRCUIT
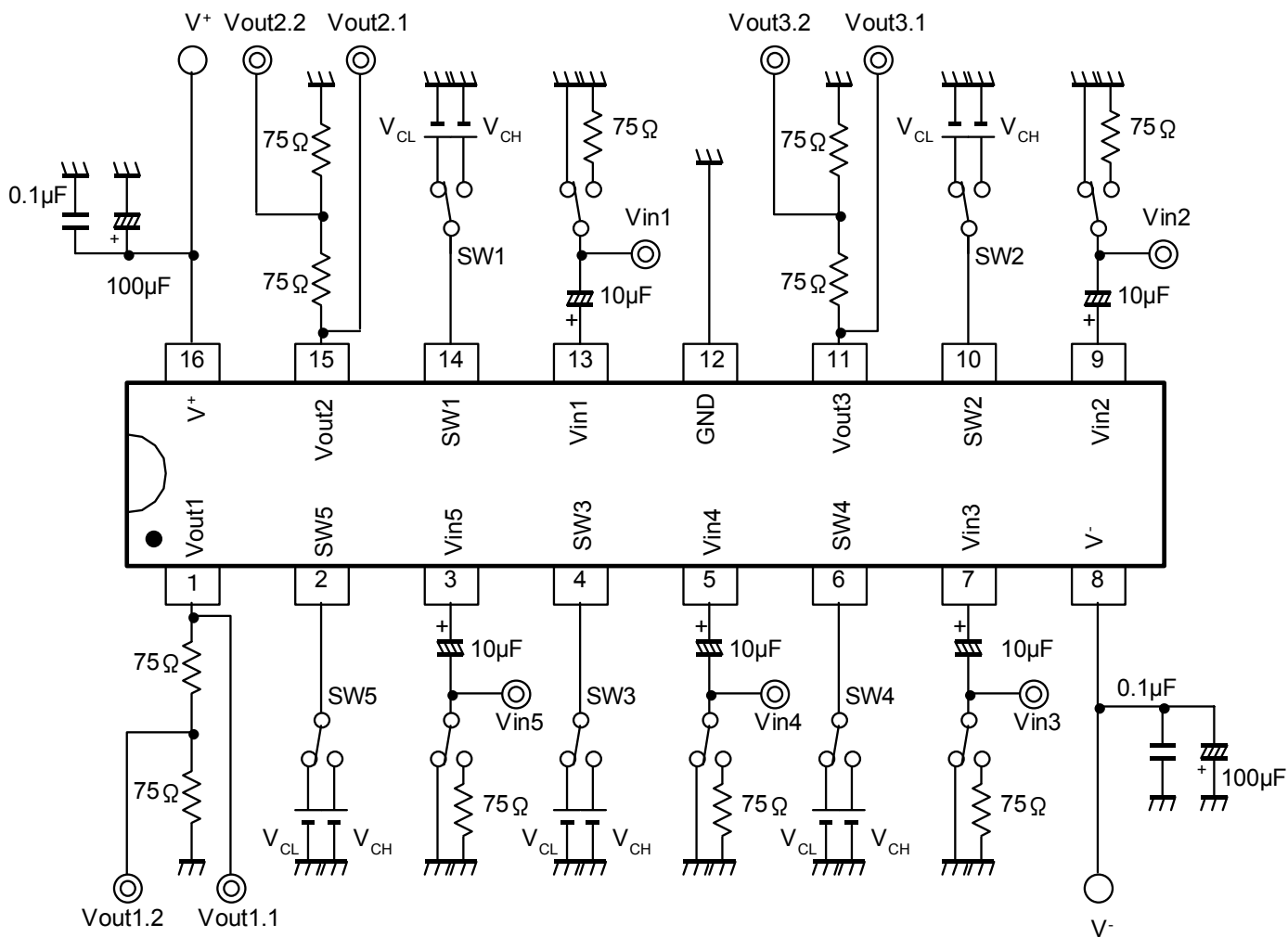
NJW1197FC2
[8-CHANNEL ELECTRONIC VOLUME WITH INPUT SELECTOR]

[STRUCTURE] Bi-CMOS
[CATEGORIES] 3D Surround & Sound Enhancement
[PACKAGE OUTLINE] QFP100-C2
[SOLDERING METHOD] For this device, soldering method is recommended Reflow.
[NOTE] –

■ABSOLUTE MAXIMUM RATINGS   Ta=25℃

BAE-45919-000-00

Power Supply Voltage	+8/-8 [V]	Operating Temperature Range	-40 to +75 [℃]
Maximum Input Voltage	V⁺/V⁻ [V]	Storage Temperature Range	-40 to +150 [℃]
Power Dissipation	1600 [mW] (Note)		

(Note) EIA/JEDEC STANDARD Test board (76.2 × 114.3 × 1.6mm, 2layer, FR-4) mounting.

■BLOCK DIAGRAM

BDE-45919-000-00
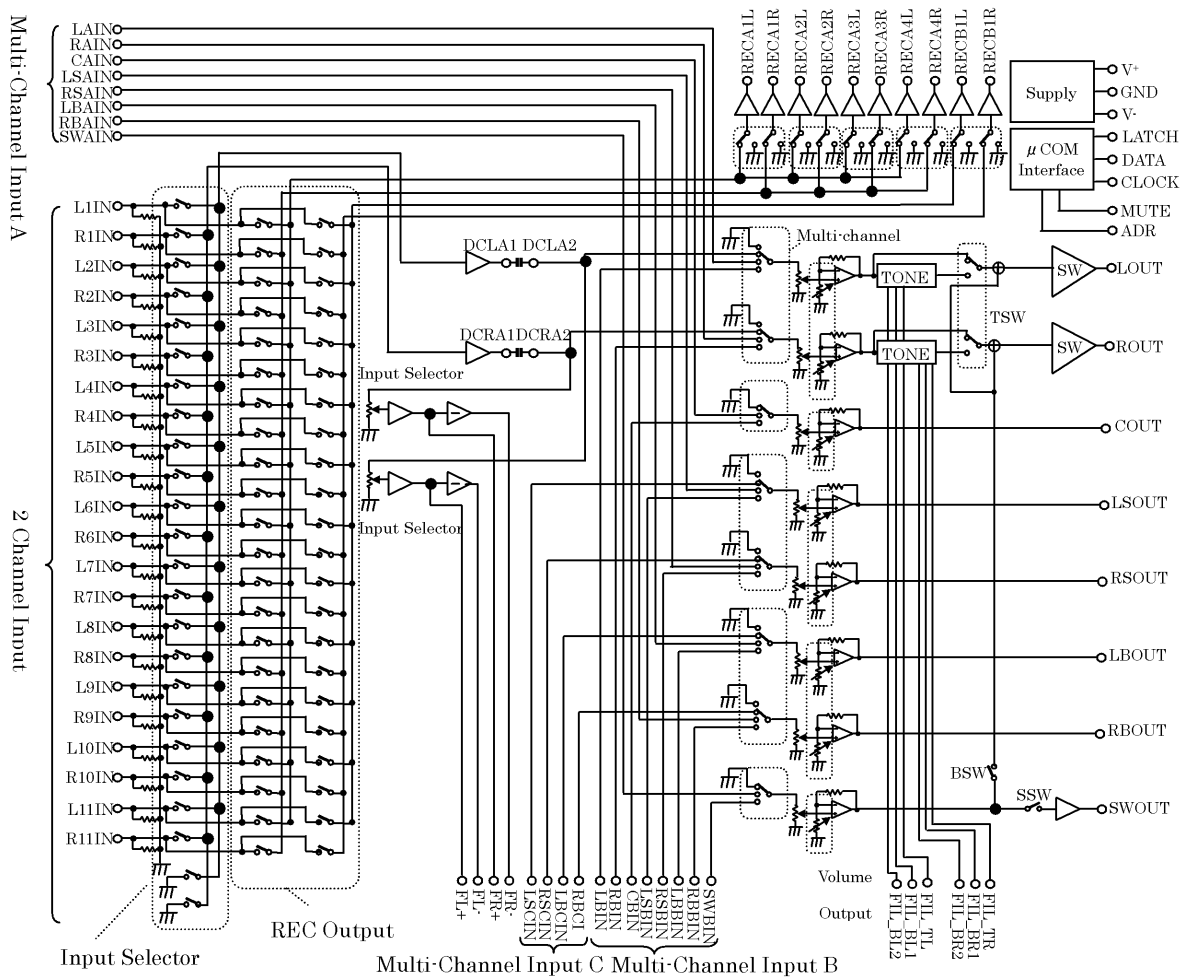
■PIN CONFIGURAITON   BEE-45919-000-00

(Top View)
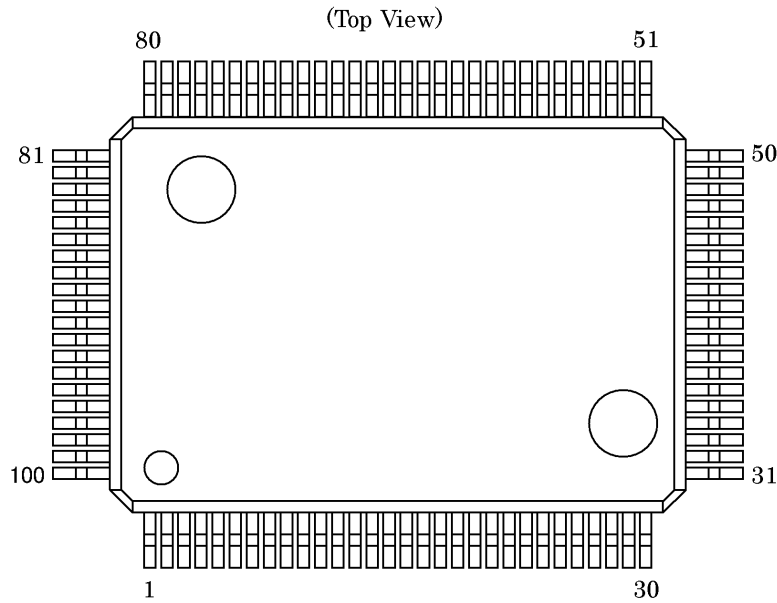
No.	SYMBOL	No.	SYMBOL	No.	SYMBOL	No.	SYMBOL
1	ROUT	26	DCCAP_RS	51	DCR_IN	76	GND
2	COUT	27	L3IN	52	DCR_OUT	77	LSCIN
3	LSOUT	28	DCCAP_LS	53	GND	78	RSCIN
4	RSOUT	29	R3IN	54	DCL_IN	79	LBCIN
5	LBOUT	30	DCCAP_C	55	DCL_OUT	80	RBCIN
6	RBOUT	31	L4IN	56	GND	81	GND
7	SWOUT	32	DCCAP_R	57	REC_B1R	82	LAIN
8	GND	33	R4IN	58	REC_B1L	83	RAIN
9	FIL_BL2	34	DCCAP_L	59	REC_A4R	84	CAIN
10	FIL_BL1	35	L5IN	60	REC_A4L	85	LSAIN
11	FIL_TL	36	GND	61	REC_A3R	86	RSAIN
12	TCAP	37	R5IN	62	REC_A3L	87	LBAIN
13	FIL_BR2	38	GND	63	REC_A2R	88	RBAIN
14	FIL_BR1	39	L6IN	64	REC_A2L	89	SWAIN
15	FIL_TR	40	L9IN	65	REC_A1R	90	GND
16	V⁺	41	R6IN	66	REC_A1L	91	LBIN
17	ADR	42	R9IN	67	VDDOUT	92	RBIN
18	V⁻	43	L7IN	68	DATA	93	CBIN
19	L1IN	44	L10IN	69	CLOCK	94	LSBIN
20	DCCAP_SW	45	R7IN	70	LATCH	95	RSBIN
21	R1IN	46	R10IN	71	MUTE	96	LBBIN
22	DCCAP_RB	47	L8IN	72	FL+	97	RBBIN
23	L2IN	48	L11IN	73	FL-	98	SWBIN
24	DCCAP_LB	49	R8IN	74	FR+	99	GND
25	R2IN	50	R11IN	75	FR-	100	LOUT

■FUNCTIONAL DESCRIPTION

(1) CONTROL DATA

NJW1197 control data is constructed with 16bits.

MSB   LSB

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Data								Select Address				Chip Address			

MSB   LSB

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
L channel Volume Control								0	0	0	0	*	*	*	*
R channel Volume Control								0	0	0	1	*	*	*	*
C channel Volume Control								0	0	1	0	*	*	*	*
LS channel Volume Control								0	0	1	1	*	*	*	*
RS channel Volume Control								0	1	0	0	*	*	*	*
LB channel Volume Control								0	1	0	1	*	*	*	*
RB channel Volume Control								0	1	1	0	*	*	*	*
SW channel Volume Control								0	1	1	1	*	*	*	*
Input Selector Gain Control		Input Selector					SSW	1	0	0	0	*	*	*	*
TC/B	Tone Control Treble					TSW	BSW	*	1	0	0	1	*	*	*	*
BC/B	Tone Control Bass				*	*	*	1	0	1	0	*	*	*	*
REC B Selector			Input Selector			1	0	1	1	*	*	*	*
SWch Volume Output Gain Control		REC B1	REC A4	REC A3	REC A2	REC A1	1	1	0	0	*	*	*	*
L, Rch Volume Output Gain Control		Cch, Volume Output Gain Control		*	*	1	1	0	1	*	*	*	*
LS, RSch Volume Output Gain Control		LB, RBch Volume Output Gain Control		SWch Selector	1	1	1	0	*	*	*	*
L, Rch Selector		Cch Selector		LS, RSch Selector		LB, RBch Selector		1	1	1	1	*	*	*	*

*: Don't Care

* Chip address is set by chip address select terminal (ADR) status.

Chip Address Select Terminal (ADR: 17pin)	Chip Address			
	D3	D2	D1	D0
Low	0	1	0	0
High	0	1	0	1

* The mute function can be controlled externally. If the Mute control terminal (71pin) is switched to High, Multi-Channel outputs are muted immediately (hardware mute).

External mute control terminal (MUTE: 71pin)	Setting
Low	Mute cancellation
High	Mute

(2) INITIAL CONDTION

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
1	1	1	1	1	1	1	1	0	0	0	0	*	*	*	*
1	1	1	1	1	1	1	1	0	0	0	1	*	*	*	*
1	1	1	1	1	1	1	1	0	0	1	0	*	*	*	*
1	1	1	1	1	1	1	1	0	0	1	1	*	*	*	*
1	1	1	1	1	1	1	1	0	1	0	0	*	*	*	*
1	1	1	1	1	1	1	1	0	1	0	1	*	*	*	*
1	1	1	1	1	1	1	1	0	1	1	0	*	*	*	*
1	1	1	1	1	1	1	1	0	1	1	1	*	*	*	*
0	0	0	0	0	0	0	0	1	0	0	0	*	*	*	*
0	0	0	0	0	0	0	0	1	0	0	1	*	*	*	*
0	0	0	0	0	0	0	0	1	0	1	0	*	*	*	*
0	0	0	0	0	0	0	0	1	0	1	1	*	*	*	*
0	0	0	0	0	0	0	0	1	1	0	0	*	*	*	*
0	0	0	0	0	0	0	0	1	1	0	1	*	*	*	*
0	0	0	0	0	0	0	0	1	1	1	0	*	*	*	*
0	0	0	0	0	0	0	0	1	1	1	1	*	*	*	*

(3) DEFINITION OF RESISTOR

・Volume Control: 0dB to -100dB in 0.5dB/step.

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
L channel Volume Control								0	0	0	0	*	*	*	*
R channel Volume Control								0	0	0	1	*	*	*	*
C channel Volume Control								0	0	1	0	*	*	*	*
LS channel Volume Control								0	0	1	1	*	*	*	*
RS channel Volume Control								0	1	0	0	*	*	*	*
LB channel Volume Control								0	1	0	1	*	*	*	*
RB channel Volume Control								0	1	1	0	*	*	*	*
SW channel Volume Control								0	1	1	1	*	*	*	*

＜Volume Control Data＞

Data								Setting
D15	D14	D13	D12	D11	D10	D9	D8	
0	0	0	0	0	0	0	0	0dB
0	0	0	0	0	0	0	1	-0.5dB
0	0	0	0	0	0	1	0	-1dB
0	0	0	0	0	0	1	1	-1.5dB
0	0	0	0	0	1	0	0	-2dB
0	0	0	0	0	1	0	1	-2.5dB
0	0	0	0	0	1	1	0	-3dB
0	0	0	0	0	1	1	1	-3.5dB
0	0	0	0	1	0	0	0	-4dB
0	0	0	0	1	0	0	1	-4.5dB
0	0	0	0	1	0	1	0	-5dB
0	0	0	0	1	0	1	1	-5.5dB
0	0	0	0	1	1	0	0	-6dB
0	0	0	0	1	1	0	1	-6.5dB
0	0	0	0	1	1	1	0	-7dB
0	0	0	0	1	1	1	1	-7.5dB
0	0	0	1	0	0	0	0	-8dB
0	0	0	1	0	0	0	1	-8.5dB
0	0	0	1	0	0	1	0	-9dB
0	0	0	1	0	0	1	1	-9.5dB
0	0	0	1	0	1	0	0	-10dB
・・・								・・・
1	1	0	0	0	0	1	0	-97dB
1	1	0	0	0	0	1	1	-97.5dB
1	1	0	0	0	1	0	0	-98dB
1	1	0	0	0	1	0	1	-98.5dB
1	1	0	0	0	1	1	0	-99dB
1	1	0	0	0	1	1	1	-99.5dB
1	1	0	0	1	0	0	0	-100dB
1	1	1	1	1	1	1	1	MUTE(*)

(*): Initial Setting

■APPLICATION CIRCUIT

BHE-45919-000-00

CIRRUS LOGIC

Leading the Digital Entertainment Revolution
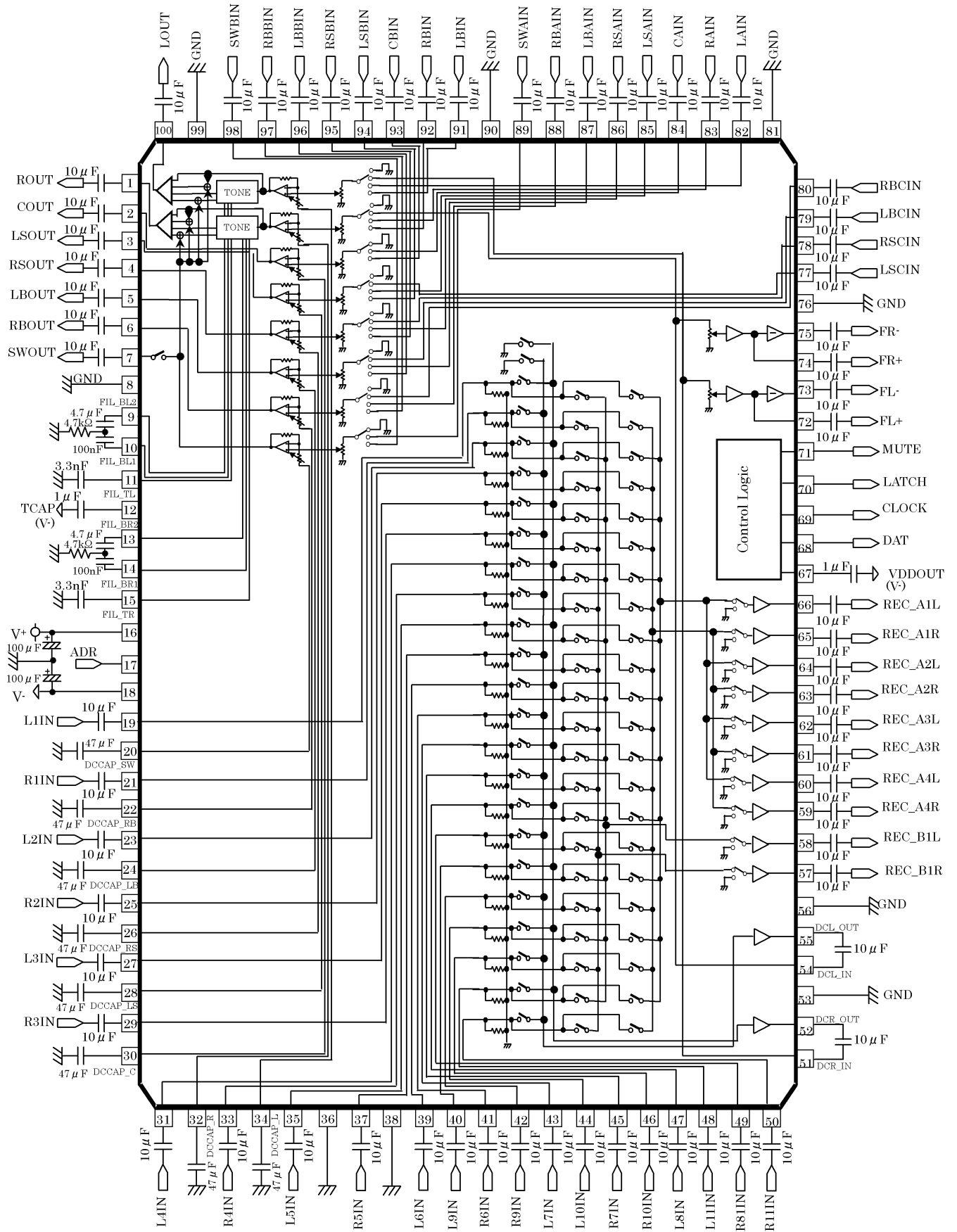
CS495xx Data Sheet

FEATURES

❏ Powerful 32-bit Dual-core Audio DSP

❏ Multi-standard 32-bit Audio Decoding plus Post Processing, Dual-decode Capable

❏ Framework Applications Library
   — Dolby® Digital Pro Logic® IIx, Dolby® Digital EX, Dolby® Digital Headphone™, Dolby® Digital Virtual Speaker™
   — DTS-ES 96/24™, DTS-ES™ Discrete 6.1, DTS-ES™ Matrix 6.1, DTS® Digital Surround
   — MPEG-2 Multichannel
   — AAC™ Multichannel 5.1
   — MP3 ~ MPEG-1/2, Layer III
   — THX® Surround EX™, THX® Ultra2 Cinema™
   — DVD Audio/Video/SACD Multichannel Bass Management

❏ 10 Channels of 32-bit Serial Audio Input

❏ 16 Channels of 32-bit PCM Output

❏ Two Master/slave SPI or I²C Format Control Ports for Audio Subsystem Management

❏ Parallel Host Control & UART

❏ Customer Software Security Keys

❏ Large On-chip X, Y, and Program RAM & ROM

❏ SDRAM, SRAM, and FLASH Memory Support

❏ Dual 192-kHz SPDIF Transmitters

32-bit Audio Decoder DSP Family

The CS495xx DSP family integrates two programmable, 32-bit DSP cores and a DMA engine with a full set of audio peripherals. Feature-rich AVR designs can be easily developed using the Framework applications library, which includes both certified application programs and a modular programming environment for easy customization. The framework includes certified state-of-the-art audio decoders, virtualizers, surround simulators, and audio enhancement algorithms.

The CS495xx family was designed to reduce system costs and development time and to provide advanced features and flexibility for competitive system-level solutions. The difficult processing tasks of Dolby® Digital Surround EX™, AAC mulitichannel, DTS-ES 96/24, and THX Ultra2 Cinema can be accomplished without the expense of external logic or memory. Additionally, the CS495xx can meet the needs of dual-decode applications with twin DSP cores, and audio-I/O-intensive designs with support for up to 10 input and 16 output channels.

Ordering Information

See page 33 for ordering information
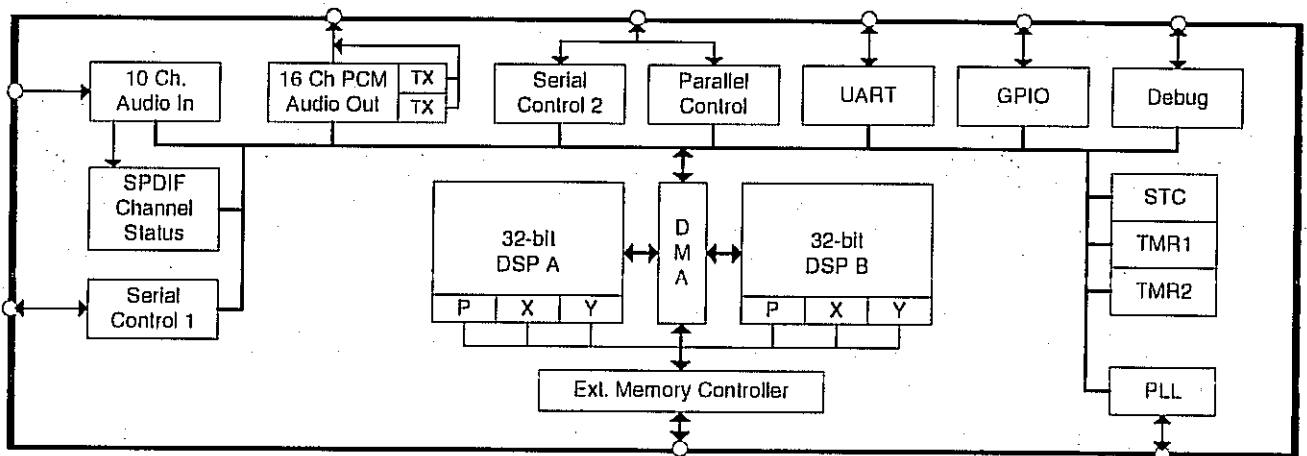
CIRRUS LOGIC
http://www.cirrus.com

NOV '05
DS631PP4

CS495xx Data Sheet
32-bit Audio Decoder DSP Family

Device	Firmware	Decoder	Mid-Processor	Post-Processor
CS495002 -CQZ 90 MHz 1080 MOPS -DQZ 80 MHz 960 MOPS	Firmware Pack	Dolby Digital DTS-ES DTS96/24 MPEG SGEN PCM (2Fs) AAC	PLIIx DTS Neo:6 Downmix Cirrus Original Surround	Tone Control Parametric EQ Bass Manager Delay
	Unbundled Code		Circle Surround (1Fs) Tru-Surround XT (1Fs)	Auto Speaker Setup (IRC1)
CS495102 *(Superset of CS495002)* -CQZ 110 MHz 1320 MOPS -DQZ 90 Mhz 1080 MOPS	Firmware Pack	Dolby Digital DTS-ES DTS96/24 DTS-ES96/24 MPEG SGEN PCM (2Fs) AAC	PLIIx DTS Neo:6 Downmix Cirrus Original Multichannel Surround	Tone Control Parametric EQ Bass Manager Delay
	Unbundled Code		Tru-Surround XT Circle Surround	Automatic Room EQ (IRC2) Dolby Headphone Dolby Headphone 2 Dolby Virtual Speaker Dolby Virtual Speaker 2
CS495202 *(Superset of CS495102)* -CQZ 120 MHz 1440 MOPS -DQZ 100 Mhz 1200 MOPS	Firmware Pack	Dolby Digital DTS-ES DTS96/24 DTS-ES96/24 MPEG SGEN PCM AAC	PLIIx DTS Neo:6 Downmix Cirrus Original Multichannel Surround	Tone Control 11-Band PEQ Bass Manager Delay THX Select THX Select2 THX Ultra2
	Unbundled Code		Tru-Surround XT Circle Surround	Automatic Room EQ (IRC2) Dolby Headphone Dolby Headphone 2 Dolby Virtual Speaker Dolby Virtual Speaker 2

Table 1. Device and Firmware Selection Guide

4. Hardware Functional Description

4.1 DSP Core

The CS495xx is a dual-core DSP with seperate X- and Y-data memory spaces, and a seperate P-code memory space. Each core is a high-performance, 32-bit, user-programmable, fixed-point DSP that is capable of performing two memory access control (MAC) operations per clock cycle. Each core has eight 72-bit accumulators, four X- and four Y-data registers, and 12 index registers.

Both DSP cores are coupled to a flexible DMA engine. The DMA engine can move data between peripherals such as the DAI and DAO, external memory, or any DSP core memory, all without the intervention of the DSP. The DMA engine offloads data move instructions from the DSP core, leaving more MIPS available for signal processing instructions.

The DSP obtains its functionality from application codes that are downloaded to the CS495xx and are provided through the Cirrus Logic Crystal Ware™ Software Licensing Program.

Both DSP cores are user-programmable in order to offer the customer the ability to implement unique post-processing algorithms. Additionally, users can choose to download standard audio decoder and post-processing modules which are available through the Cirrus Logic Crystal Ware™ Software Licensing Program.

The CS495xx is suitable for AVR/Outboard Decoder, DVD Audio/Video Player, and Digital Broadcast applications.

4.1.1 DSP Memory

Each DSP core has its own on-chip data and program memory and does not require external memory for any of today's popular audio algorithms including Dolby Digital Surround EX, AAC Mulitichannel, DTS-ES 96/24, and THX Ultra2 Cinema.

The memory maps for the DSPs are as follows. All memory sizes are composed of 32-bit words.

Memory Type	DSP A	DSP B
X	16k SRAM, 32k ROM	8k SRAM, 8k ROM
Y	16k SRAM, 32k ROM	16k SRAM, 8k ROM
P	8k SRAM, 32k ROM	8k SRAM, 8k ROM

Table 2. DSP Memory Sizes

4.1.2 DMA Controller

The powerful 12-channel DMA controller can move data between 8 on-chip resources. Each resource has its own arbiter: X-, Y-, and P-RAMs on DSP A; X-, Y-, P-RAMs on DSP B; external memory; and the peripherial bus. Modulo and linear addressing modes are supported, with flexible start address and increment controls. The service interval for each DMA channel as well as up to 6 interrupt events, is programmable.

4.2 On-chip DSP Peripherals

4.2.1 Digital Audio Input Port (DAI)

The 10-channel DAI port supports a wide variety of data input formats. The port is capable of accepting PCM or IEC61937. Up to 32-bit PCM and 16-bit compressed data input word lengths are supported. The port has two independent slave-only clock domains, each data input can be independently assigned to a clock domain. The sample rate of the input clock domains can be determined automatically by the DSP, eliminating the host from the task of monitoring the SPDIF receiver. A special channel status word function separates IEC channel status data from PCM data and places it into a separate data buffer for analysis by the DSP. A time-stamping feature allows the input data to be sample-rate converted via software.

4.2.2 Digital Audio Output Port (DAO)

There are two DAO ports, each port can output 8 channels of up to 32-bit PCM data. The port supports data rates from 32kHz to 192kHz. Each port can be configured as an independent clock domain in slave mode, or the ratio of the two clocks can be set to even multiples of each other in master mode. The two ports can be ganged together into a single clock domain. Each port has a 192kHz SPDIF transmitter that can be used instead of a PCM output.

4.2.3 Serial Control Port 1 & 2 (I^2C or SPI)

There are two on-chip serial control ports that are capable of operating in master or slave mode in either I^2C or SPI modes. Serial control port 2 shares pins with the parallel control port.

4.2.4 Parallel Control Port

The CS495xx parallel port can be used for either parallel control (Motorola®, Intel® , or multiplexed Intel modes). The parallel port pins are muxed with serial control port 2.

4.2.5 External Memory Interface

The external memory interface controller supports up to 128 Mbit of SDRAM, using a 16-bit data bus. The memory controller supports up to 1MB of SRAM and 1MB of FLASH memory in either 8-bit or 16-bit bus widths.

4.2.6 GPIO

The CS495xx has 42 GPIO pins multiplexed with other peripherial functions. Each GPIO can be configured as an output, an input, or an input with interrupt. Each input-pin interrupt can be configured as rising edge, falling edge, active-low, or active-high.

