

harman/kardon

# HK 990

## STEREO INTEGRATED AMPLIFIER

# SERVICE MANUAL



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## 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 charge 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 of 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.

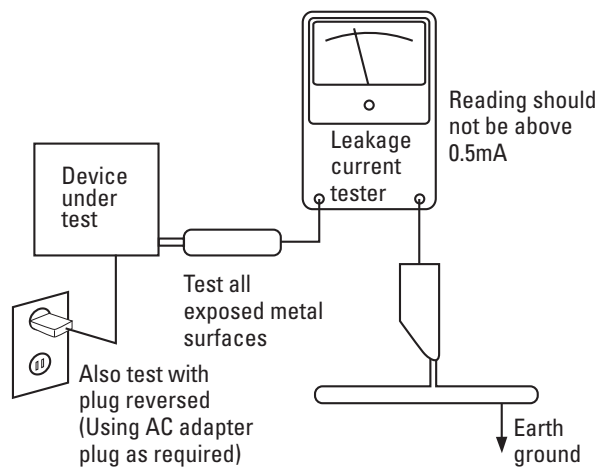
Components identified with the IEC symbol  in the parts list are special significance to safety. When replacing a component identified with , use only the replacement parts designated, or parts with the same ratings or resistance, wattage, or voltage that are designated in the parts list in this manual. 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 0.5mA.



### 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.**

## HK 990

## Specifications

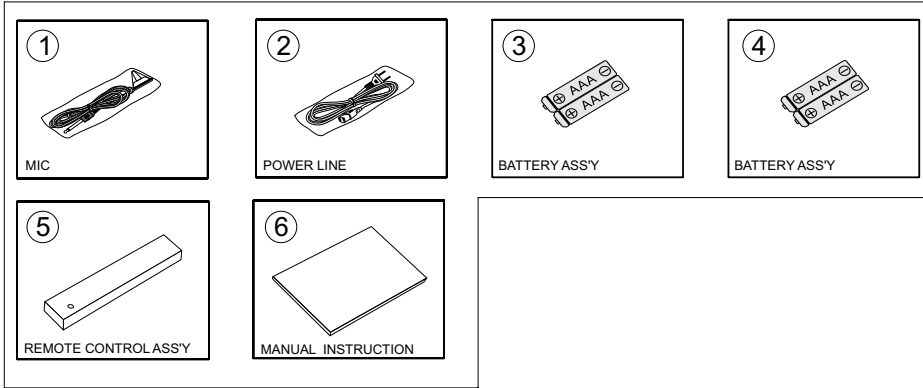
**Specifications**

Continuous average power per channel (FTC), 20Hz – 20kHz, both channels driven:	150 watts @ <0.03% THD (8 ohms) 300 watts @ <0.3% THD (4 ohms)
Dynamic power (1HF, 1kHz tone burst):	220 watts (8 ohms) 440 watts (4 ohms)
High instantaneous current capability (HCC):	±200 amps
Power bandwidth @ half-rated output, 8Ω :	20Hz – 100kHz
Frequency response @ 1W (+0/-3dB):	5Hz – 120kHz
Damping factor (20Hz – 20kHz):	>200
Signal-to-noise ratio (reference rated power output, A-WTD):	100dB (Tuner/CD) 75dB (Phono – MC)
Input sensitivity/impedance:	350mV/43k ohms (Tuner/CD) 10mV/47k ohms (Phono – MM) 1mV/100k ohms (Phono – MC)
Overload:	2.8V (Tuner/CD) 85mV (Phono – MM) 8.5mV (Phono – MC)
Tone control range, bass @ 100Hz/treble @ 10kHz:	±10dB/±10dB
Power supply:	AC 120V, 60Hz
Power consumption:	1000W
Standby power consumption:	1W
Dimensions (width x height x depth):	17-5/16" x 6-3/8" x 17-1/2" (440mm x 160mm x 444mm)
Weight:	43.2 lb (19.6kg)

Depth includes Volume button and loudspeaker terminals.

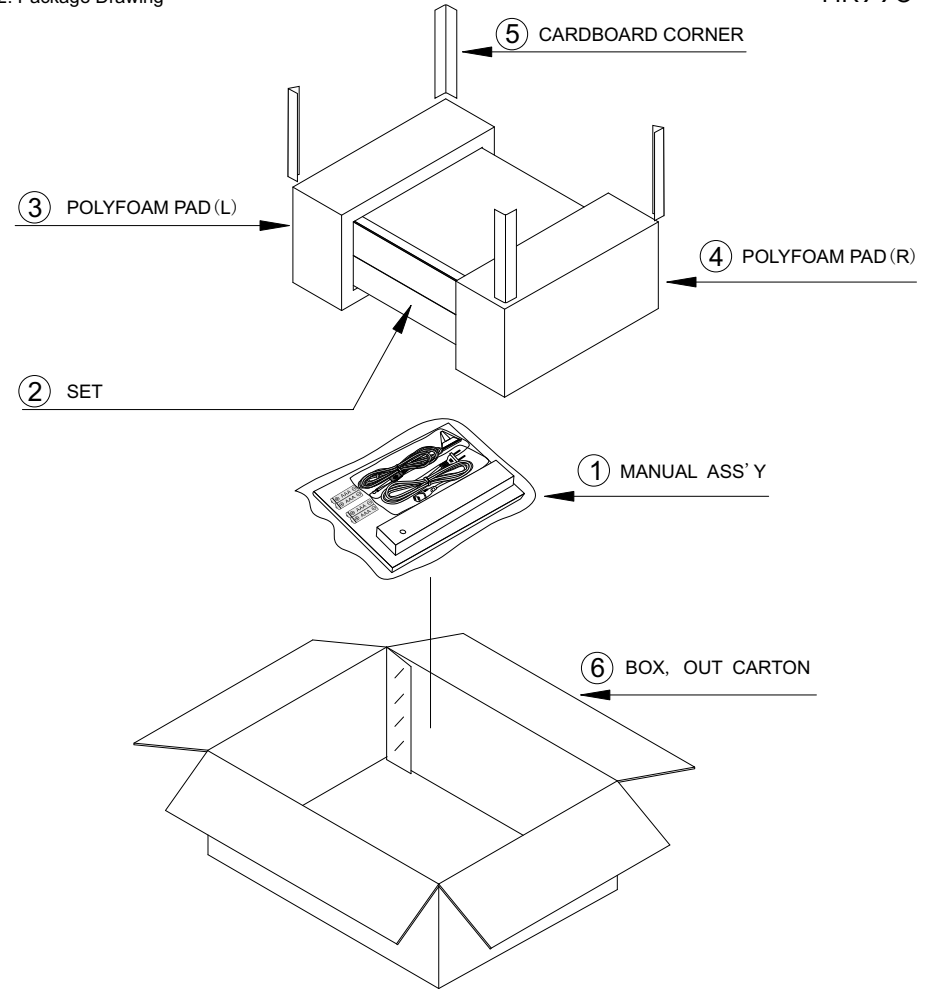


1. Instruction manual ass'y - Accessories



NO	DESCRIPTION	PARTS NO.	Q.ty
1	MICROPHONE	9599 0001 0002	1
2	AC POWER CORD	3701 1011 0865	1
3	BATTERY ASS'Y		2
4	BATTERY ASS'Y		2
5	REMOTE CONTROL ASS'Y	9843 4900 0101	1
6	MANUAL, OWNER' S	visit <a href="http://www.harmankardon.com">www.harmankardon.com</a>	1

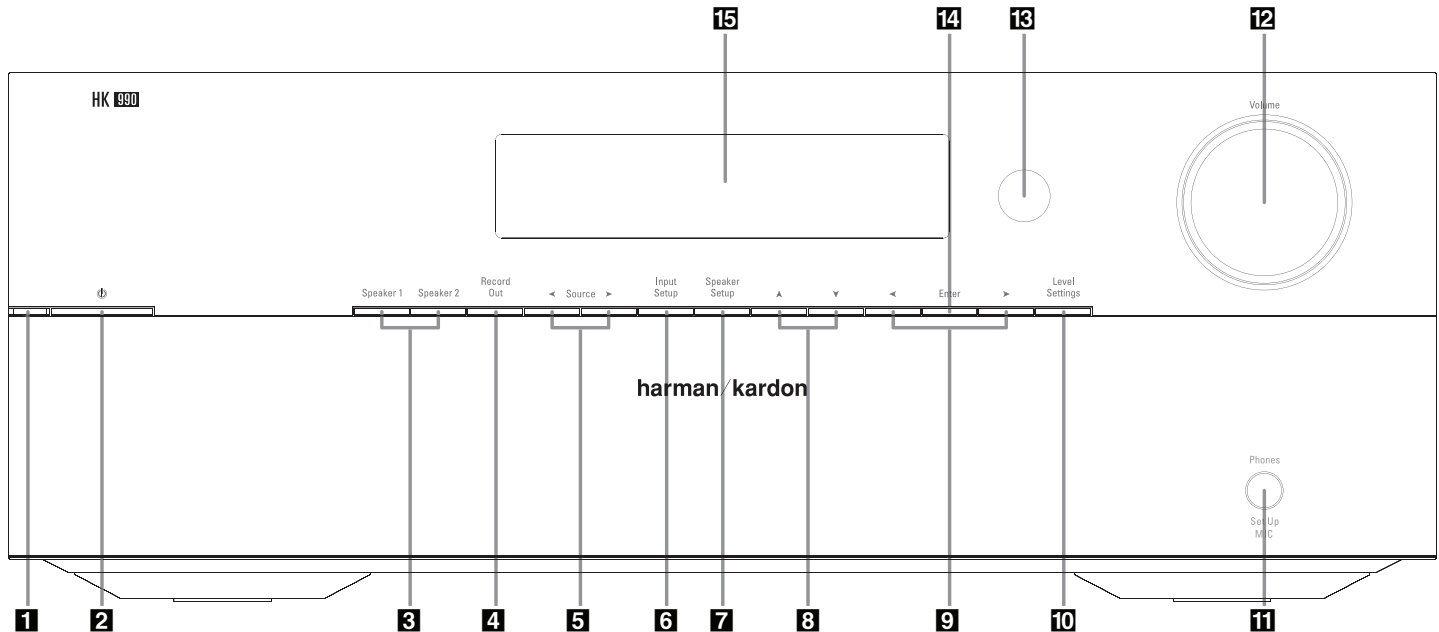
2. Package Drawing



NO	DESCRIPTION	PARTS NO.	Q.ty
1	MANUAL ASS'Y		1
2	SET	HK990	1
3	POLYFOAM PAD (Left)	8249 102B 0000	1
4	POLYFOAM PAD (Right)	8249 101B 0000	1
5	CARDBOARD CORNER		4
6	BOX, OUT CARTON	8149 101A 0200	1

## HK 990

## Controls and Functions



**1 Power indicator:** This LED will illuminate in amber when the unit is in the Standby mode to signal that the unit is ready to be turned on. When the unit is in operation, the indicator will turn white.

**2 System power control:** Press this button to turn on the HK 990; press it again to turn the unit off (to Standby). Entering Standby also saves all setup parameters.

**3 Speaker 1/2 selectors:** Press to select speaker pair 1 or 2, or both, or neither (headphone output only).

**4 Record Out selector:** First press shows the record source presently selected in the display. Pressing on the Source selector **5** within a few seconds after pressing **4** changes the record source. Exit this function by pressing **6** again, or wait for a few seconds until exit takes place automatically.

**5 Input Source selector:** Select input source for listening by pressing one of the Source buttons repeatedly to scroll through all the inputs either forwards or backwards, until the display shows the desired source.

**6 Input Setup button:** Press this button to enter/exit the Input Setup mode. Here you can select the physical connection for each source (Analog/Digital, etc.) as well as Gain, Bass/Treble, etc. Refer to the Setup section of this manual.

**7 Speaker Setup selector:** Press this button to enter the Speaker Setup menu, where you can switch subwoofers on and off, select crossover frequency, run automatic speaker setup (EzSet/EQ), etc. Refer to "Setup Instructions" on page 12 in this manual.

**8 Up/Down Arrow buttons:** Press to scroll through various options for adjustment in a menu.

**9 Left/Right Arrow buttons:** Press to increase/decrease a parameter or to select between parameters after selecting a menu for adjustment with the Up/Down Arrow buttons.

**10 Level Settings button:** Press to enter/exit the Balance left/right adjustment for the speakers as well as subwoofer level.

**11 Headphone Jack/Setup Microphone input:** Plug in headphones if desired.

With both Speaker 1 and Speaker 2 selectors in the off position, output is supplied only to headphones. When using the automatic loudspeaker setup and calibration system (EzSet/EQ), plug the microphone in here.

**12 Volume control:** Turn to raise or lower output volume.

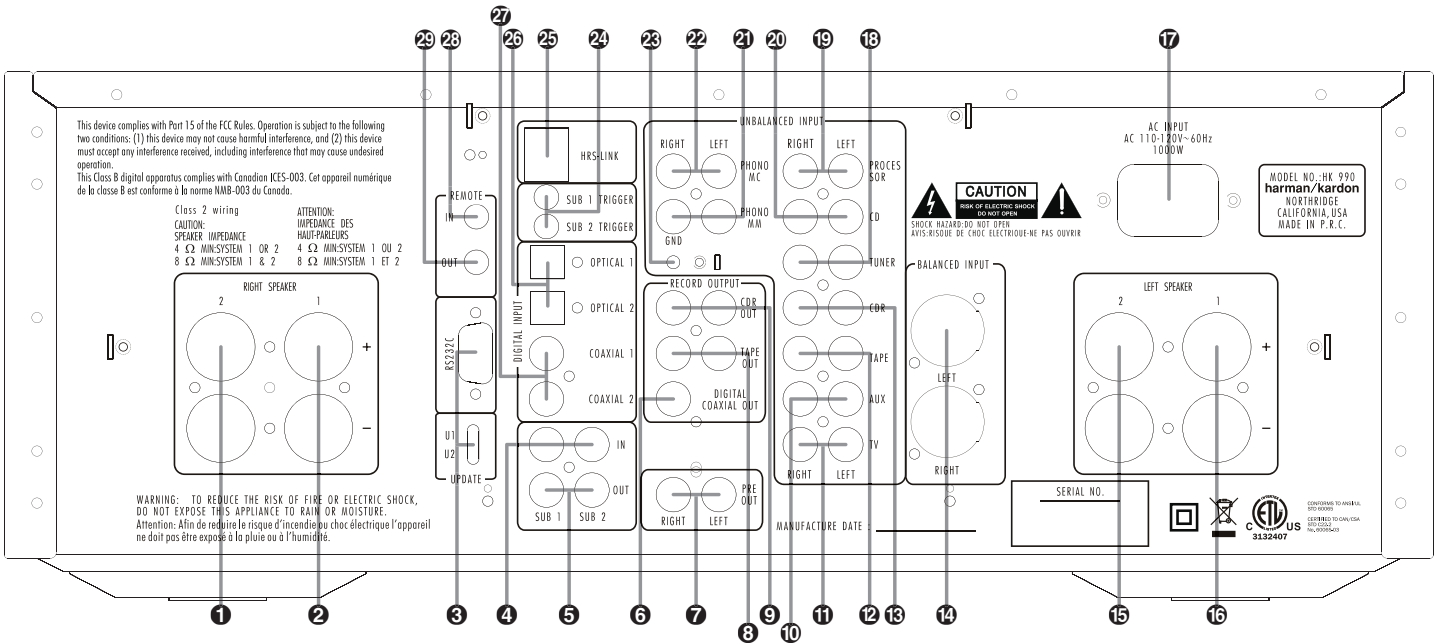
**13 Remote Sensor Window:** The sensor behind this window receives infrared signals from the remote control. Aim the remote at this area and do not block or cover it unless an external remote sensor is installed.

**14 Enter button:** Press to select a parameter for adjustment and to confirm.

**15 Main Information Display:** This display delivers messages and status indications to help you operate the amplifier.

# HK 990

## Connections



- 1 Right Speaker output, System 2.
- 2 Right Speaker output, System 1.
- 3 RS-232C connector for possible future PC update, plus Update switch.
- 4 Input jacks for one or two subwoofer signals from external surround processor.
- 5 Output jacks for two subwoofers.
- 6 Digital Coaxial output jack for digital recording. Also permits digital recording of analog sources.
- 7 Preamplifier output jacks.
- 8 Analog output jacks for tape recording.
- 9 Analog output jacks for CD-recorder analog recording.
- 10 Auxiliary input jacks, suitable for analog signals from video games, video recorders, etc.
- 11 TV input jacks for analog-sound input from your TV.
- 12 Tape input jacks for analog tape replay.
- 13 CDR input jacks for CD-recorder analog replay.
- 14 Balanced analog inputs (XLR) for use with all signal sources that output balanced signals. Available via the CD Input function only, as an alternative to the unbalanced RCA jacks (input 20). Pin configuration for the XLR Inputs: Pin 1 is ground, Pin 2 is plus/hot, Pin 3 is minus/cold.
- 15 Left Speaker output, System 2.
- 16 Left Speaker output, System 1.
- 17 AC power-cord connection.
- 18 Tuner analog-input jacks.
- 19 Processor analog inputs. These inputs go directly to the power amplifier section of the HK 990, bypassing the Volume and Tone Control. Here you can connect the Front Channel Pre Out L+R signals from an external surround processor, to benefit from the superior power of the HK 990 and control volume from the processor. **NOTE:** Only use the Processor input with a device that has its own volume control!
- 20 CD analog-input jacks. You can select either this input or the balanced input (14) as analog input in the CD Input Setup mode.
- 21 Phono input for record player with Moving Magnet (high output and high impedance) or High-Output Moving Coil cartridge.
- 22 Phono input for record player with Moving Coil (low output and low impedance) cartridge.
- 23 If your record player has a separate ground wire, attach it here to avoid hum noise.
- 24 Connect the trigger input (if available) on one or two subwoofers to these Trigger On/Off output jacks. When you switch on the HK 990, it sends a trigger signal, which switches on the subwoofer. When you switch off the HK 990, the subwoofer also switches off.
- 25 HRS (High-Resolution Synchronization) input. Use the included HRS cable to connect the HD 990 CD player (or other similarly equipped player) for optimum sound quality.
- 26 Optical digital inputs (TOSLINK™). Connect any digital device with Optical digital output to one of these inputs. Push the Optical jack through the hinged door that covers the input until it clicks into place.
- 27 Coaxial digital inputs. Connect any digital device with Coaxial digital output to one of these inputs. Usually, Coaxial digital transmission is preferred to optical, given a choice.
- 28 Remote In. To control your HK 990 with an external infrared remote sensor, connect the wire from the remote sensor here.
- 29 Remote Out. Connect other Harman Kardon devices (you may also experiment with other brands) that you wish to control with the HK 990 remote control to this output.