4.2.7 Channel Status Word (CSW)

The Channel Status Word peripheral extracts SPDIF IEC data and stores it in the CS495xx's internal memory for use by application code. The CSW operates in two modes: 1. extracting data from a DAI channel that is connected to a SPDIF receiver such as the Cirrus Logic CS8416 configured in IEC format mode (IEC data embedded in the I^2S stream); or 2. capturing IEC data output from a SPDIF receiver on discrete data, clock, and frame clock pins. The CSW has two data input pins to capture two simultaneous synchronous data streams (U and C).

4.2.8 PLL-based Clock Generator

The PLL-based clock generator provides clock generation and system synchronization for the device. The low-jitter PLL generates integer multiples of a reference frequency which are used to clock the DSP core and peripherals. A second, dependent clock domain can be output on the DAO port for driving Delta-Sigma audio converters. The CS495xx is clocked from the external reference frequency until the

PLL is configured and locked, at which time the clocks can be switched. A built-in crystal oscillator circuit with dedicated, buffered output pin is provided to eliminate an external crystal oscillator.

4.3 DSP I/O Description

4.3.1 Multiplexed Pins

The CS495xx incorporates a large amount of flexibility into a 144-pin package. The pins are internally multiplexed to serve multiple purposes. Some pins are designed to operate in one mode at power up, and serve a different purpose when the DSP is running. Other pins have functionality which can be controlled by the application running on the DSP. In order to better explain the behavior of the part, the pins which are multiplexed have been given multiple names. Each name is specific to the pin's operation in a particular mode.

4.3.2 Termination Requirements

The CS495xx incorporates open-drain pins which must be pulled high for proper operation. PCP_IRQ# and SCP_IRQ# are always open drain which requires a pull-up for proper operation. The SCP_SDA and SCP_CLK lines are open drain in I^2C communication mode.

The specific termination requirements may vary since the state of some of the GPIO pins will determine the communication mode at the rising edge of Reset. For the explicit termination requirements of each communication mode please see the *Typical Connection* diagrams in the *CS495xx Hardware User's Manual.*

Generally a 3.3 kΩ resistor is recommended for open-drain and mode-select pins. A 10 kΩ resistor is sufficient for all other unused inputs.

4.3.3 Pads

The CS495xx has two different I/O voltage levels. All signal pins operate from the 3.3 V supply and are 5 V-tolerant.

4.4 Application Code Security

The external program code is encrypted by the programmer to protect any intellectual property it may contain. A secret, customer-specific key is used to encrypt the program code that is to be stored external to the device.

CS495xx Data Sheet
32-bit Audio Decoder DSP Family

7. Package Pinout, 144-Pin QFP/LQFP
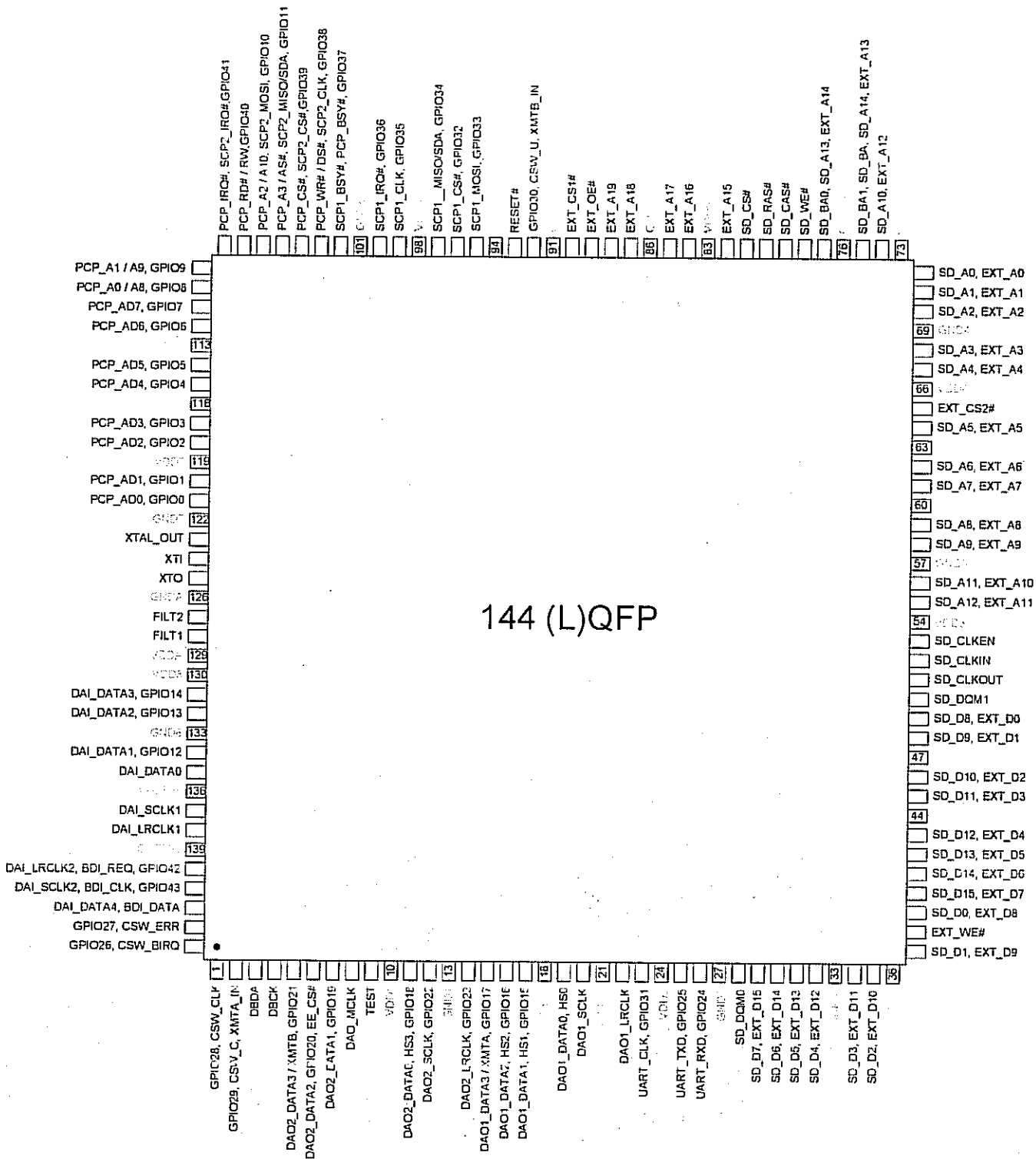
Figure 23. 144-Pin (L)QFP Package Pinout

DS631PP4

HCF4053B

TRIPLE 2-CHANNEL
ANALOG MULTIPLEXER/DEMULTIPLEXER

- LOW "ON" RESISTANCE : 125Ω (Typ.) OVER 15V p.p SIGNAL-INPUT RANGE FOR V_{DD} - V_{EE} = 15V
- HIGH "OFF" RESISTANCE : CHANNEL LEAKAGE $\pm$ 100pA (Typ.) at V_{DD} - V_{EE} = 18V
- BINARY ADDRESS DECODING ON CHIP
- HIGH DEGREE OF LINEARITY : < 0.5% DISTORTION TYP. at f_{IS} = 1KHz, V_{IS} = 5 V_{pp}, V_{DD} - $V_{SS} \geq$ 10V, RL = 10KΩ
- VERY LOW QUIESCENT POWER DISSIPATION UNDER ALL DIGITAL CONTROL INPUT AND SUPPLY CONDITIONS : 0.2 μW (Typ.) at V_{DD} - V_{SS} = V_{DD} - V_{EE} =10V
- MATCHED SWITCH CHARACTERISTICS : R_{ON} = 5Ω (Typ.) FOR V_{DD} - V_{EE} = 15V
- WIDE RANGE OF DIGITAL AND ANALOG SIGNAL LEVELS : DIGITAL 3 to 20, ANALOG TO 20V p.p.
- QUIESCENT CURRENT SPECIF. UP TO 20V
- 5V, 10V AND 15V PARAMETRIC RATINGS
- INPUT LEAKAGE CURRENT I_I = 100nA (MAX) AT V_{DD} = 18V T_A = 25°C
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B " STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"

DESCRIPTION
The HCF4053B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor

	DIP	SOP
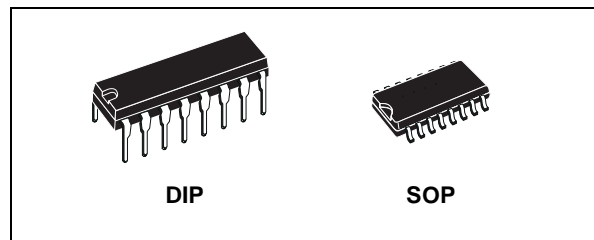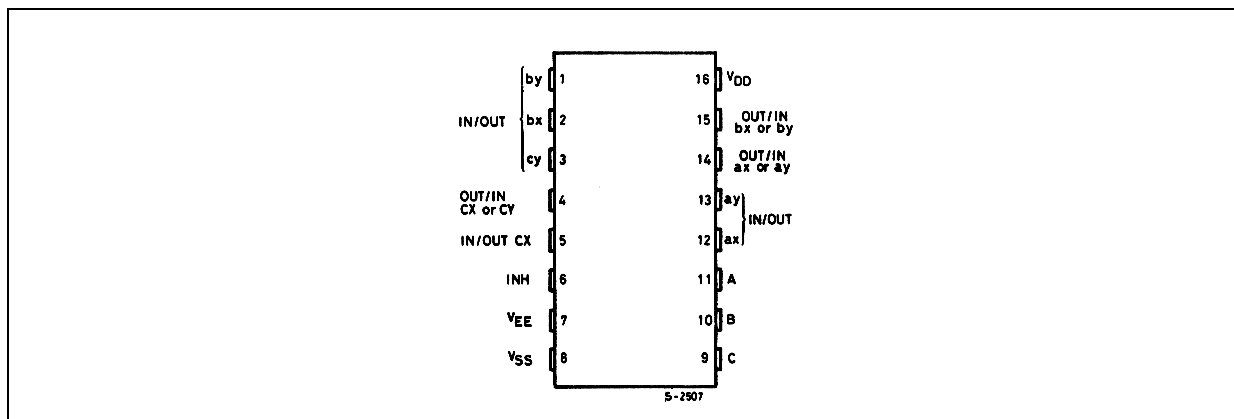
ORDER CODES

PACKAGE	TUBE	T & R
DIP	HCF4053BEY	
SOP	HCF4053BM1	HCF4053M013TR

technology available in DIP and SOP packages.
The HCF4053B analog multiplexer/demultiplexer is a digitally controlled analog switch having low ON impedance and very low OFF leakage current. This multiplexer circuit dissipate extremely low quiescent power over the full V_{DD} - V_{SS} and V_{DD} - V_{EE} supply voltage range, independent of the logic state of the control signals.
When a logic "1" is present at the inhibit input terminal all channel are off. This device is a triple 2-channel multiplexer having three separate digital control inputs, A, B, and C, and an inhibit input. Each control input selects one of a pair of channels which are connected in a single pole double-throw configuration.

PIN CONNECTION

HCF4053B

INPUT EQUIVALENT CIRCUIT

CS03790
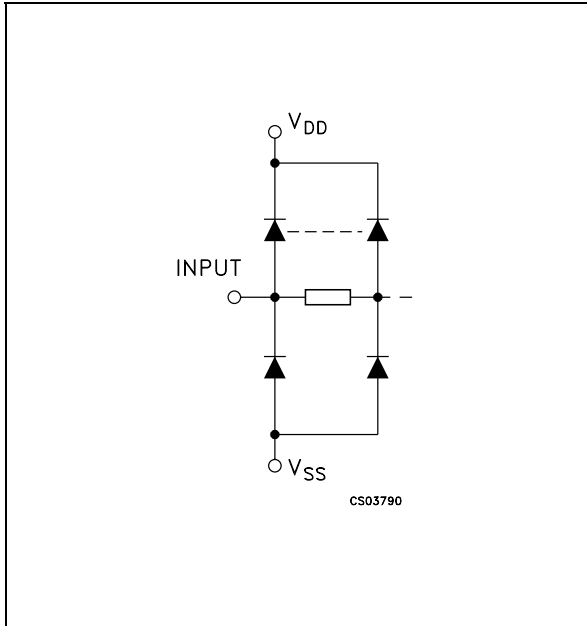
PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
11, 10, 9	A, B, C	Binary Control Inputs
6	INH	Inhibit Inputs
12, 13, 2, 1, 5, 3	IN/OUT	ax,ay,bx,by,cx,cy Input/Output
14	OUT/IN	ax or ay
15	OUT/IN	bx or by
4	OUT/IN	cx or cy
7	V_{EE}	Supply Voltage
8	V_{SS}	Negative Supply Voltage
16	V_{DD}	Positive Supply Voltage

TRUTH TABLE

INHIBIT	C or B or A	
0	0	ax or bx or cx
0	1	ay or by or cy
1	X	NONE

X : Don't Care

FUNCTIONAL DIAGRAM

S-44431
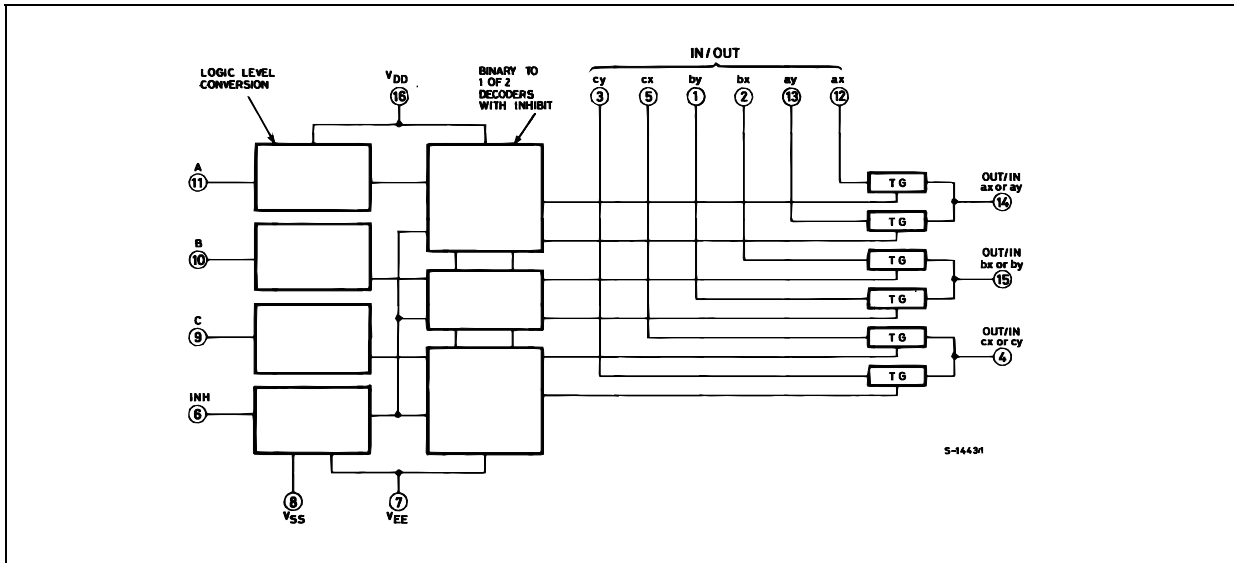
L7800 SERIES

POSITIVE VOLTAGE REGULATORS

- OUTPUT CURRENT TO 1.5A
- OUTPUT VOLTAGES OF 5; 5.2; 6; 8; 8.5; 9; 10; 12; 15; 18; 24V
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- OUTPUT TRANSITION SOA PROTECTION

DESCRIPTION

The L7800 series of three-terminal positive regulators is available in TO-220, TO-220FP, TO-220FM, TO-3 and D^{2}PAK packages and several fixed output voltages, making it useful in a wide range of applications. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage and currents.

TO-220

TO-220FP
TO-220FM

D^{2}PAK

TO-3
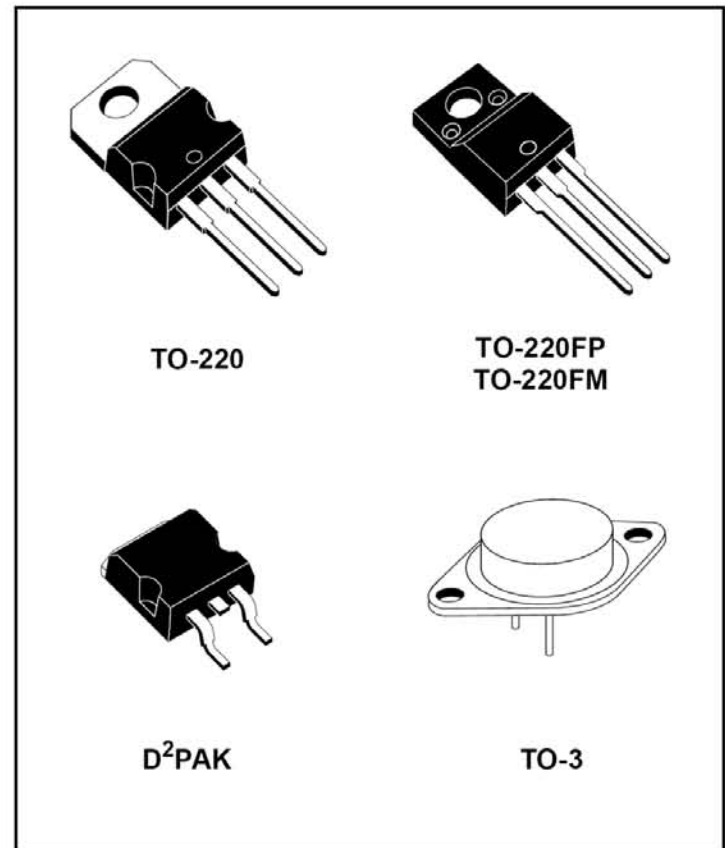
Figure 1: Schematic Diagram

OUTER DIMENSIONS

SAMSUNG SDI

PATTERN AREA
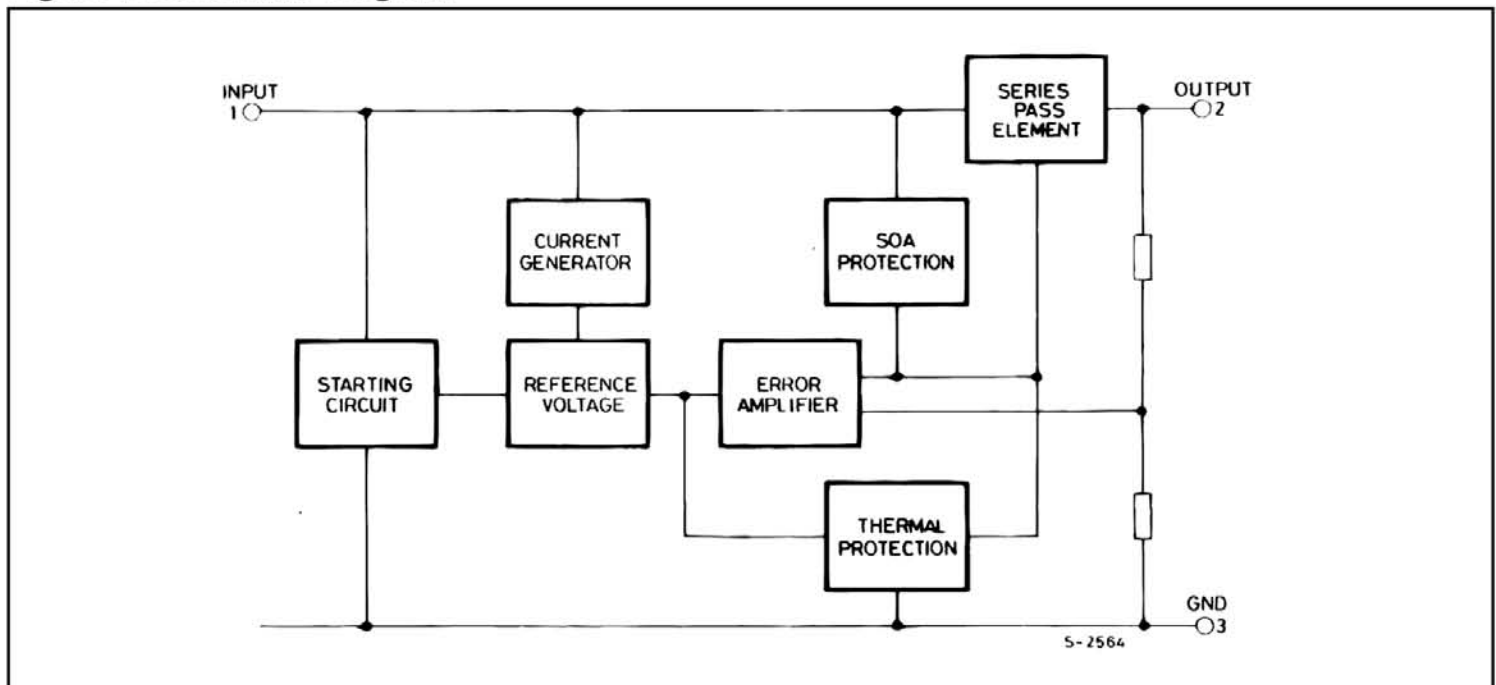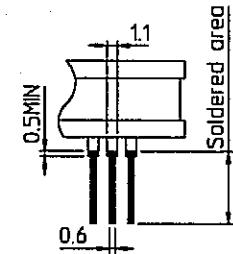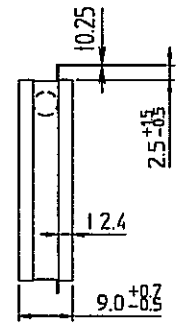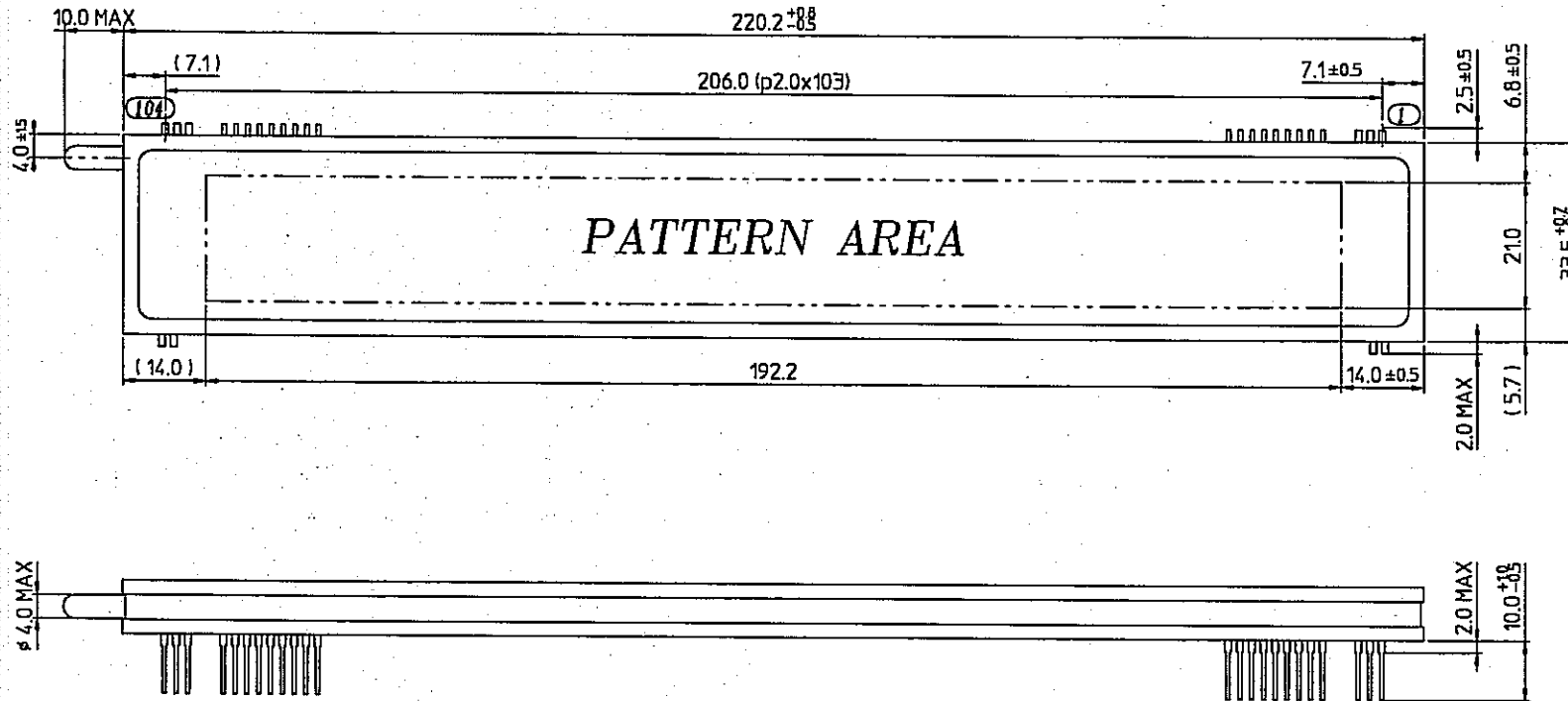
LEAD DETAILS

PIN CONNECTION

PIN NO.	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90~15	14~6	5	4	3	2	1
CONNECTION	F2	F2	F2	NP	NP	V$_{DISP}$	L-GND	D-GND	V$_{DD}$	OSCO	/RST	/CS	/CP	DA	NP	NC	NP	NP	F1	F1	F1

*Notes

Fn : Filament Pin

NP : No Pin

NC : No Connection Pin

MODEL : HCA-18ML03
OUTER DIMENSIONS
Rev.① 20-Jan-2005

97

GRID ASSIGNMENT

SAMSUNG SDI

1G
☐ DIGITAL EX
☐ PRO LOGIC II
☐ 3 STEREO
☐ HEADPHONE
☐ dts

2G
☐ LOGIC 7
☐ VMAx
☐ DSP
☐ 57CH. STEREO
☐ SURR. OFF

3G 4G 5G 6G 7G 8G 9G 10G 11G 12G 13G 14G 15G 16G

17G

L   [C]   R
LFE
SL   ◯   SR
[SBL] — [SBR]

18G	
☐ VID 1	☐ DVD 12
☐ VID 2	☐ CD
☐ VID 3	☐ FMAM
☐ VID 4	☐ TAPE
☐ VID 5	☐ 68CH

```
[1]  [2]  [3]  [4]  [5]
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```

(3G–16G)

B1   B4   B5   B6   B7
B2   B8
B3   B9
B11   B14
B12   B10   B15
B13   B16
B20
B17   B19   B22
B18   B21

(17G)
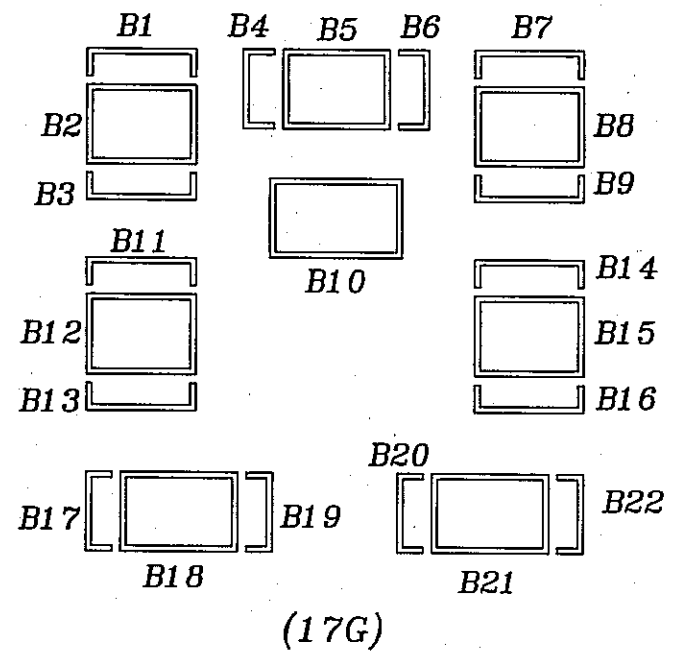
MODEL : HCA-18ML03
GRID ASSIGNMENT
Rev.① 20-Jan-2005

ANODE CONNECTION

SAMSUNG SDI

SEGB	COM1 (1G)	COM2 (2G)	COM3 (3G)	~ (~)	COM16 (16G)	COM17 (17G)	COM18 (18G)
SEGB 1	□(DIGITAL EX)	□(LOGIC 7)	1	1	1	B1	□(VID 1)
SEGB 2			2	2	2	B2	VID 1
SEGB 3			3	3	3	L	□(DVD 12)
SEGB 4			4	4	4	B3	DVD
SEGB 5			5	5	5	B4	1
SEGB 6	DXI DIGITAL	LOGIC7	6	6	6	B5	2
SEGB 7			7	7	7	C	□(VID 2)
SEGB 8			8	8	8	B6	VID 2
SEGB 9			9	9	9	B7	□(CD)
SEGB 10			10	10	10	B8	CD
SEGB 11	EX	□(VMAx)	11	11	11	R	□(VID 3)
SEGB 12			12	12	12	B9	VID 3
SEGB 13			13	13	13	B10	□(FM AM)
SEGB 14			14	14	14	LFE	FM
SEGB 15			15	15	15	B11	AM
SEGB 16	□(PRO LOGIC)	VMAx	16	16	16	B12	□(VID 4)
SEGB 17			17	17	17	SL	VID 4
SEGB 18			18	18	18	B13	□(TAPE)
SEGB 19			19	19	19	⬤	TAPE
SEGB 20			20	20	20	B14	□(VID 5)
SEGB 21	DXI PRO LOGIC	□(DSP)	21	21	21	B15	VID 5
SEGB 22			22	22	22	SR	□(68CH)
SEGB 23			23	23	23	B16	6
SEGB 24			24	24	24	B17	8
SEGB 25			25	25	25	B18	CH
SEGB 26	I	DSP	26	26	26	SBL	
SEGB 27			27	27	27	B19	
SEGB 28			28	28	28	—	
SEGB 29			29	29	29	B20	
SEGB 30			30	30	30	B21	
SEGB 31	□(3 STEREO)	□(57CH.)	31	31	31	SBR	
SEGB 32			32	32	32	B22	
SEGB 33			33	33	33		
SEGB 34			34	34	34		
SEGB 35			35	35	35		

SEGA	COM1 (1G)	COM2 (2G)	COM3 (3G)	~ (~)	COM16 (16G)	COM17 (17G)	COM18 (18G)
SEGA 1	DXI	5	36	36	36		
SEGA 2			37	37	37		
SEGA 3			38	38	38		
SEGA 4			39	39	39		
SEGA 5			40	40	40		
SEGA 6	3	7	41	41	41		
SEGA 7			42	42	42		
SEGA 8			43	43	43		
SEGA 9			44	44	44		
SEGA 10			45	45	45		
SEGA 11	STEREO	CH. STEREO	46	46	46		
SEGA 12			47	47	47		
SEGA 13			48	48	48		
SEGA 14			49	49	49		
SEGA 15			50	50	50		
SEGA 16	□(HEADPHONE)	□(SURR.OFF)	51	51	51		
SEGA 17			52	52	52		
SEGA 18			53	53	53		
SEGA 19			54	54	54		
SEGA 20			55	55	55		
SEGA 21	DXI HEADPHONE	SURR. OFF	56	56	56		
SEGA 22			57	57	57		
SEGA 23			58	58	58		
SEGA 24			59	59	59		
SEGA 25			60	60	60		
SEGA 26	□(DTS,ES)		61	61	61		
SEGA 27			62	62	62		
SEGA 28			63	63	63		
SEGA 29			64	64	64		
SEGA 30			65	65	65		
SEGA 31	▱		66	66	66		
SEGA 32			67	67	67		
SEGA 33			68	68	68		
SEGA 34			69	69	69		
SEGA 35	▭		70	70	70		

MODEL : HCA-18LM03
ANODE CONNECTION
Rev. ① 20-Jan-2005

TOSHIBA   T5CC1

<div align="center">

CMOS 16-Bit Microcontrollers
T5CC1

</div>

1. Outline and Features

T5CC1 is a high-speed 16-bit microcontroller designed for the control of various mid- to large-scale equipment.

T5CC1 comes in a 100-pin flat package.

Listed below are the features.

(1) High-speed 16-bit CPU (900/L1 CPU)
- Instruction mnemonics are upward-compatible with TLCS-90/900
- General-purpose registers and register banks
- 16 Mbytes of linear address space
- 16-bit multiplication and division instructions; bit transfer and arithmetic instructions
- Micro DMA: 4-channels (593 ns/2 bytes at 27 MHz)

(2) Minimum instruction execution time: 148 ns (at 27 MHz)

(3) Built-in RAM: 16 Kbytes
Built-in ROM: 256 Kbytes Flash memory
          4 Kbytes mask ROM (used for booting)

TOSHIBA   T5CC1

(4)   External memory expansion
  - Expandable up to 16 Mbytes (shared program/data area)
  - Can simultaneously support 8-/16-bit width external data bus
    ⋯ Dynamic data bus sizing

(5)   8-bit timers: 8 channels

(6)   16-bit timer/event counter: 2 channels

(7)   General-purpose serial interface: 2 channels
  - UART/ Synchronous mode: 2 channels
  - IrDA ver1.0 (115.2 kbps) supported: 1 channel

(8)   Serial bus interface: 1 channel
  - I²C bus mode/clock synchronous Select mode

(9)   10-bit AD converter (built-in sample hold circuit) : 8 channels

(10) Watchdog timer

(11) Special timer for clock

(12) Chip Select/Wait controller: 4 channels

(13) Interrupts: 45 interrupts
  - 9 CPU interrupts: Software interrupt instruction and illegal instruction
  - 26 internal interrupts: ⎤
                            ⎥ Seven selectable priority levels
  - 10 external interrupts: ⎦

(14) Input/Output ports: 81 pins

(15) Standby function
      Three HALT modes: IDLE2 (programmable), IDLE1, STOP

(16) Clock controller
  - Clock Gear function: Select a high-frequency clock (fc to fc/16)
  - Special timer for CLOCK (fs = 32.768 kHz)

(17) Operating voltage
  - V_{CC} = 2.7 V to 3.6 V (fc max = 27 MHz, flash memory read operation)
  - V_{CC} = 3.0 V to 3.6 V (fc max = 27 MHz, flash memory erase/program operations)

(18) Package
  - 100-pin LQFP: LQFP100-P-1414-0.50F

Note: This LSI does not build in Clock doubler (DFM.)
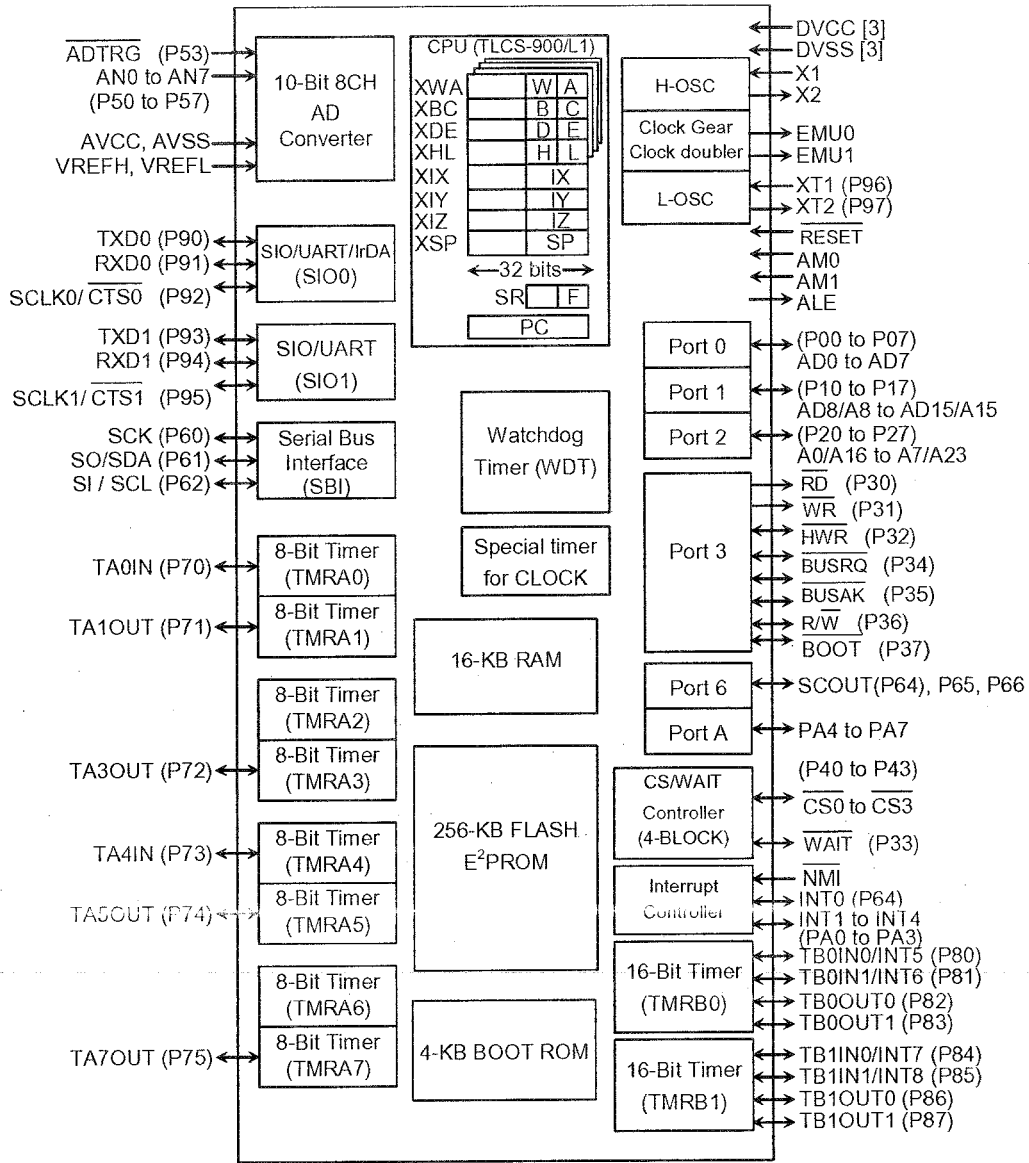
Figure 1.1 T5CC1 Block Diagram

2. Pin Assignment and Pin Functions

The assignment of input/output pins for the T5CC1, their names and functions are as follows:

2.1 Pin Assignment Diagram

Figure 2.1.1 shows the pin assignment of the T5CC1.

DVCC	89
P66	90
DVSS	91
P50/AN0	92
P51/AN1	93
P52/AN2	94
P53/AN3/ADTRG	95
P54/AN4	96
P55/AN5	97
P56/AN6	98
P57/AN7	99
VREFH	100

88	P65
87	P64/SCOUT
86	P63/INT0
85	P62/SI/SCL
84	P61/SO/SDA
83	P60/SCK
82	P43/CS3
81	P42/CS2
80	P41/CS1
79	P40/CS0
78	P37/BOOT
77	P36/R/W
76	P35/BUSAK

VREFL	1
AVSS	2
AVCC	3
P70/TA0IN	4
P71/TA1OUT	5
P72/TA3OUT	6
P73/TA4IN	7
P74/TA5OUT	8
P75/TA7OUT	9
P80/TB0IN0/INT5	10
P81/TB0IN1/INT6	11
P82/TB0OUT0	12
P83/TB0OUT1	13
P84/TB1IN0/INT7	14
P85/TB1IN1/INT8	15
P86/TB1OUT0	16
P87/TB1OUT1	17
P90/TXD0	18
P91/RXD0	19
P92/SCLK0/CTS0	20
P93/TXD1	21
P94/RXD1	22
P95/SCLK1/CTS1	23
AM0	24
DVCC	25

Top view
QFP100

75	P34/BUSRQ
74	P33/WAIT
73	P32/HWR
72	P31/WR
71	P30/RD
70	P27/A7/A23
69	P26/A6/A22
68	P25/A5/A21
67	P24/A4/A20
66	P23/A3/A19
65	P22/A2/A18
64	DVCC
63	NMI
62	DVSS
61	P21/A1/A17
60	P20/A0/A16
59	P17/AD15/A15
58	P16/AD14/A14
57	P15/AD13/A13
56	P14/AD12/A12
55	P13/AD11/A11
54	P12/AD10/A10
53	P11/AD9/A9
52	P10/AD8/A8
51	P07/AD7

X2	26
DVSS	27
X1	28
AM1	29
RESET	30
P96/XT1	31
P97/XT2	32
EMU0	33
EMU1	34
PA0/INT1	35
PA1/INT2	36
PA2/INT3	37

50	P06/AD6
49	P05/AD5
48	P04/AD4
47	P03/AD3
46	P02/AD2
45	P01/AD1
44	P00/AD0
43	ALE
42	PA7
41	PA6
40	PA5
39	PA4
38	PA3/INT4

Figure 2.1.1 Pin assignment diagram (100-pin LQFP)

TOSHIBA   T5CC1

2.2   Pin Names and Functions

The names of the input/output pins and their functions are described below.

Table 2.2.1 Pin names and functions.

Table 2.2.1 Pin names and functions (1/3)

Pin Name	Number of Pins	I/O	Functions
P00~P07	8	I/O	Port 0: I/O port that allows I/O to be selected at the bit level
AD0~AD7		I/O	Address and data (lower): Bits 0 to 7 of address and data bus
P10~P17	8	I/O	Port 1: I/O port that allows I/O to be selected at the bit level
AD8~AD15		I/O	Address and data (upper): Bits 8 to 15 for address and data bus
A8~A15		Output	Address: Bits 8 to 15 of address bus
P20~P27	8	I/O	Port 2: I/O port that allows I/O to be selected at the bit level
A0~A7		Output	Address: Bits 0 to 7 of address bus
A16~A23		Output	Address: Bits 16 to 23 of address bus
P30	1	Output	Port 30: Output port
$\overline{RD}$		Output	Read: Strobe signal for reading external memory
			This port output RD signal also case of reading internal-area by setting P3 <P30> = 0 and P3FC <P30F> = 1.
P31	1	Output	Port 31: Output port
$\overline{WR}$		Output	Write: Strobe signal for writing data to pins AD0 to AD7
P32	1	I/O	Port 32: I/O port (with pull-up resistor)
$\overline{HWR}$		Output	High Write: Strobe signal for writing data to pins AD8 to AD15
P33	1	I/O	Port 33: I/O port (with pull-up resistor)
$\overline{WAIT}$		Input	Wait: Pin used to request CPU bus wait
			((1+N) WAIT mode)
P34	1	I/O	Port 34: I/O port (with pull-up resistor)
$\overline{BUSRQ}$		Input	Bus Request: Signal used to request Bus Release
P35	1	I/O	Port 35: I/O port (with pull-up resistor)
$\overline{BUSAK}$		Output	Bus Acknowledge: Signal used to acknowledge Bus Release
P36	1	I/O	Port 36: I/O port (with pull-up resistor)
$R/\overline{W}$		Output	Read/Write: 1 represents Read or Dummy cycle; 0 represents Write cycle.
P37	1	I/O	Port 36: I/O port (with pull-up resistor)
$\overline{BOOT}$		Input	This pin sets single boot mode.
			When released reset, Single boot mode is started at P37 = Low level.
P40	1	I/O	Port 40: I/O port (with pull-up resistor)
$\overline{CS0}$		Output	Chip Select 0: Outputs 0 when address is within specified address area
P41	1	I/O	Port 41: I/O port (with pull-up resistor)
$\overline{CS1}$		Output	Chip Select 1: Outputs 0 if address is within specified address area
P42	1	I/O	Port 42: I/O port (with pull-up resistor)
$\overline{CS2}$		Output	Chip Select 2: Outputs 0 if address is within specified address area
P43	1	I/O	Port 43: I/O port (with pull-up resistor)
$\overline{CS3}$		Output	Chip Select 3: Outputs 0 if address is within specified address area
P50~P57	8	Input	Port 5: Pin used to input port
AN0~AN7		Input	Analog input: Pin used to input to AD converter
$\overline{ADTRG}$		Input	AD Trigger: Signal used to request start of AD converter (Shared with53 pin)

Table 2.2.1 Pin names and functions (2/3)

Pin Name	Number of Pins	I/O	Functions
P60 SCK	1	I/O I/O	Port 60: I/O port Serial bus interface clock in SIO Mode
P61 SO SDA	1	I/O Output I/O	Port 61: I/O port Serial bus interface send data at SIO mode Serial bus interface send/recive data at I^2C bus mode Open-drain output mode by programmable
P62 SI SCL	1	I/O Input I/O	Port 62: I/O port Serial bus interface recive data at SIO mode Serial bus interface clock I/O data at I^2C bus mode Open-drain output mode by programmable
P63 INT0	1	I/O Input	Port 63: I/O port Interrupt Request Pin 0: Interrupt request pin with programmable level / rising edge / falling edge
P64 SCOUT	1	I/O Output	Port 64: I/O port System Clock Output: Outputs f_{FPH} or fs clock.
P65	1	I/O	Port 65 I/O port
P66	1	I/O	Port 66 I/O port
P70 TA0IN	1	I/O Input	Port 70I/O port 8bitt timer 0 input:: Timer 0 input
P71 TA1OUT	1	I/O Output	Port 71I/O port 8-bit timer 1 output: Timer 0 or Timer 1 output
P72 TA3OUT	1	I/O Output	Port 72I/O port 8bit 8-bit timer 3 output: Timer 2 or Timer 3 output
P73 TA4IN	1	I/O Input	Port 73: I/O port 8-bit timer 4 input: Timer 4 input
P74 TA5OUT	1	I/O Output	Port 74: I/O port 8-bit timer 5 output: Timer 4 or Timer 5 output
P75 TA7OUT	1	I/O Output	Port 75: I/O port 88-bit timer 7 output: Timer 6 or Timer 7 output
P80 TB0IN0 INT5	1	I/O Input Input	Port 80: I/O port 16bit timer 0 input 0: 16bit Timer 0 count / capture trigger input Interrupt Request Pin 5: Interrupt request pin with programmable rising edge / falling edge.
P81 TB0IN1 INT6	1	I/O Input Input	Port 81: I/O port 16bit timer 0 input 1: 16bit Timer 0 count / capture trigger input Interrupt Request Pin 6: Interrupt request on rising edge
P82 TB0OUT0	1	I/O Output	Port 82: I/O port 16bit timer 0 output 0: 16bit Timer 0 output
P83 TB0OUT1	1	I/O Output	Port 83: I/O port 16bit timer 0 output 1: 16bit Timer 0 output
P84 TB1IN0 INT7	1	I/O Input Input	Port 84: I/O port 16bit timer 1 input 0: 16bit Timer 1 count / capture trigger input Interrupt Request Pin 7: Interrupt request pin with programmable rising edge / falling edge.
P85 TB1IN1 INT8	1	I/O Input Input	Port 85: I/O port 16bit timer 1 input 1: 16bit Timer 1 count / capture trigger input Interrupt Request Pin 8: Interrupt request on rising edge
P86 TB1OUT0	1	I/O Output	Port 86: I/O port 16bit timer 1 output 0: 16bit Timer 1 output 16bit
P87 TB1OUT1	1	I/O Output	Port 87: I/O port 16bit timer 1 output 1: 16bit Timer 1 output 16bit 16bit

TOSHIBA   T5CC1

Table 2.2.1 Pin names and functions (3/3)

Pin Name	Number of Pins	I/O	Functions
P90	1	I/O	Port 90: I/O port
TXD0		Output	Serial Send Data 0 (programmable open-drain)
P91	1	I/O	Port 91: I/O port
RXD0		Input	Serial Receive Data 0
P92	1	I/O	Port 92: I/O port
SCLK0		I/O	Serial Clock I/O 0
$\overline{CTS0}$		Input	Serial Data Send Enable 0 (Clear to Send)
P93	1	I/O	Port 93: I/O port
TXD1		Output	Serial Send Data 1 (programmable open-drain)
P94	1	I/O	Port 94: I/O port (with pull-up resistor)
RXD1		Input	Serial Receive Data 1
P95	1	I/O	Port 95: I/O port (with pull-up resistor)
SCLK1		I/O	Serial Clock I/O 1
$\overline{CTS1}$		Input	Serial Data Send Enable 1 (Clear to Send)
P96	1	I/O	Port 96: I/O port (open-drain output)
XT1		Input	Low-frequency oscillator connection pin
P97	1	I/O	Port 97: I/O port (open-drain output)
XT2		Output	Low-frequency oscillator connection pin
PA0~PA3	4	I/O	Ports A0 to A3: I/O ports
INT1~INT4		Input	Interrupt Request Pins 1 to 4: Interrupt request pins with programmable rising edge / falling edge.
PA4~PA7	4	I/O	Ports A4 to A7: I/O ports
ALE	1	Output	Address Latch Enable Can be disabled to reduce noise.
$\overline{NMI}$	1	Input	Non-Maskable Interrupt Request Pin: Interrupt request pin with programmable falling edge or both edge.
AM0~1	2	Input	Operation mode: Fixed to AM1 = 1, AM0 = 1
EMU0	1	Output	Open pin
EMU1	1	Output	Open pin
$\overline{RESET}$	1	Input	Reset: initializes T5CC1. (With pull-up resistor)
VREFH	1	Input	Pin for reference voltage input to AD converter (H)
VREFL	1	Input	Pin for reference voltage input to AD converter (L)
AVCC	1		Power supply pin for AD converter
AVSS	1		GND pin for AD converter (0 V)
X1/X2	2	I/O	High-frequency oscillator connection pins
DVCC	3		Power supply pins (All DVCC pins should be connected with the power supply pin.)
DVSS	3		GND pins (0 V) (All DVSS pins should be connected with the power supply pin.)

Note: An external DMA controller cannot access the device's built-in memory or built-in I/O devices using the $\overline{BUSRQ}$ and $\overline{BUSAK}$ signal.

3. Operation

This following describes block by block the functions and operation of the T5CC1.

3.1 CPU

The T5CC1 incorporates a high-performance 16-bit CPU (The 900/L1 CPU). For CPU operation, see the "TLCS-900/L1 CPU".

The following describe the unique function of the CPU used in the T5CC1; these functions are not covered in the TLCS-900/L1 CPU section.

3.1.1 Reset

When resetting the T5CC1 microcontroller, ensure that the power supply voltage is within the operating voltage range, and that the internal high-frequency oscillator has stabilized. Then hold the $\overline{\text{RESET}}$ input to low level for at least 10 system clocks (12µs at 27MHz).

Thus, when turn on the switch, be set to the power supply voltage is within the operating voltage range, and that the internal high-frequency oscillator has stabilized. Then hold the $\overline{\text{RESET}}$ input to low level at least for 10 system clocks.

Clock gear is initialized 1/16 mode by reset operation. It means that the system clock mode fSYS is set to fc/32 (= fc/16 × 1/2).

When the reset is accept, the CPU:

- Sets as follows the program counter (PC) in accordance with the reset vector stored at address FFFF00H to FFFF02H:

  PC<7:0>   ← Value at FFFF00H address

  PC<15:8>   ← Value at FFFF01H address

  PC<23:16>   ← Value at FFFF02H address

- Sets the stack pointer (XSP) to 100H.

- Sets bits <IFF2:0> of the status register (SR) to 111 (Sets the interrupt level mark register to level 7).

- Sets the <MAX> bit of the status register to 1 (MAX mode).
  (Note: As this product does not support MIN mode, do not write a 0 to the <MAX>.)

- Clears bits <RFP2:0> of the status register to 000 (Sets the register bank to 0).

When reset is released the CPU starts executing instructions in accordance with the program counter settings. CPU internal registers not mentioned above do not change when the reset is released.

When the reset is accepted, the CPU sets internal I/O. ports, and other pins as follows.

- Initializes the internal I/O registers.

- Sets the port pins, including the pins that also act as internal I/O, to general-purpose input or output port mode.

- Sets ALE pin to "High-Z"

Note: The CPU internal register (except to PC, SR, XSP) and internal RAM data do not change by resetting.

Figure 3.1.1 is a reset timing of the T5CC1.

TOSHIBA T5CC1

Read Write

Sampling

Sampling

(After reset is released, startting 0 wait read cycle)

(P20~P27 imput mode)

(P40~P43 imput mode)

(P36 imput mode)

(P00~PC7, P10~P17 imput mode)

(P30 out put mode)

(P00~PC7, P10~P17 imput mode)

(P31 out put mode)

(P32 imput mode)

(Output mode)

(Imput mode)

(Imput mode)

Address

Address

Data-out

Address

f_{FPH}

$\overline{RESET}$

A16~A23

$\overline{CS0}$~$\overline{CS3}$

R/$\overline{W}$

ALE

AD0~AD15

$\overline{RD}$

AD0~AD15

$\overline{WR}$

$\overline{HWR}$

P30~P31

P32~P37, P40~P43

P00~P07, P10~P17,
P20~P27, P60~P66,
P70~P75, P80~P87,
P90~P97, PA0~PA7

Pull-up (Internal)

High-Z

3.1.2   Outline of Operation Modes

There are single-chip and single-boot modes. Which mode is selected depends on the device's pin state after a reset.

- Single-chip mode: The device normally operations in this mode. After a reset, the device starts executing the internal memory program.

- Single-boot mode: This mode is used to rewrite the internal flash memory by serial transfer (UART).
  After a reset, internal boot program starts up, executing an on-board rewrite program.

Table 3.1.1 Operation Mode Setup Table

Operation Mode	Mode Setup Input Pin			
	RESET	BOOT (P37)	AM0	AM1
Single-chip mode	⟋	H	H	H
Single-boot mode		L		

AKM

AK4589
2/8-Channel Audio CODEC with DIR

ASAHI KASEI   [AK4589]

■

AK4589VQ   -10 ~ +70°C   80pin LQFP(0.5mm pitch)
AKD4589

■

```
                    I  T  T  M  V  D  I  R  C  R  C  R  T  R  P  R  P  R  N  R
                    N  X  X  C  I  A  2  X  A  X  A  X  E  X  V  P  V  X  C  X
                    T  1  0  L  N  U  C  7  D  6  D  5  S  4  D  S  S  3     2
                    0        K     X        1     0     T     D     S
                                   2        1        0                   2

                    80 79 78 77 76 75 74 73 72 71 70 69 68 67 66 65 64 63 62 61

        INT1  ▢     1                                                  60    ▢  TEST1
        BOUT  ▢     2      ◯                                           59    ▢  RX1
        TVDD  ▢     3                                                  58    ▢  NC
        DVDD  ▢     4                                                  57    ▢  RX0
        DVSS  ▢     5                                                  56    ▢  AVSS
         XTO  ▢     6                                                  55    ▢  AVDD
         XTI  ▢     7                                                  54    ▢  VREFH
       TEST3  ▢     8              (Top View)                          53    ▢  VCOM
       MCKO2  ▢     9                                                  52    ▢  RIN
       MCKO1  ▢    10                                                  51    ▢  LIN
        COUT  ▢    11                                                  50    ▢  ROUT1+
        UOUT  ▢    12                                                  49    ▢  ROUT1-
        VOUT  ▢    13                                                  48    ▢  LOUT1+
       SDTO2  ▢    14                                                  47    ▢  LOUT1-
       BICK2  ▢    15                                                  46    ▢  ROUT2+
       LRCK2  ▢    16                                                  45    ▢  ROUT2-
       SDTO1  ▢    17                                                  44    ▢  LOUT2+
       BICK1  ▢    18                                                  43    ▢  LOUT2-
       LRCK1  ▢    19                                                  42    ▢  ROUT3+
        CDTO  ▢    20                                                  41    ▢  ROUT3-