# HK 990

## Connections

### Connecting Other Components

1. Make sure your amplifier and other components are turned off.
2. Connect each component's output/play jacks to the corresponding input jacks on the back of your amplifier and, if available, the component's input/record jacks to the output jacks of the HK 990. Use the white, black or gray plugs to connect Left-channel jacks; use the red plugs for Right-channel jacks.

### Wired Remote Control

To control your amplifier with an external infrared remote sensor, connect the wire from the remote sensor to the Remote In jack on the back panel. Or, if another stereo component has a built-in infrared remote sensor and a Remote Out jack, it may be possible to connect this jack to the Remote In jack of your amplifier. All Harman Kardon products with Remote In and Remote Out jacks are compatible with one another, except for the Citation 22, 24 and 25.

Other manufacturers' remote sensors and components may not be compatible, but it will not hurt to experiment. A second wire may be used to connect your amplifier's Remote Out jack to the remote input of another stereo component. Continue this process to include additional components (if compatible).

### Connecting Speakers

3. For best performance, use high-quality speaker cables. However, ordinary copper wire can be used if the gauge meets the following requirements:

Wire Length	Min. Diameter
Up to 8.2 feet (up to 2.5 meters)	1/32" (1mm)
Up to 13.1 feet (up to 4 meters)	3/64" (1.25mm)
Up to 19.7 feet (up to 6 meters)	1/16" (1.6mm)
Above 19.7 feet (above 6 meters)	5/64–3/32" (2–2.5mm)

4. Avoid rolling excess wire with or near signal interconnects.

**IMPORTANT:** When connecting two pairs of speakers, determine the impedance of each pair by looking on the back of the speakers or in your owner's manual, or by contacting your dealer or manufacturer.

**You can listen to two pairs of speakers at the same time ONLY if the impedance of EACH speaker is NOT LESS THAN 8 ohms.**

**WARNING:** Do not play sets of speakers simultaneously except as recommended above. Amplifier may overheat.

### AC Power

Plug the cord into a 120V AC wall outlet. The Power indicator will light up to indicate power on. To disconnect the power input completely, the main plug must be disconnected from the mains.

# HK 990

## Remote Control

### Independent Remote Control

The system remote of the HK 990 can control the amplifier, compatible tuners, CD players and CD recorders. The Remote In jack of units without an integrated IR receiver must be connected to the amplifier's Remote Control Output jack so that the system remote control can operate them.

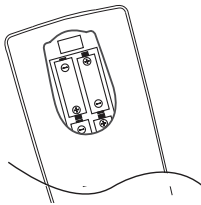
Important notes:

- To remote-control a tuner, CD recorder or CD player, the appropriate input ("TUNER," "CDR" or "CD") must have been selected with the source buttons of the remote control (selecting on the front panel is not sufficient).
- Note that DVD players cannot be controlled by the remote.

### Operating Conditions

The control unit operates effectively within a distance of 23 feet (7 meters) and an angle of 30° from the amplifier. Using the control near fluorescent lights may shorten this range, as will any dust or dirt that accumulates on the front of the remote control or the remote-sensor area of the amplifier. Also, avoid blocking the line of sight between amplifier and remote.

Install the four supplied AAA batteries in the remote as shown. Be certain to follow the (+) and (-) polarity indicators that are on the top of the battery compartment.



When you replace weak batteries, replace all at the same time. When the remote is to be unused for an extended period, remove the batteries to prevent damage from corrosion.

### Instructions for Users on Removal and Disposal of Used Batteries. Specification of Included Battery Types.



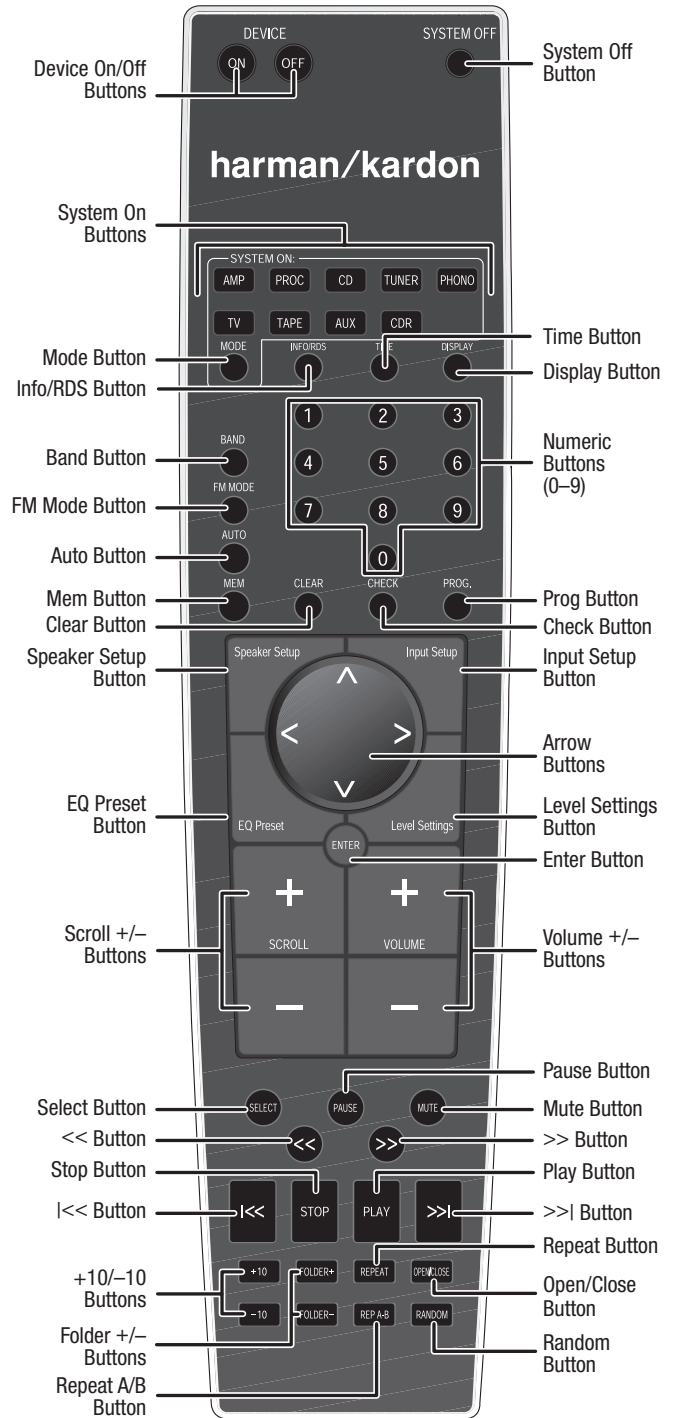
These symbols shown on the product, the packaging or in the manual or separate information sheet mean that the product itself, as well as the batteries included or built into the product, should never be thrown away with general household waste. Take them to applicable collection points, where proper treatment, recycling and recovery takes place, in accordance with national or local legislation, or European Directives 2002/96/EC and 2006/66/EC.

Correct handling of the product and batteries to be disposed helps save resources and prevents possible negative effects on the environment or human health.

The batteries included with your equipment may be alkaline, carbon zinc/manganese or lithium (button cells) type. All types should be disposed of according to the above instructions.

To remove the batteries from your equipment or remote control, reverse the procedure described in the Owner's Manual for inserting batteries.

For products with a built-in battery that lasts for the lifetime of the product, removal may not be possible for the user. In this case, recycling or recovery centers handle the dismantling of the product and the removal of the battery. If, for any reason, it becomes necessary to replace such a battery, this procedure must be performed by authorized service centers.



## HK 990

## Remote Control

## HK 990 Remote Control Functions

**Device On/Off:** Press these two buttons to switch on and off a (Harman Kardon) device selected with the Mode button or selected by pressing its System On source button (in both cases, the System On device button lights up).

**System Off:** Press to switch off the entire system (the HK 990 and other Harman Kardon products that have a remote sensor or are connected to the Remote jacks on the HK 990 back panel).

**System On:** This group of nine buttons switches on the HK 990 as well as the (Harman Kardon) device labeled on the button ("AMP," "CD," "TUNER," "CDR," "TAPE") that you press. It also switches the remote's frequencies to control the device indicated on the active button and selects this device to be input to the HK 990. Please note that while to a number of remote functions are switched to control the device selected, some of the amplifier's main functions always remain active, such as Volume. Please refer to the "Remote Function List" on page 10 for information on which functions can be remote controlled for each type of device and which buttons always control the HK 990.

**Mode:** Press to scroll through the nine System On buttons, each button lighting up in turn. This feature allows you to control the device you select without changing the input of the HK 990. Note that a number of remote functions are always active for the HK 990 no matter which device you select with the Mode button. Refer to the "Remote Function List" on page 10.

**Info/RDS:** Press to select information for a CD player, such as CD-Text if available on the CD. Selects RDS function for a tuner.

**Time:** Press to select time information for a CD player or a CD recorder.

**Display:** Press to switch the display brightness of the HK 990 and other HK units in steps of "Full" brightness, "Reduced" brightness and "Display Off."

**Numeric Buttons (0–9):** Press to enter track numbers on CD or CDR units or to enter preset numbers/frequency digits on a tuner. You may begin play of a CD with the Numeric buttons by entering the digits of the track directly. Press "5" to initiate play from track 5, "1" immediately followed by "4" to initiate play from track 14, "2" immediately followed by "7" to initiate play from track 27, etc.

**Band:** Press to switch between frequency bands on a tuner.

**FM Mode:** Press to switch between Stereo and Mono on a tuner.

**Auto:** Press to switch between Automatic and Manual tuning on a tuner.

**Mem:** Press to memorize a radio station in the Preset Memory of a tuner.

**Clear:** Press to clear the memory of a CD/CDR or clear a preset from tuner station list.

**Check:** Press to check the order of tracks programmed into a CD player's memory.

**Prog:** Press to begin the process of programming a CD player to play the tracks of a disc in a specific order.

**Speaker Setup:** Press to enter the HK 990 Speaker Setup functions. See "Speaker Setup" on page 12 for explanation of the process.

**Input Setup:** Press to enter the HK 990 Input Setup functions. See "Input Setup" on page 11 for explanation of the process.

**Arrow Buttons (><^v):** Press to navigate within the menus of the HK 990.

**EQ Preset:** Press to enter the HK 990 Equalizer Preset functions. See "EQ Preset" on page 13 for explanation of the EQ presets.

**Level Settings:** Press to enter the HK 990 Level Setting functions. See "Level Settings" on page 13 for explanation of the level-setting process.

**Enter:** Press to confirm a selection within an HK 990 setup procedure or to switch between selections. See under each setup process for further explanations.

**Scroll +/-:** When listening to a tuner, press + to tune to higher-frequency stations and – to tune to lower-frequency stations. Also see the owner's manual for your Harman Kardon tuner.

**Volume +/-:** Press to adjust the HK 990 volume up or down.

**Select:** When listening to a tuner, press this button to alternate between Auto Tune, Manual Tune or Preset Tune.

**Pause:** When playing a CD, press this button to pause the disc momentarily. Press again to resume play.

**Mute:** Press this button to silence the HK 990 momentarily. "Muted" flashes in the front-panel display. Press again to re-activate sound output.

**<< and >> (Search buttons):** Press one of these buttons to search fast forward or backward on a CD or tape. You can hear intermittent sounds from the CD while searching. Normal playback resumes when you release the button.

**[<< and >>] (Skip buttons):** Press one of these buttons to move to the next track or to the previous track on a CD or Tape. Repeatedly pressing one of the buttons skips more tracks. On a CD, pressing Skip Forward while playing the last track skips to track 1, and pressing Skip Back while playing track 1 skips to the last track.

**Stop:** Press to stop play of a CD or tape.

**Play:** Press to start playback of a CD or Tape. If the CD drawer is open, the drawer closes and play begins. Pressing the Play Button again pauses play momentarily, same as the Pause Button.

**+10 and –10:** When playing a CD, press the +10 button to skip 10 tracks forward and the –10 button to skip 10 tracks backward from the track you are playing. Another press skips 10 more tracks. If there are fewer than 10 tracks to the end or start of the CD, the last or first track is played.

**Folder + and Folder –:** When the system is playing a CD with MP3 files, press these buttons to move to the next or the previous folder with MP3 material.

**Repeat:** When playing a CD, pressing this button once repeats the current track, shown as "Rep 1" in the CD player's display. Pressing once more repeats the entire CD, shown as "Rep All" in the CD player's display. Third press exits repeat play.

**Repeat A-B:** When playing a CD, press once to establish a starting point (shown as "Rep A" in the CD player's display) and a second time to establish an end point (shown as "Rep A-B" in the CD player's display). The audio between these two points is repeated as a loop until you press the button a third time, returning to normal play.

**Open/Close:** Press to open the CD drawer when it is closed and to close it when it is open. The drawer may also be closed by pressing "Play."

**Random:** When playing a CD, press this button to play all tracks in random order.

# HK 990

## Setup Instructions

### HK 990 – Setup

Here are the factory settings of the HK 990 stereo integrated amplifier:

- Source listen: CD
- Source record: CD
- Processor input: analog unbalanced
- CD input: analog unbalanced
- Tuner input: analog unbalanced
- Aux input: analog unbalanced
- CDR input: digital coaxial 1
- Tape input: analog unbalanced
- TV input: digital coaxial 2
- Phono (turntable) input: analog MM (moving magnet)

#### Speaker 1 & 2 (front panel only)

When pressing the buttons Speaker 1 or Speaker 2, you will first see the current status setting; pressing one more time within five seconds on Speaker 1 and/or Speaker 2 will turn the settings ON or OFF. Up to two speaker pairs can be connected and amplified at the same time. NOTE the minimum load warning above.

#### Source < and > (front panel only)

The Source buttons can be used in two ways:

- Directly, giving access to the Playback Source, switched with immediate effect.
- After having entered the Record Out mode to select the Source to be routed to the Record path.

#### Record Out (front panel only)

When pressing the Record Out button, you will have access to the selection of the source you would like to get directed to the Record outputs. Scroll through the list of record sources – CD, TUNER, AUX, CDR, TAPE, TV and PHONO – with the < and > buttons until the desired source appears in the display.

Whether the source is analog or digital, the HK 990 will deliver the record signal in both domains simultaneously through both the analog (CDR and Tape) and the digital (Coaxial) outputs. This means that any analog input can be recorded digitally without addition of an external analog/digital converter.

#### Input Setup (front panel and remote control)

Each input of the HK 990 can be configured to match the system and your personal taste. In the following you can read a description of the Input Setup settings in detail, followed by the options available for each input. Pressing the Input Setup button on the front panel or the remote control enters and exits the Input Setup menu.

Note that the selection and navigation through the setup menus is made using the Up, Down, Left and Right Arrow buttons and the Enter button.

### Input Type

Each input can be configured to the following connections on the rear panel:

#### CD

- Unbalanced Analog
  - Balanced Analog
  - Coaxial 1
  - Coaxial 2
  - Optical 1
  - Optical 2
  - HRS-Link
- } Digital

#### TUNER

- Unbalanced Analog
  - Coaxial 1
  - Coaxial 2
  - Optical 1
  - Optical 2
- } Digital

#### PHONO

- Moving Magnet Analog
- Moving Coil Analog

#### TV

- Unbalanced Analog
  - Coaxial 1
  - Coaxial 2
  - Optical 1
  - Optical 2
- } Digital

#### AUX

- Unbalanced Analog
  - Coaxial 1
  - Coaxial 2
  - Optical 1
  - Optical 2
- } Digital

#### CDR

- Unbalanced Analog
  - Coaxial 1
  - Coaxial 2
  - Optical 1
  - Optical 2
- } Digital

#### TAPE

- Unbalanced Analog
  - Coaxial 1
  - Coaxial 2
  - Optical 1
  - Optical 2
- } Digital

#### PROCESSOR

- Unbalanced Analog

The physical rear-panel connection that you have associated with each input in the Input Setup procedure also determines the recording-signal source when you select that device in the Record Out menu.



## HK 990

## Setup Instructions

**Audio Mode**

The HK 990 can handle analog as well as digital signals. It can process any input in the digital domain to equalize the signal and tailor the sound to the loudspeakers and room acoustics, once either the EzSet/EQ or the Manual Bass Management has been set up (see below).

You choose the method and the processing according to your preference within the Input Setup menu.