                    21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

                    C  C  C  D  S  S  S  S  X  X  P  M  D  D  L  L  R  R  L  L
                    C  D  S  A  D  D  D  D  T  T  D  A  Z  Z  O  O  O  O  O  O
                    L  T  N  U  T  T  T  T  L  L  N  S  F  F  U  U  U  U  U  U
                    K  I     X  I  I  I  I  1  0     T  2  1  T  T  T  T  T  T
                    /  /     1  4  3  2  1           E        4  4  4  4  3  3
                    S  S                             R        -  +  -  +  -  +
                    C  D
                    L  A
```

ASAHI KASEI   [AK4589]

■ AK4588

Functions	AK4588	AK4589
DAC		
DAC S/(N+D)	90dB	94dB
DAC S/N	106dB	114dB
DAC Output voltage	Typ 3.0Vpp	Typ ±2.7Vpp
DAC AOUT	AOUT=0.6xVREFH	AOUT=0.54xVREFH
Load Resistance	5k ohm	2k ohm
Frequency Response 80kHz	±1.0	+0/-0.6
	#35, #37, #39,#41,#43,#45,#47,#49	#35 - #50
	Min=4.5V, Max=5.5V	Min=4.75V, Max=5.25V

( )AK4589   ADC/DAC   (AK4588   )   DIR/DIT   (AK4588
)

No.	Pin Name	I/O	Function
1	INT1	O	Interrupt 1 Pin
2	BOUT	O	Block-Start Output Pin for Receiver Input "H" during first 40 flames.
3	TVDD	-	Output Buffer Power Supply Pin, 2.7V~5.25V
4	DVDD	-	Digital Power Supply Pin, 4.75V~5.25V
5	DVSS	-	Digital Ground Pin
6	XTO	O	X'tal Output Pin
7	XTI	I	X'tal Input Pin
8	TEST3	I	Test 3 Pin This pin should be connected to DVSS.
9	MCKO2	O	Master Clock Output 2 Pin
10	MCKO1	O	Master Clock Output 1 Pin
11	COUT	O	C-bit Output Pin for Receiver Input
12	UOUT	O	U-bit Output Pin for Receiver Input
13	VOUT	O	V-bit Output Pin for Receiver Input
14	SDTO2	O	Audio Serial Data Output Pin (DIR/DIT part)
15	BICK2	I/O	Audio Serial Data Clock Pin (DIR/DIT part)
16	LRCK2	I/O	Channel Clock Pin (DIR/DIT part)
17	SDTO1	O	Audio Serial Data Output Pin (ADC/DAC part)
18	BICK1	I/O	Audio Serial Data Clock Pin (ADC/DAC part)
19	LRCK1	I/O	Input Channel Clock Pin
20	CDTO	O	Control Data Output Pin in Serial Mode, I2C= "L".
21	CCLK	I	Control Data Clock Pin in Serial Mode, I2C= "L"
	SCL	I	Control Data Clock Pin in Serial Mode, I2C= "H"
22	CDTI	I	Control Data Input Pin in Serial Mode, I2C= "L".
	SDA	I/O	Control Data Pin in Serial Mode, I2C= "H".
23	CSN	I	Chip Select Pin in Serial Mode, I2C= "L".
		I	This pin should be connected to DVSS, I2C= "H".
24	DAUX1	I	AUX Audio Serial Data Input Pin (ADC/DAC part)
25	SDTI4	I	DAC4 Audio Serial Data Input Pin
26	SDTI3	I	DAC3 Audio Serial Data Input Pin
27	SDTI2	I	DAC2 Audio Serial Data Input Pin
28	SDTI1	I	DAC1 Audio Serial Data Input Pin
29	XTL1	I	X'tal Frequency Select 0 Pin
30	XTL0	I	X'tal Frequency Select 1 Pin

ASAHI KASEI   [AK4589]

No.	Pin Name	I/O	Function	
31	PDN	I	Power-Down Mode Pin When "L", the AK4589 is powered-down, all digital output pins go "L", all registers are reset. When CAD1/0 pins are changed, the AK4589 should be reset by PDN pin.	
32	MASTER	I	Master Mode Select Pin "H": Master mode, "L": Slave mode	
33	DZF2	O	Zero Input Detect 2 Pin (Table 13) When the input data of the group 1 follow total 8192 LRCK cycles with "0" input data, this pin goes to "H". And when RSTN bit is "0", PWDAN bit is "0", this pin goes to "H". It always is in "L" when P/S pin is "H".	
	OVF	O	Analog Input Overflow Detect Pin This pin goes to "H" if the analog input of Lch or Rch overflows.	
34	DZF1	O	Zero Input Detect 1 Pin (Table 13) When the input data of the group 1 follow total 8192 LRCK cycles with "0" input data, this pin goes to "H". And when RSTN bit is "0", PWDAN bit is "0", this pin goes to "H". Output is selected by setting DZFE pin when P/S pin is "H".	
35	LOUT4-	O	DAC4 Lch Negative Analog Output Pin	470pF capacitor should be connected between LOUT4- and LOUT4+.
36	LOUT4+	O	DAC4 Lch Positive Analog Output Pin	
37	ROUT4-	O	DAC4 Rch Negative Analog Output Pin	470pF capacitor should be connected between ROUT4- and ROUT4+.
38	ROUT4+	O	DAC4 Rch Positive Analog Output Pin	
39	LOUT3-	O	DAC3 Lch Negative Analog Output Pin	470pF capacitor should be connected between LOUT3- and LOUT3+.
40	LOUT3+	O	DAC3 Lch Positive Analog Output Pin	
41	ROUT3-	O	DAC3 Rch Negative Analog Output Pin	470pF capacitor should be connected between ROUT3- and ROUT3+.
42	ROUT3+	O	DAC3 Rch Positive Analog Output Pin	
43	LOUT2-	O	DAC2 Lch Negative Analog Output Pin	470pF capacitor should be connected between LOUT2- and LOUT2+.
44	LOUT2+	O	DAC2 Lch Positive Analog Output Pin	
45	ROUT2-	O	DAC2 Rch Negative Analog Output Pin	470pF capacitor should be connected between ROUT2- and ROUT2+.
46	ROUT2+	O	DAC2 Rch Positive Analog Output Pin	
47	LOUT1-	O	DAC1 Lch Negative Analog Output Pin	470pF capacitor should be connected between LOUT1- and LOUT1+.
48	LOUT1+	O	DAC1 Lch Positive Analog Output Pin	
49	ROUT1-	O	DAC1 Rch Negative Analog Output Pin	470pF capacitor should be connected between ROUT1- and ROUT1+.
50	ROUT1+	O	DAC1 Rch Positive Analog Output Pin	
51	LIN	I	Lch Analog Input Pin	
52	RIN	I	Rch Analog Input Pin	
53	VCOM	-	Common Voltage Output Pin 2.2μF capacitor should be connected to AVSS externally.	
54	VREFH	-	Positive Voltage Reference Input Pin, AVDD	

No.	Pin Name	I/O	Function
55	AVDD	-	Analog Power Supply Pin, 4.75V~5.25V
56	AVSS	-	Analog Ground Pin, 0V
57	RX0	I	Receiver Channel 0 Pin (Internal biased pin. Internally biased at PVDD/2)
58	NC	-	No Connect pin No internal bonding. This pin should be connected to PVSS.
59	RX1	I	Receiver Channel 1 Pin (Internal biased pin. Internally biased at PVDD/2)
60	TEST1	I	Test 1 Pin This pin should be connected to PVSS.
61	RX2	I	Receiver Channel 2 Pin (Internal biased pin. Internally biased at PVDD/2)
62	NC	-	No Connect pin No internal bonding. This pin should be connected to PVSS.
63	RX3	I	Receiver Channel 3 Pin (Internal biased pin. Internally biased at PVDD/2)
64	PVSS	-	PLL Ground pin
65	R	-	External Resistor Pin 12kΩ +/-1% resistor should be connected to PVSS externally.
66	PVDD	-	PLL Power supply Pin, 4.75V~5.25V
67	RX4	I	Receiver Channel 4 Pin (Internal biased pin. Internally biased at PVDD/2)
68	TEST2	I	Test 2 Pin This pin should be connected to PVSS.
69	RX5	I	Receiver Channel 5 Pin (Internal biased pin. Internally biased at PVDD/2)
70	CAD0	I	Chip Address 0 Pin (ADC/DAC part)
71	RX6	I	Receiver Channel 6 Pin (Internal biased pin. Internally biased at PVDD/2)
72	CAD1	I	Chip Address 1 Pin (ADC/DAC part)
73	RX7	I	Receiver Channel 7 Pin (Internal biased pin. Internally biased at PVDD/2)
74	I2C	I	Control Mode Select Pin. "L": 4-wire Serial, "H": I^{2}C Bus
75	DAUX2	I	Auxiliary Audio Data Input Pin (DIR/DIT part)
76	VIN	I	V-bit Input Pin for Transmitter Output
77	MCLK	I	Master Clock Input Pin
78	TX0	O	Transmit Channel (Through Data) Output 0 Pin
79	TX1	O	Transmit Channel Output1 pin When DIT bit = "0", Through Data. When DIT bit = "1", DAUX2 Data.
80	INT0	O	Interrupt 0 Pin

Notes: (RX0-7, LIN, RIN)
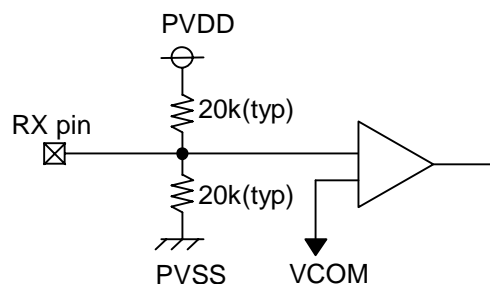
Internal biased pin Circuit

ASAHI KASEI   [AK4589]

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Classification	Pin Name	Setting
Analog	RX0-7, LOUT1-4, ROUT1-4, LIN, RIN	These pins should be open.
Digital	INT0-1, BOUT, XTO, MCKO1-2, COUT, UOUT, VOUT, SDTO1-2, CDTO, DZF1-2, TX1-0	These pins should be open.
	CSN, DAUX1-2, SDTI1-4, XTL0-1	These pins should be connected to DVSS.
	TEST1-3	These pins should be connected to PVSS.

JRC   **NJM7900**

3-TERMINAL NEGATIVE VOLTAGE REGULATOR

■ **GENERAL DESCRIPTION**

The NJM7900 series of Monolithic 3-Terminal Negative Regulators is constructed using the New JRC Planar epitaxial process. These negative regulators are intended as complements to the popular NJM7800 series of positive voltage regulators, and they are available in the same voltage options from −5 to −24V. The 7900 series employ internal current-limiting, safe-area protection, and thermal shutdown, making the virtually indestructible.

■ **FEATURES**

● Internal Short Circuit Current Limit
● Internal Thermal Overload Protection
● Excellent Ripple Rejection
● Guarantee'd 1.5A Output Current
● Package Outline   TO-220F
● Bipolar Technology

■ **PACKAGE OUTLINE**

(TO-220F)

1. COMMON
2. IN
3. OUT

1 2 3
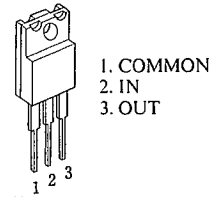
NJM7900FA

(note) The radiation fin is connected to Pin 2.

■ **EQUIVALENT CIRCUIT**
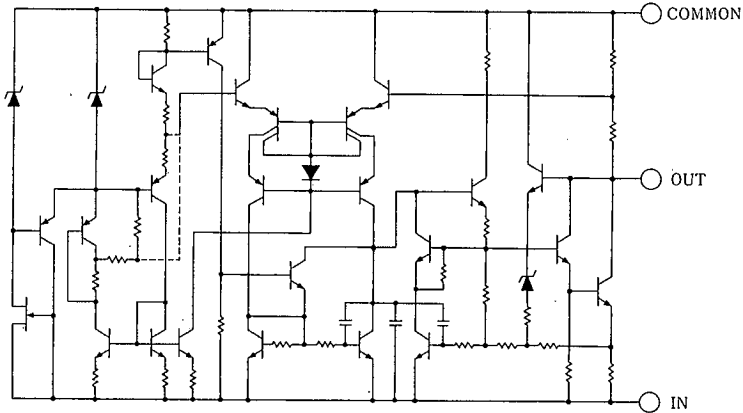
M29W800DT
M29W800DB

8 Mbit (1Mb x8 or 512Kb x16, Boot Block)
3V Supply Flash Memory

FEATURES SUMMARY

■ SUPPLY VOLTAGE
   – V_{CC} = 2.7V to 3.6V for Program, Erase and Read
■ ACCESS TIMES: 45, 70, 90ns
■ PROGRAMMING TIME
   – 10µs per Byte/Word typical
■ 19 MEMORY BLOCKS
   – 1 Boot Block (Top or Bottom Location)
   – 2 Parameter and 16 Main Blocks
■ PROGRAM/ERASE CONTROLLER
   – Embedded Byte/Word Program algorithms
■ ERASE SUSPEND and RESUME MODES
   – Read and Program another Block during Erase Suspend
■ UNLOCK BYPASS PROGRAM COMMAND
   – Faster Production/Batch Programming
■ TEMPORARY BLOCK UNPROTECTION MODE
■ COMMON FLASH INTERFACE
   – 64 bit Security Code
■ LOW POWER CONSUMPTION
   – Standby and Automatic Standby
■ 100,000 PROGRAM/ERASE CYCLES per BLOCK
■ ELECTRONIC SIGNATURE
   – Manufacturer Code: 0020h
   – Top Device Code M29W800DT: 22D7h
   – Bottom Device Code M29W800DB: 225Bh

Figure 1. Packages

SO44 (M)

TSOP48 (N)
12 x 20mm

TFBGA48 (ZA)
6 x 9 mm

TFBGA48 (ZE)
6 x 8mm
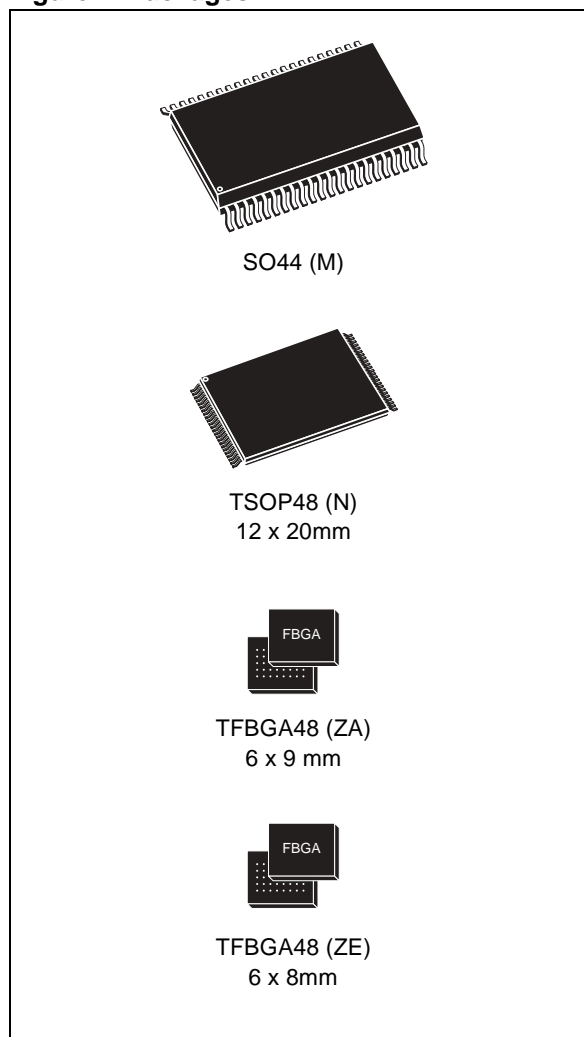
M29W800DT, M29W800DB

SUMMARY DESCRIPTION

The M29W800D is a 8 Mbit (1Mb x8 or 512Kb x16) non-volatile memory that can be read, erased and reprogrammed. These operations can be performed using a single low voltage (2.7 to 3.6V) supply. On power-up the memory defaults to its Read mode where it can be read in the same way as a ROM or EPROM.

The memory is divided into blocks that can be erased independently so it is possible to preserve valid data while old data is erased. Each block can be protected independently to prevent accidental Program or Erase commands from modifying the memory. Program and Erase commands are written to the Command Interface of the memory. An on-chip Program/Erase Controller simplifies the process of programming or erasing the memory by taking care of all of the special operations that are required to update the memory contents.

The end of a program or erase operation can be detected and any error conditions identified. The command set required to control the memory is consistent with JEDEC standards.

The blocks in the memory are asymmetrically arranged, see Figures 6 and 7, Block Addresses. The first or last 64 Kbytes have been divided into four additional blocks. The 16 Kbyte Boot Block can be used for small initialization code to start the microprocessor, the two 8 Kbyte Parameter Blocks can be used for parameter storage and the remaining 32K is a small Main Block where the application may be stored.

Chip Enable, Output Enable and Write Enable signals control the bus operation of the memory. They allow simple connection to most microprocessors, often without additional logic.

The memory is offered in SO44, TSOP48 (12 x 20mm), TFBGA48 6 x 9mm (0.8mm pitch) and TFBGA48 6 x 8mm (0.8mm pitch) packages. The memory is supplied with all the bits erased (set to '1').

Figure 2. Logic Diagram
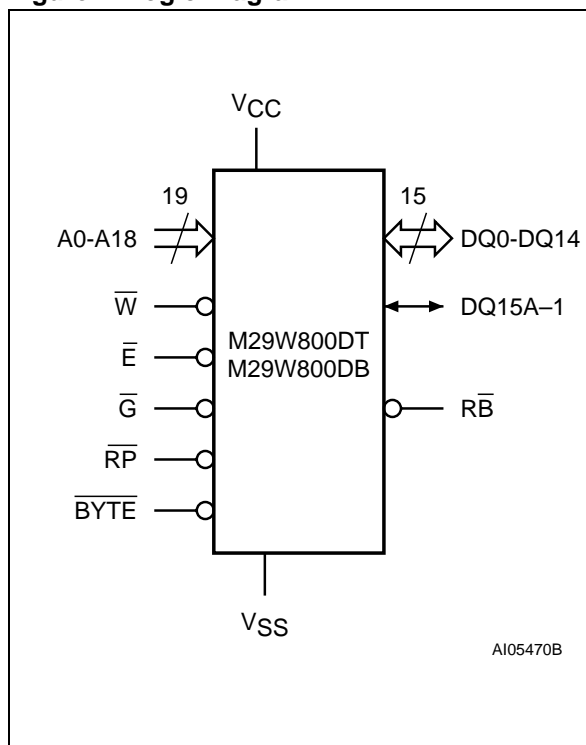
Table 1. Signal Names

A0-A18	Address Inputs
DQ0-DQ7	Data Inputs/Outputs
DQ8-DQ14	Data Inputs/Outputs
DQ15A–1	Data Input/Output or Address Input
$\overline{E}$	Chip Enable
$\overline{G}$	Output Enable
$\overline{W}$	Write Enable
$\overline{RP}$	Reset/Block Temporary Unprotect
$R\overline{B}$	Ready/Busy Output (not available on SO44 package)
$\overline{BYTE}$	Byte/Word Organization Select
V_{CC}	Supply Voltage
V_{SS}	Ground
NC	Not Connected Internally

M29W800DT, M29W800DB

Figure 3. SO Connections

$\overline{RP}$	①		44	$\overline{W}$
A18	2		43	NC
A17	3		42	A8
A7	4		41	A9
A6	5		40	A10
A5	6		39	A11
A4	7		38	A12
A3	8		37	A13
A2	9		36	A14
A1	10		35	A15
A0	11	M29W800DT	34	A16
$\overline{E}$	12	M29W800DB	33	$\overline{BYTE}$
V$_{SS}$	13		32	V$_{SS}$
$\overline{G}$	14		31	DQ15A–1
DQ0	15		30	DQ7
DQ8	16		29	DQ14
DQ1	17		28	DQ6
DQ9	18		27	DQ13
DQ2	19		26	DQ5
DQ10	20		25	DQ12
DQ3	21		24	DQ4
DQ11	22		23	V$_{CC}$

AI05462b
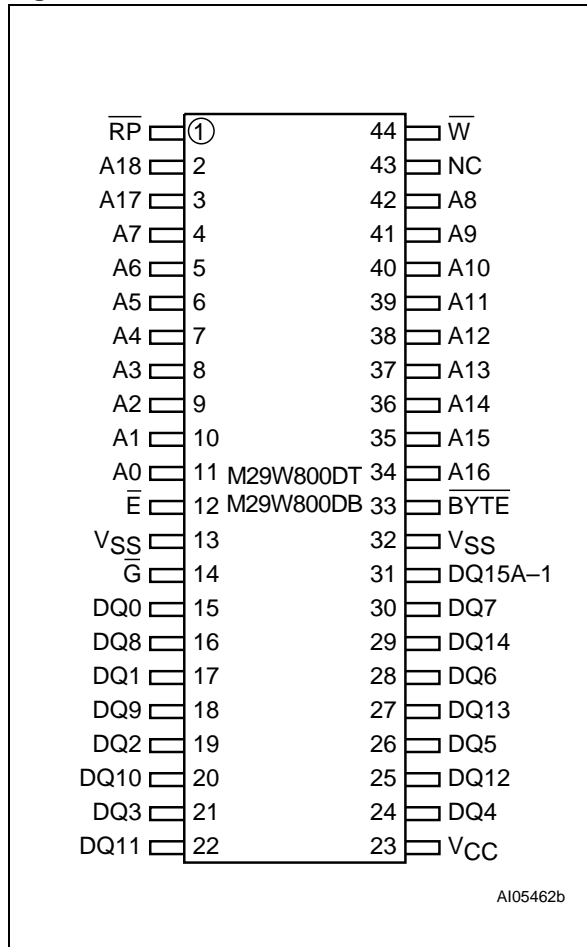
Figure 4. TSOP Connections

A15	①		48	A16
A14				$\overline{BYTE}$
A13				V$_{SS}$
A12				DQ15A–1
A11				DQ7
A10				DQ14
A9				DQ6
A8				DQ13
NC				DQ5
NC				DQ12
$\overline{W}$				DQ4
$\overline{RP}$	12	M29W800DT	37	V$_{CC}$
NC	13	M29W800DB	36	DQ11
NC				DQ3
R$\overline{B}$				DQ10
A18				DQ2
A17				DQ9
A7				DQ1
A6				DQ8
A5				DQ0
A4				$\overline{G}$
A3				V$_{SS}$
A2				$\overline{E}$
A1	24		25	A0

AI05461

120
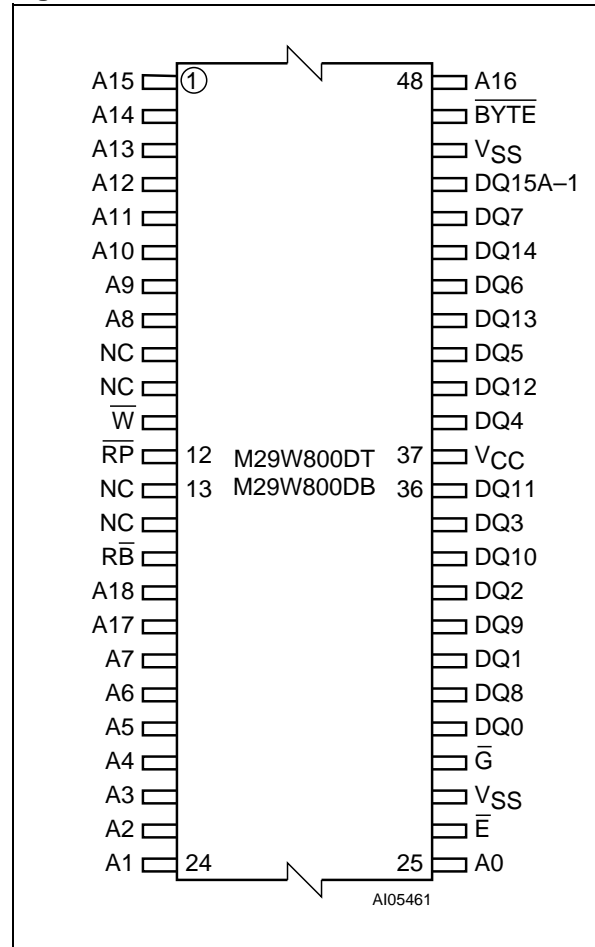
M29W800DT, M29W800DB

Figure 6. Block Addresses (x8)

M29W800DT
Top Boot Block Addresses (x8)

FFFFFh	16 KByte
FC000h	
FBFFFh	8 KByte
FA000h	
F9FFFh	8 KByte
F8000h	
F7FFFh	32 KByte
F0000h	
EFFFFh	64 KByte
E0000h	
1FFFFh	64 KByte
10000h	
0FFFFh	64 KByte
00000h	

Total of 15
64 KByte Blocks

M29W800DB
Bottom Boot Block Addresses (x8)

FFFFFh	64 KByte
F0000h	
EFFFFh	64 KByte
E0000h	
1FFFFh	64 KByte
10000h	
0FFFFh	32 KByte
08000h	
07FFFh	8 KByte
06000h	
05FFFh	8 KByte
04000h	
03FFFh	16 KByte
00000h	

Total of 15
64 KByte Blocks

AI05463

Note: Also see APPENDIX A., Tables 21 and 22 for a full listing of the Block Addresses.

M29W800DT, M29W800DB

Figure 7. Block Addresses (x16)

M29W800DT
Top Boot Block Addresses (x16)

Address	Block
7FFFFh	8 KWord
7E000h / 7DFFFh	4 KWord
7D000h / 7CFFFh	4 KWord
7C000h / 7BFFFh	16 KWord
78000h / 77FFFh	32 KWord
70000h	
0FFFFh	32 KWord
08000h / 07FFFh	32 KWord
00000h	

Total of 15
32 KWord Blocks

M29W800DB
Bottom Boot Block Addresses (x16)

Address	Block
7FFFFh	32 KWord
78000h / 77FFFh	32 KWord
70000h	
0FFFFh	32 KWord
08000h / 07FFFh	16 KWord
04000h / 03FFFh	4 KWord
03000h / 02FFFh	4 KWord
02000h / 01FFFh	8 KWord
00000h	

Total of 15
32 KWord Blocks

AI05464

Note: Also see APPENDIX A., Tables 21 and 22 for a full listing of the Block Addresses.

122

M29W800DT, M29W800DB

SIGNAL DESCRIPTIONS

See Figure 2., Logic Diagram, and Table 1., Signal Names, for a brief overview of the signals connected to this device.