The five Audio modes are as follows:

- 1. Direct Path:** Selection of the Direct Path is an analog-input-only option. It bypasses all digital processing (ADC, DSP and DAC) to reduce the signal path to an absolute minimum, consisting of volume control only. If you select an input to be associated with a digital source, the Direct Path setting is not available, being an analog-only option.
- 2. DSP Path:** Selecting the DSP Path opens access to the tone-control circuits. In this mode, the analog signals are routed to the A/D Converter, Digital Sound Processor and D/A Converter path prior to volume adjustment.
- 3. EQ1 LF (low-frequency correction):** This mode should be selected once the EzSet/EQ Setup has been carried out (see below). If selected before the EzSet/EQ Setup, it will simply provide the same result as the DSP Path, being a flat response with access to the tone controls. The EQ1 LF mode is the first preset available after the EzSet/EQ calibration has been carried out. This preset processes the subwoofer channels only, correcting the acoustics of the room in the low-frequency range while keeping the response curve of the main speakers unchanged.
- 4. EQ2 LF+MF (low- and mid-frequency correction):** This mode should be selected once the EzSet/EQ Setup has been carried out (see below). If selected before the EzSet/EQ Setup, it will simply provide the same result as the DSP Path, being a flat response with access to tone controls. The EQ2 LF + MF mode is the second preset available after the EzSet/EQ calibration has been carried out. This preset is active for the low- and mid-frequency responses of both the main speakers and the subwoofers when it calibrates the system to the room. As a result, both the subwoofer and main speaker response curves are modified to accommodate the system response to the room. The response curve of the main speakers is corrected up to 1kHz and kept unaffected above this frequency, leaving the rest of the audio spectrum unaffected.
- 5. EQ3 LF + MF + HF (low-, mid- and high-frequency correction):** This mode should be selected once the EzSet/EQ Setup has been carried out (see below). If selected before the EzSet/EQ Setup, it will simply provide the same result as the DSP Path, being a flat response with access to tone controls. The EQ3 LF + MF + HF mode is the third preset available after the EzSet/EQ calibration has been carried out. This preset optimizes not only the main speaker and subwoofer responses to accommodate the room acoustics, but also corrects the high-frequency response of the speaker at the listening position by correcting off-axis response.

Please observe that all the five Audio modes described above can be selected independently for all inputs.

**Gain**

The level of different sources may vary. To avoid annoying level changes when switching between inputs, Gain Adjustment from -6dB to +6dB is an option for each Input. The processor input has a different range (-24dB to +6dB), to accommodate the output levels of most processors.

**Bass and Treble**

Bass and treble adjustment is accessible only when the Audio mode is not direct (i.e., is set to DSP, EQ 1, EQ 2 or EQ 3). When in this mode, you can adjust the bass and treble from -10 to +10dB below 100Hz and above 10kHz.

**Speaker Setup**

When pressing the Speaker Setup button, a menu opens to offer a choice between Manual mode or EzSet/EQ Setup. Below is a description of both options.

**Manual Mode**

If you know your system and your room well and simply want to manage the low-frequency response of your system without correcting the frequency response of subwoofers and main speakers, select the Manual Mode. This is a basic Bass Manager Setup.

Once Manual Mode has been selected, follow the steps below:

- 1. "Subwoofer 1 On/Off":** Select "On" if a subwoofer is connected to the Sub 1 output.
- 2. "Subwoofer 2 On/Off":** Select "On" if a subwoofer is connected to the Sub 2 output.
- 3. "Crossover Frequency":** If either SUB1 or SUB2 is ON, you can select the crossover frequency, where the main speakers' lower frequency limit and the subwoofer's upper frequency limit is placed. The setting goes from 40 to 200Hz in 10Hz steps.
- 4. Save and Exit:** To save the steps 1 to 3, press Enter after each step.

**EzSet/EQ Mode**

If you want to benefit from the HK 990's advanced, automatic frequency correction and setup system, select EzSet/EQ Mode. The process is described in detail below.

**Setup Process**

The setup process consists of the following steps:

- 1. "Subwoofer 1 On/Off":** Select "On" if a subwoofer is connected to the Sub 1 output.
- 2. "Subwoofer 2 On/Off":** Select "On" if a subwoofer is connected to the Sub 2 output.
- 3. "Crossover Frequency Automatic/Manual" (only if at least one subwoofer is connected to the HK 990):** Select whether you want to set a crossover frequency of your choice manually or let the HK 990's algorithm measure your main speaker limitations automatically.

- Manual Mode:**

"Crossover Frequency": Select which crossover frequency you want for the system, between 40 and 200Hz in 10Hz steps. When the frequency is adjusted, you will be asked to follow the same steps as below in the Automatic mode.

- Automatic Mode:**

a) "Connect mic and place it at listening position": Following this message, connect the supplied measuring microphone to the front-panel jack shared with headphones. Place it in your listening position, at the correct height, then press Enter. In order to read the complete message on the Display, press the > Arrow button on the remote.

b) The system generates two loud, brief frequency sweeps through the speakers. If you are not comfortable with loud noise, use ear plugs or have someone else perform the calibration. The volume of the sweeps is pre-determined. You can control this level by simply adjusting the volume with the Volume button on the front panel or with the Volume buttons on the Remote Control. Please note that if you set the volume too low, the calibration does not function, and setting it too loud may damage your loudspeakers. After calibration is performed, the volume reverts to the level that you used previously.

When the sweeps have been done, you may get an error message "Mic or speaker not detected" in the display. In this case, check the connection to the microphone and/or increase the volume slightly; then press Enter again. If no error is found, the system will bring you to Step 3. If you still get an error message, you must switch off the amplifier to exit the calibration menu.



## HK 990

## Setup Instructions

- c) Once the sweeps are performed without error, the display will show “Filter Design, please wait...” During this process, the filter parameters are computed and written into the DSP flash memory. When this is done, the system goes to Step 4.
- d) “Place mic at 60cm in front of the left speaker” appears in the display. Position the microphone as prompted (60cm is about two feet), preferably at normal listening height (you may use a photo tripod; there is a threaded hole at the bottom of the microphone for this purpose). Then press Enter. A new sweep will be generated. If it is unsuccessful, you will be asked to check the distance or the volume of the system with this message in the Display: “Wrong distance or level, please check and press Enter.” If successful, you will go to Step 5.
- e) “Place mic at 60cm in front of the right speaker” appears in the display. Again, position the microphone as prompted (60cm or two feet), then press Enter. A new sweep will be generated. If it is unsuccessful, you will be asked to check the distance or the volume of the system with this message in the display: “Wrong distance or level, please check and press Enter.” If successful, you will go to Step 6 if at least one subwoofer is connected, or to Step 7 in a pure 2.0 system.
- f) There are two possibilities at this stage, depending on the number of subwoofers selected in Step 1 of the Setup Process:
- **One Subwoofer:** The display shows this message: “Place mic at listening position, press Enter.” After you do it, two sweeps are generated. If successful, you will jump to Step 7. If not, the following message is shown: “Sub not connected or incorrect level, please check and press Enter.” Check the connection and/or adjust the subwoofer level and press Enter again. When successful, you will go to Step 7.
  - **Two Subwoofers:** The display shows this message: “Place mic at 1st listening position, press Enter.” Place the microphone 90cm (about three feet) to the left of your listening position. After pressing Enter, four sweeps are generated. Then you will be asked to “Place mic at 2nd listening position, press Enter.” Now place the microphone 90cm to the right of your listening position. After pressing Enter, two sweeps are generated. If successful you will jump to Step 7. If not, the following message is shown: “Sub 1 or 2 not connected or incorrect level, please check and press Enter.” Check the connections and/or adjust the subwoofer levels and press Enter again. When successful, you will go to Step 7.
- g) The setup procedure is now complete, and the display shows this message: “EQ setup completed, unplug microphone, press Enter to save EQ Setup.” Press Enter as prompted. The display shows: “Saving system equalization.”

Now the HK 990 goes back to the previous playback mode, and you can test the results of the setup process by going through the various options, pressing the EQ Preset button repeatedly (see below).

## EzSet/EQ Description

During the automatic EzSet/EQ process, several frequency sweeps were made. Here is a brief explanation of their use.

### Far Field

The first sweeps that occur during Step 2 are used to calibrate the speaker system (adjust relative levels and delay, and determine the crossover frequency if “Manual Crossover Frequency” was not selected earlier). Also, the low-frequency response of the speakers is equalized by applying a correction curve (with a range of 20Hz to 1kHz). This is the curve that is stored during the “Filter Design” phase.

### Near Field

The next sweeps measured in front of each speaker (Steps 4 and 5) serve to correct the on-axis response of the main speakers. By applying sweeps to each speaker, a correction curve above 1kHz is generated for each speaker. The curves are stored after Step 7.

### BassQ

If at least one subwoofer is connected, the final steps of the EzSet/EQ process adjust the low-frequency response of the system, taking into consideration the acoustics of the room. The system can correct up to two subwoofers in its processing loop. Using two subwoofers offers the advantage of a more linear low-frequency characteristic, limiting the node effects usually found in this frequency range.

The curves are stored after Step 7.

### EQ Preset

The HK 990 provides direct access to the three sets of filters via the remote control through the EQ Preset button. Use this button to toggle between these three modes:

1. BassQ (EQ1 LF)
2. BassQ + Far Field (EQ2 LF + MF)
3. BassQ + Far Field + Near Field (EQ3 LF + MF + HF)

It will also toggle through the Direct and DSP paths, thus allowing five possible settings. Note that the EQ Preset button is in fact a shortcut button for the Audio mode function of the Input Setup described above.

The EzSet/EQ measurements are stored in a flash memory and are not lost even if the amplifier is disconnected from the AC mains.

## Level Settings

The Level Settings menu permits adjusting the levels of the different activated speakers and subwoofer(s) of the system. Depending on what was adjusted during the Speaker Setup process, SUB1 and/or SUB2 may or may not be activated.

The Level Settings menu adjustments are:

1. To adjust the Balance between left and right speakers up to 12dB for each side.
2. To adjust the Subwoofer 1 level between + and – 6dB (when on).
3. To adjust the Subwoofer 2 level between + and – 6dB (when on).

## HK 990

## Operating Instructions

## Listening to Your CD Player, Tape Deck, Tuner or Other Source

1. Press the Power switch **2** to turn on the amplifier. The power indicator lights white and the protection circuitry checks for short circuits or other problems for a few seconds before sound output.
2. Press "Speaker 1" to hear loudspeakers connected to the rear Speaker 1 terminals. Press "Speaker 2" to hear loudspeakers connected to the rear Speaker 2 terminals. Press both to hear both speaker pairs at once. To listen to headphones only, press to turn off any active speaker pair.
3. Select desired source for listening by pressing the front-panel Source Selector **5** Up or Down button repeatedly until the name of the source is shown in the Main Information Display, or by pressing the desired System On button on the remote control. Please take the time to associate physical input jacks to source names; then press the Power button to place the amplifier in standby to have it save your preferences.
4. Begin playing the desired source.
5. Adjust the volume control to the desired level.

With the Input Setup, you may adjust bass and treble as well as balance if you have not already done this during the setup process.

With the EQ Preset you can select one, two or three stages of equalization, if you did already perform the EzSet/EQ Setup automated adjusting process as described above.

## Making a Recording

You may record any source to tape or to CDR or to both simultaneously. You may also connect a second tape deck to the CDR inputs and outputs to record from tape to tape (in either direction).

To select the desired source for recording (it can be a source different from the one being listened to), press the Record Out button, followed by the Source Selector Up or Down button on the front panel, repeatedly until the indicator for the name of the source to be recorded is shown in the Main Information Display. All input signals, digital or analog, are available for recording in both digital and analog form. This means that if you wish to copy a vinyl record to a digital recorder, you simply start vinyl play, select "Phono" as Record Source and begin recording on your digital recorder. The built-in analog/digital converters transform the analog Phono signal to digital form. The reverse is also possible: if you have connected a CD player to the HK 990 with a digital cable, its signal is available from the analog recording outputs as well as the digital outputs.

**NOTE:** The record-output signal is taken directly from the program source and is unaffected by the volume, bass, treble or balance controls.

### Important Notes:

- "Record Source" can be selected on the front panel only, not from the remote control.
- Three-head cassette decks with monitoring function can be connected to Tape or CDR connectors, too, but their monitoring function cannot be used.
- Always turn the HK 990 to Standby with the Power button before unplugging the power cord (or before switching off an external multiplug). This saves your current setup in the memory, in addition to safely switching off the power-amplifier section of the HK 990.

## HK 990

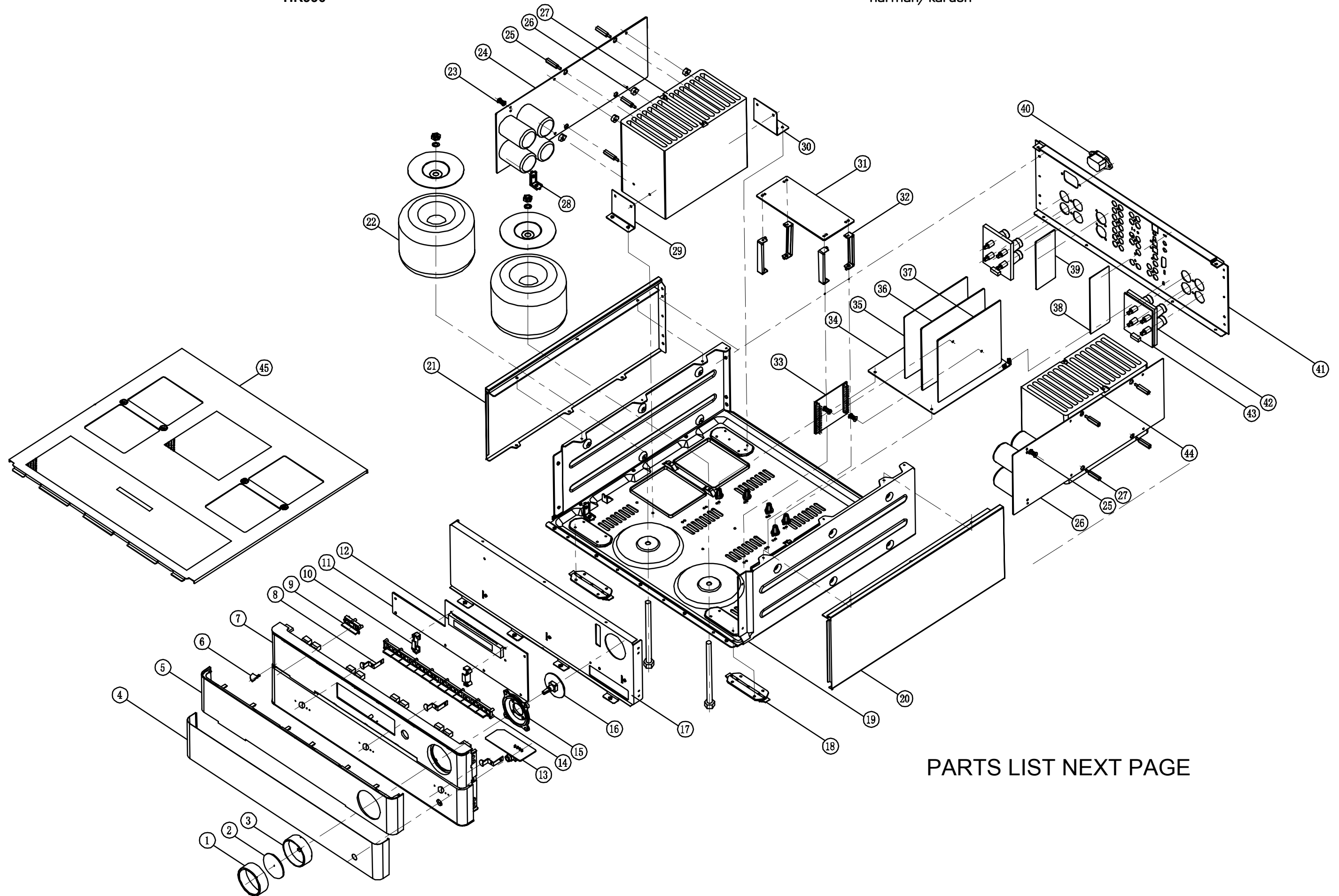
## Troubleshooting

**Troubleshooting**

This unit is designed for trouble-free operation. Most problems users encounter are due to operating errors. So if you have a problem, first check this list for a possible solution. If the problem persists, consult your authorized Harman Kardon service center.

<b>If the problem is...</b>	<b>Make sure that...</b>
No lights illuminate when power cord is plugged into AC outlet.	<ul style="list-style-type: none"> <li>• The unit is plugged into a live outlet.</li> </ul>
No sound is heard.	<ul style="list-style-type: none"> <li>• Speaker switches corresponding to the desired speakers are pressed.</li> <li>• Correct source button has been pressed.</li> <li>• Volume is turned up.</li> <li>• Speaker wires are connected properly.</li> <li>• Hookup wires to source component are connected properly.</li> </ul>
Sound is not heard from the speaker system on one side.	<ul style="list-style-type: none"> <li>• The speaker wires and connection wires are connected correctly.</li> <li>• The balance setting is at 0.</li> </ul>
When listening to stereo sound, the left and right sounds are reversed.	<ul style="list-style-type: none"> <li>• The speaker wires are connected correctly.</li> <li>• The wires between components are connected correctly.</li> </ul>
Intermittent or continuous buzzing or hissing.	<ul style="list-style-type: none"> <li>• The unit is away from fluorescent lights, TV, motors and other electrical appliances.</li> </ul>
The remote control and front panel controls don't appear to work.	<ul style="list-style-type: none"> <li>• You try disconnecting the AC line cord from the wall socket, waiting five minutes and then reconnecting it.</li> </ul>
Humming noise when listening to LP.	<ul style="list-style-type: none"> <li>• Ground wire from record player has been connected to ground terminal on amplifier.</li> <li>• Cable from record player is away from power cords and speaker cables.</li> </ul>
Howl or ringing when listening to LP.	<ul style="list-style-type: none"> <li>• Record player is not too close to speakers.</li> <li>• Record player is on stable surface.</li> </ul>
Low sound level when listening to LP.	<ul style="list-style-type: none"> <li>• Cable from record player is connected to the Phono jacks.</li> <li>• The MM Input has not inadvertently been used with an MC phono cartridge.</li> </ul>
LP sound is distorted and too loud.	<ul style="list-style-type: none"> <li>• The MC Input has not inadvertently been used with an MM or MC High Output cartridge.</li> </ul>

You can find additional troubleshooting information in the FAQs link on the Support page at [www.harmankardon.com](http://www.harmankardon.com).



PARTS LIST NEXT PAGE

HK990 Exploded View			
ITEM	PART NUMBER	DESCRIPTION	QTY
1	6549 101A 0000	VOLUME KNOB COVER	1
2	7448 1020 0000	VOLUME KNOB LENS	1
3	7548 101C 0000	VOLUME KNOB	1
4	6049 101E 0000	AL PANEL	1
5	7749 101A 0000	DISPLAY LENS	1
6	7448 103A 0000	STANDY LENS	1
7	7049 101D 0000	FRONT PANEL	1
8	5548 103A 0000	EARTHING CUPREM	3
9	7348 101A 0000	POWER KNOB	1
10	7549 101A 0000	DISPLAY BRACKET	2
11	0099 1011 0001	DISPLAY PCB	1
12	1521 6151 0101	DISPLAY	1
13	0099 1171 0000	HEADPHONE BOARD	1
14	7349 101A 0000	FUNCTION KNOB	2
15	7549 102B 0000	LAMPSHADE	1
16	0099 1192 0000	VOL PCB	1
17	5349 104D 0000	SUBPANEL	1
18	7948 1010 0000	FOOT	4
19	6249 101F 0000	BOTTOM COVER	1
20	6449 102A 0000	RIGHT SIDE PANEL	1
21	6449 101A 0000	LEFT SIDE PANEL	1
22	4090 1011 0000	TOROIDAL TRANSFORMER	2
23	7900 0040 0000	STANDOFF H=14	2
24	0099 1070 0003	POWER PCB	2
25	5349 1060 0000	BOLT	8
26	7900 0070 0000	STANDOFF H=5	8
27	5149 105D 0000	LEFT HEATSINK	1
28	5349 101A 0000	PCB BRACKET	2
29	5349 102A 0000	HEATSINK FRONT BRACKET	2
30	5349 103A 0000	HEATSINK REAR BRACKET	2
31	0099 1122 0000	RELAY PCB	1
32	5349 105A 0000	RELAY PCB BRACKET	4
33	0099 1280 0001	DSP	1
34	0099 1290 0001	PREAMP MAIN PCB	1
35	0099 1510 0001	I/O PCB	1
36	0099 1210 0002	PHONO PCB	1
37	0099 1162 0000	DIGITAL PCB	1
38	0099 1031 0000	IR PCB	1
39	0099 1080 0000	XLR PCB	1
40	3103 1202 0952	AC SOCKET	1
41	6349 101E 0000	REAR PANEL	1
42	7548 1021 0000	SPEAKER BRACKET	2
43	0099 1321 0000	SPEAKER JOINT BOARD	2
44	5149 106D 0000	RIGHT HEATSINK	1
45	6149 101A 0000	TOP COVER	1

AMP Adjustment

Idling Adjustment

Precaution for handling measuring instrument

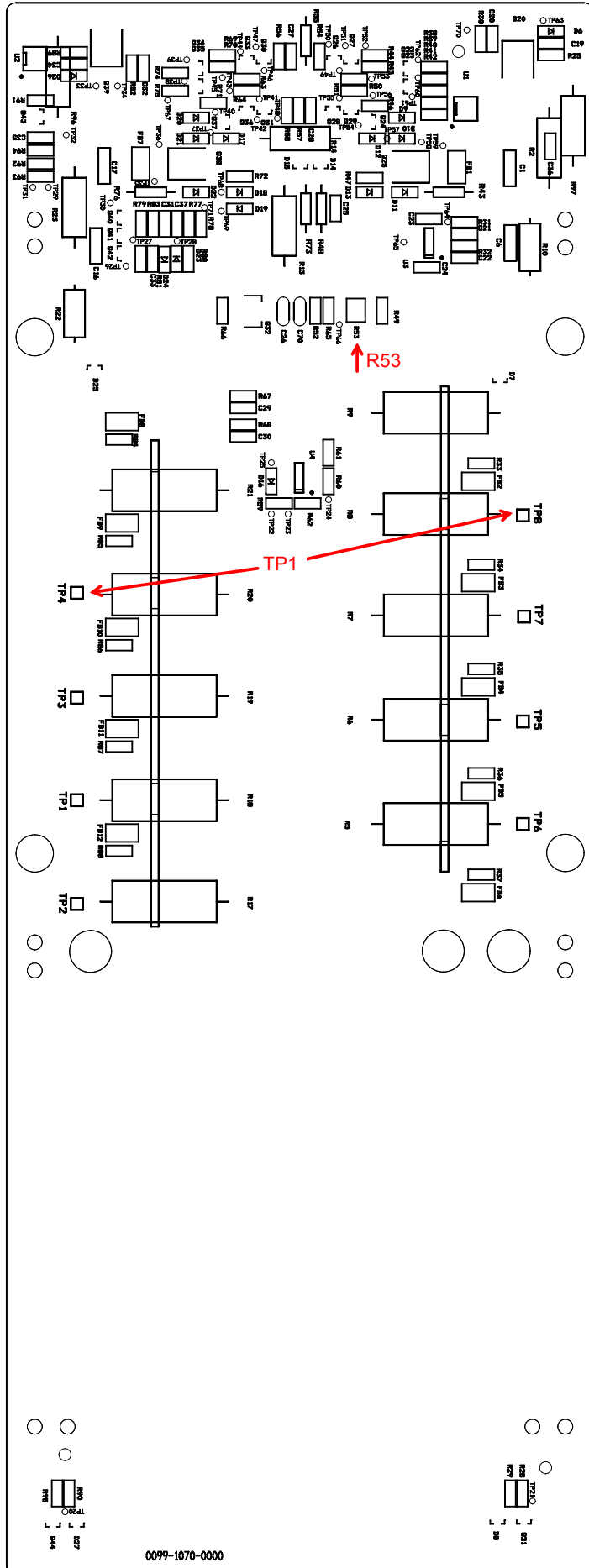
The ground side of the measuring instrument to be connected to the speaker terminal of this unit must be kept in floating condition because this unit is equipped with the floating balanced power amplifier.

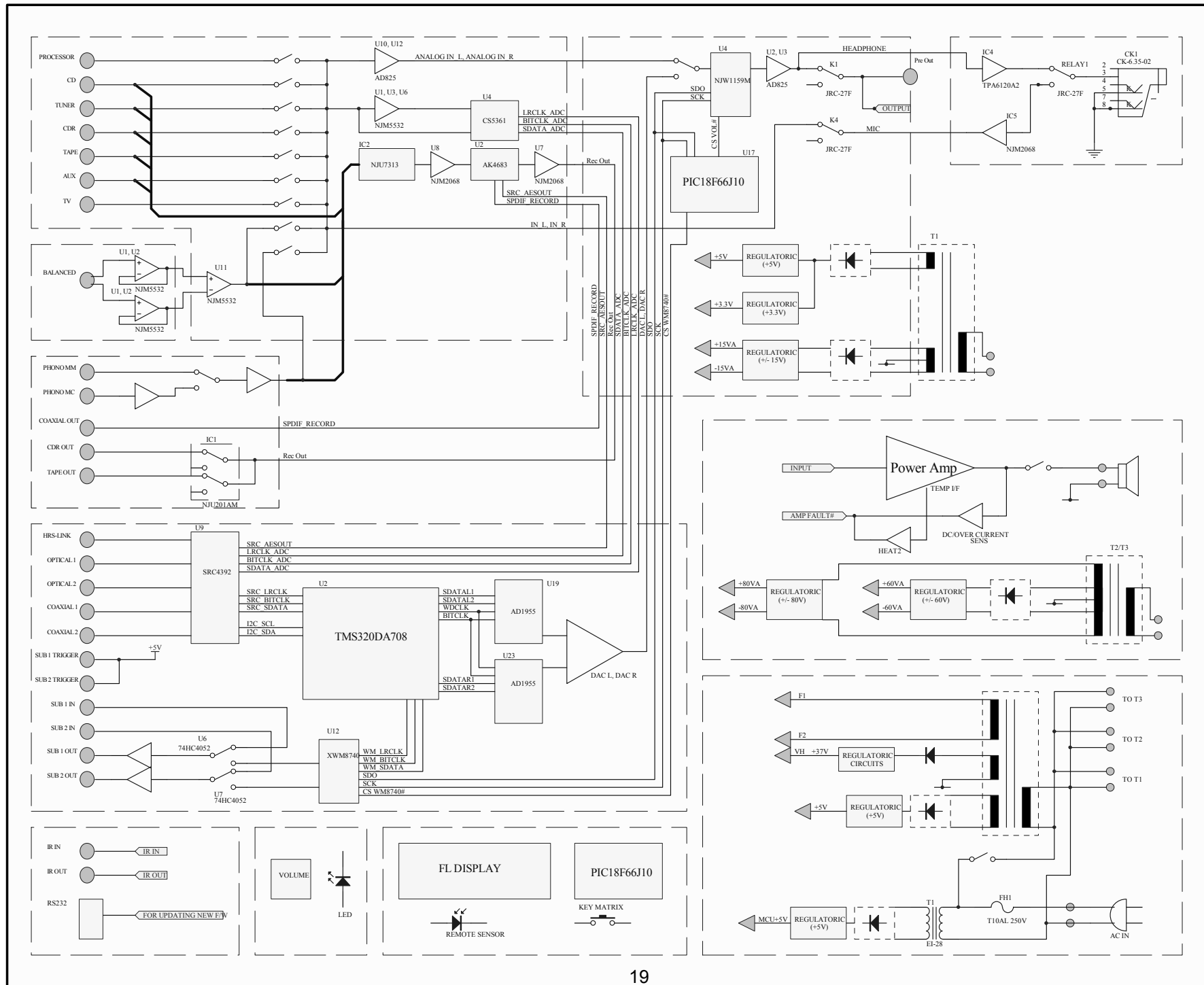
Condition

- \* Start adjustment 5 minutes or more after the power is turned on.
- \* Non loaded condition.

Idling Adjustment

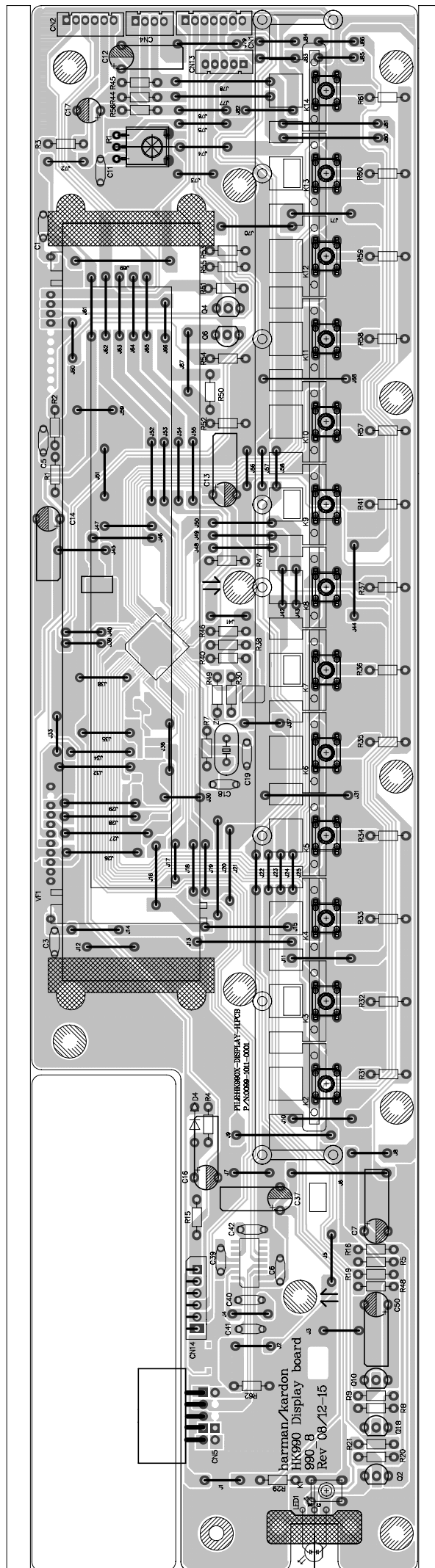
Adjust R53 so that the DC voltage of TP1 becomes +38mV .





HK990

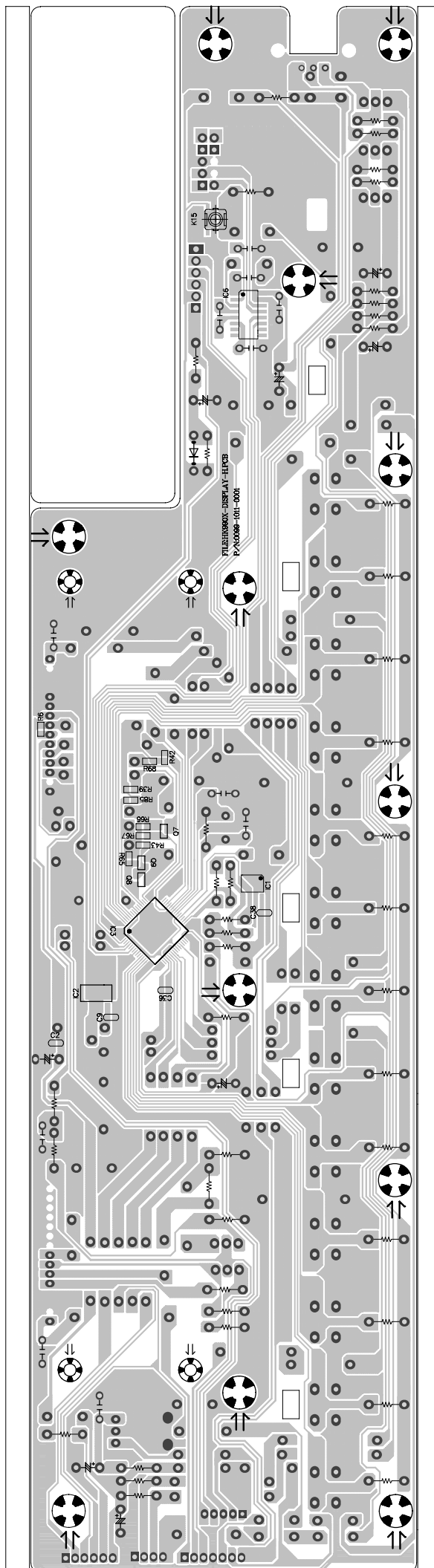
harman/kardon





HK990

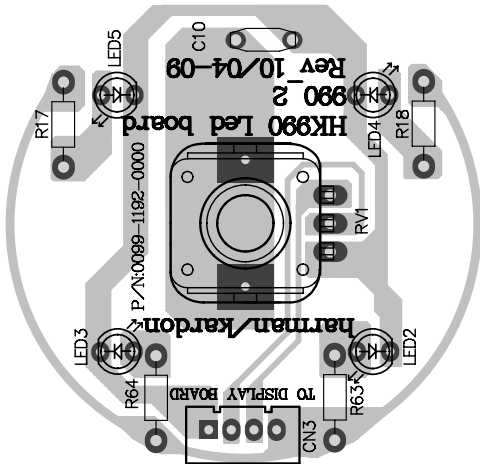
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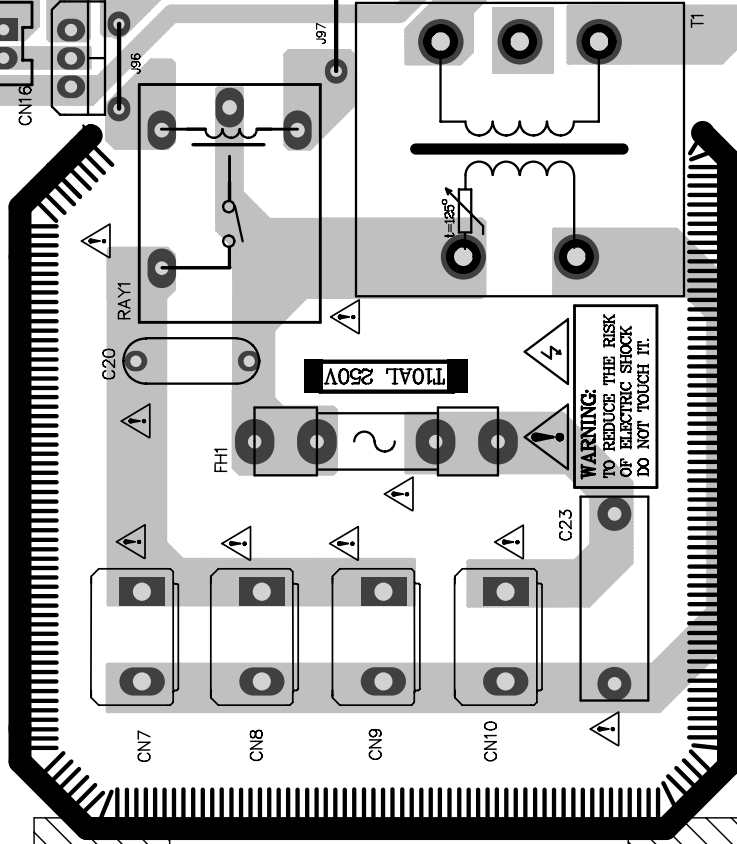
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P/N:0099-1302-0000