Address Inputs (A0-A18). The Address Inputs select the cells in the memory array to access during Bus Read operations. During Bus Write operations they control the commands sent to the Command Interface of the internal state machine.

Data Inputs/Outputs (DQ0-DQ7). The Data Inputs/Outputs output the data stored at the selected address during a Bus Read operation. During Bus Write operations they represent the commands sent to the Command Interface of the internal state machine.

Data Inputs/Outputs (DQ8-DQ14). The Data Inputs/Outputs output the data stored at the selected address during a Bus Read operation when $\overline{BYTE}$ is High, V_{IH}. When BYTE is Low, V_{IL}, these pins are not used and are high impedance. During Bus Write operations the Command Register does not use these bits. When reading the Status Register these bits should be ignored.

Data Input/Output or Address Input (DQ15A-1). When BYTE is High, V_{IH}, this pin behaves as a Data Input/Output pin (as DQ8-DQ14). When BYTE is Low, V_{IL}, this pin behaves as an address pin; DQ15A–1 Low will select the LSB of the Word on the other addresses, DQ15A–1 High will select the MSB. Throughout the text consider references to the Data Input/Output to include this pin when BYTE is High and references to the Address Inputs to include this pin when BYTE is Low except when stated explicitly otherwise.

Chip Enable (E). The Chip Enable, $\overline{E}$, activates the memory, allowing Bus Read and Bus Write operations to be performed. When Chip Enable is High, V_{IH}, all other pins are ignored.

Output Enable (G). The Output Enable, $\overline{G}$, controls the Bus Read operation of the memory.

Write Enable (W). The Write Enable, $\overline{W}$, controls the Bus Write operation of the memory's Command Interface.

Reset/Block Temporary Unprotect ($\overline{RP}$). The Reset/Block Temporary Unprotect pin can be used to apply a Hardware Reset to the memory or to temporarily unprotect all Blocks that have been protected.

A Hardware Reset is achieved by holding Reset/Block Temporary Unprotect Low, V_{IL}, for at least t_{PLPX}. After Reset/Block Temporary Unprotect goes High, V_{IH}, the memory will be ready for Bus Read and Bus Write operations after t_{PHEL} or t_{RHEL}, whichever occurs last. See the Ready/Busy Output section, Table 15. and Figure 15., Reset/Block Temporary Unprotect AC Waveforms, for more details.

Holding $\overline{RP}$ at V_{ID} will temporarily unprotect the protected Blocks in the memory. Program and Erase operations on all blocks will be possible. The transition from V_{IH} to V_{ID} must be slower than t_{PHPHH}.

Ready/Busy Output ($\overline{RB}$). The Ready/Busy pin is an open-drain output that can be used to identify when the device is performing a Program or Erase operation. During Program or Erase operations Ready/Busy is Low, V_{OL}. Ready/Busy is high-impedance during Read mode, Auto Select mode and Erase Suspend mode.

After a Hardware Reset, Bus Read and Bus Write operations cannot begin until Ready/Busy becomes high-impedance. See Table 15., Reset/Block Temporary Unprotect AC Characteristics and Figure 15., Reset/Block Temporary Unprotect AC Waveforms.

The use of an open-drain output allows the Ready/Busy pins from several memories to be connected to a single pull-up resistor. A Low will then indicate that one, or more, of the memories is busy.

Byte/Word Organization Select (BYTE). The Byte/Word Organization Select pin is used to switch between the 8-bit and 16-bit Bus modes of the memory. When Byte/Word Organization Select is Low, V_{IL}, the memory is in 8-bit mode, when it is High, V_{IH}, the memory is in 16-bit mode.

V_{CC} Supply Voltage. The V_{CC} Supply Voltage supplies the power for all operations (Read, Program, Erase etc.).

The Command Interface is disabled when the V_{CC} Supply Voltage is less than the Lockout Voltage, V_{LKO}. This prevents Bus Write operations from accidentally damaging the data during power up, power down and power surges. If the Program/Erase Controller is programming or erasing during this time then the operation aborts and the memory contents being altered will be invalid.

A 0.1µF capacitor should be connected between the V_{CC} Supply Voltage pin and the V_{SS} Ground pin to decouple the current surges from the power supply. The PCB track widths must be sufficient to carry the currents required during program and erase operations, I_{CC3}.

V_{SS} Ground. The V_{SS} Ground is the reference for all voltage measurements.

BUS OPERATIONS

There are five standard bus operations that control the device. These are Bus Read, Bus Write, Output Disable, Standby and Automatic Standby. See Tables 2 and 3, Bus Operations, for a summary. Typically glitches of less than 5ns on Chip Enable or Write Enable are ignored by the memory and do not affect bus operations.

Bus Read. Bus Read operations read from the memory cells, or specific registers in the Command Interface. A valid Bus Read operation involves setting the desired address on the Address Inputs, applying a Low signal, V_{IL}, to Chip Enable and Output Enable and keeping Write Enable High, V_{IH}. The Data Inputs/Outputs will output the value, see Figure 12., Read Mode AC Waveforms, and Table 12., Read AC Characteristics for details of when the output becomes valid.

Bus Write. Bus Write operations write to the Command Interface. A valid Bus Write operation begins by setting the desired address on the Address Inputs. The Address Inputs are latched by the Command Interface on the falling edge of Chip Enable or Write Enable, whichever occurs last. The Data Inputs/Outputs are latched by the Command Interface on the rising edge of Chip Enable or Write Enable, whichever occurs first. Output Enable must remain High, V_{IH}, during the whole Bus Write operation. See Figures 13 and 14, Write AC Waveforms, and Tables 13 and 14, Write AC Characteristics, for details of the timing requirements.

Output Disable. The Data Inputs/Outputs are in the high impedance state when Output Enable is High, V_{IH}.

Standby. When Chip Enable is High, V_{IH}, the memory enters Standby mode and the Data Inputs/Outputs pins are placed in the high-imped-ance state. To reduce the Supply Current to the Standby Supply Current, I_{CC2}, Chip Enable should be held within $V_{CC} \pm 0.2V$. For the Standby current level see Table 11., DC Characteristics.

During program or erase operations the memory will continue to use the Program/Erase Supply Current, I_{CC3}, for Program or Erase operations until the operation completes.

Automatic Standby. If CMOS levels ($V_{CC} \pm 0.2V$) are used to drive the bus and the bus is inactive for 150ns or more the memory enters Automatic Standby where the internal Supply Current is reduced to the Standby Supply Current, I_{CC2}. The Data Inputs/Outputs will still output data if a Bus Read operation is in progress.

Special Bus Operations. Additional bus operations can be performed to read the Electronic Signature and also to apply and remove Block Protection. These bus operations are intended for use by programming equipment and are not usually used in applications. They require V_{ID} to be applied to some pins.

Electronic Signature. The memory has two codes, the manufacturer code and the device code, that can be read to identify the memory. These codes can be read by applying the signals listed in Tables 2 and 3, Bus Operations.

Block Protection and Blocks Unprotection.

Each block can be separately protected against accidental Program or Erase. Protected blocks can be unprotected to allow data to be changed.

There are two methods available for protecting and unprotecting the blocks, one for use on programming equipment and the other for in-system use. Block Protect and Chip Unprotect operations are described in APPENDIX C.

Table 2. Bus Operations, $\overline{BYTE} = V_{IL}$

Operation	$\overline{E}$	$\overline{G}$	$\overline{W}$	Address Inputs DQ15A–1, A0-A18	Data Inputs/Outputs	
					DQ14-DQ8	DQ7-DQ0
Bus Read	V_{IL}	V_{IL}	V_{IH}	Cell Address	Hi-Z	Data Output
Bus Write	V_{IL}	V_{IH}	V_{IL}	Command Address	Hi-Z	Data Input
Output Disable	X	V_{IH}	V_{IH}	X	Hi-Z	Hi-Z
Standby	V_{IH}	X	X	X	Hi-Z	Hi-Z
Read Manufacturer Code	V_{IL}	V_{IL}	V_{IH}	A0 = V_{IL}, A1 = V_{IL}, A9 = V_{ID}, Others V_{IL} or V_{IH}	Hi-Z	20h
Read Device Code	V_{IL}	V_{IL}	V_{IH}	A0 = V_{IH}, A1 = V_{IL}, A9 = V_{ID}, Others V_{IL} or V_{IH}	Hi-Z	D7h (M29W800DT) 5Bh (M29W800DB)

Note: X = V_{IL} or V_{IH}.

M29W800DT, M29W800DB

Table 3. Bus Operations, $\overline{BYTE} = V_{IH}$

Operation	$\overline{E}$	$\overline{G}$	$\overline{W}$	Address Inputs A0-A18	Data Inputs/Outputs DQ15A–1, DQ14-DQ0
Bus Read	V_{IL}	V_{IL}	V_{IH}	Cell Address	Data Output
Bus Write	V_{IL}	V_{IH}	V_{IL}	Command Address	Data Input
Output Disable	X	V_{IH}	V_{IH}	X	Hi-Z
Standby	V_{IH}	X	X	X	Hi-Z
Read Manufacturer Code	V_{IL}	V_{IL}	V_{IH}	A0 = V_{IL}, A1 = V_{IL}, A9 = V_{ID}, Others V_{IL} or V_{IH}	0020h
Read Device Code	V_{IL}	V_{IL}	V_{IH}	A0 = V_{IH}, A1 = V_{IL}, A9 = V_{ID}, Others V_{IL} or V_{IH}	22D7h (M29W800DT) 225Bh (M29W800DB)

Note: X = V_{IL} or V_{IH}.

COMMAND INTERFACE

All Bus Write operations to the memory are interpreted by the Command Interface. Commands consist of one or more sequential Bus Write operations. Failure to observe a valid sequence of Bus Write operations will result in the memory returning to Read mode. The long command sequences are imposed to maximize data security.

The address used for the commands changes depending on whether the memory is in 16-bit or 8-bit mode. See either Table 4, or 5, depending on the configuration that is being used, for a summary of the commands.

Read/Reset Command. The Read/Reset command returns the memory to its Read mode where it behaves like a ROM or EPROM, unless otherwise stated. It also resets the errors in the Status Register. Either one or three Bus Write operations can be used to issue the Read/Reset command.

The Read/Reset Command can be issued, between Bus Write cycles before the start of a program or erase operation, to return the device to read mode. Once the program or erase operation has started the Read/Reset command is no longer accepted. The Read/Reset command will not abort an Erase operation when issued while in Erase Suspend.

Auto Select Command. The Auto Select command is used to read the Manufacturer Code, the Device Code and the Block Protection Status. Three consecutive Bus Write operations are required to issue the Auto Select command. Once the Auto Select command is issued the memory remains in Auto Select mode until a Read/Reset command is issued. Read CFI Query and Read/Reset commands are accepted in Auto Select mode, all other commands are ignored.

From the Auto Select mode the Manufacturer Code can be read using a Bus Read operation with A0 = V_{IL} and A1 = V_{IL}. The other address bits may be set to either V_{IL} or V_{IH}. The Manufacturer Code for STMicroelectronics is 0020h.

The Device Code can be read using a Bus Read operation with A0 = V_{IH} and A1 = V_{IL}. The other address bits may be set to either V_{IL} or V_{IH}. The Device Code for the M29W800DT is 22D7h and for the M29W800DB is 225Bh.

The Block Protection Status of each block can be read using a Bus Read operation with A0 = V_{IL}, A1 = V_{IH}, and A12-A18 specifying the address of the block. The other address bits may be set to either V_{IL} or V_{IH}. If the addressed block is protected then 01h is output on Data Inputs/Outputs DQ0-DQ7, otherwise 00h is output.

Program Command. The Program command can be used to program a value to one address in the memory array at a time. The command requires four Bus Write operations, the final write operation latches the address and data in the internal state machine and starts the Program/Erase Controller.

If the address falls in a protected block then the Program command is ignored, the data remains unchanged. The Status Register is never read and no error condition is given.

During the program operation the memory will ignore all commands. It is not possible to issue any command to abort or pause the operation. Typical program times are given in Table 6. Bus Read operations during the program operation will output the Status Register on the Data Inputs/Outputs. See the section on the Status Register for more details.

After the program operation has completed the memory will return to the Read mode, unless an error has occurred. When an error occurs the memory will continue to output the Status Register. A Read/Reset command must be issued to reset the error condition and return to Read mode.

Note that the Program command cannot change a bit set at '0' back to '1'. One of the Erase Commands must be used to set all the bits in a block or in the whole memory from '0' to '1'.

Unlock Bypass Command. The Unlock Bypass command is used in conjunction with the Unlock Bypass Program command to program the memory. When the access time to the device is long (as with some EPROM programmers) considerable time saving can be made by using these commands. Three Bus Write operations are required to issue the Unlock Bypass command.

Once the Unlock Bypass command has been issued the memory will only accept the Unlock Bypass Program command and the Unlock Bypass Reset command. The memory can be read as if in Read mode.

Unlock Bypass Program Command. The Unlock Bypass Program command can be used to program one address in memory at a time. The command requires two Bus Write operations, the final write operation latches the address and data in the internal state machine and starts the Program/Erase Controller.

The Program operation using the Unlock Bypass Program command behaves identically to the Program operation using the Program command. A protected block cannot be programmed; the operation cannot be aborted and the Status Register is read. Errors must be reset using the Read/Reset command, which leaves the device in Unlock Bypass Mode. See the Program command for details on the behavior.