DATE:2010-04-09 WSX



harman/kardon HK990 Fuse board

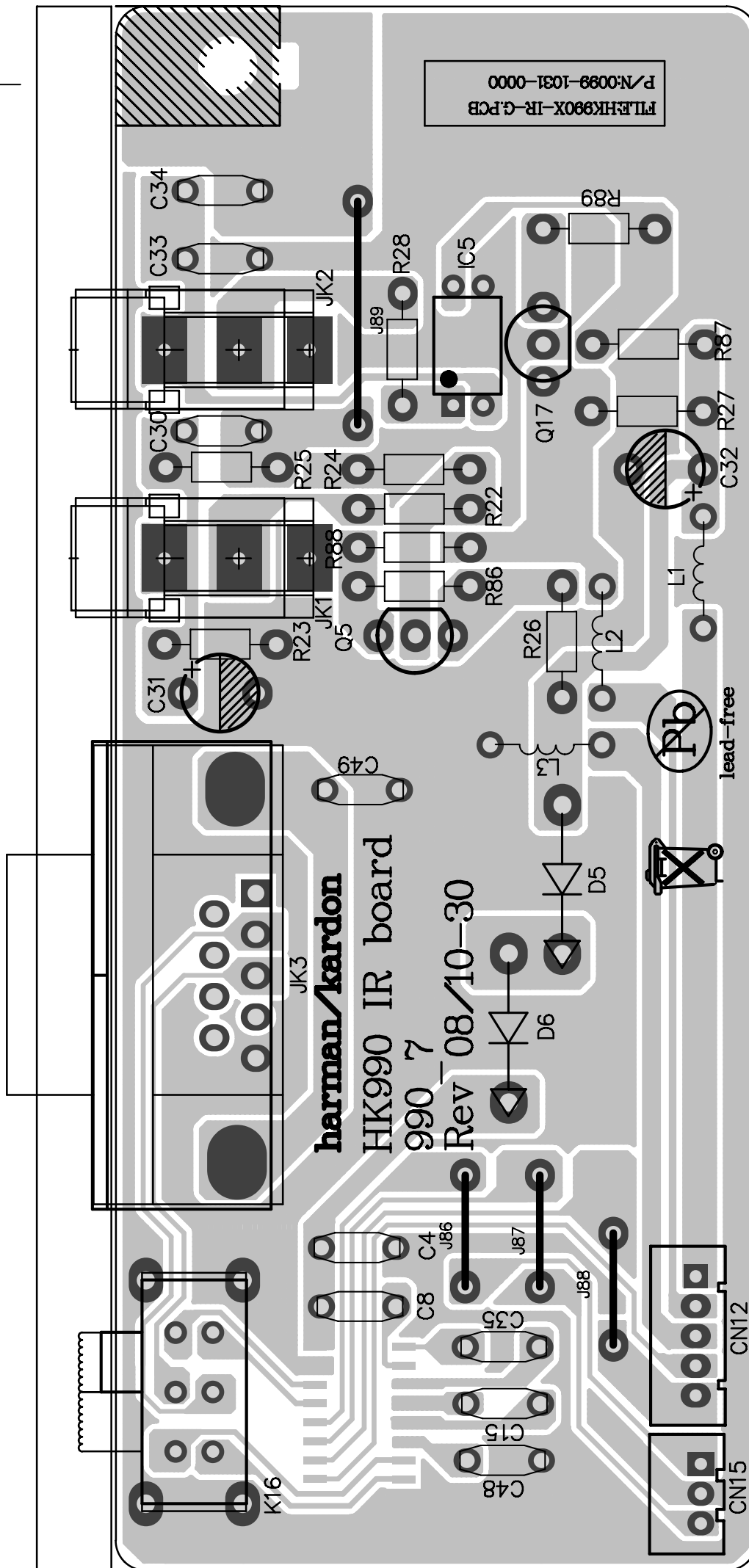


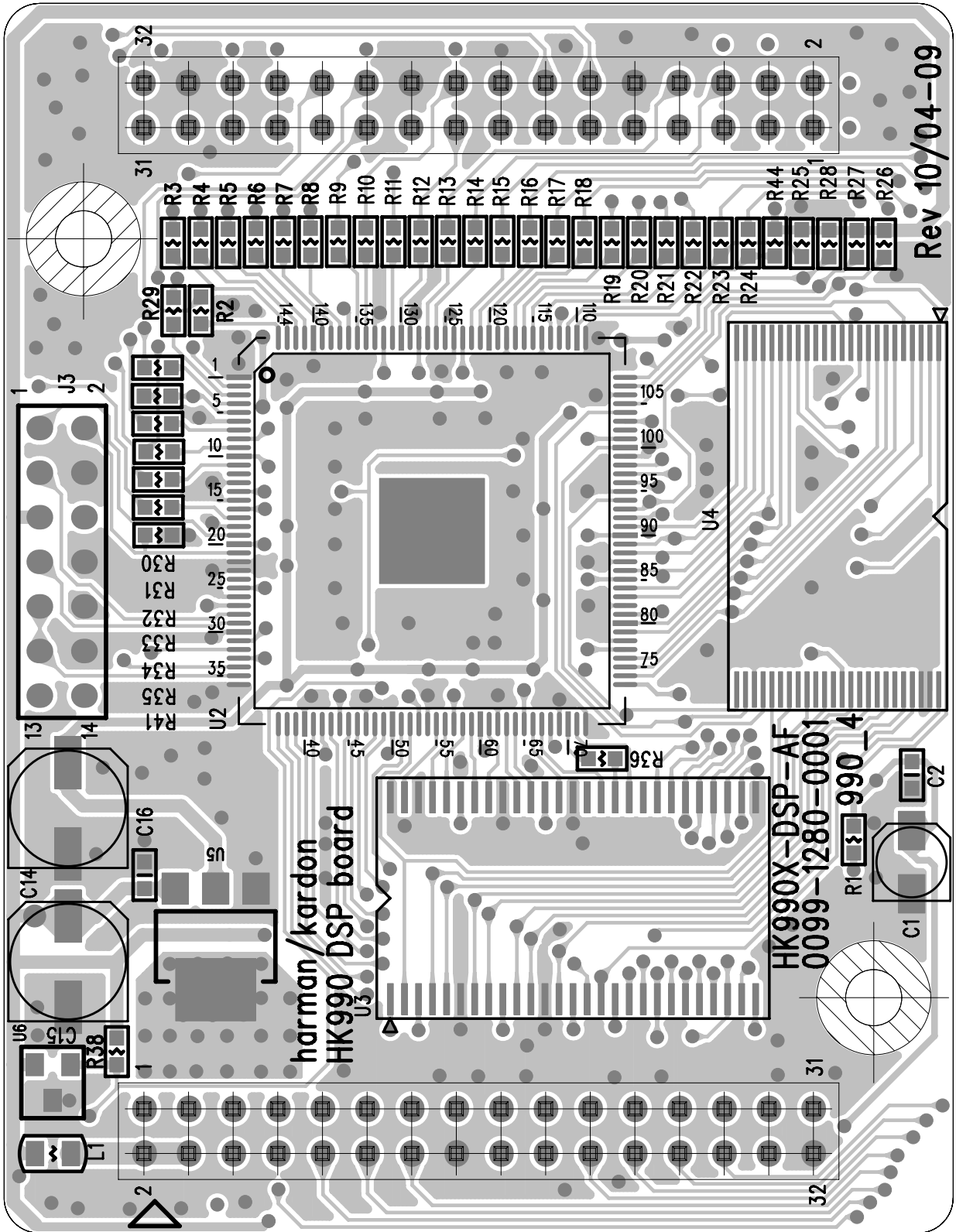
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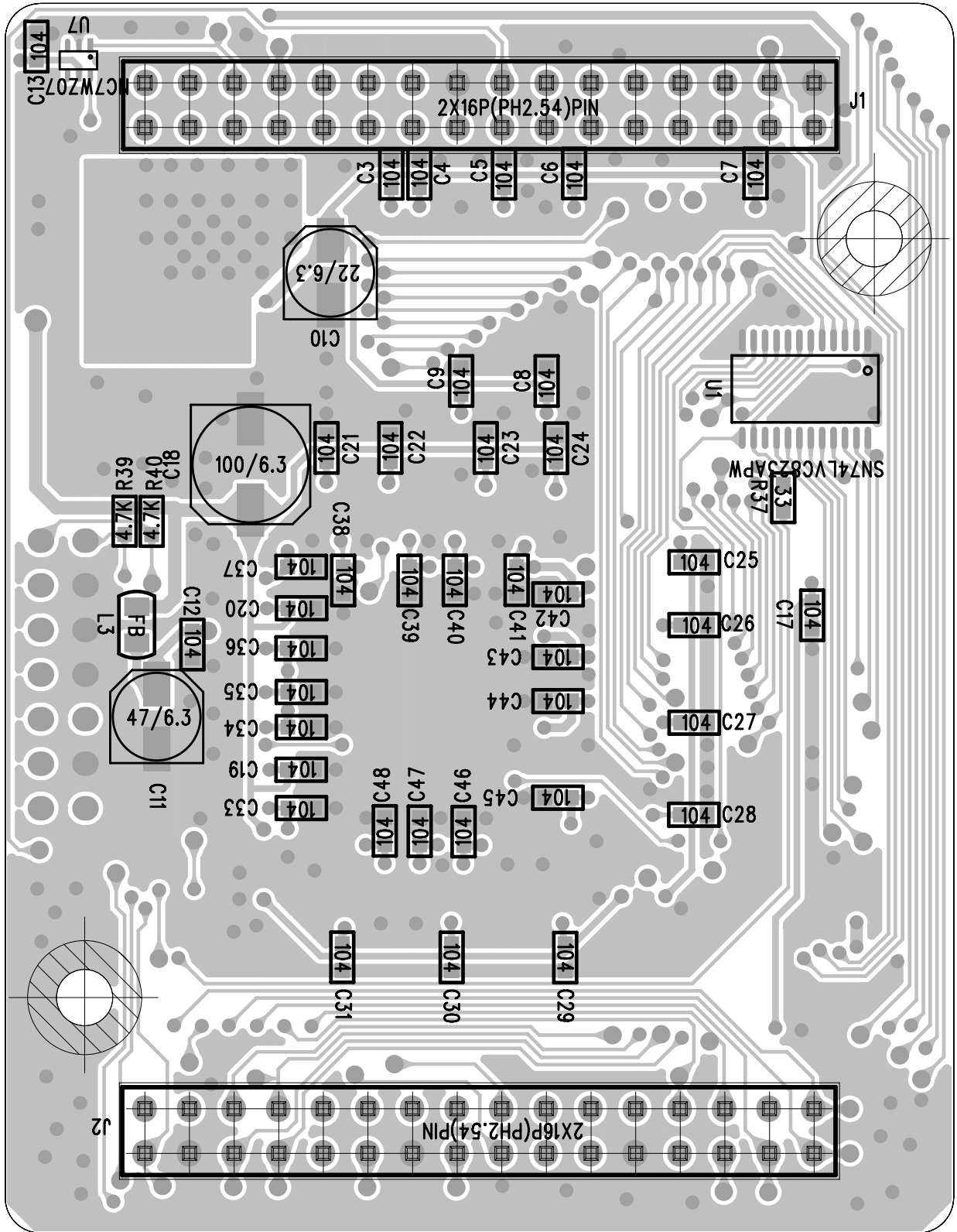
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Rev 10/04-09

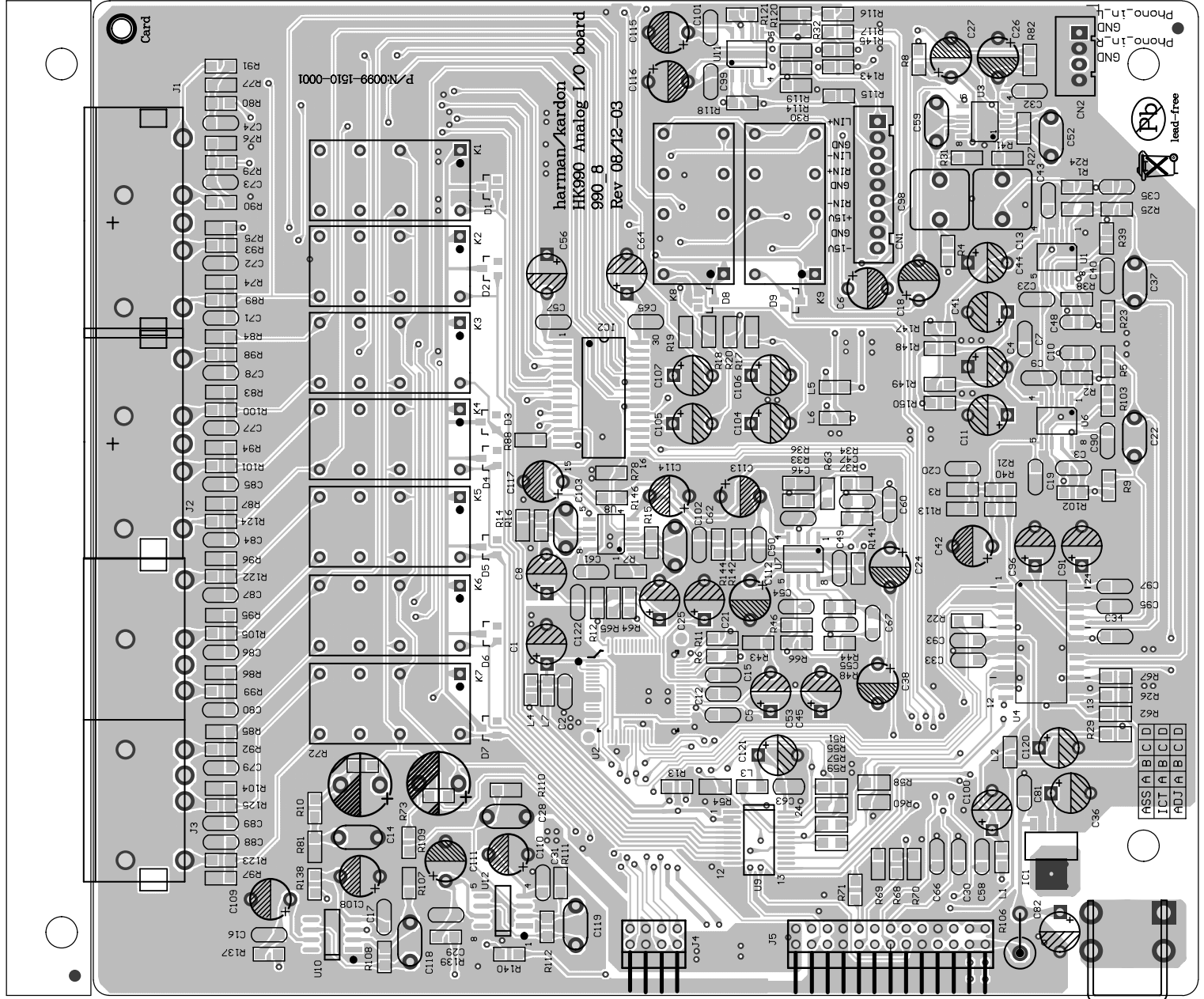
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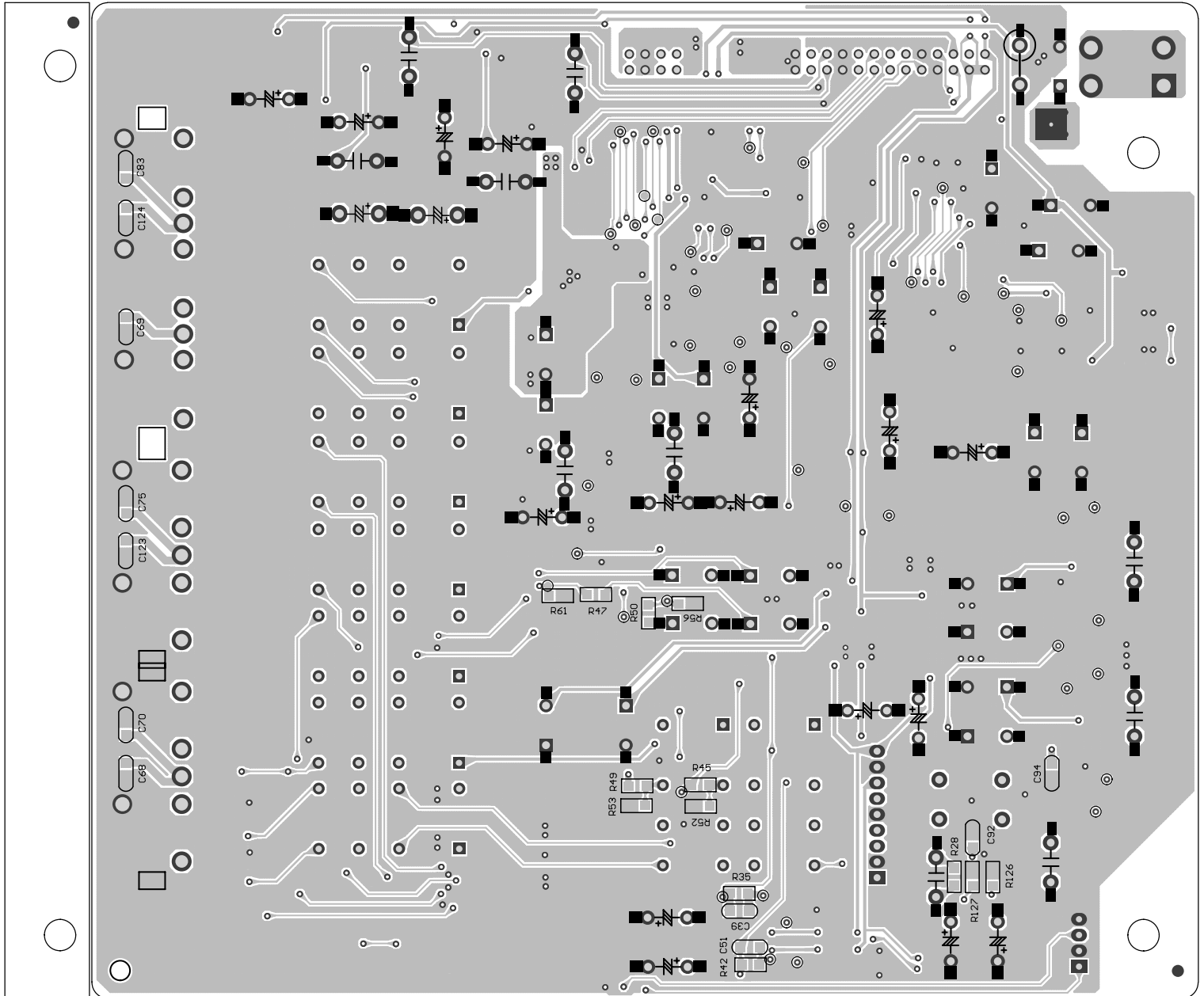
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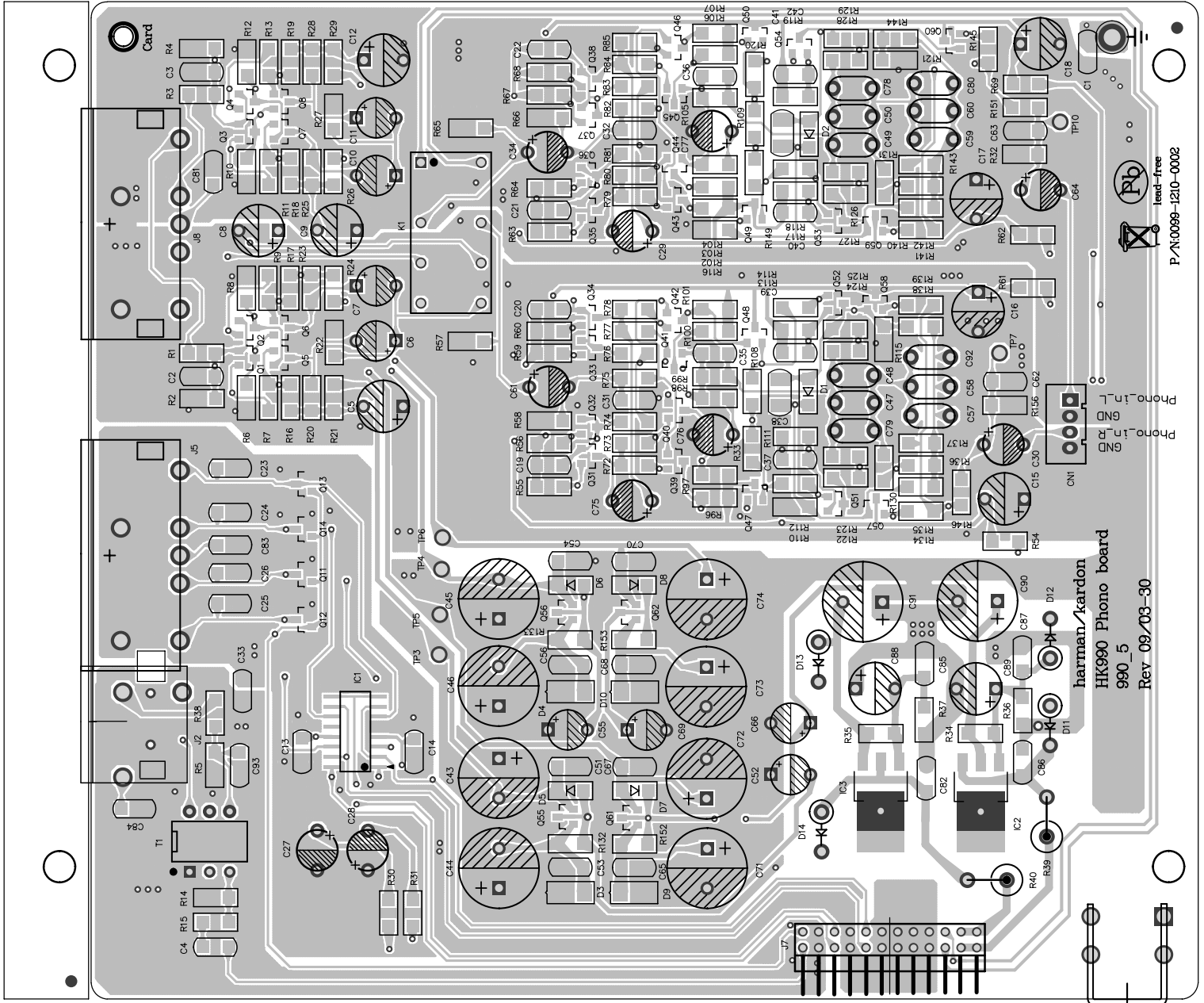








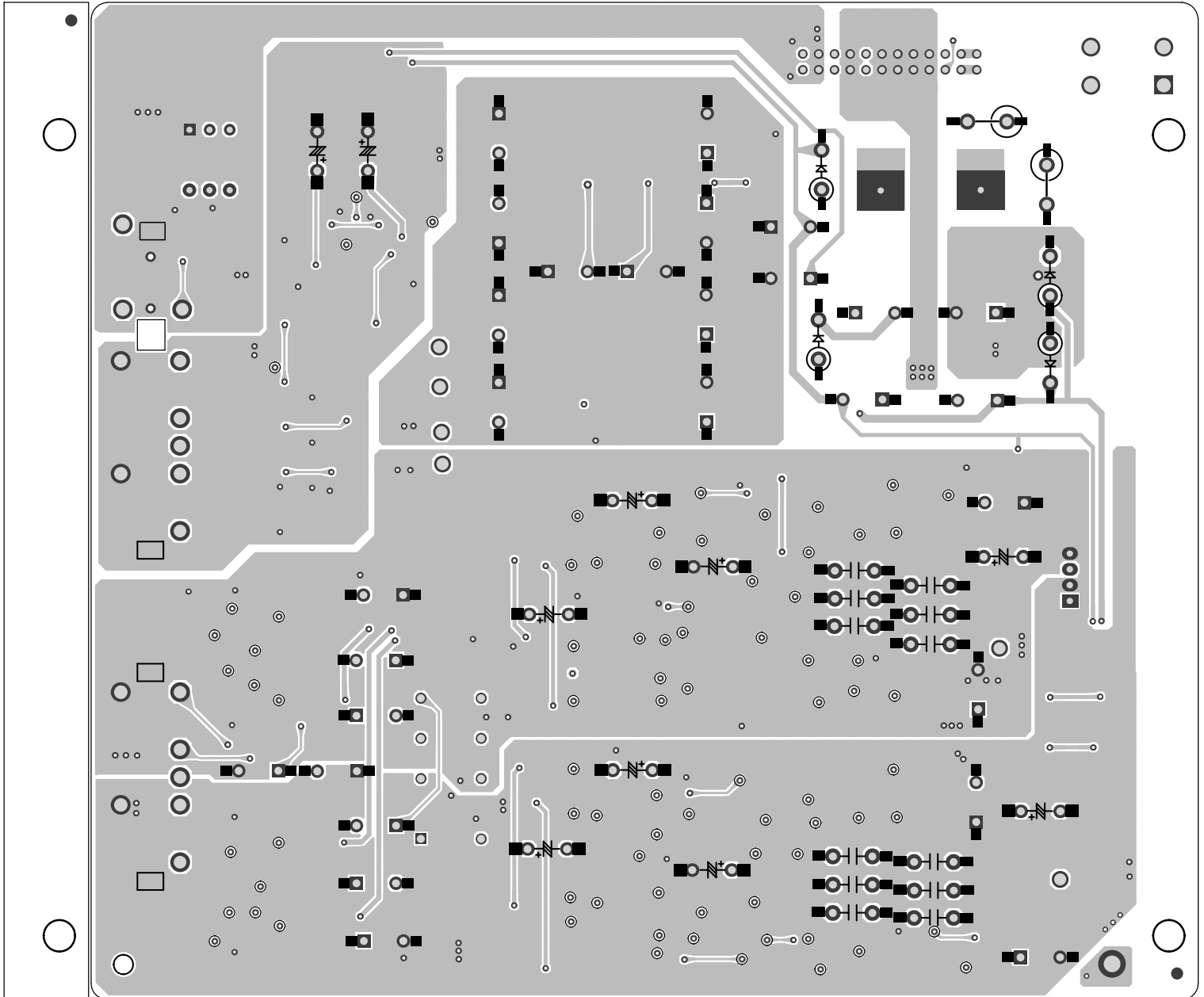


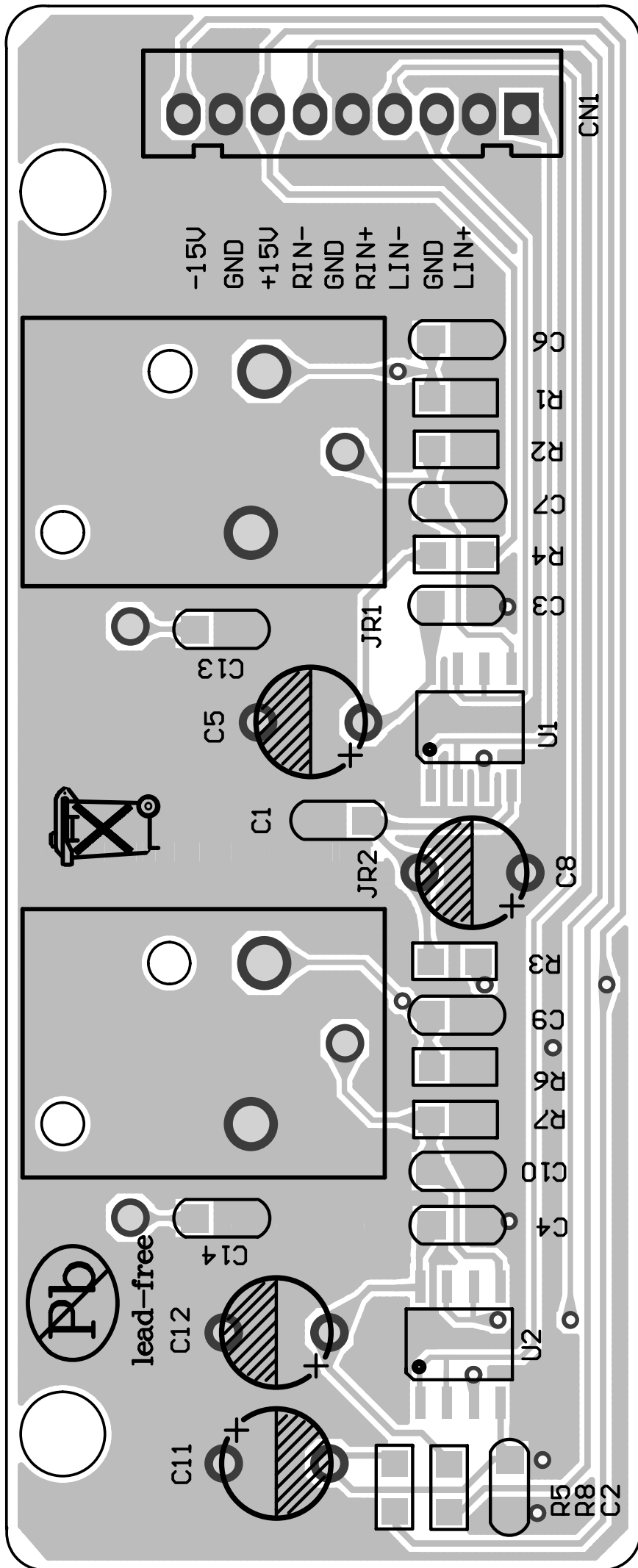


harman/kardon  
HK990 Phono board  
990\_5  
Rev\_09/03-30

lead-free  
P/N:0099-1210-0002

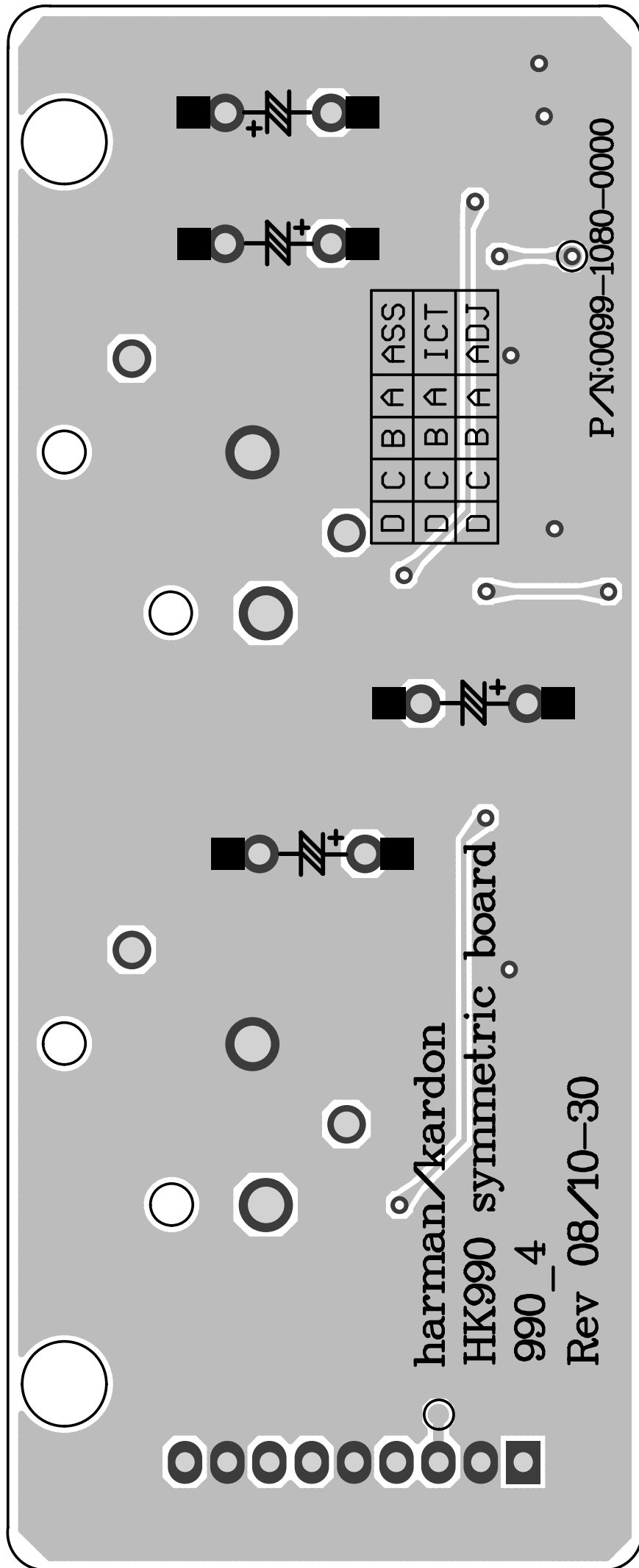


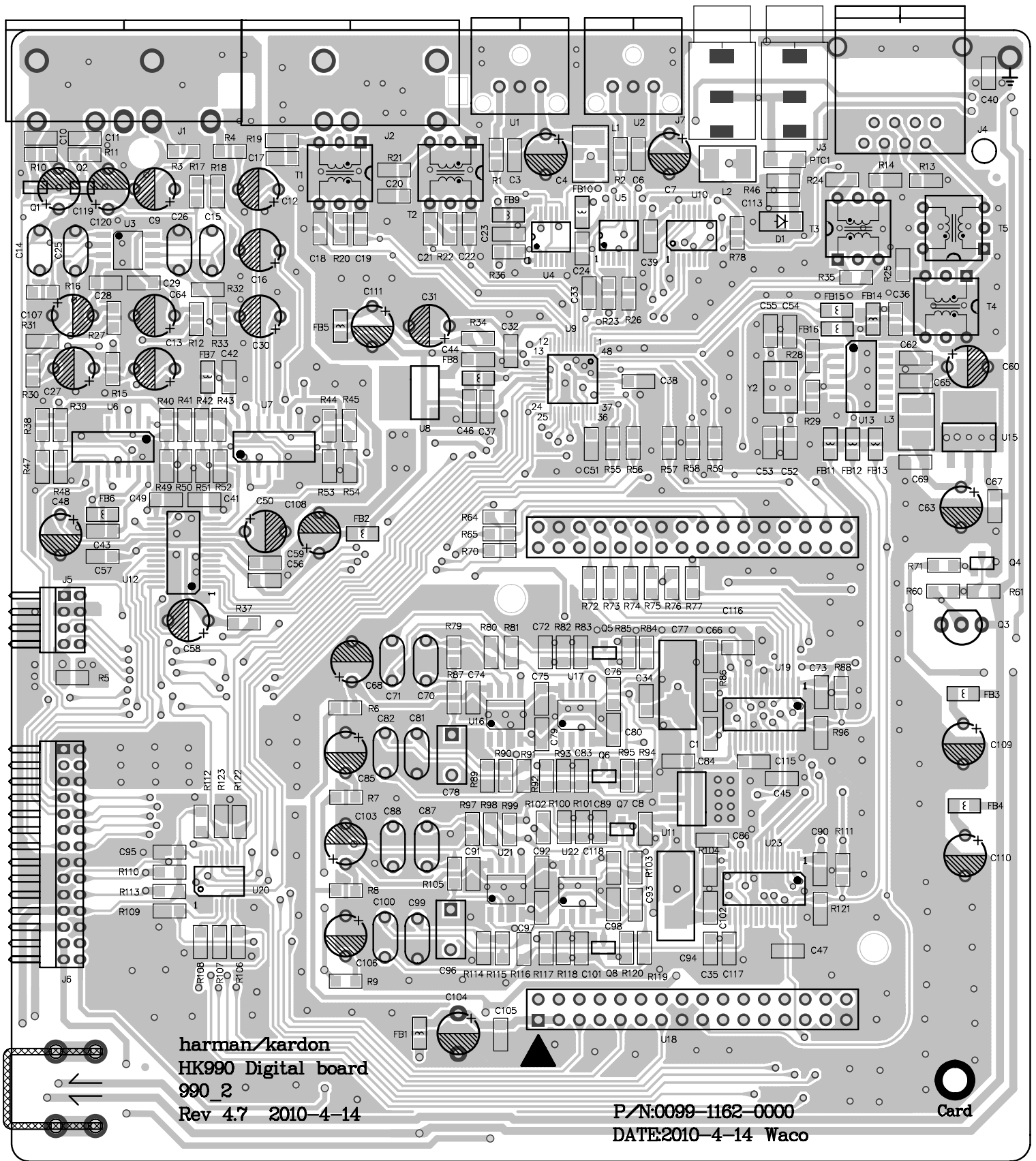




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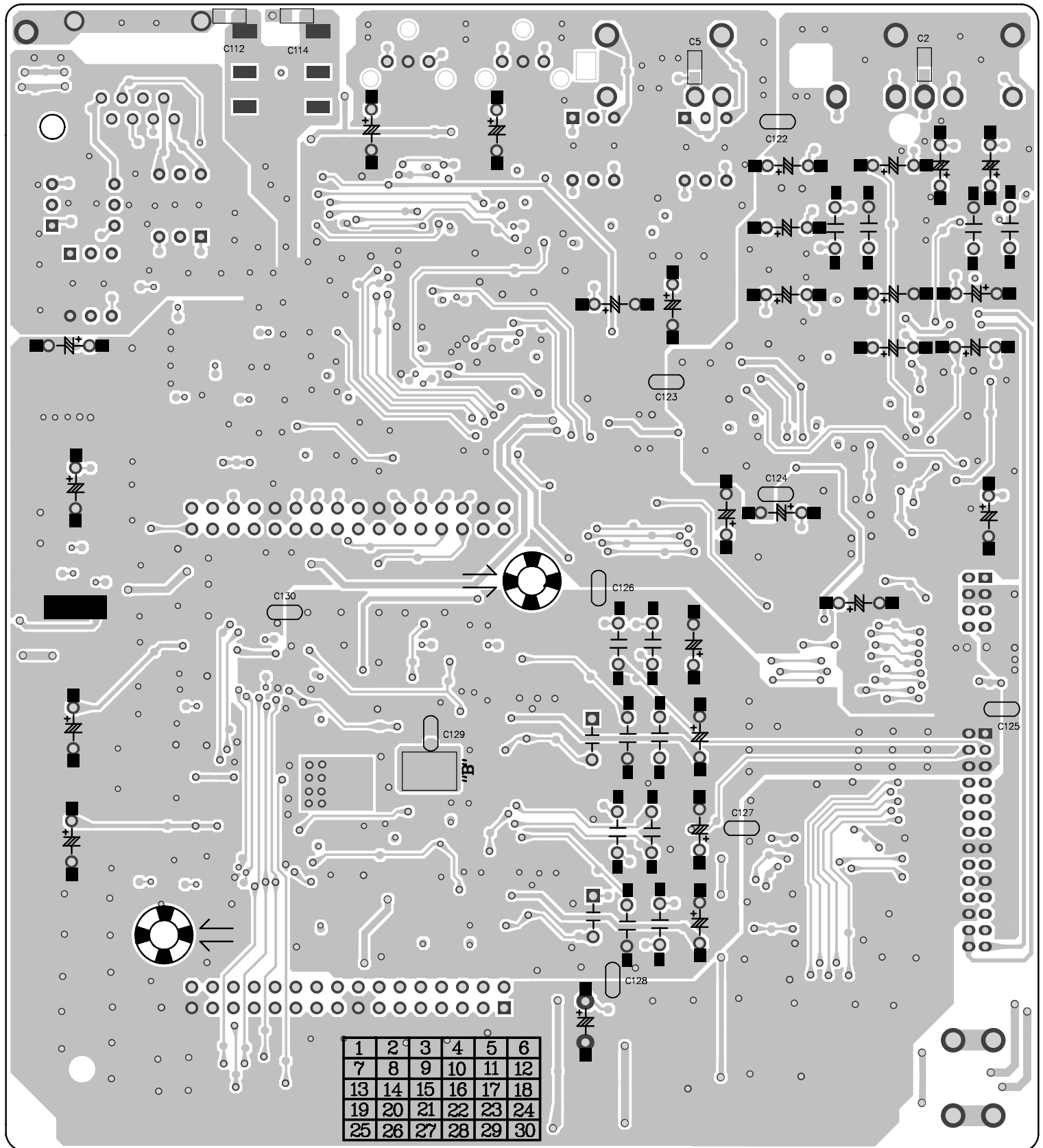


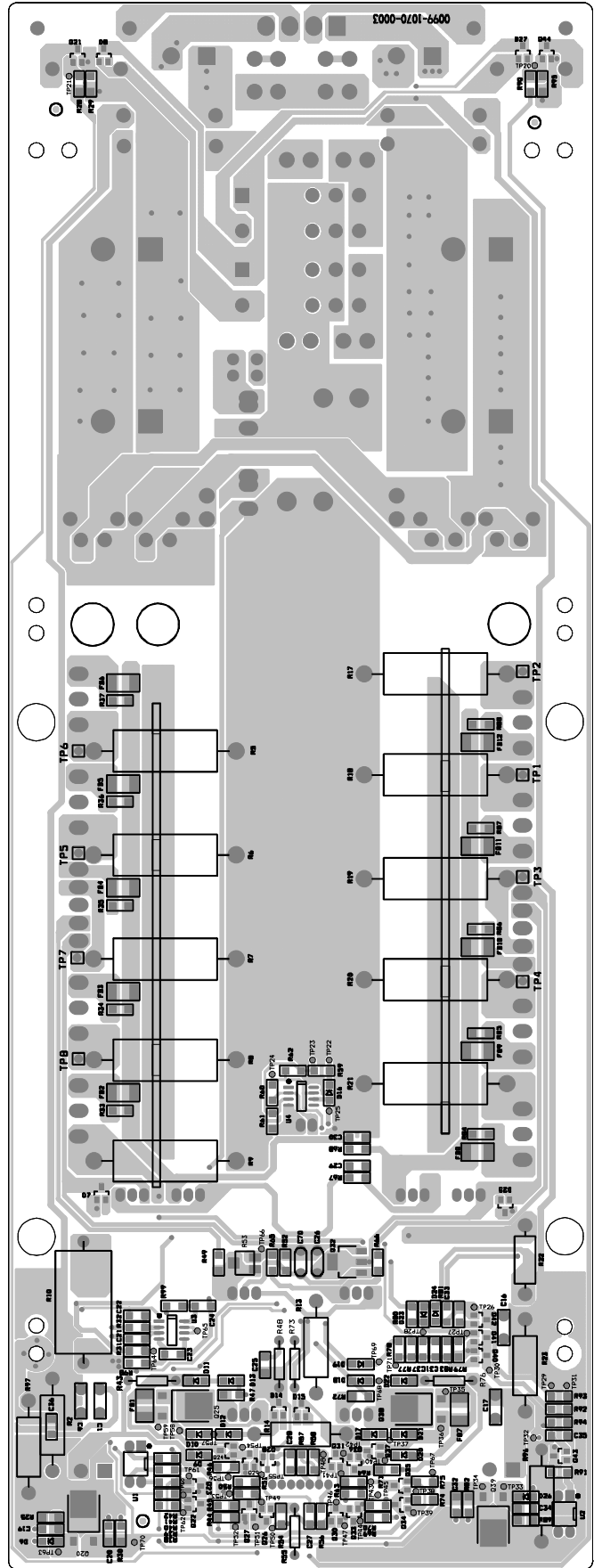
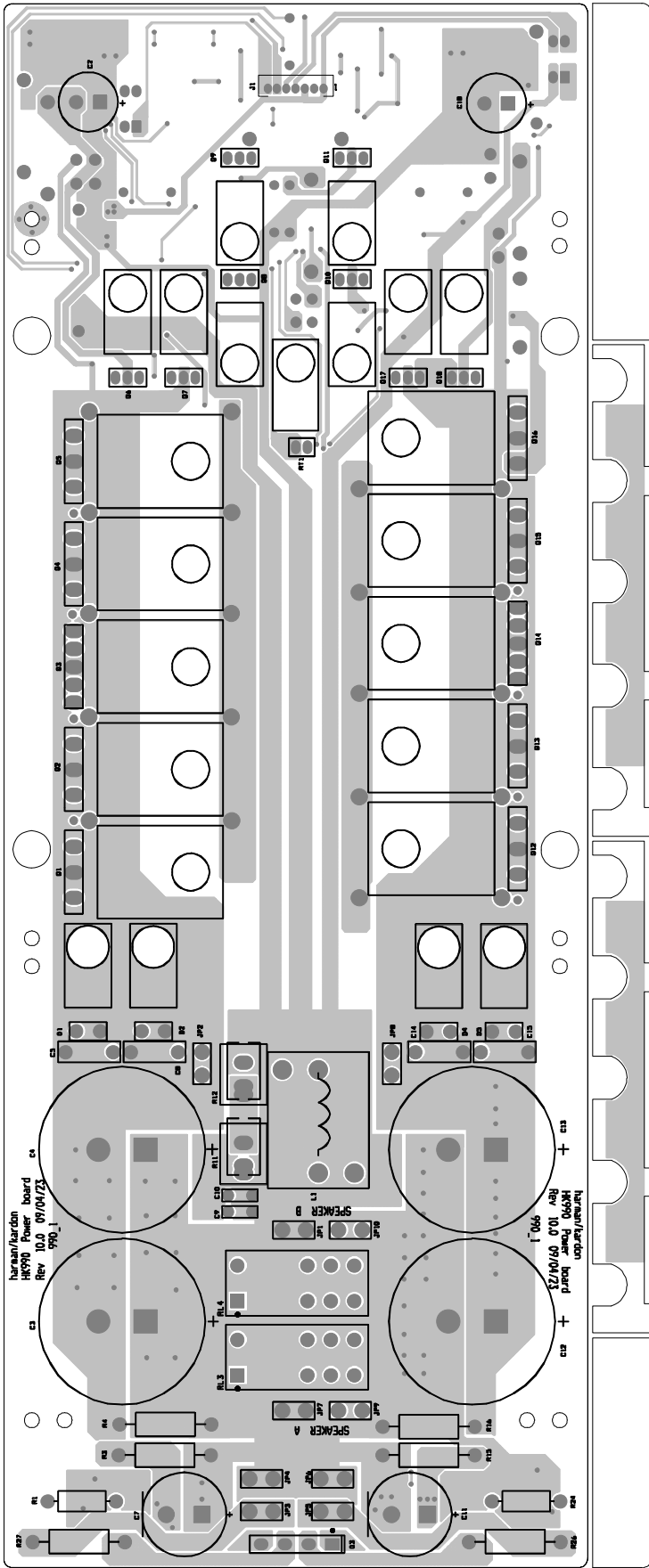