Unlock Bypass Reset Command. The Unlock Bypass Reset command can be used to return to Read/Reset mode from Unlock Bypass Mode. Two Bus Write operations are required to issue the Unlock Bypass Reset command. Read/Reset command does not exit from Unlock Bypass Mode.

Chip Erase Command. The Chip Erase command can be used to erase the entire chip. Six Bus Write operations are required to issue the Chip Erase Command and start the Program/Erase Controller.

If any blocks are protected then these are ignored and all the other blocks are erased. If all of the blocks are protected the Chip Erase operation appears to start but will terminate within about 100µs, leaving the data unchanged. No error condition is given when protected blocks are ignored.

During the erase operation the memory will ignore all commands. It is not possible to issue any command to abort the operation. Typical chip erase times are given in Table 6. All Bus Read operations during the Chip Erase operation will output the Status Register on the Data Inputs/Outputs. See the section on the Status Register for more details.

After the Chip Erase operation has completed the memory will return to the Read Mode, unless an error has occurred. When an error occurs the memory will continue to output the Status Register. A Read/Reset command must be issued to reset the error condition and return to Read Mode.

The Chip Erase Command sets all of the bits in unprotected blocks of the memory to '1'. All previous data is lost.

Block Erase Command. The Block Erase command can be used to erase a list of one or more blocks. Six Bus Write operations are required to select the first block in the list. Each additional block in the list can be selected by repeating the sixth Bus Write operation using the address of the additional block. The Block Erase operation starts the Program/Erase Controller about 50µs after the last Bus Write operation. Once the Program/Erase Controller starts it is not possible to select any more blocks. Each additional block must therefore be selected within 50µs of the last block. The 50µs timer restarts when an additional block is selected. The Status Register can be read after the sixth Bus Write operation. See the Status Register for details on how to identify if the Program/Erase Controller has started the Block Erase operation.

If any selected blocks are protected then these are ignored and all the other selected blocks are erased. If all of the selected blocks are protected the Block Erase operation appears to start but will terminate within about 100µs, leaving the data unchanged. No error condition is given when protected blocks are ignored.

During the Block Erase operation the memory will ignore all commands except the Erase Suspend command. Typical block erase times are given in Table 6. All Bus Read operations during the Block Erase operation will output the Status Register on the Data Inputs/Outputs. See the section on the Status Register for more details.

After the Block Erase operation has completed the memory will return to the Read Mode, unless an error has occurred. When an error occurs the memory will continue to output the Status Register. A Read/Reset command must be issued to reset the error condition and return to Read mode.

The Block Erase Command sets all of the bits in the unprotected selected blocks to '1'. All previous data in the selected blocks is lost.

M29W800DT, M29W800DB

Erase Suspend Command. The Erase Suspend Command may be used to temporarily suspend a Block Erase operation and return the memory to Read mode. The command requires one Bus Write operation.

The Program/Erase Controller will suspend within the Erase Suspend Latency Time (refer to Table 6. for value) of the Erase Suspend Command being issued. Once the Program/Erase Controller has stopped the memory will be set to Read mode and the Erase will be suspended. If the Erase Suspend command is issued during the period when the memory is waiting for an additional block (before the Program/Erase Controller starts) then the Erase is suspended immediately and will start immediately when the Erase Resume Command is issued. It is not possible to select any further blocks to erase after the Erase Resume.

During Erase Suspend it is possible to Read and Program cells in blocks that are not being erased; both Read and Program operations behave as normal on these blocks. If any attempt is made to program in a protected block or in the suspended block then the Program command is ignored and the data remains unchanged. The Status Register is not read and no error condition is given. Reading from blocks that are being erased will output the Status Register.

It is also possible to issue the Auto Select, Read CFI Query and Unlock Bypass commands during an Erase Suspend. The Read/Reset command must be issued to return the device to Read Array mode before the Resume command will be accepted.

Erase Resume Command. The Erase Resume command must be used to restart the Program/Erase Controller from Erase Suspend. An erase can be suspended and resumed more than once.

Read CFI Query Command. The Read CFI Query Command is used to read data from the Common Flash Interface (CFI) Memory Area. This command is valid when the device is in the Read Array mode, or when the device is in Auto Select mode.

One Bus Write cycle is required to issue the Read CFI Query Command. Once the command is issued subsequent Bus Read operations read from the Common Flash Interface Memory Area.

The Read/Reset command must be issued to return the device to the previous mode (the Read Array mode or Auto Select mode). A second Read/Reset command would be needed if the device is to be put in the Read Array mode from Auto Select mode.

See APPENDIX B., Tables 23, 24, 25, 26, 27 and 28 for details on the information contained in the Common Flash Interface (CFI) memory area.

Block Protect and Chip Unprotect Commands. Each block can be separately protected against accidental Program or Erase. The whole chip can be unprotected to allow the data inside the blocks to be changed.

Block Protect and Chip Unprotect operations are described in APPENDIX C.

MITSUMI

Video Switch · 75Ω driver · Y/C mix
Monolithic IC MM1501 Series

Outline

This IC extends the series of ICs for video/audio signal switching, with a 2-input 1-output single video switch, video signal/chroma signal 75Ω driver, and Y/C mixing circuit in one small package (SOT-26).

Features

(1) Low power consumption achieved.
(2) Low power supply voltage realized.
(3) Frequency bandwidth   without 75Ω driver: 10MHz   with 75Ω driver: 7MHz
(4) Cross talk   70dB   When 4.43MHz
(5) With SAG measures pin (75Ω driver and Y/C mix driver)

Package

SOT-26A (with 75Ω driver)
SOT-26B (without 75Ω driver)

Applications

(1) TV
(2) VTR
(3) Video camera
(4) Digital still camera
(5) Other visual equipment

Line-up

Functions	Model Name	Input	Output	Clamp	6dB amp	75Ω driver	SAG measures pin	Power supply voltage
Switch	MM1501	2	1	×	×	×	×	4.5~13.0V
	MM1502			×	○	×	×	4.5~13.0V
	MM1503			○	×	×	×	4.5~13.0V
	MM1504			○	○	×	×	4.5~13.0V
	MM1505			×	×	○	×	4.5~13.0V
	MM1506			×	○	○	×	4.5~13.0V
	MM1507			○	×	○	×	4.5~13.0V
	MM1508			○	○	○	×	4.5~13.0V
Driver	MM1509	1	1	×	○	○	○	4.5~13.0V
	MM1510			○	○	○	○	4.5~13.0V
Y/C mix	MM1511	1	1	○/×	×	×	×	4.5~13.0V
	MM1512			○/×	○	○	○	4.5~13.0V

Block Diagram

■ MM1501

SW Vcc
① ③
bias
15k 15k
IN 1 ⑥
IN 2 ④
Buf.
② 47μ +
OUT 5k
⑤
GND

■ MM1502

SW Vcc
① ③
bias
15k 15k
IN 1 ⑥
IN 2 ④
6dB
② 47μ +
OUT 5k
⑤
GND

■ MM1503

SW Vcc
① ③
bias
Clamp Clamp
IN 1 ⑥
IN 2 ④
Buf.
② 47μ +
OUT 5k
⑤
GND

■ MM1504

SW Vcc
① ③
bias
Clamp Clamp
IN 1 ⑥
IN 2 ④
6dB
② 47μ +
OUT 5k
⑤
GND

■ MM1505

SW Vcc
① ③
bias
15k 15k
IN 1 ⑥
IN 2 ④
DRV.
② 470μ +
OUT 75
75
⑤
GND

■ MM1506

SW Vcc
① ③
bias
15k 15k
IN 1 ⑥
IN 2 ④
DRV. 6dB
② 470μ +
OUT 75
75
⑤
GND
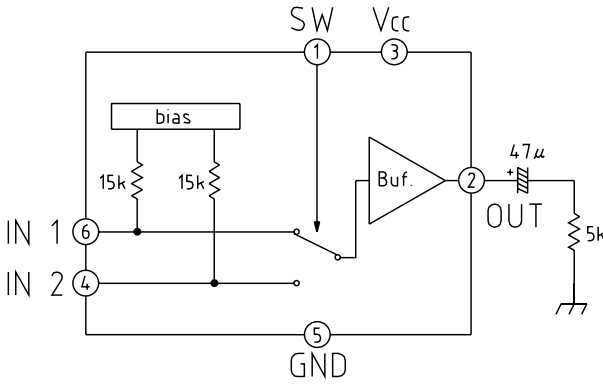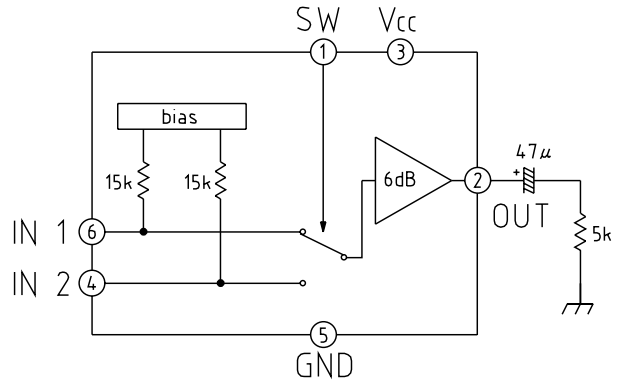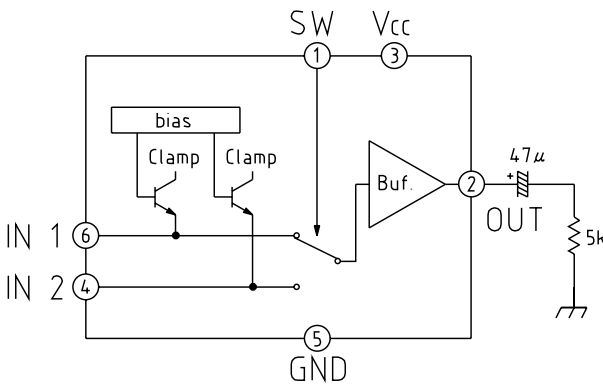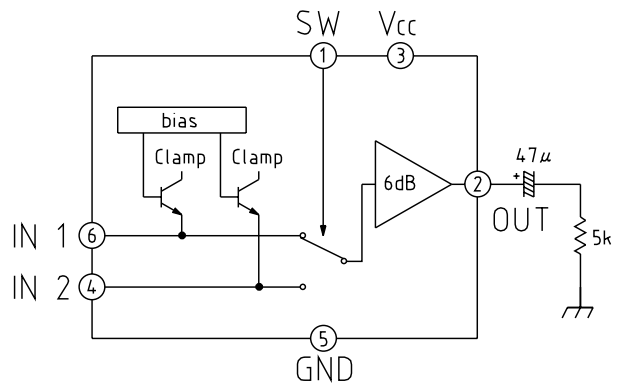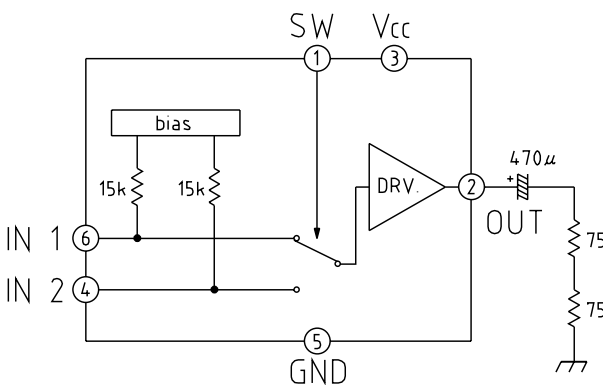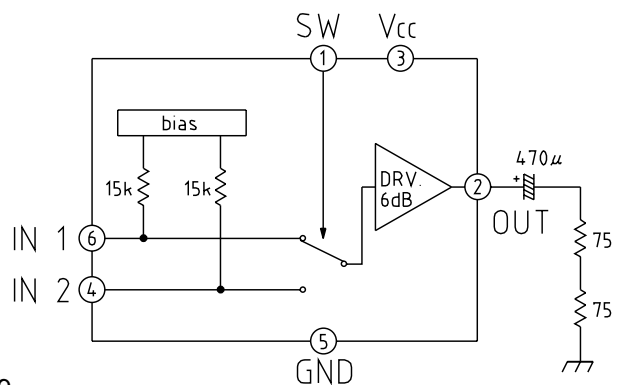
MITSUMI   Video Switch · 75Ω driver · Y/C mix   MM1501

■

MM1507
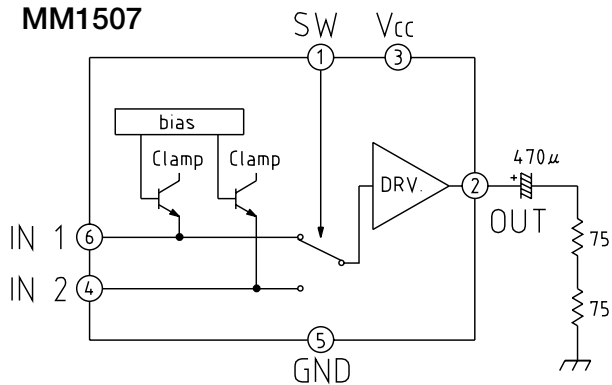
MM1508
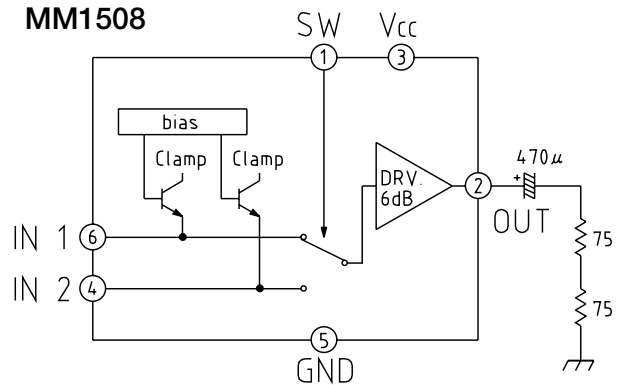
■ MM1509
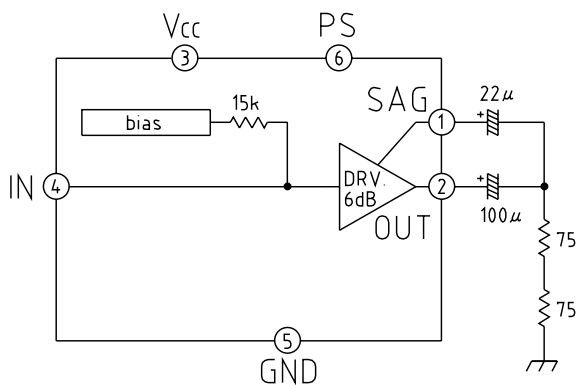
■ MM1510

■ MM1511

■ MM1512

130

JRC
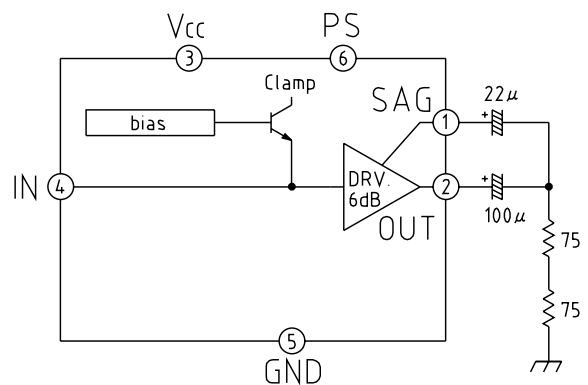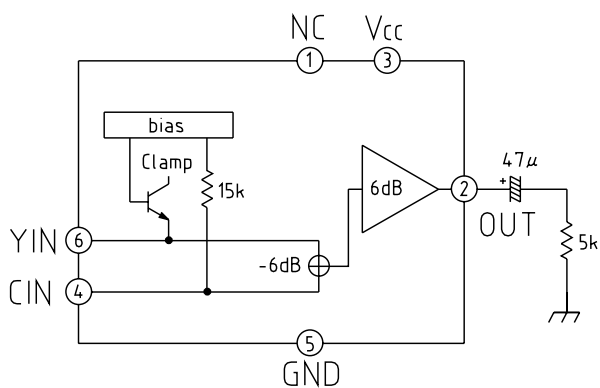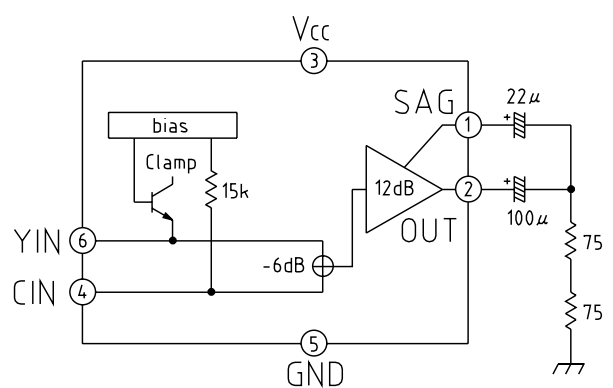
NJL31H/31V/32H/33H/34H000A

INFRARED REMOTE CONTROL RECEIVER

■ GENERAL DESCRIPTION

The NJL30H/V000A series are small and high performance receiving devices for infrared remote control system.

They can operate under low and wide supply voltage (2.7V to 5.5V) with enhanced immunity against power saving light.

The NJL30H/V000A series have six kinds of package including seven types of metal case to meet the various applications.

■ FEATURES

1. Wide and low supply voltage   2.7V to 5.5V

2. Low supply current   0.43mA typ.   Vcc=3.3V

3. Six kinds of metal case type to meet the design of front panel.

4. Line-up for various center carrier frequencies.

■ APPLICATIONS

1. Home application such as Room light, Fan, etc.

2. AV instruments such as Audio, TV, DVD, STB etc.

■ LINE-UP

View Height Carrier Frequency	Side
	6.3mm
fo= 36 kHz	NJL31V360A-M
36.7 kHz	NJL31V367A-M
38 kHz	NJL31V380A-M
40 kHz	NJL31V400A-M

View Height Carrier Frequency	Top				
	5.7mm	5.7mm	8mm	11mm	15mm
fo= 36 kHz	NJL31H360A-M	NJL31H360AF3-M	NJL32H360A	NJL33H360A	NJL34H360A
36.7 kHz	NJL31H367A-M	NJL31H367AF3-M	NJL32H367A	NJL33H367A	NJL34H367A
38 kHz	NJL31H380A-M	NJL31H380AF3-M	NJL32H380A	NJL33H380A	NJL34H380A
40 kHz	NJL31H400A-M	NJL31H400AF3-M	NJL32H400A	NJL33H400A	NJL34H400A

Regarding other frequency or packages, please contact to New JRC individually.

■ BLOCK DIAGRAM
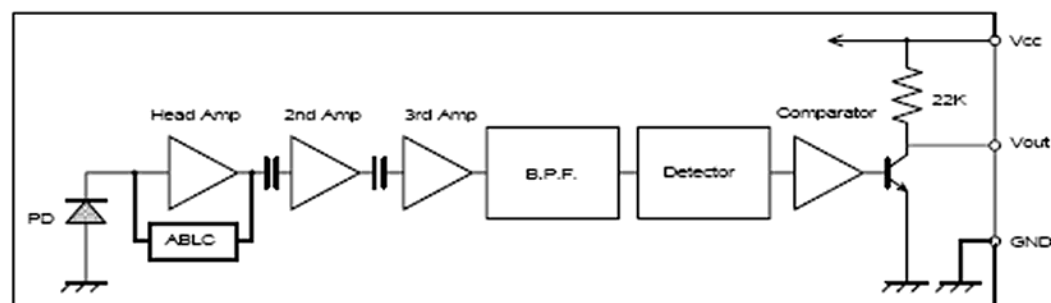
KEC
KOREA ELECTRONICS CO.,LTD.

SEMICONDUCTOR
TECHNICAL DATA

KTD600K
EPITAXIAL PLANAR NPN TRANSISTOR

LOW FREQUENCY POWER AMP,
MEDIUM SPEED SWITCHING APPLICATIONS

FEATURES
· High breakdown voltage V_{CEO} 120V, high current 1A.
· Low saturation voltage and good linearity of h_{FE}.

MAXIMUM RATINGS (Ta=25℃)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Base Voltage		V_{CBO}	120	V
Collector-Emitter Voltage		V_{CEO}	120	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current	I_C	1	A
	I_{CP}	2	
Collector Power Dissipation	Ta=25℃	P_C	1.5	W
	Tc=25℃		8	
Junction Temperature		T_j	150	℃
Storage Temperature Range		T_{stg}	-55~150	℃

TO-126

DIM	MILLIMETERS
A	8.3 MAX
B	5.8
C	0.7
D	⌀3.1±0.1
E	3.5
F	11.0±0.3
G	2.9 MAX
H	1.0 MAX
J	1.9 MAX
K	0.75±0.15
L	14.0 MIN
M	2.3±0.1
N	0.75±0.15
O	1.6
P	3.4 MAX

1. EMITTER
2. COLLECTOR
3. BASE
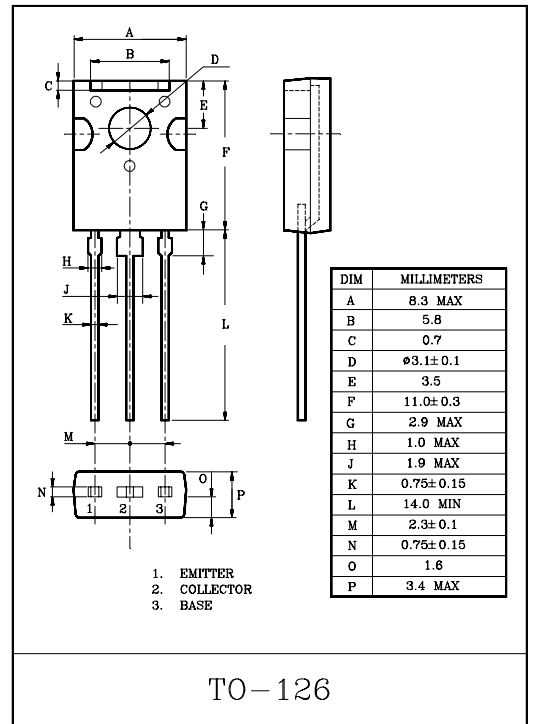
ELECTRICAL CHARACTERISTICS (Ta=25℃)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cut of Current		I_{CBO}	V_{CB}=50V, I_E=0	–	–	1	μA
Emitter Cut of Current		I_{EBO}	V_{EB}=4V, I_C=0	–	–	1	μA
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	I_C=10μA	120	–	–	V
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	I_C=1mA	120	–	–	V
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	I_E=10μA	5	–	–	V
DC Current Gain	$h_{FE}(1)$Note	V_{CE}=5V, I_C=50mA	100	–	320	
	$h_{FE}(2)$	V_{CE}=5V, I_C=500mA	20	–	–	
Gain Bandwidth Product		f_T	V_{CE}=10V, I_C=50mA	–	130	–	MHz
Output Capacitance		C_{ob}	V_{CB}=10V, f=1MHz	–	20	–	pF
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C=500mA, I_B=50mA	–	0.15	0.4	V
Base-Emitter Saturation Voltage		$V_{BE(sat)}$	I_C=500mA, I_B=50mA	–	0.85	1.2	V
Switching Time	Turn-on Time	t_{on}		–	100	–	nS
	Turn-off Time	t_{off}		–	500	–	
	Storage Time	t_{stg}		–	700	–	

V_{CE}=12V
I_C=10I_{B1}=-10I_{B2}=500mA

(Note) : $h_{FE}(1)$ Classification   Y:100~200,   GR:160~320

FAIRCHILD
SEMICONDUCTOR®

www.fairchildsemi.com

MC78XX/LM78XX/MC78XXA
3-Terminal 1A Positive Voltage Regulator

Features

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

Description

The MC78XX/LM78XX/MC78XXA series of three terminal positive regulators are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

TO-220

D-PAK

1. Input 2. GND 3. Output
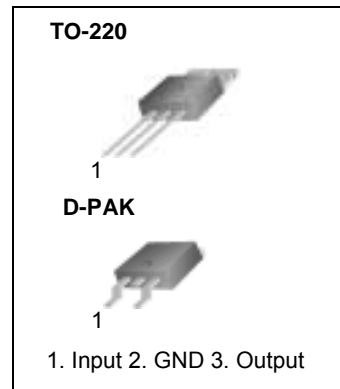
Internal Block Digram
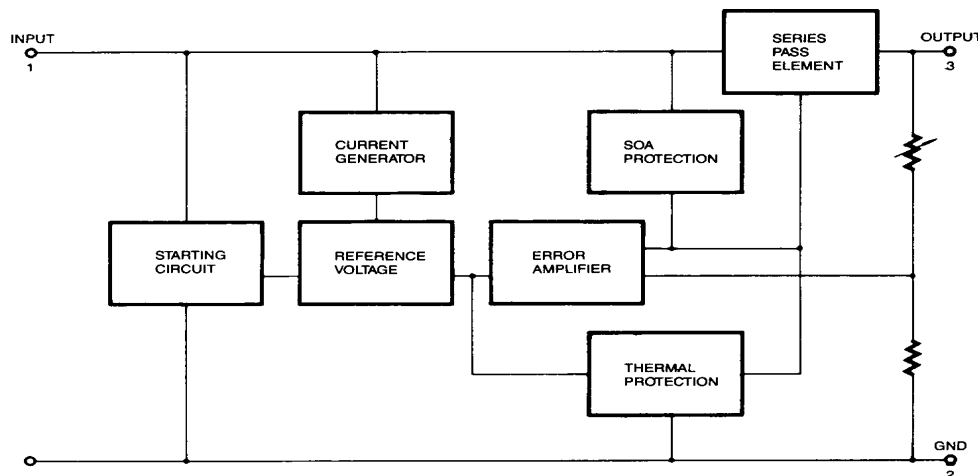
JRC   NJM2068

LOW-NOISE DUAL OPERATIONAL AMPLIFIER

■ GENERAL DESCRIPTION

The NJM2068 is a high performance, low noise dual operational amplifier. This amplifier features popular pin-out, superior noise performance, and superior total harmonic distortion. This amplifier also features guaranteed noise performance with substantially higher gain-bandwidth product and slew rate which far exceeds that of the 4558 type amplifier. The specially designed low noise input transistors allow the NJM2068 to be used in very low noise signal processing applications such as audio preamplifiers and servo error amplifier.
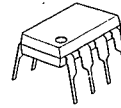
■ FEATURES

● Operating Voltage   ($\pm 4V \sim \pm 18V$)
● Low Total Harmonic Distortion   (0.001% typ.)
● Low Noise Voltage   (FLAT+JISA, 0.56μV typ.)
● High Slew Rate   (6V/μs typ.)
● Unity Gain Bandwidth   (27MHz @f=10kHz)
● Package Outline   DIP8, DMP8, SIP8, SSOP8
● Bipolar Technology

■ PACKAGE OUTLINE

NJM2068D   NJM2068M

NJM2068V   NJM2068L

■ PIN CONFIGURATION
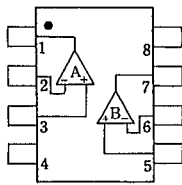
NJM2068D
NJM2068M
NJM2068V

NJM2068L

PIN FUNCITON
1. A OUTPUT
2. A—INPUT
3. A+INPUT
4. V⁻
5. B+INPUT
6. B—INPUT
7. B OUTPUT
8. V⁺

■ EQUIVALENT CIRCUIT (1/2 Shown)

JRC   # NJM4556A

DUAL HIGH CURRENT OPERATIONAL AMPLIFIER

■ GENERAL DESCRIPTION

The NJM4556A integrated circuit is a high-gain, high output current dual operational amplifier capable of driving ±70mA into 150 Ω loads (±10.5V output voltage), and operating low supply voltage ($V^+/V^- = \pm 2V \sim$).