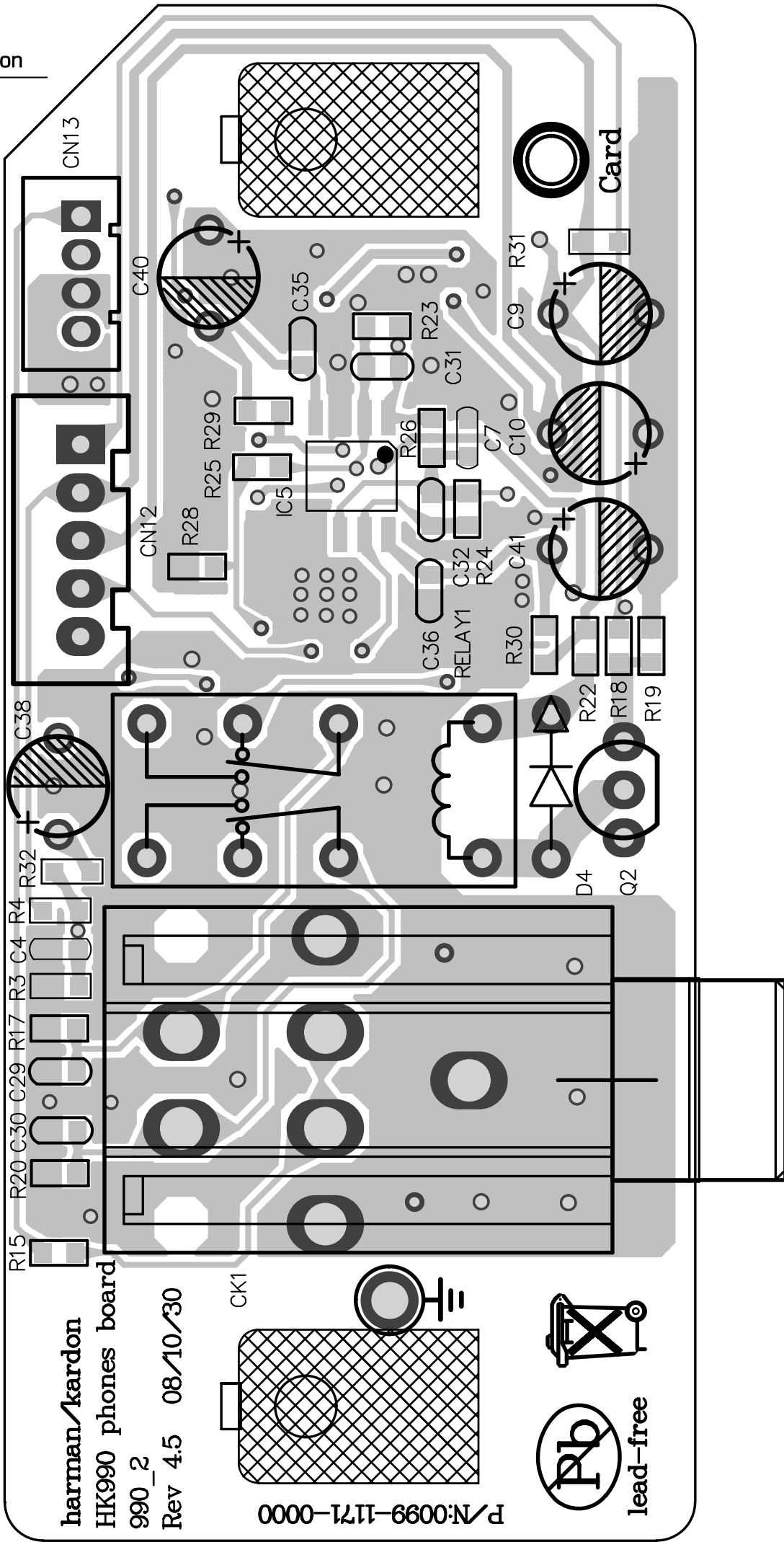
harman/kardon  
HK990 Digital board  
990\_2  
Rev 4.7 2010-4-14

P/N:0099-1162-0000  
DATE:2010-4-14 Waco

Card







harman/kardon

HK990 phones board

990\_2

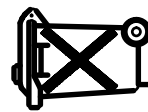
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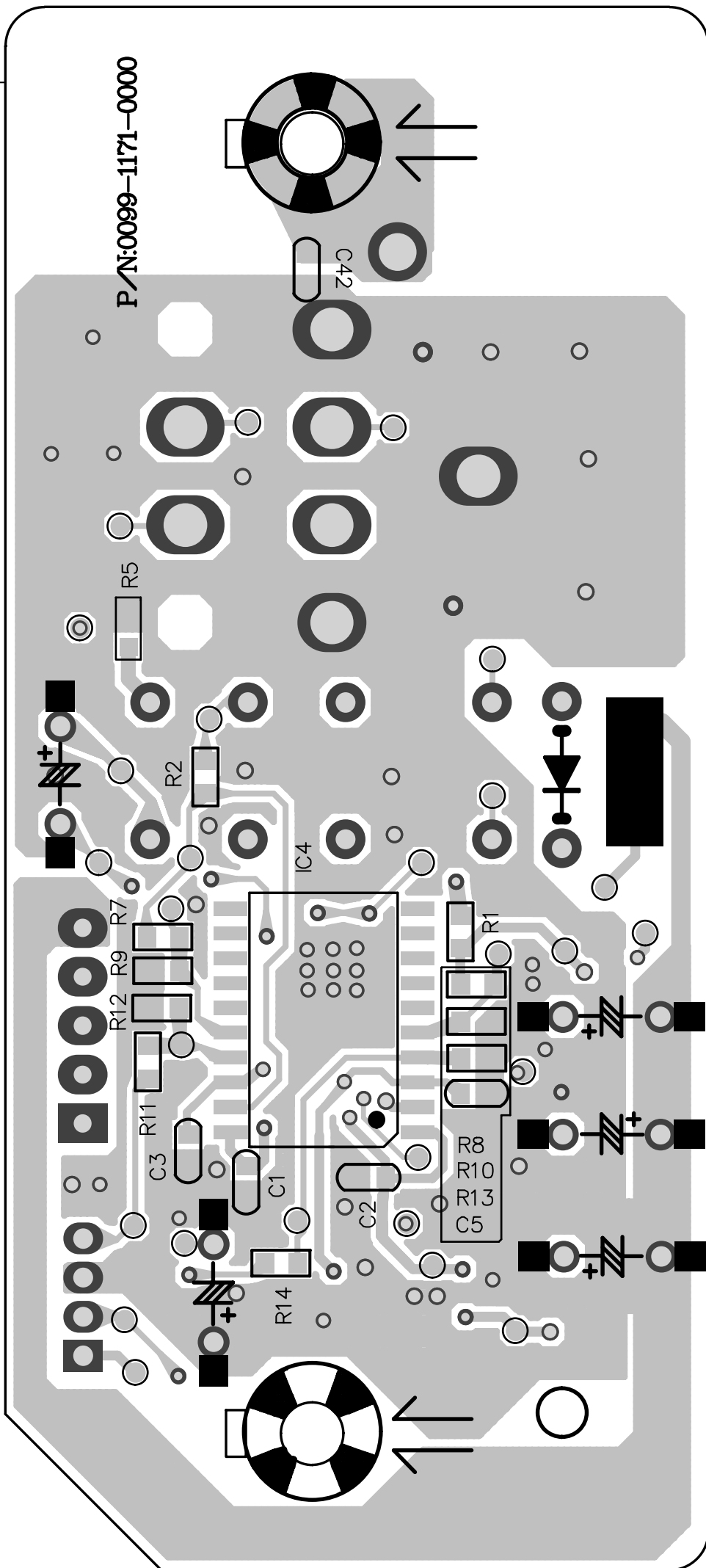
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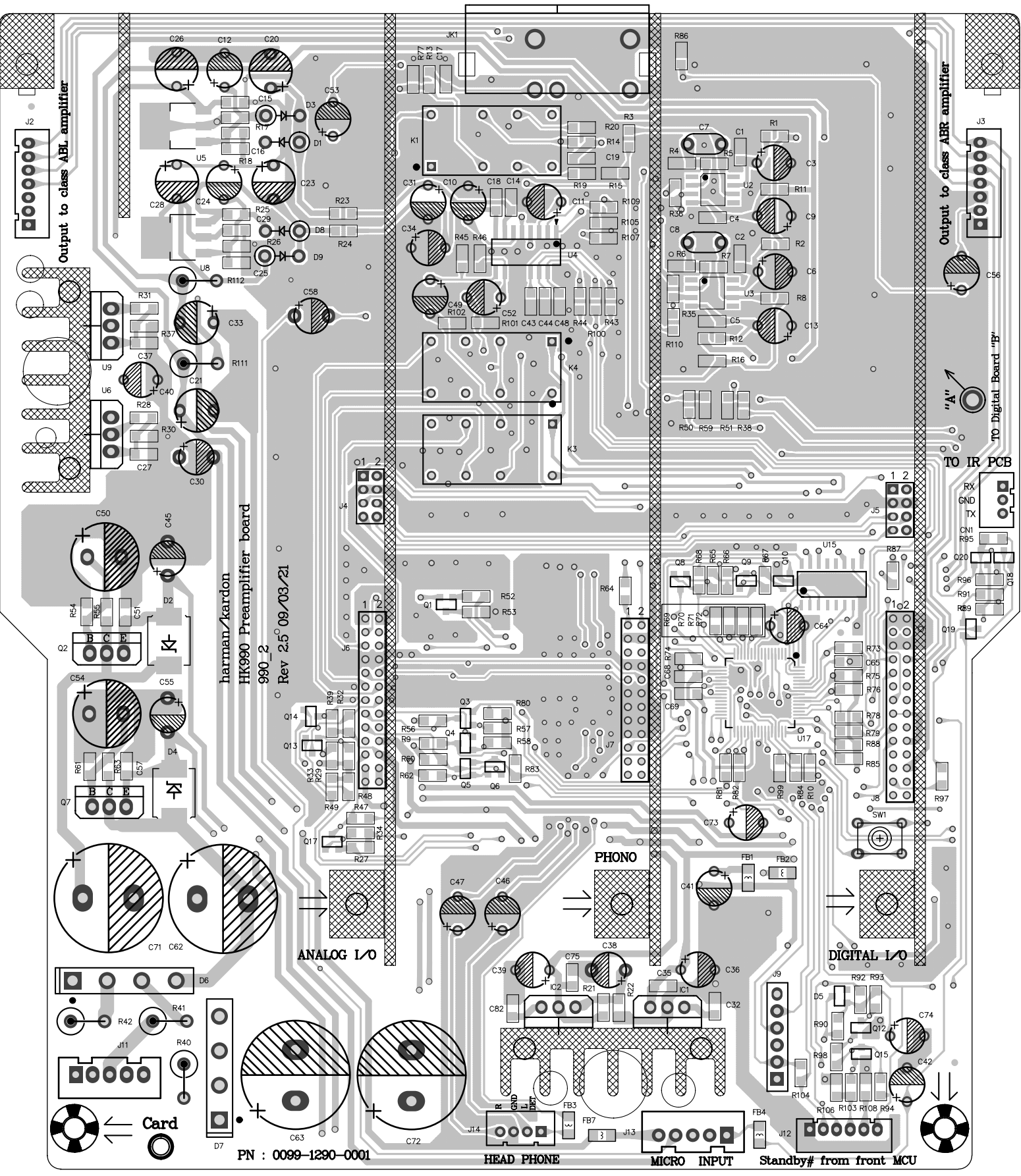