The NJM4556A combines many of the fetures of the popular NJM4558 as well as having the capability of driving 150Ω loads. In addition, the wide band-width, low noise, high slew rate and low distortion of the NJM4556A make it ideal for many audio, telecommunications and instrumentation applications.

■ FEATURES

● Operating Voltage   ($\pm 2V \sim \pm 18V$)
● High Output Current   (Io=70mA)
● Slew Rate   ($3V/\mu s$ typ.)
● Gain Band Width Product   (8MHz typ.)
● Package Outline   DIP8, DMP8, SIP8, SSOP8
● Bipolar Technology

■ PACKAGE OUTLINE
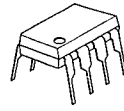
NJM4556AD   NJM4556AM
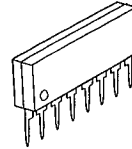
NJM4556AL   NJM4556AV

■ PIN CONFIGURATION
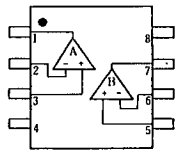
NJM4556AD.
NJM4556AM
NJM4556AV
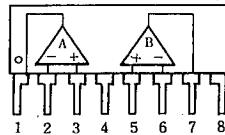
NJM4556AL

PIN FUNCTION
1 . A OUTPUT
2 . A−INPUT
3 . A+INPUT
4 . V⁻
5 . B+INPUT
6 . B−INPUT
7 . B OUTPUT
8 . V⁺

■ EQUIVALENT CIRCUIT (1/2 Shown)
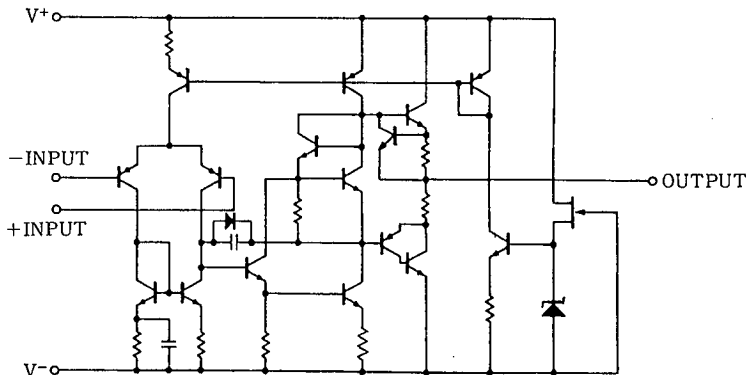
JRC   # NJM7800

3-TERMINAL POSITIVE VOLTAGE REGULATOR

■ GENERAL DESCRIPTION

The NJM7800 series of monolithic 3-Terminal Positive Voltage Regulators is constructed using the New JRC Planar epitaxial process. These regulators employ internal current-limiting, thermal-shutdown and safe-area compensation making them essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. They are intended as fixed voltage regulators in a wide range of applications including local (on card) regulation for elimination of distribution problems associated with single point regulation. In addition to use as fixed voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents.

■ FEATURES

● Operating Voltage
● Internal Short Circuit Current Limit
● Internal Thermal Overload Protection
● Excellent Ripple Rejection
● Guarantee'd 1.5A Output Current
● Package Outline   TO-220F, TO-252
● Bipolar Technology

■ PACKAGE OUTLINE

(TO-220F)   (TO-252)
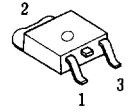
NJM7800FA	NJM7800DLA
1. IN	1. IN
2. GND	2. GND
3. OUT	3. OUT

(note) The radiation fin is connected pin2.

■ EQUIVALENT CIRCUIT

6
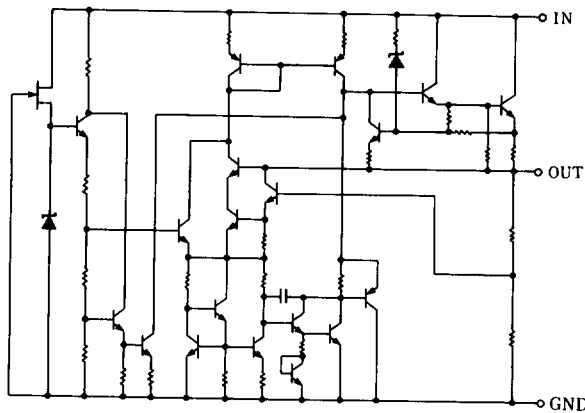
M24C64
M24C32

64Kbit and 32Kbit Serial I²C Bus EEPROM

FEATURES SUMMARY

- Two-Wire I²C Serial Interface Supports 400kHz Protocol
- Single Supply Voltage:
  - 4.5 to 5.5V for M24Cxx
  - 2.5 to 5.5V for M24Cxx-W
  - 1.8 to 5.5V for M24Cxx-R
- Write Control Input
- BYTE and PAGE WRITE (up to 32 Bytes)
- RANDOM and SEQUENTIAL READ Modes
- Self-Timed Programming Cycle
- Automatic Address Incrementing
- Enhanced ESD/Latch-Up Protection
- More than 1 Million Erase/Write Cycles
- More than 40-Year Data Retention

Figure 1. Packages

PDIP8 (BN)

SO8 (MN)
150 mil width

TSSOP8 (DW)
169 mil width

UFDFPN8 (MB)
2x3mm² (MLP)

Table 1. Product List

Reference	Part Number
M24C64	M24C64
	M24C64-W
	M24C64-R
M24C32	M24C32
	M24C32-W
	M24C32-R
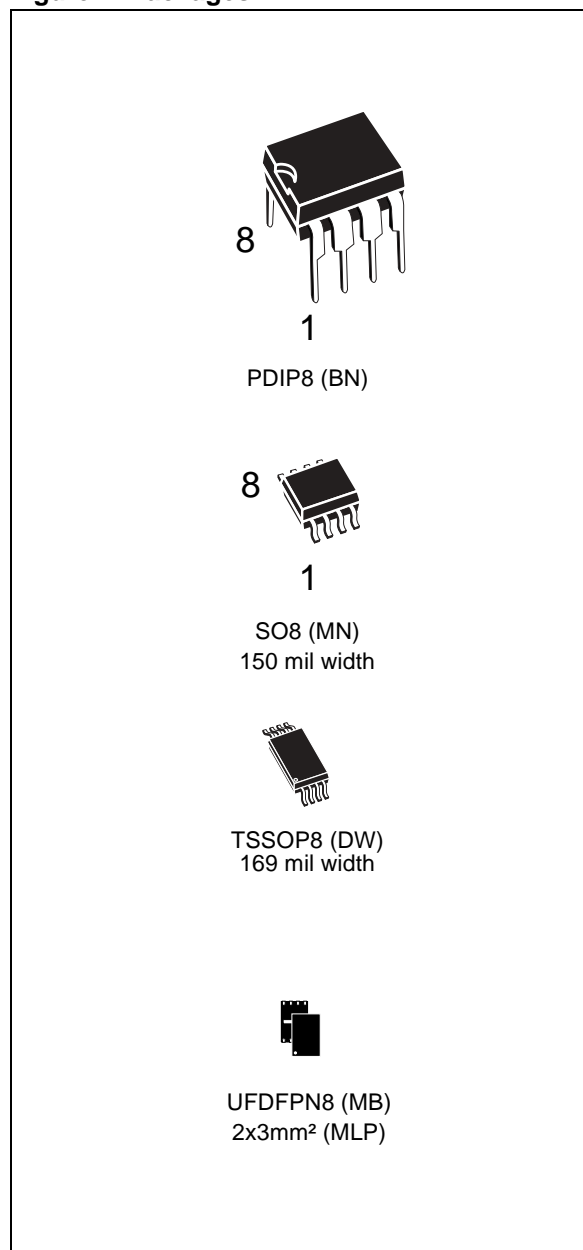
M24C64, M24C32

SUMMARY DESCRIPTION

These I^2C-compatible electrically erasable programmable memory (EEPROM) devices are organized as 8192 x 8 bits (M24C64) and 4096 x 8 bits (M24C32).

Figure 2. Logic Diagram

AI01844B
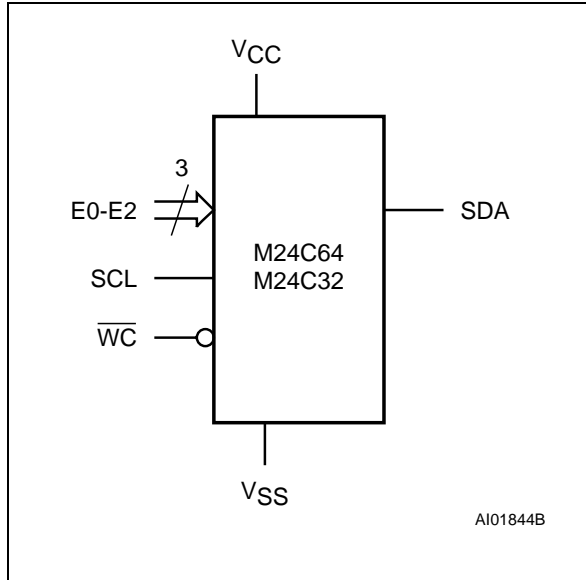
I^2C uses a two-wire serial interface, comprising a bi-directional data line and a clock line. The devices carry a built-in 4-bit Device Type Identifier code (1010) in accordance with the I^2C bus definition.

The device behaves as a slave in the I^2C protocol, with all memory operations synchronized by the serial clock. Read and Write operations are initiated by a Start condition, generated by the bus master. The Start condition is followed by a Device Select Code and Read/Write bit (RW) (as described in Table 3.), terminated by an acknowledge bit.

When writing data to the memory, the device inserts an acknowledge bit during the 9th bit time, following the bus master's 8-bit transmission. When data is read by the bus master, the bus master acknowledges the receipt of the data byte in the same way. Data transfers are terminated by a Stop condition after an Ack for Write, and after a NoAck for Read.

Table 2. Signal Names

E0, E1, E2	Chip Enable
SDA	Serial Data
SCL	Serial Clock
$\overline{WC}$	Write Control
V_{CC}	Supply Voltage
V_{SS}	Ground

Power On Reset: V_{CC} Lock-Out Write Protect

In order to prevent data corruption and inadvertent Write operations during Power-up, a Power On Reset (POR) circuit is included. At Power-up, the internal reset is held active until V_{CC} has reached the Power On Reset (POR) threshold voltage, and all operations are disabled – the device will not respond to any command. In the same way, when V_{CC} drops from the operating voltage, below the Power On Reset (POR) threshold voltage, all operations are disabled and the device will not respond to any command.

A stable and valid V_{CC} (as defined in Table 9. and Table 10.) must be applied before applying any logic signal.

Figure 3. DIP, SO, TSSOP and UFDFPN Connections

AI01845C
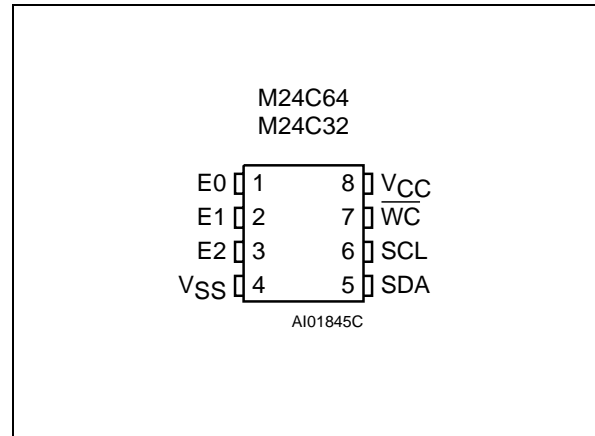
Note: See PACKAGE MECHANICAL section for package dimensions, and how to identify pin-1.

SIGNAL DESCRIPTION

Serial Clock (SCL). This input signal is used to strobe all data in and out of the device. In applications where this signal is used by slave devices to synchronize the bus to a slower clock, the bus master must have an open drain output, and a pull-up resistor must be connected from Serial Clock (SCL) to V_{CC}. (Figure 4. indicates how the value of the pull-up resistor can be calculated). In most applications, though, this method of synchronization is not employed, and so the pull-up resistor is not necessary, provided that the bus master has a push-pull (rather than open drain) output.

Serial Data (SDA). This bi-directional signal is used to transfer data in or out of the device. It is an open drain output that may be wire-OR'ed with other open drain or open collector signals on the bus. A pull up resistor must be connected from Se-

rial Data (SDA) to V_{CC}. (Figure 4. indicates how the value of the pull-up resistor can be calculated).

Chip Enable (E0, E1, E2). These input signals are used to set the value that is to be looked for on the three least significant bits (b3, b2, b1) of the 7-bit Device Select Code. These inputs must be tied to V_{CC} or V_{SS}, to establish the Device Select Code.

Write Control ($\overline{WC}$). This input signal is useful for protecting the entire contents of the memory from inadvertent write operations. Write operations are disabled to the entire memory array when Write Control ($\overline{WC}$) is driven High. When unconnected, the signal is internally read as V_{IL}, and Write operations are allowed.

When Write Control ($\overline{WC}$) is driven High, Device Select and Address bytes are acknowledged, Data bytes are not acknowledged.

Figure 4. Maximum R_L Value versus Bus Capacitance (C_{BUS}) for an I^{2}C Bus
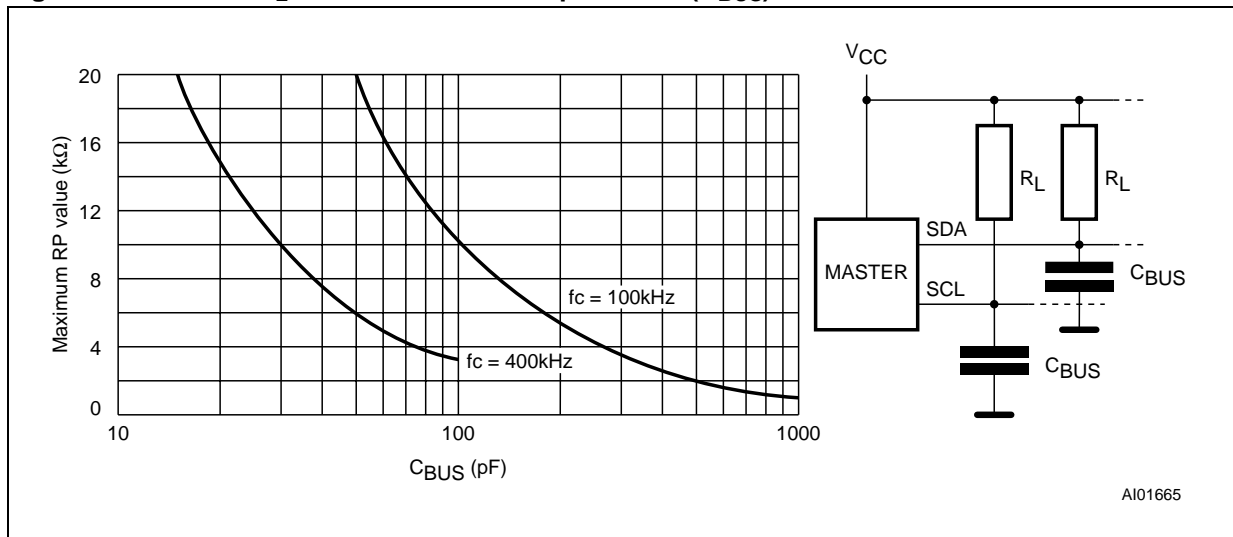
MEMORY ORGANIZATION

The memory is organized as shown in Figure 6..

Figure 6. Block Diagram
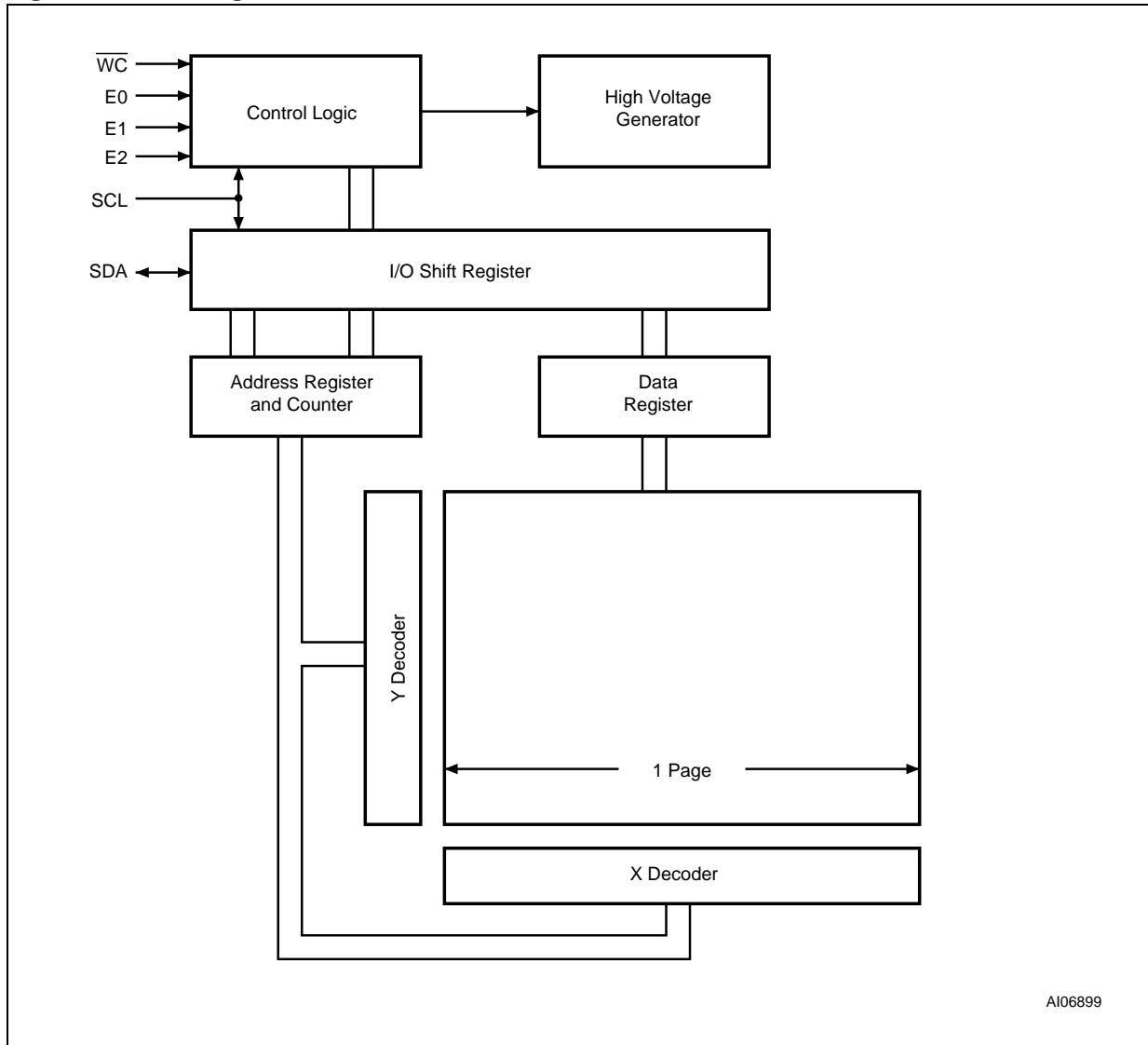
M24C64, M24C32

DEVICE OPERATION

The device supports the I^{2}C protocol. This is summarized in Figure 5.. Any device that sends data on to the bus is defined to be a transmitter, and any device that reads the data to be a receiver. The device that controls the data transfer is known as the bus master, and the other as the slave device. A data transfer can only be initiated by the bus master, which will also provide the serial clock for synchronization. The M24Cxx device is always a slave in all communication.

Start Condition

Start is identified by a falling edge of Serial Data (SDA) while Serial Clock (SCL) is stable in the High state. A Start condition must precede any data transfer command. The device continuously monitors (except during a Write cycle) Serial Data (SDA) and Serial Clock (SCL) for a Start condition, and will not respond unless one is given.

Stop Condition

Stop is identified by a rising edge of Serial Data (SDA) while Serial Clock (SCL) is stable and driven High. A Stop condition terminates communication between the device and the bus master. A Read command that is followed by NoAck can be followed by a Stop condition to force the device into the Stand-by mode. A Stop condition at the end of a Write command triggers the internal Write cycle.

Acknowledge Bit (ACK)

The acknowledge bit is used to indicate a successful byte transfer. The bus transmitter, whether it be bus master or slave device, releases Serial Data (SDA) after sending eight bits of data. During the 9th clock pulse period, the receiver pulls Serial Data (SDA) Low to acknowledge the receipt of the eight data bits.

Data Input

During data input, the device samples Serial Data (SDA) on the rising edge of Serial Clock (SCL). For correct device operation, Serial Data (SDA) must be stable during the rising edge of Serial Clock (SCL), and the Serial Data (SDA) signal must change *only* when Serial Clock (SCL) is driven Low.

Memory Addressing

To start communication between the bus master and the slave device, the bus master must initiate a Start condition. Following this, the bus master sends the Device Select Code, shown in Table 3. (on Serial Data (SDA), most significant bit first).

The Device Select Code consists of a 4-bit Device Type Identifier, and a 3-bit Chip Enable "Address" (E2, E1, E0). To address the memory array, the 4-bit Device Type Identifier is 1010b.

Up to eight memory devices can be connected on a single I^{2}C bus. Each one is given a unique 3-bit code on the Chip Enable (E0, E1, E2) inputs. When the Device Select Code is received, the device only responds if the Chip Enable Address is the same as the value on the Chip Enable (E0, E1, E2) inputs.

The 8th bit is the Read/Write bit (R$\overline{\text{W}}$). This bit is set to 1 for Read and 0 for Write operations.

If a match occurs on the Device Select code, the corresponding device gives an acknowledgment on Serial Data (SDA) during the 9th bit time. If the device does not match the Device Select code, it deselects itself from the bus, and goes into Stand-by mode.

Table 6. Operating Modes

Mode	R$\overline{\text{W}}$ bit	$\overline{\text{WC}}$ [1]	Bytes	Initial Sequence
Current Address Read	1	X	1	START, Device Select, R$\overline{\text{W}}$ = 1
Random Address Read	0	X	1	START, Device Select, R$\overline{\text{W}}$ = 0, Address
	1	X		reSTART, Device Select, R$\overline{\text{W}}$ = 1
Sequential Read	1	X	≥ 1	Similar to Current or Random Address Read
Byte Write	0	V$_{IL}$	1	START, Device Select, R$\overline{\text{W}}$ = 0
Page Write	0	V$_{IL}$	≤ 32	START, Device Select, R$\overline{\text{W}}$ = 0

Note: 1. X = V$_{IH}$ or V$_{IL}$.

Figure 7. Write Mode Sequences with $\overline{WC}$=1 (data write inhibited)

AI01120C
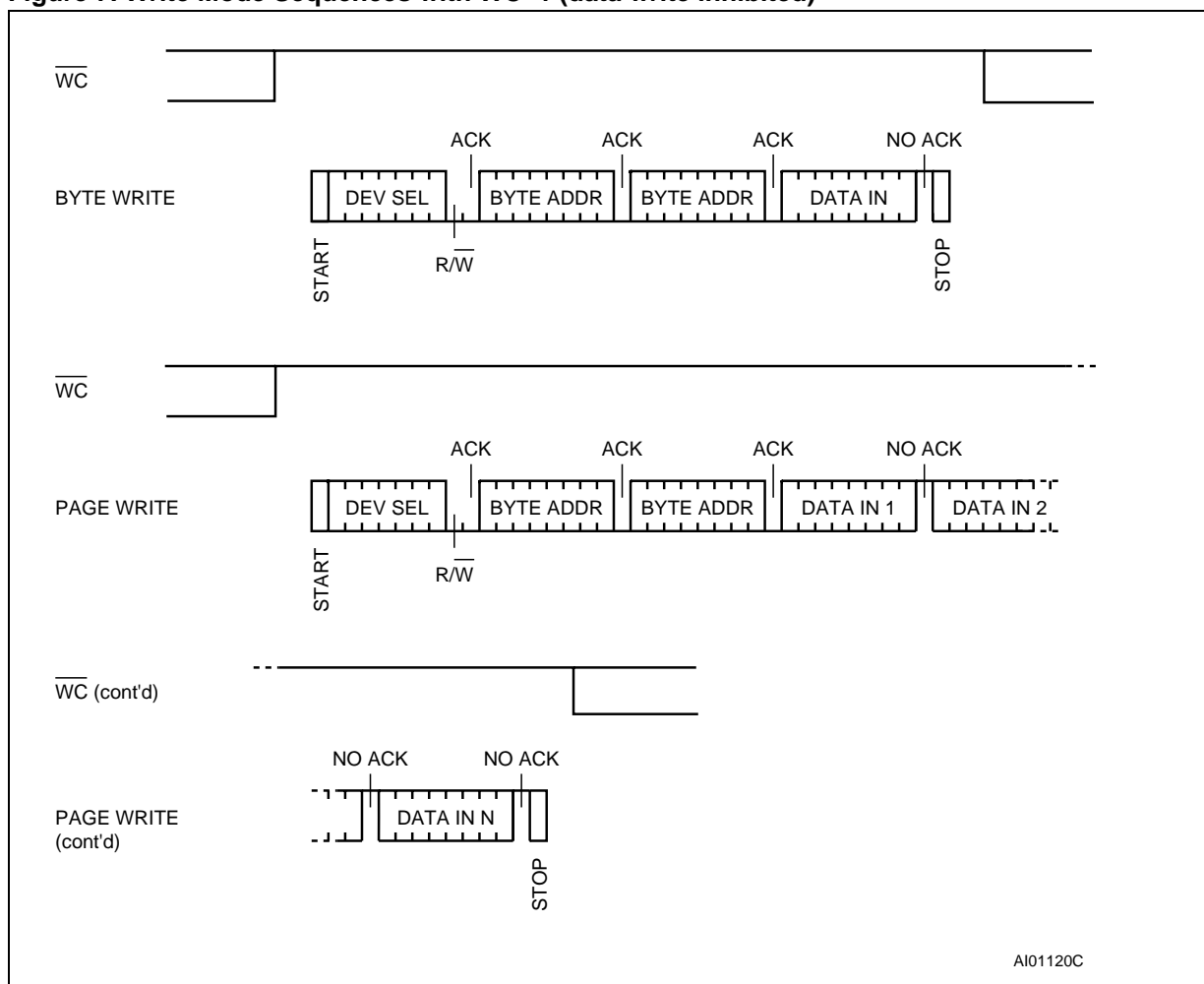
Write Operations

Following a Start condition the bus master sends a Device Select Code with the Read/Write bit (RW) reset to 0. The device acknowledges this, as shown in Figure 8., and waits for two address bytes. The device responds to each address byte with an acknowledge bit, and then waits for the data byte.

Writing to the memory may be inhibited if Write Control (WC) is driven High. Any Write instruction with Write Control (WC) driven High (during a period of time from the Start condition until the end of the two address bytes) will not modify the memory contents, and the accompanying data bytes are *not* acknowledged, as shown in Figure 7..

Each data byte in the memory has a 16-bit (two byte wide) address. The Most Significant Byte (Table 4.) is sent first, followed by the Least Significant Byte (Table 5.). Bits b15 to b0 form the address of the byte in memory.

When the bus master generates a Stop condition immediately after the Ack bit (in the "10th" bit time

slot), either at the end of a Byte Write or a Page Write, the internal Write cycle is triggered. A Stop condition at any other time slot does not trigger the internal Write cycle.

After the Stop condition, the delay t_W, and the successful completion of a Write operation, the device's internal address counter is incremented automatically, to point to the next byte address after the last one that was modified.

During the internal Write cycle, Serial Data (SDA) is disabled internally, and the device does not respond to any requests.

Byte Write

After the Device Select code and the address bytes, the bus master sends one data byte. If the addressed location is Write-protected, by Write Control (WC) being driven High, the device replies with NoAck, and the location is not modified. If, instead, the addressed location is not Write-protected, the device replies with Ack. The bus master terminates the transfer by generating a Stop condition, as shown in Figure 8..

9/26

M24C64, M24C32

Page Write

The Page Write mode allows up to 32 bytes to be written in a single Write cycle, provided that they are all located in the same 'row' in the memory: that is, the most significant memory address bits (b12-b5 for M24C64, and b11-b5 for M24C32) are the same. If more bytes are sent than will fit up to the end of the row, a condition known as 'roll-over' occurs. This should be avoided, as data starts to become overwritten in an implementation dependent way.

The bus master sends from 1 to 32 bytes of data, each of which is acknowledged by the device if Write Control (WC) is Low. If Write Control (WC) is High, the contents of the addressed memory location are not modified, and each data byte is followed by a NoAck. After each byte is transferred, the internal byte address counter (the 5 least significant address bits only) is incremented. The transfer is terminated by the bus master generating a Stop condition.

Figure 8. Write Mode Sequences with WC=0 (data write enabled)

AI01106C
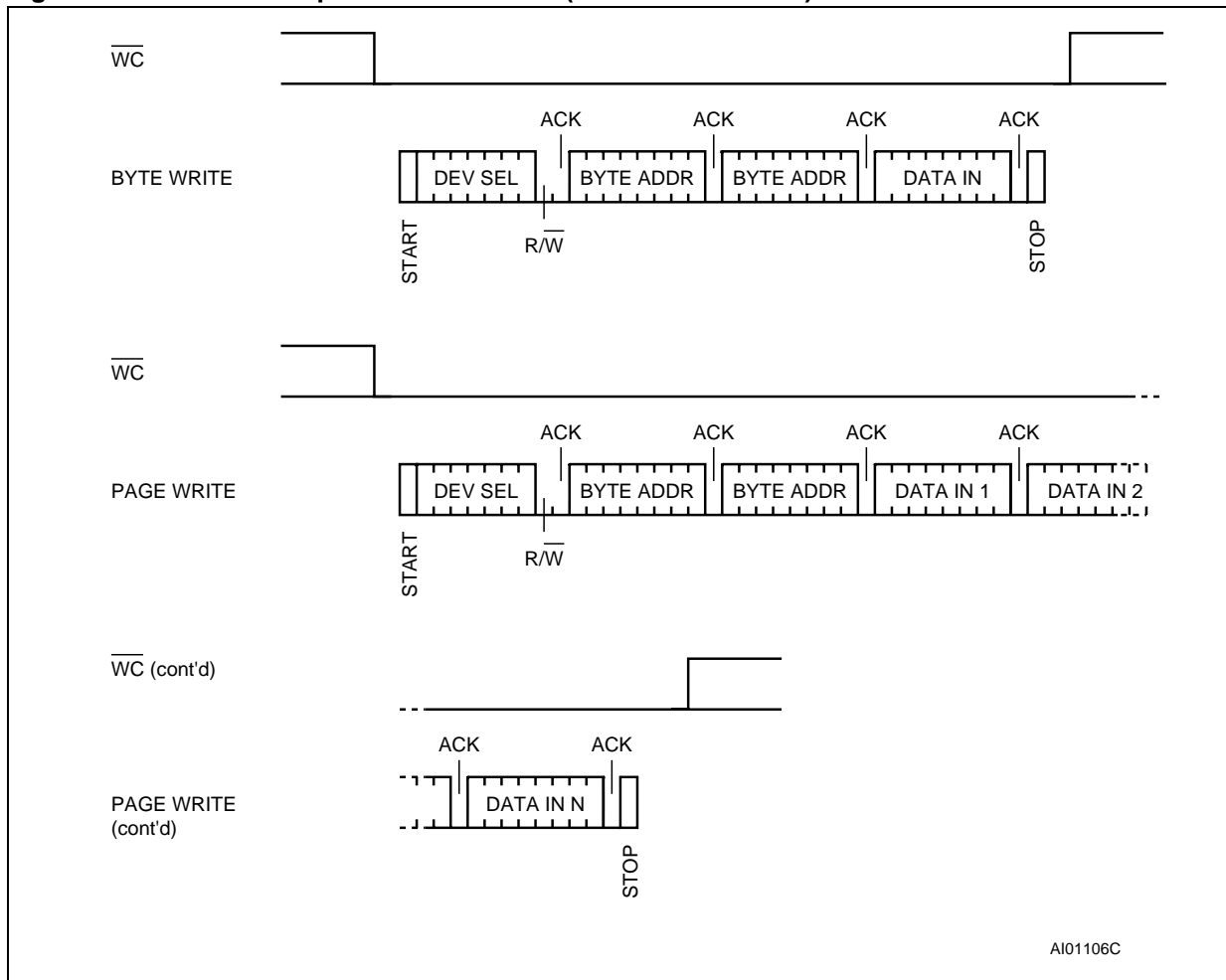
Figure 9. Write Cycle Polling Flowchart using ACK
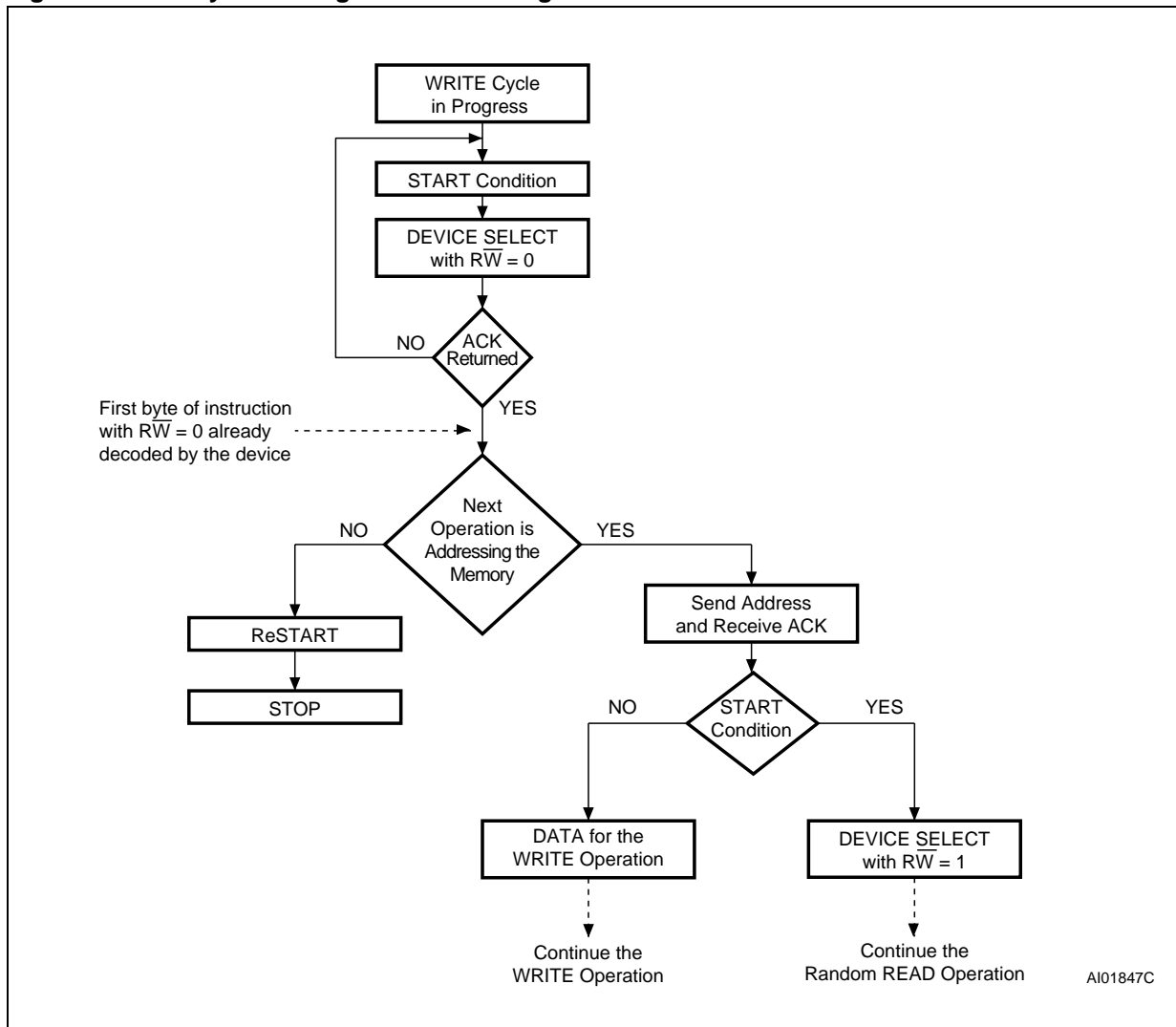
Minimizing System Delays by Polling On ACK

During the internal Write cycle, the device disconnects itself from the bus, and writes a copy of the data from its internal latches to the memory cells. The maximum Write time (t_W) is shown in Table 16. and Table 17., but the typical time is shorter. To make use of this, a polling sequence can be used by the bus master.

The sequence, as shown in Figure 9., is:

– Initial condition: a Write cycle is in progress.

– Step 1: the bus master issues a Start condition followed by a Device Select Code (the first byte of the new instruction).

– Step 2: if the device is busy with the internal Write cycle, no Ack will be returned and the bus master goes back to Step 1. If the device has terminated the internal Write cycle, it responds with an Ack, indicating that the device is ready to receive the second part of the instruction (the first byte of this instruction having been sent during Step 1).

M24C64, M24C32

Figure 10. Read Mode Sequences
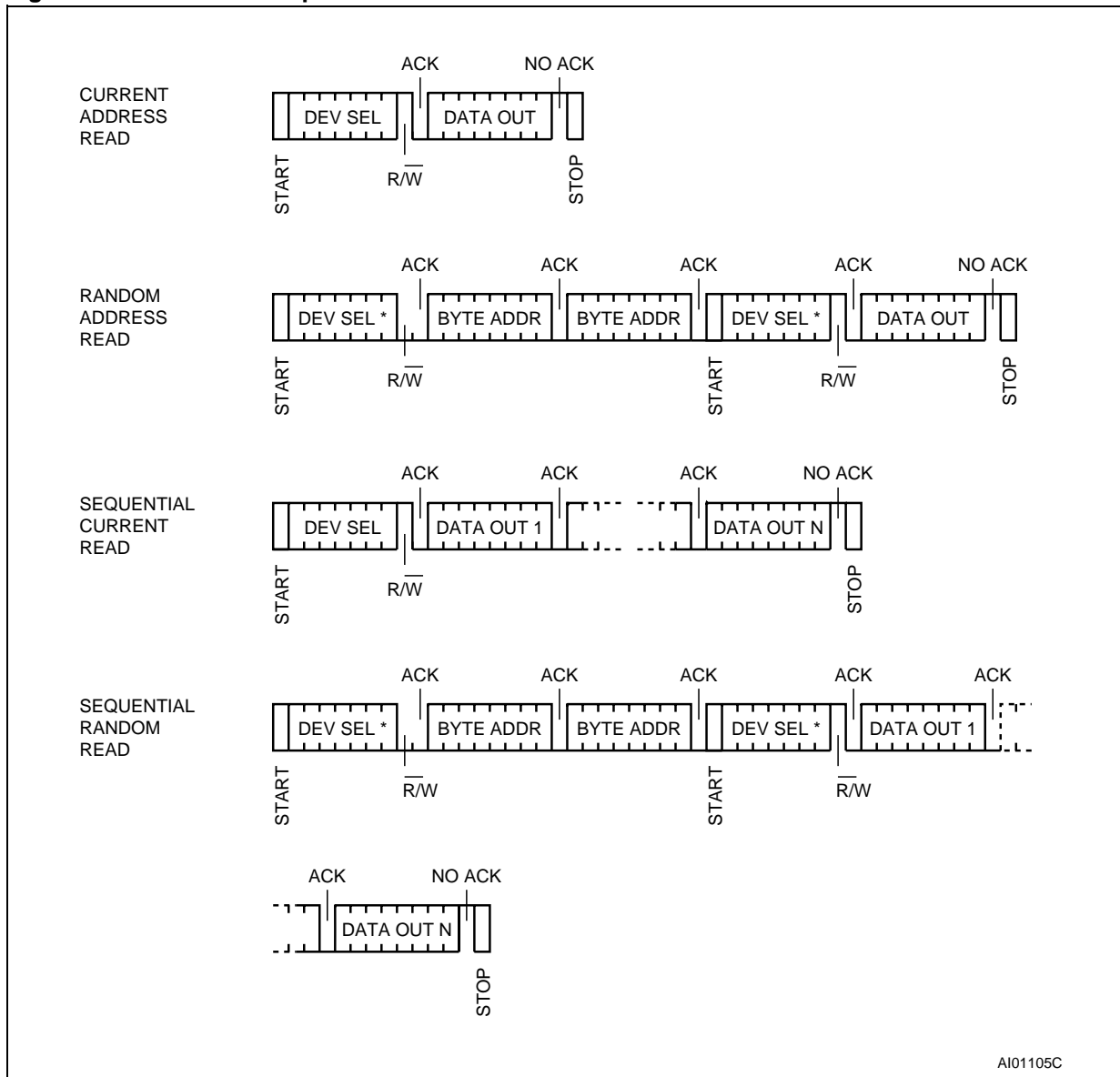
AI01105C

Note: 1. The seven most significant bits of the Device Select Code of a Random Read (in the 1st and 4th bytes) must be identical.

Read Operations

Read operations are performed independently of the state of the Write Control (WC) signal.

After the successful completion of a Read operation, the device's internal address counter is incremented by one, to point to the next byte address.

Random Address Read

A dummy Write is first performed to load the address into this address counter (as shown in Figure 10.) but *without* sending a Stop condition. Then, the bus master sends another Start condition, and repeats the Device Select Code, with the Read/Write bit (RW) set to 1. The device acknowledges this, and outputs the contents of the addressed byte. The bus master must *not* acknowledge the byte, and terminates the transfer with a Stop condition.

Current Address Read

For the Current Address Read operation, following a Start condition, the bus master only sends a Device Select Code with the Read/Write bit (RW) set to 1. The device acknowledges this, and outputs the byte addressed by the internal address counter. The counter is then incremented. The bus master terminates the transfer with a Stop condition, as shown in Figure 10., *without* acknowledging the byte.
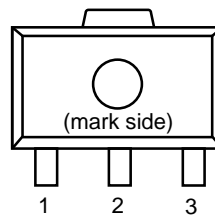
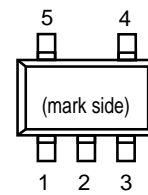# LOW VOLTAGE DETECTOR
R×5VT SERIES

PIN CONFIGURATION

• TO-92   **• SOT-89**   **• SOT-23-5**

(mark side)   (mark side)   (mark side)

5   4

1   2   3   1   2   3   1   2   3

PIN DESCRIPTION

• TO-92	
Pin No.	**Symbol**
1	OUT
2	V_{DD}
3	GND

• SOT-89	
Pin No.	**Symbol**
1	OUT
2	V_{DD}
3	GND

• SOT-23-5	
Pin No.	**Symbol**
1	OUT
2	V_{DD}
3	GND
4	NC
5	NC

VOLTAGE DETECTOR
R✕5VL SERIES

R✕5VL

PIN CONFIGURATION
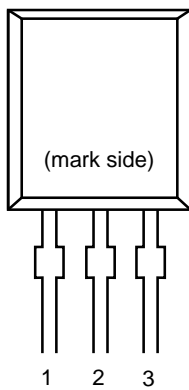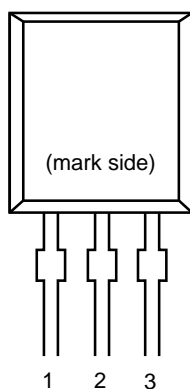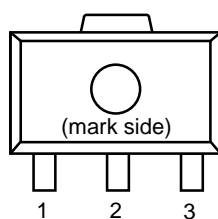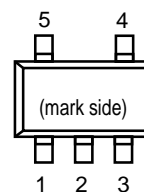
• TO-92

• SOT-89

• SOT-23-5

PIN DESCRIPTION

• TO-92

Pin No	Symbol
1	OUT
2	V$_{DD}$
3	GND

• SOT-89

Pin No	Symbol
1	OUT
2	V$_{DD}$
3	GND

• SOT-23-5

Pin No	Symbol
1	OUT
2	V$_{DD}$
3	GND
4	NC
5	NC

1A LOWDROP OUT VOLTAGE REGULATOR (ADJUSTABLE & FIXED)   LM1117

FEATURES

● Output Current up to 1 A
● Low Dropout Voltage (700mV at 1A Output Current)
● Three Terminal Adjustable or Fixed 1.5V, 1.8V, 2.5V, 2.85V, 3.0V, 3.3V, 5.0V
● 2.85V Device for SCSI-II Active Terminator
● 0.04% Line Regulaion, 0.1% Load Regulation
● Very Low Quiescent Current
● Internal Current andTerminal Limit
● Logic-Controlled Electronics Shutdown
● Surface Mount Package SOT-223 & TO-263 (D2-Pack)
● 100% Thermal Limit Burn-In

APPLICATION

● Active SCSI Terminators
● Portable/Plan Top/Notebook Computers
● High Efficiency Linear Regulators
● SMPS Post Regulators
● Mother B/D Clock Supplies
● Disk Drives
● Battery Chargers

SOT-223 PKG (FRONT VIEW)

PIN FUNCTION
1. Adj/Gnd
2. Vout
3. Vin

TO-263 (D2 PKG, FRONT VIEW)

PIN FUNCTION
1. Adj/Gnd
2. Vout
3. Vin

ORDERING INFORMATION

Device (Marking)	Package
LM1117S	SOT-223
LM1117S-XX	
LM1117T	TO-263 (D2)
LM1117T-XX	

(X=Output Voltage=1.5V, 1.8V, 2.5V, 2.85V,
'3.0V, 3.3V, 5.0V, Adjustable=AD)

DESCRIPTION

The LM1117 is a low power positive-voltage regulator designed to meet 1A output current and comply with SCSI-II specifications with a fixed output voltage of 2.85V. This device is an excellent choice for use in battery-powered applications, as active terminators for the SCSI bus, and portable computers.
The LM1117 features very low quiescent current and very low dropout voltage of 700mV at a full load   and lower as output current decreases. LM1117 is available as an adjustable or fixed 1.5V, 1.8V, 2.5V, 2.85V, 3.0V, 3.3V, and 5.0V output voltages.
The LM1117 is offered in a 3-pin surface mount package SOT-223 & TO-263. The output capacitor of 10μF or larger is needed for output stability of LM1117 as required by most of the other regulator circuits.

ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
DC Input Voltage	V_{IN}		7	V
Lead Temperature (Soldering, 5 Seconds)	T_{SOL}		260	℃
Storage Temperature Range	T_{STG}	−65	150	℃
Operating Junction Temperature Range	T_{OPR}	0	125	℃

HTC

1

JRC   # NJM2391
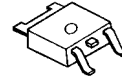
LOW DROPOUT VOLTAGE REGULATOR

■ GENERAL DESCRIPTION

The NJM2391 is low dropout voltage regulators featuring high precision voltage.

It is suitable for Notebook PCs, PC cards and hard disks where 3.3V need to be generated from 5V supply.

A small TO-252 package is adopted for the space saving.

■ PACKAGE OUTLINE

NJM2391DL1

■ FEATURES

- ●Output Current   Io(max.)=1A
- ●High Precision Output Voltage   Vo±1%
- ●Low Dropout Voltage ΔV_{I-O} =1.1V typ. At Io=1A
- ●Internal Excessive Voltage Protection Circuit
- ●Internal Short Circuit Current Limit
- ●Internal Thermal Overload Protection
- ●Bipolar Technology
- ●Package Outline   TO-252

■ PIN CONFIGURATION
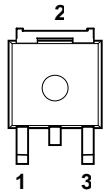
PIN FUNCTION
1. V_{IN}
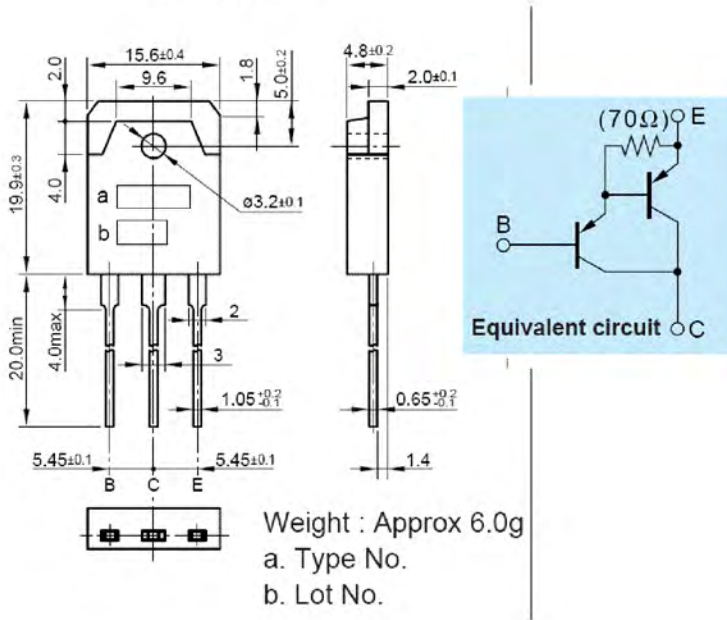2. GND
3. V_{OUT}

NJM2391DL1

■ ABSOLUTE MAXIMUM RATINGS   (Ta=25°C)

PARAMETER	SYMBOL	RATINGS		UNIT
Input Voltage	V^+	+10		V
Power Dissipation	P_D	TO-252	8 (Tc=25°C) 0.8(Ta≤25°C)	W
Operating Temperature	Topr	−40 ~ +85		°C
Storage Temperature	Tstg	−50 ~ +125		°C

■ OUTPUT VOLTAGE RANK LIST

Device Name	V_{OUT}
NJM2391DL1-25	2.5V
NJM2391DL1-26	2.6V
NJM2391DL1-28	2.85V
NJM2391DL1-03	3.0V
NJM2391DL1-33	3.3V
NJM2391DL1-35	3.5V
NJM2391DL1-05	5.0V

2SB1559
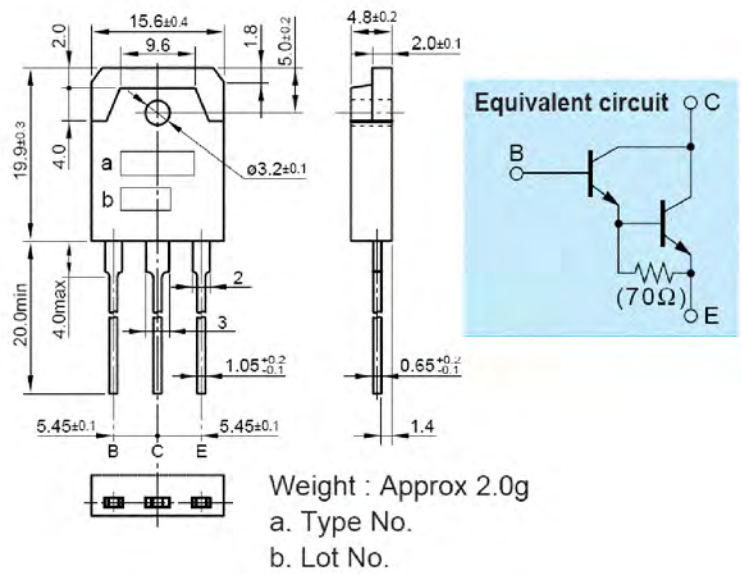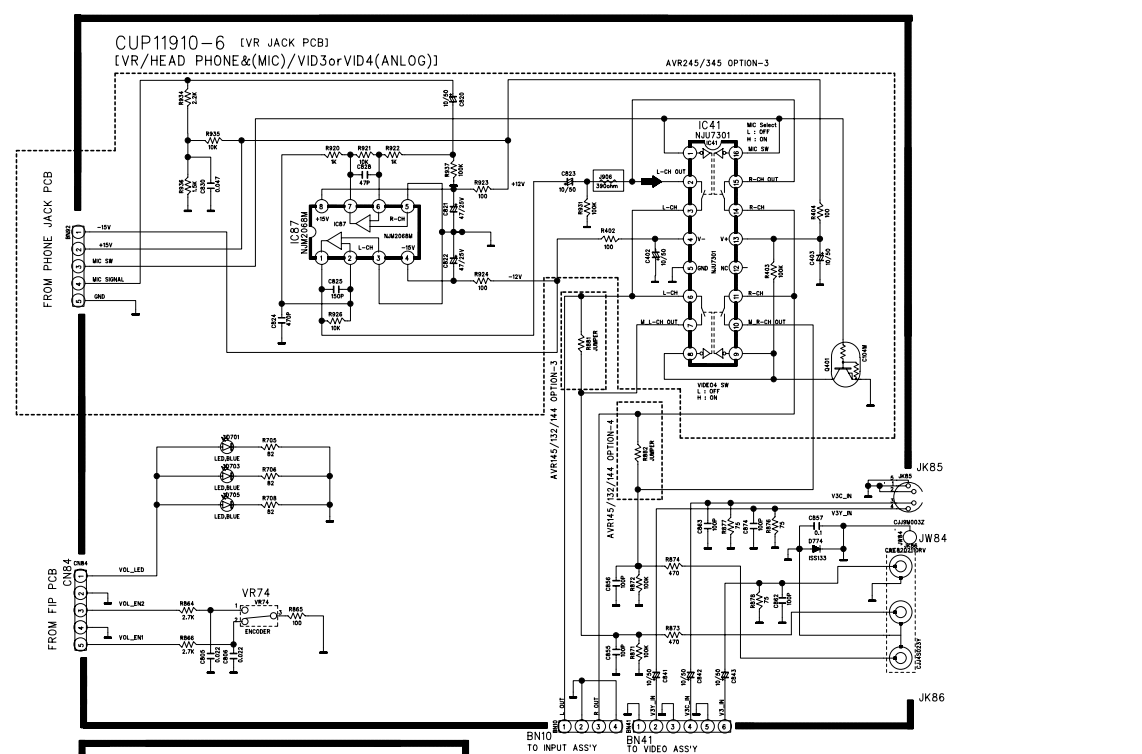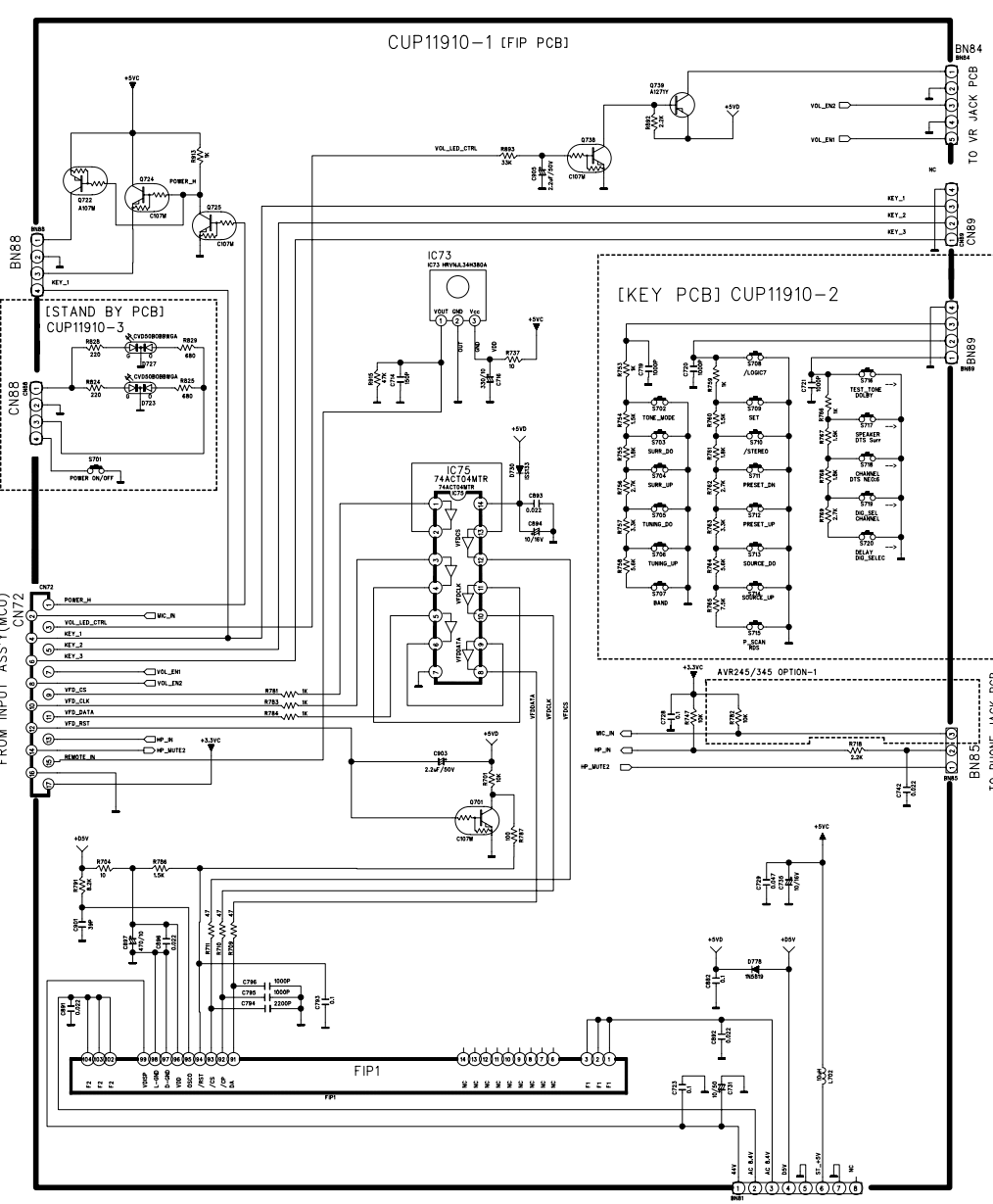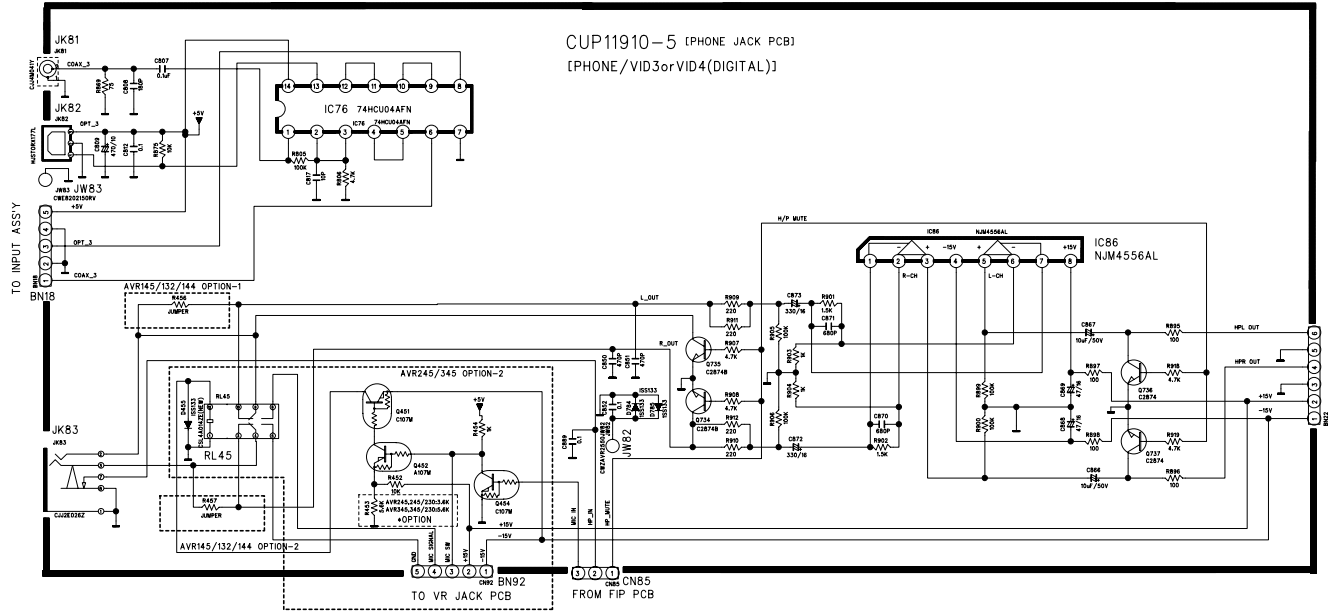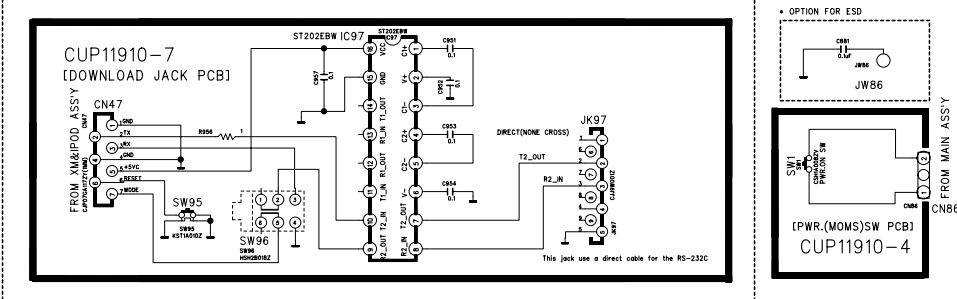
Weight : Approx 6.0g
a. Type No.
b. Lot No.

2SD2389

Weight : Approx 2.0g
a. Type No.
b. Lot No.

CUP11910Y

Schematic diagram — CUP11910Y (harman/kardon AVR144). Boards shown: CUP11910-7 [DOWNLOAD JACK PCB], CUP11910-4 [PWR.(MOMS)SW PCB], CUP11910-1 [FIP PCB], CUP11910-2 [KEY PCB], CUP11910-3 [STAND BY PCB], CUP11910-5 [PHONE JACK PCB], CUP11910-6 [VR JACK PCB], CUP11910-8 [BLACKET JACK PCB FOR CARD CABLE], CUP11910-9 [BLACKET JACK PCB FOR PHONE JACK].

REVISION	2		4		6	
1		3		5		7

SCHEMATIC DIAGRAM			SHEET
MODEL	AVR145/245/345/132/144		1/7
DESIGN	CHECK	APPROVE	DRAWING NO
S.H.Y	Y.W.Y	H.Y.L	CUP11910SCMY
06.10.23	06.10.23	06.10.23	

M/P MULTI. 06.10.23

CUP11931Y

CS495** VDDIO + BEA

CS495** VDD + BEA

+OPTION : EMC COUNTERMEASUER
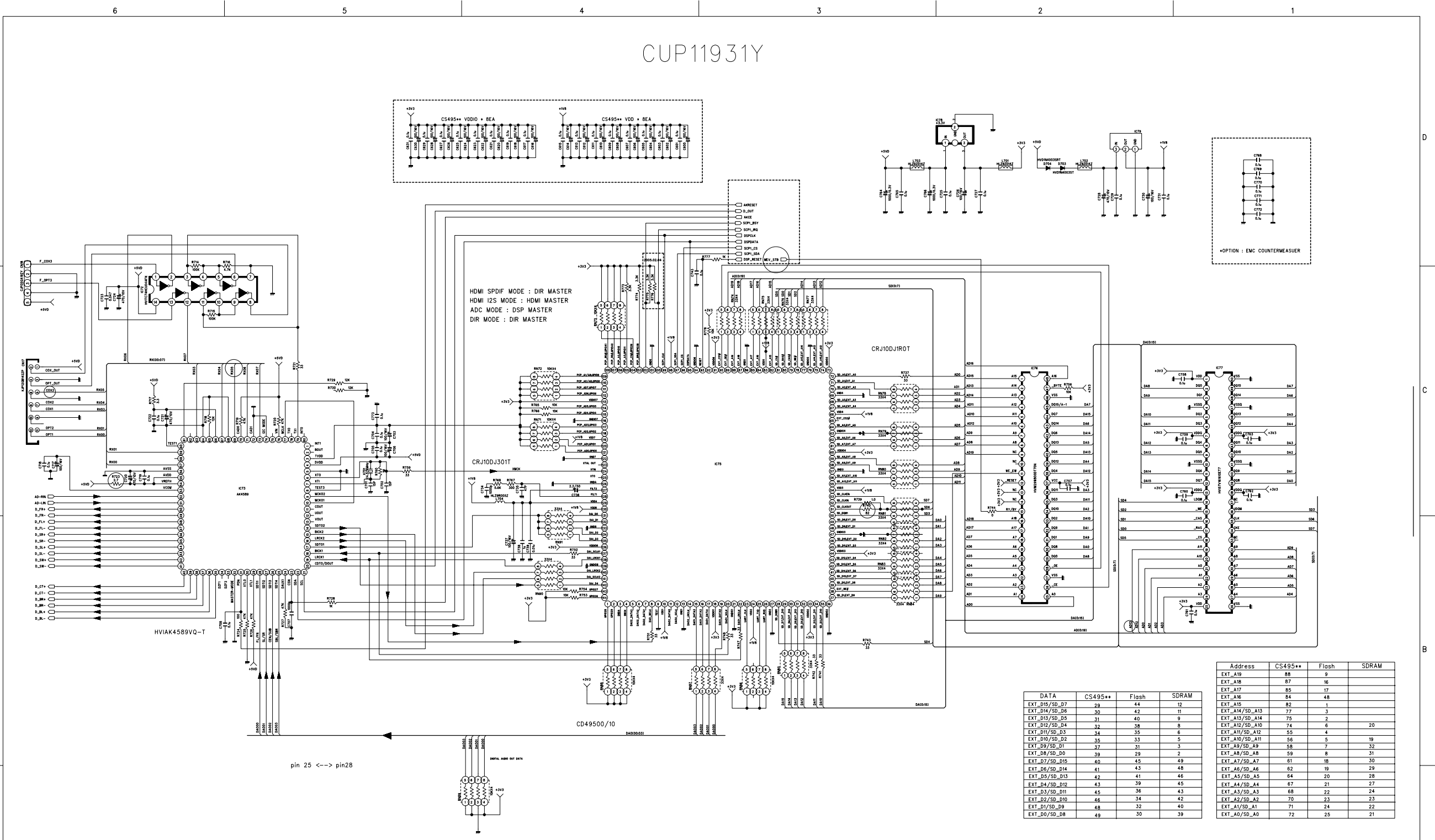
HDMI SPDIF MODE : DIR MASTER
HDMI I2S MODE : HDMI MASTER
ADC MODE : DSP MASTER
DIR MODE : DIR MASTER

CRJ10DJ1ROT

CRJ10DJ301T

IC75

IC73
AK4589

HVIAK4589VQ-T

CD49500/10

pin 25 <--> pin28

SDX(0:7)

DATA	CS495**	Flash	SDRAM
EXT_D15/SD_D7	29	44	12
EXT_D14/SD_D6	30	42	11
EXT_D13/SD_D5	31	40	9
EXT_D12/SD_D4	32	38	8
EXT_D11/SD_D3	34	35	6
EXT_D10/SD_D2	35	33	5
EXT_D9/SD_D1	37	31	3
EXT_D8/SD_D0	39	29	2
EXT_D7/SD_D15	40	45	49
EXT_D6/SD_D14	41	43	48
EXT_D5/SD_D13	42	41	46
EXT_D4/SD_D12	43	39	45
EXT_D3/SD_D11	45	36	43
EXT_D2/SD_D10	46	34	42
EXT_D1/SD_D9	48	32	40
EXT_D0/SD_D8	49	30	39

Address	CS495**	Flash	SDRAM
EXT_A19	88	9	
EXT_A18	87	16	
EXT_A17	85	17	
EXT_A16	84	48	
EXT_A15	82		
EXT_A14/SD_A13	77	1	
EXT_A13/SD_A14	75	2	
EXT_A12/SD_A10	74	6	20
EXT_A11/SD_A12	55	4	
EXT_A10/SD_A11	56	5	19
EXT_A9/SD_A9	58	7	32
EXT_A8/SD_A8	59	8	31
EXT_A7/SD_A7	61	18	30
EXT_A6/SD_A6	62	19	29
EXT_A5/SD_A5	64	20	28
EXT_A4/SD_A4	67	21	27
EXT_A3/SD_A3	68	22	24
EXT_A2/SD_A2	70	23	23
EXT_A1/SD_A1	71	24	22
EXT_A0/SD_A0	72	25	21

REVISION	2		4		6	
1		3		5		7

SCHEMATIC DIAGRAM SHEET

| MODEL | AVR132/144 | 4/5 |

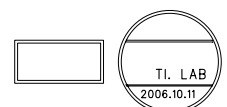| DESIGN	CHECK	APPROVE	DRAWING NO
M.S.K	W.Y.Y	H.W.L	1931SCMY
06.10.11	06.10.11	06.10.11	(INPUT)

TI. LAB
2006.10.11
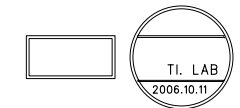
CUP11931Y
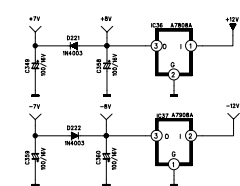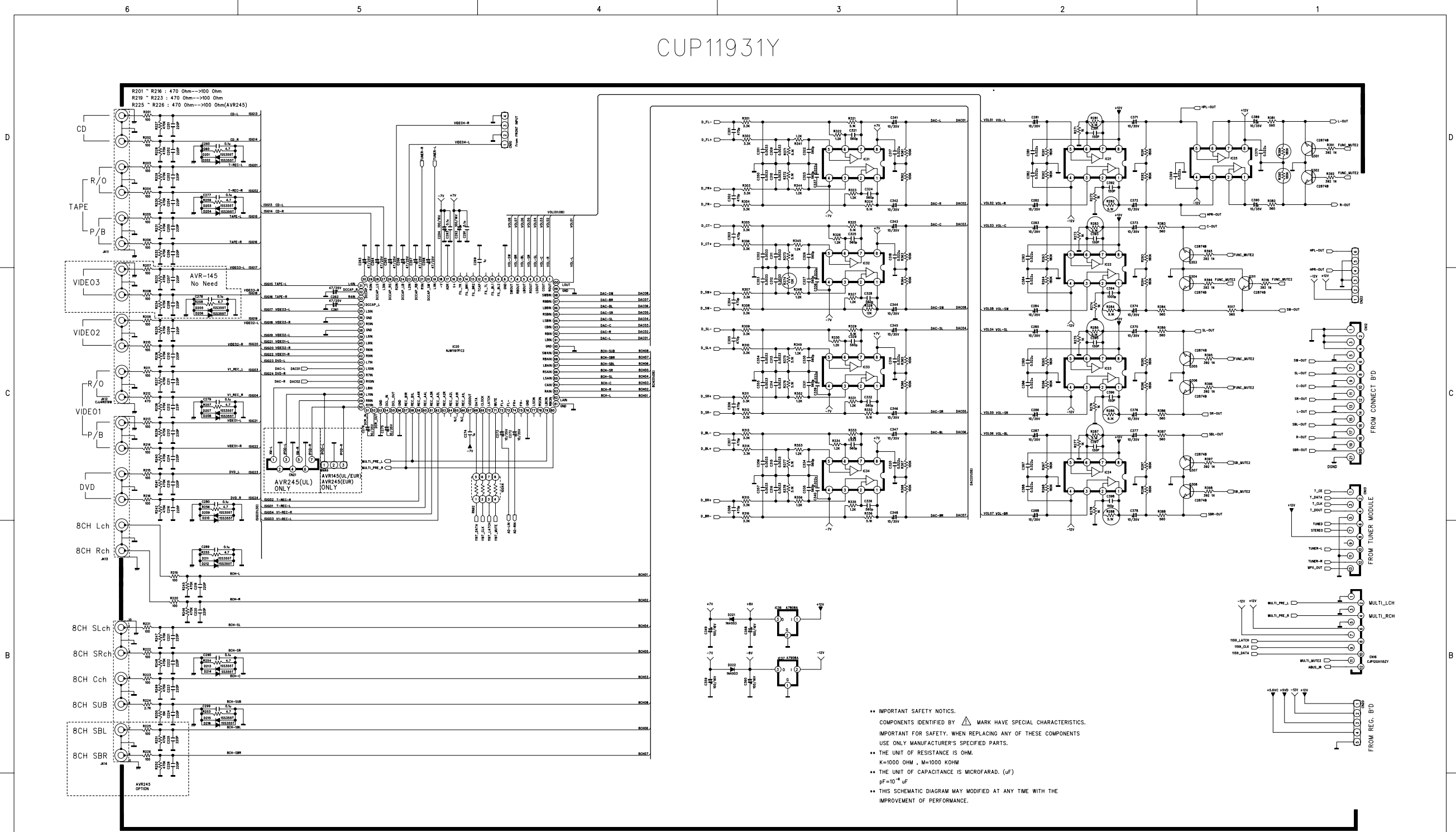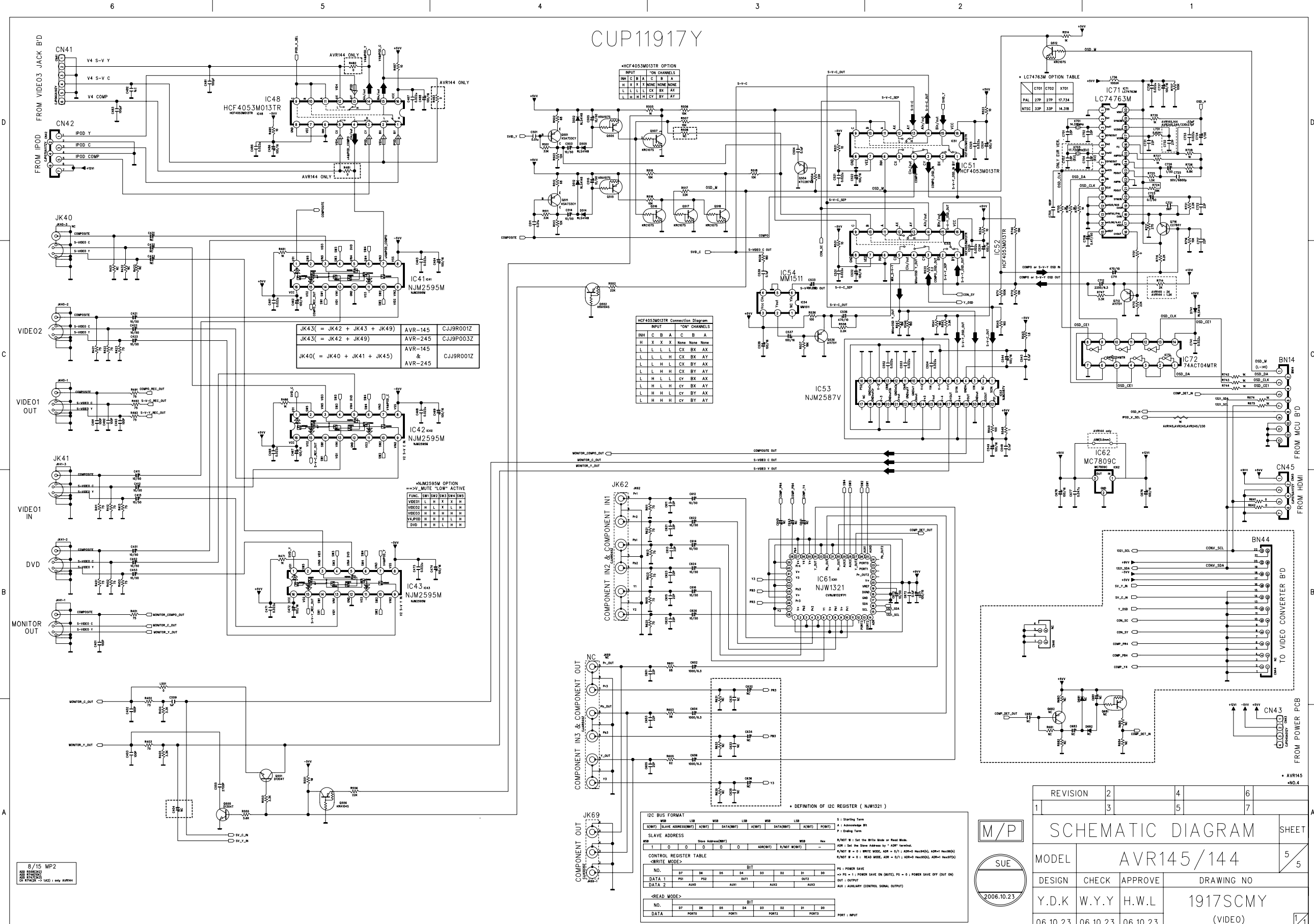

IMPORTANT SAFETY NOTICS.

COMPONENTS IDENTIFIED BY ⚠ MARK HAVE SPECIAL CHARACTERISTICS.
IMPORTANT FOR SAFETY. WHEN REPLACING ANY OF THESE COMPONENTS
USE ONLY MANUFACTURER'S SPECIFIED PARTS.

THE UNIT OF RESISTANCE IS OHM.
K=1000 OHM , M=1000 KOHM

THE UNIT OF CAPACITANCE IS MICROFARAD. (uF)
pF=10⁻⁶ uF

THIS SCHEMATIC DIAGRAM MAY MODIFIED AT ANY TIME WITH THE
IMPROVEMENT OF PERFORMANCE.

REVISION	2		4		6	
1		3		5		7

SCHEMATIC DIAGRAM

		SHEET
MODEL	AVR132/144	4
DESIGN	CHECK	APPROVE	DRAWING NO	5
M.S.K	W.Y.Y	H.W.L	1931SCMZ	
06.10.11	06.10.11	06.10.11	(INPUT)	1/3

TI. LAB
2006.10.11

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CUP11917Y

SCHEMATIC DIAGRAM

REVISION						
		2		4		6
1		3		5		7

MODEL	AVR145/144		SHEET
DESIGN	CHECK	APPROVE	DRAWING NO
Y.D.K	W.Y.Y	H.W.L	1917SCMY
06.10.23	06.10.23	06.10.23	(VIDEO)

5/5

M/P

SUE 2006.10.23

CUP11931Y

TO VIDEO PCB

RDS SECTION(EUR Ver. ONLY)

RADIAL TYPE

+5VD
GND
MPX_OUT
RDS_CLK
RDS_DATA

TO FRONT PCB

TO XM& IPOD PCB

AVR-145

Update: LOW

○: PULL_UP
GPIO : Input/Out Port(without pull_up resistor)

ONLY FOR AVR245/345

Do not use

IC90
T5CC1

FUNC_MUTE
HP_MUTE
MULTI_MUTE
SB_MUTE

245 Only

+OPTION_C
AVR132/230 & AVR144
USE : R712

RESET IN

REMOTE_IN

REMOTE_OUT

AVR145 ONLY

AVR245 / 345 ONLY
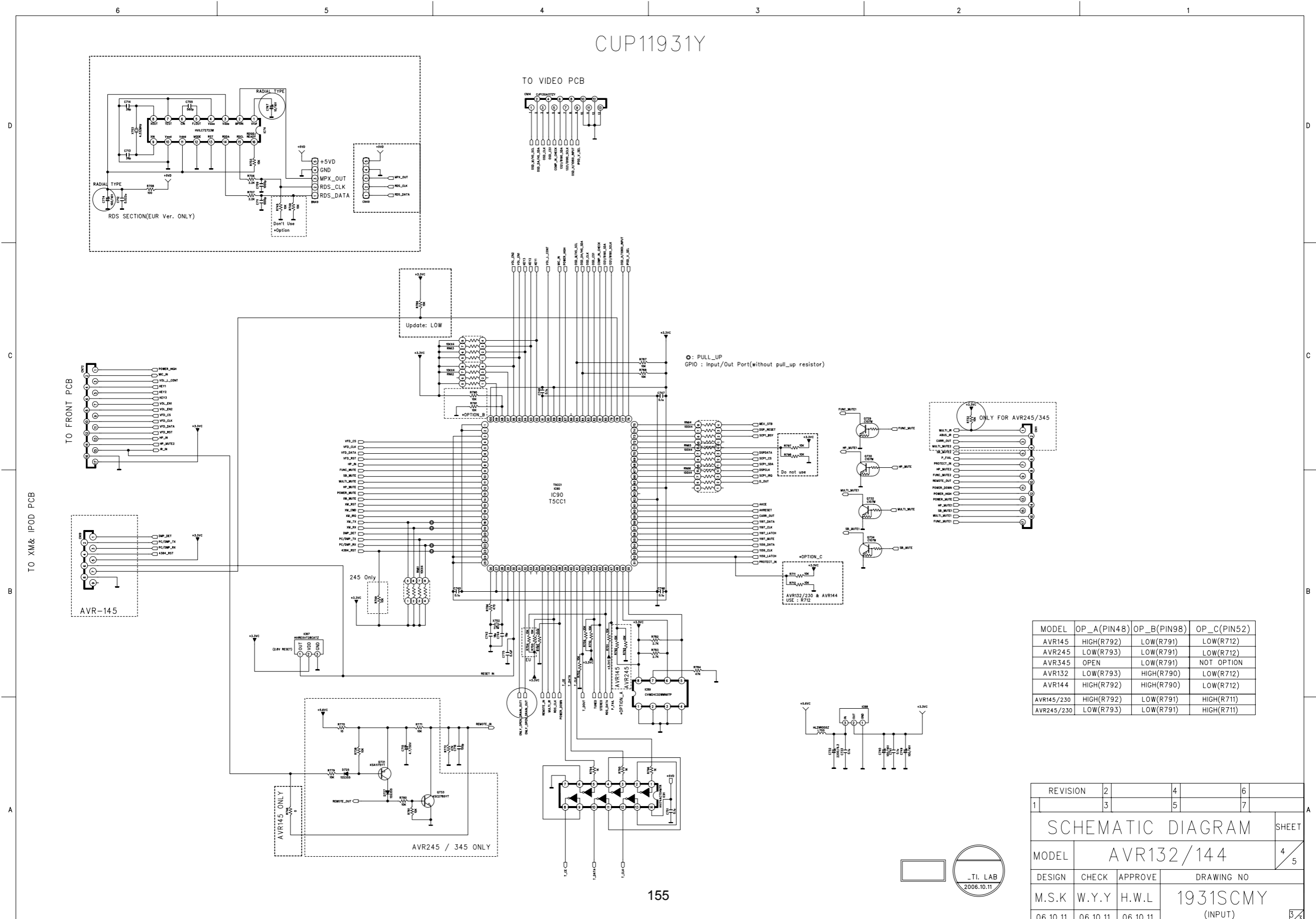
MODEL	OP_A(PIN48)	OP_B(PIN98)	OP_C(PIN52)
AVR145	HIGH(R792)	LOW(R791)	LOW(R712)
AVR245	LOW(R793)	LOW(R791)	LOW(R712)
AVR345	OPEN	LOW(R791)	NOT OPTION
AVR132	LOW(R793)	HIGH(R790)	LOW(R712)
AVR144	HIGH(R792)	HIGH(R790)	LOW(R712)
AVR145/230	HIGH(R792)	LOW(R791)	HIGH(R711)
AVR245/230	LOW(R793)	LOW(R791)	HIGH(R711)

SCHEMATIC DIAGRAM

REVISION	2		4		6	
1		3		5		7

SCHEMATIC DIAGRAM			SHEET
MODEL	AVR132/144		4/5
DESIGN	CHECK	APPROVE	DRAWING NO
M.S.K	W.Y.Y	H.W.L	1931SCMY
06.10.11	06.10.11	06.10.11	(INPUT)

_TI. LAB
2006.10.11

CUP11911Y

SR-CH

C-CH

BL-CH

FR-CH

SL-CH

FL-CH

DC PROTECTOR

THERMAL PROTECTOR

OVERLOAD DETECTION

ONLY FAN USING

EXCEPT AVR145

FOR USING FAN

ONLY AVR145

AVR345 ONLY

EXCEPT AVR145/144/132

BR-CH

ONLY FOR AVR342

FROM INPUT B'D

FROM TRANS B'D

GAIN	R561, R562, R563, R564, R565, R850 R851
AVR145	1.8K
AVR245	1.6K
AVR345	1.6K

TO REMOTE IN/OUT B'D

FROM TRANS

AC IN

TO REG B'D

156

** IMPORTANT SAFETY NOTICE.
   INPORTANT FOR SAFETY WHEN REPLACING ANY OF THESE COMPONENTS
   USE ONLY MANUFACTURE'S SPECIFIED PARTS.
** THE UNIT OF RESISTANCE IS OHM.
   K=1000 OHM, M=1000 KOHM.
** THE UNIT OF CAPACITANCE IS MICROFARAD (uF)
   pF = 10⁻⁶ uF
** THIS SCHEMATIC DIAGRAM MAY MODIFIED AT ANY TIME WIHE THE
   IMPROVEMENT OF PERFORMANCE

REVISION	1		2		3		SHEET
SCHEMATIC DIAGRAM							
MODEL	AVR145/245/345/132/144						2
DESIGN	CHECK		APPROVE		DRAWING NO		7
L.C.B	W.Y.Y		L.H.W		1911SCMY		
06.10.23	06.10.23		06.10.23		(MAIN)		

M/P

SUE
2006.10.23

CUP11916Y

< DIGITAL IN/OUT PCB >

CUP11916-1

< BIAS T.R PCB >

CUP11916-2

CUP11916

CUP11916-3

MAIN TRANS

CUP11916-4

CUP11916-5

CUP11916-6

< REMOTE IN/OUT PCB >

CUP11916-7
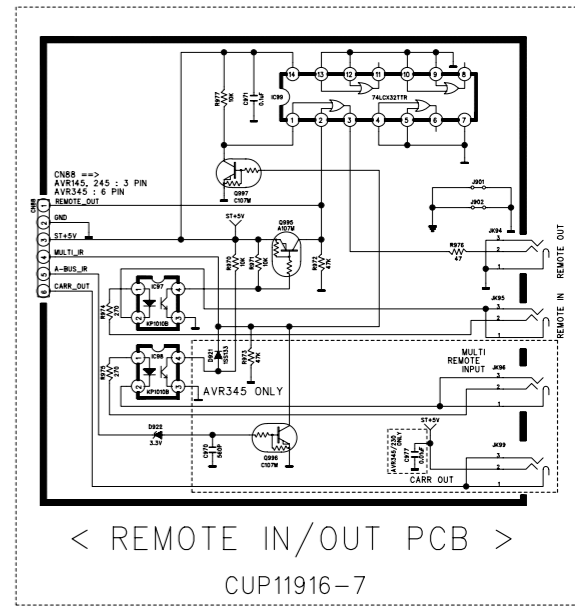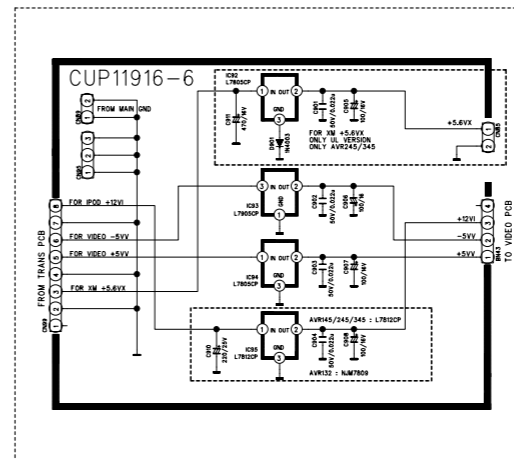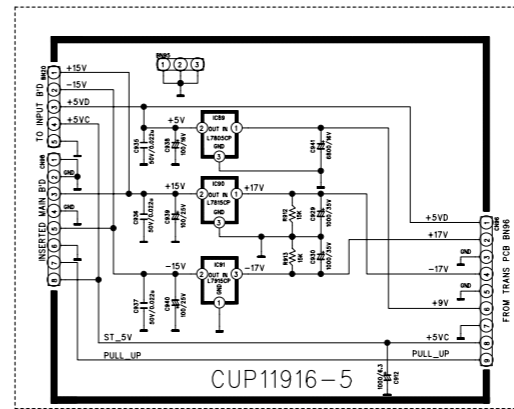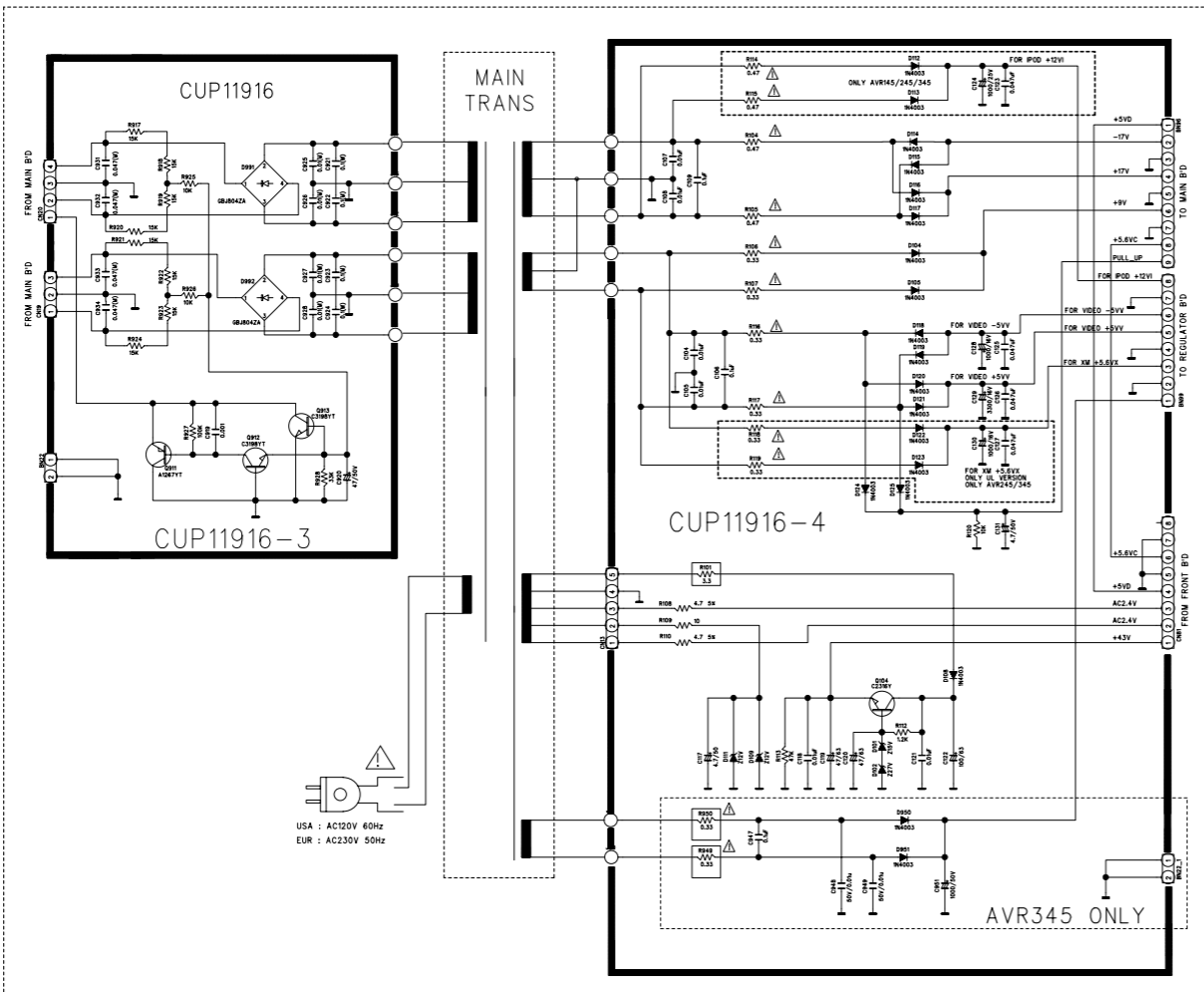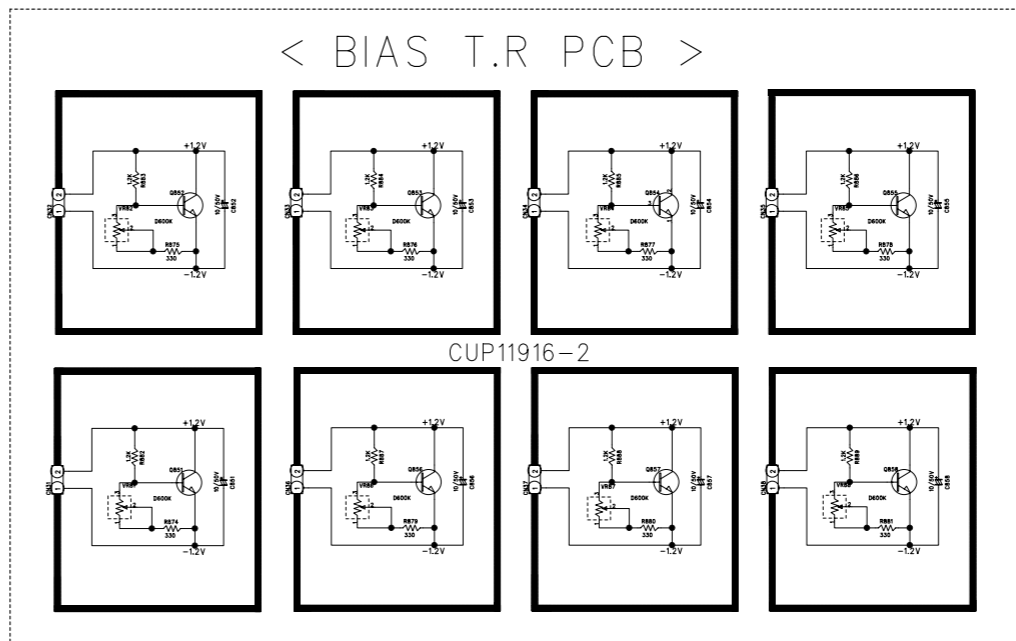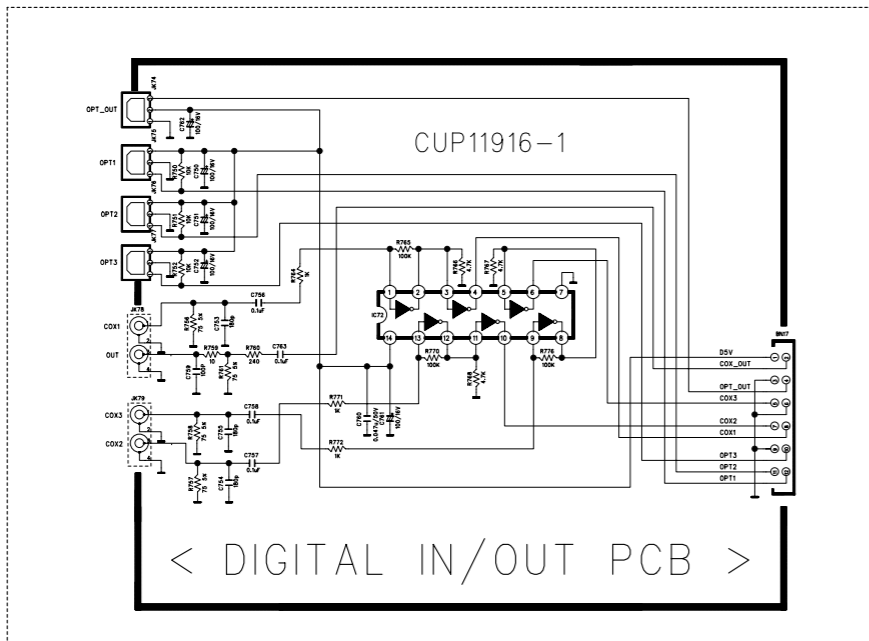
USA : AC120V 60Hz
EUR : AC230V 50Hz

AVR345 ONLY

REVISION	2		4		6	
1		3		5		7

SCHEMATIC DIAGRAM   SHEET

MODEL	AVR145/245/345/132/144		3/7
DESIGN	CHECK	APPROVE	DRAWING NO
L.C.B	Y.W.Y	L.H.W	1916SCMY
06.10.23	06.10.23	06.10.23	(POWER)

M/P   SUE 2006.10.23   1/1

AVR132/144 WIRING DIAGRAM

USA : 120V 60Hz
EUR : 230V 50Hz

CN19(3P)
CN20(4P)
CUP11916-3

POWER TRANS

CUP11916-4
CN13(5P)

BN96(8P)   BN99(8P)   CN81(8P)

CUP11916-5
REG B'd-1
CN96(9P)
BN95(3P)   BN20(5P)
BN98(8P)

CUP11916-6
REG B'd-2
CN95(3P)
CN89(2P)
BN43(4P)
CN96(8P)

CN86(2P)
CUP11910-4
MOMS S/W

CN88(4P)

CUP11910-3

JW82
BN22(6P)
CN85(2P)   CN92(5P)   BN18(5P)
HEADPHONE
OPT/COAX
CUP11910-5

From Trans
CN91(3P)
JW93
JW93
BN90(2P)
TO MOMS S/W
CN92
AC CORD
CWB3FB43280UP

CUP11911-1
MAIN B'd

CWEE21210VV
GND JW90 JW90 GND
JW91GND

BLUE BLK RED
BN19(3P)
WHT BLK RED
BN20(3P)

JW91GND
CWB8212180VY

BN98(8P)
BN89(2P)
GND

CN61(2P)   CN64(2P)   CN63(2P)   CN65(2P)   CN62(2P)

BN86(2P)   BN85(2P)   BN84(2P)   BN83(2P)   BN82(2P)

CN86(2P)   CN85(2P)   CN84(2P)   CN83(2P)   CN82(2P)

HEAT SINK ASS'Y

CN11(13P)
CN12(21P)

CUP11916-1
BN17(12P)
DIGITAL
IN/OUT B'd
CN17(12P)

CUP11930-1/ CUP11917-1
(EUR VER)   VIDEO B'd   (USA VER)
AVR132/230   AVR144
CN43(4P)   BN14(9P/13P)   CN41(6P)
(EUR/ USA VER)

TUNER
MODULE
CNC1C4A13B090B

CN13(13P)
CN10(4P)

CUP11931-1
MCU & INPUT B'd

CN19(9P)

CN11(13P)

CN12(21P)

CN20(9P)
CN1B(5P)
CN14(9P/13P)
(EUR/ USA VER)
CN72(17P)
CN22(6P)

CN72(17P)
BN84(9P)
CUP11910-6
VOL & MIC B'd
CN84(9P)

CUP11910-1
FRONT B'd

Do not use avr132,144
CN89(4P)

BN85(2P)

BN92(5P)
BN41(6P)
BN10(4P)

BN49(5P)
CUP11931-2
RDS B'd
EUR ONLY(132)

CUP11910-2
KEY-B'd
BN89(4P)

Do not use avr132,144

ILLAB
2006.10.23

REVISION	2		4		6	
1		3		5		7

SCHEMATIC DIAGRAM   SHEET

MODEL	AVR132,144	1

DESIGN	CHECK	APPROVE	DRAWING NO
J.T.B	W.Y.Y	H.Y.L	WIRING DIAGRAM
2006.10.23	2006.10.23	2006.10.23	1190WCDZ