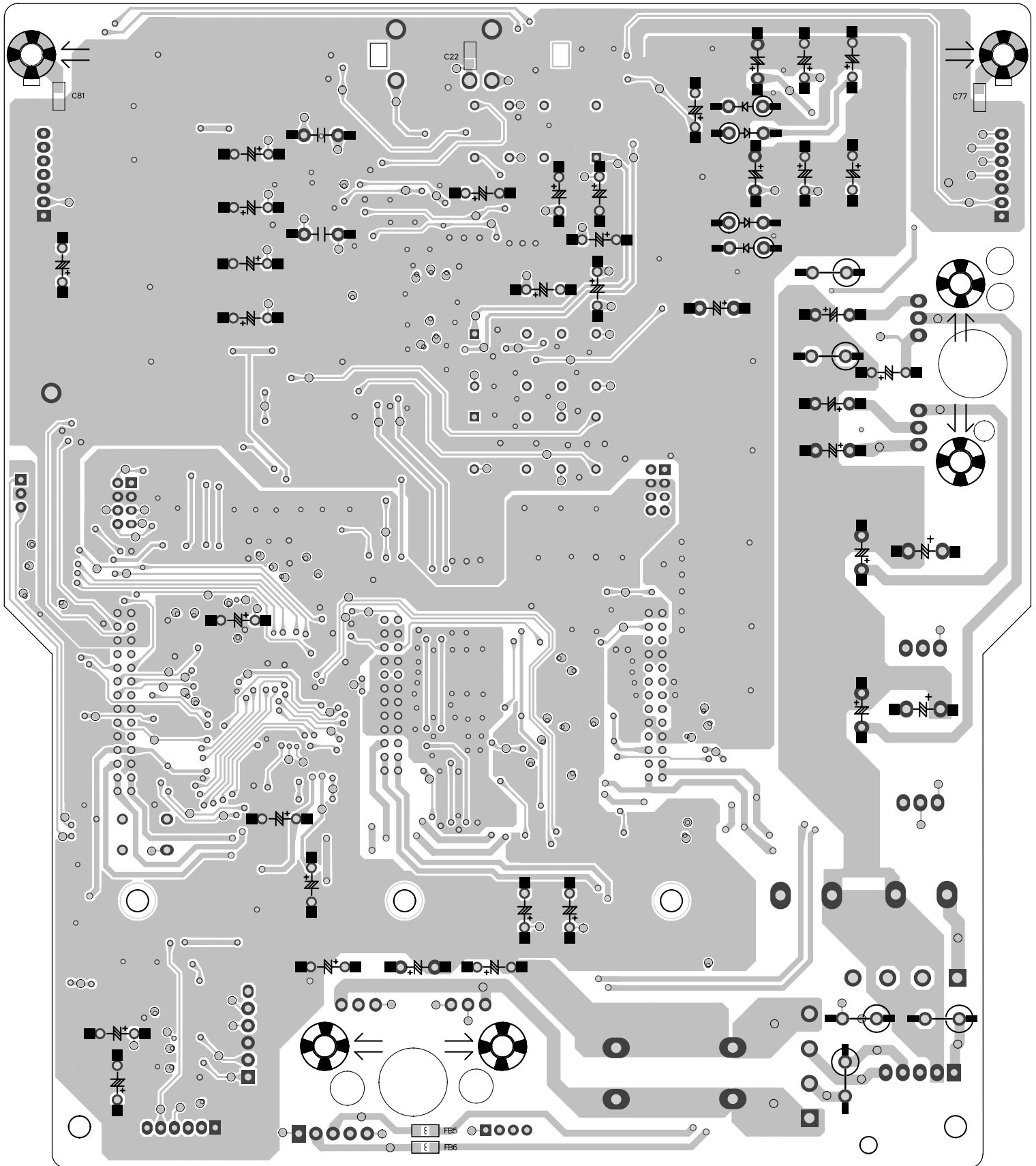
lead-free











HK990 ELECTRICAL PARTS LIST (120v)			
Description	Qty	Ref. Designator	Part Number
<b>DISPLAY PCB P/N:0099-1011-0001</b>			
<i>Capacitors</i>			
30pF/50V±10%	2	C18 C19	2115 6300 0123
0.1uF/50V±10%	4	C1 C3 C5 C11	2115 6104 0123
0.1uF/50V±5% 0603	4	C2 C9 C36 C38	2156 1040 0130
10uF/10V±20% E.CAP	2	C7 C50	2310 0210 1015
10uF/16V±20% E.CAP	1	C16	2310 0310 1015
47uF/10V±20% E.CAP	2	C14 C17	2340 0210 0015
100uF/16V±20% E.CAP	2	C12 C37	2311 0310 1015
<i>Semiconductors</i>			
IN4148	1	D4	1311 1414 8000
AT24C02 SOP8 (ATMEL) SERIAL EEPROM	1	IC1	1002 4010 6620
LD1117S33 SOT-223 (ST) ADJ. POSITIVE REGULATORS	1	IC2	1054 1117 2800
PIC18F66J10 TQFP64 FLASH MICROCONTROLLER	1	IC3	1001 8662 1326
KS-803LM(90°)	1	IR1	1304 0008 0300
LED (Y&W)	1	LED1	1402 1203 0015
2SC2406 SC-59 (PANASONIC)	3	Q7 Q8 Q9	1132 4060 5000
2SC1815 TO-92 (TOSHIBA)	3	Q2 Q4 Q6	1131 8150 0172
2SC2458 TO-92 (TOSHIBA)	1	Q10	1132 4580 0172
2SA950 TO-92 (TOSHIBA)	1	Q18	1110 9500 0162
<i>Resistors</i>			
1MΩ/8W±5%	1	R7	2401 0221 0511
4.7KΩ/8W±5%	1	R16	2401 0224 7211
10KΩ/8W±5%	25	R4 R5 R15 R19 R29 R31 R32 R33 R34 R35 R36 R37 R38 R40 R41 R44 R45 R46 R47 R57 R58 R59 R60 R61 R62	2401 0221 0311
10KΩ±5% 0603	5	R39 R42 R65 R67 R85	2401 1221 0303
4.7KΩ±5% 0603	3	R43 R66 R68	2401 1224 7203
27KΩ±5% 0603	1	R6	2401 1222 7303
10Ω/8W±5%	2	R1 R2	2401 0221 0011
27Ω/8W±5%	2	R30 R49	2401 0222 7011
27KΩ/8W±5%	1	R6	2401 0222 7311
39KΩ/8W±5%	2	R54 R55	2401 0223 9311
47Ω/8W±5%	1	R56	2401 0224 7011
100KΩ/8W±5%	2	R52 R53	2401 0221 0411
100Ω/8W±5%	3	R3 R50 R51	2401 0221 0111
470Ω/8W±5%	1	R21	2401 0224 7111
560Ω/8W±5%	1	R20	2401 0225 6111
<i>Miscellaneous</i>			
TSHC-78A-5.0	14	K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13	4502 4007 8100
16-BT-151GINK	1	VF1	1521 6151 0101
24.576MHZ(HC-49S)	1	Z1	2705 2457 6026
7P PLUG TO HOUSING2468#26X7C 2.0 L=300mm	1	CN1	3307 0704 0335
4P HOUSING TO HOUSING2468#26X4C 2.0 L=60mm	1	CN4	3304 0504 0064
5P PLUG TO HOUSING2468#26X7C 2.0 L=300mm	1	CN13	3304 0505 0302
6P PLUG TO PHOUSING 2468#26X6C 2.0 L=380mm	1	CN2	3306 0504 0385
1*6P(2.5)(90°)	1	CN14	3100 0506 0802

Description	Qty	Ref. Designator	Part Number
<b>RELAY PCB P/N:0099-1122-0000</b>			
<i>Capacitors</i>			
220uF/10V±20% E.CAP	1	C24	2321 0210 2015
10uF/16V±20% E.CAP	2	C29 C43	2310 0310 1015
100uF/16V±20% E.CAP	2	C25 C53	2311 0310 1015
470uF/25V±20% E.CAP	2	C26	2341 0410 1015
0.1uF/50V±10%	5	C21 C22 C44 C46 C52	2115 6104 0123
47uF/50V±20% E.CAP	1	C47	2340 0610 1010
100uF/50V±20% E.CAP	1	C27	2311 0610 1015
100uF/63V±20% E.CAP	2	C28 C45	2311 0710 1015
0.1uF/275VAC(X2)	1	C23	2210 3104 0600
JY103M(X1/400V.Y2/300V)	1	C20	2210 3103 0600
<i>Semiconductors</i>			
IN4148	1	D2	1311 1414 8000
IN4001	2	D1 D3	1360 1400 1005
HZ7B2ST	1	DW1	1300 5660 0200
HZ38-3ST	1	DW2	1303 8002 0200
KA7805 TO-220 (FAIRCHILD) POSITIVE REGULATOR	2	IC4 IC7	1019 7805 0800
2SC2120 TO-92 (TOSHIBA)	1	Q1	1132 1200 0162
2SC2235 TO-92 (TOSHIBA)	1	Q11	1132 2350 6000
2SC2458 TO-92 (TOSHIBA)	1	Q16	1132 4580 0172
2SA950 TO-92 (TOSHIBA)	1	Q15	1110 9500 0162
2SC2073 TO-220 (MOSPEC)	2	Q3 Q14	1132 0730 7000
2SC1815 TO-92 (TOSHIBA)	2	Q12 Q13	1131 8150 0172
<i>Resistors</i>			
1K1/8W±5%	1	R12	2401 0221 0211
1.2K1/8W±5%	3	R69 R73 R78	2401 0221 2211
4.7K1/8W±5%	2	R83 R91	2401 0224 7211
10K1/8W±5%	2	R74 R79	2401 0221 0311
12K1/8W±5%	2	R72 R77	2401 0221 2311
15K1/8W±5%	2	R71 R80	2401 0221 5311
22K1/8W±5%	3	R10 R82 R84	2401 0222 2311
220Ω1/8W±5%	2	R75 R76	2401 0222 2111
470Ω1/8W±5%	2	R70 R81	2401 0224 7111
100Ω1/4W±5%	1	R90	2401 0321 0111
2.2Ω0.5W±5%	1	R14	2406 4222 2900
RF11/4W±5%	1	R13	2406 3210 9000
RF0.221/4W±5%	1	R11	2406 0322 2815
<i>Miscellaneous</i>			
DB101G	2	BL1	1361 3011 0100
2P(2.5) SOCKET	4	CN16 CN17 CN18 CN19	3100 5020 0200
3P(3.96) SOCKET	4	CN7 CN8 CN9 CN10	3100 0702 0050
7P(2.0) SOCHET	1	CN6	3100 4070 0200
7P(2.5) SOCKET	1	CN11	3100 5070 0200
FUSE T10AL 250V	1	FH1	1610 5010 0200
HF152F-012-1HT	1	RAY1	4712 3215 2006
EI-28 Transformer	1	T1	4070 1281 0000
EI-57Transformer	1	T2	4090 1575 0003
Toroidal Transformer	2	T3 T4	4090 1015 0001
THERMISTANCE 02DSBJ WITH LEAD AND 2P2.5mm	2		1609 0282 0070
FAN A9225 M12S DC12V 0.24A	2		9105 2518 7242
FUSE HOLDER	2		1601 0001 0000
FUSE COVER	1		1608 0001 0000

Description	Qty	Ref. Designator	Part Number
<b>VOLUME PCB P/N:0099-1192-0000</b>			
0.1uF/50V±10%	1	C10	2115 6104 0123
LED IL0445W31BOLG201	4	LED2 LED3 LED4 LED5	1402 0705 0006
220Ω/8W±5%	4	R17 R18 R63 R64	2401 0222 2111
R122ECA-D1-19.5F-24-W ENCODER	1	RV1	4401 2211 9524
<b>IR PCB P/N:0099-1031-0000</b>			
<i>Capacitors</i>			
0.1uF/50V±10%	9	C4 C8 C15 C30 C33 C34 C35 C48 C49	2115 6104 0123
47uF/10V±20% E.CAP	1	C32	2340 0210 0015
100uF/10V±20% E.CAP	1	C31	2311 0210 1015
<i>Semiconductors</i>			
K1010(817) DIP4 (COSMO) PHOTOCOUPLER	1	IC5	1022 8170 7012
MAX232 SOP16 (MAXIM) RS232 DRIVER/RECEIVER	1	IC8	1000 2320 3613
2SA1015 TO-92 (TOSHIBA)	2	Q5 Q17	1111 0510 0712
IN4148	2	D5 D6	1311 1414 8000
<i>Resistors</i>			
3.9KΩ/8W±5%	1	R27	2401 0223 9211
10KΩ/8W±5%	1	R87	2401 0221 0311
22KΩ/8W±5%	3	R86 R88 R89	2401 0222 2311
47KΩ/8W±5%	1	R24	2401 0224 7311
10Ω/8W±5%	1	R26	2401 0221 0011
47Ω/8W±5%	2	R22 R23	2401 0224 7011
75Ω/8W±5%	1	R25	2401 0227 5011
270Ω/8W±5%	1	R28	2401 0222 7111
<i>Miscellaneous</i>			
5P(2.0) SOCKET	1	CN12	3100 4050 0200
3P PLUG TO HOUSING2468#26X3C 2.0 L=150MM	1	CN15	3303 0504 0063
DB9	1	JK3	2806 0590 0000
CKX3.5-12A 3.5mm	2	JK1 JK2	2801 1335 1203
SK-22H03G6-RS	1	K16	4200 2200 0500
10uH	3	L1 L2 L3	1881 0002 0000
<b>DSP-PCB P/N:0099-1280-0001</b>			
<i>Capacitors</i>			
0.1UF/50V±5% 0603	41	C2 C3 C4 C5 C6 C7 C8 C9 C12 C13 C16 C17 C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C33 C34 C35 C36 C37 C38 C39 C40 C41 C42 C43 C44 C45 C46 C47 C48	2156 1040 0130
10UF/6.3V±20% SMDE.CAP 4X5.4	1	C1	2310 0100 0138
22UF/6.3V ±20% SMDE.CAP 5X5.4	1	C10	2320 0121 1138
47UF/6.3V ±20% SMDE.CAP 5X5.4	1	C11	2340 0111 1138
100UF/6.3V ±20% SMDE.CAP 6.3X5.4	3	C14 C15 C18	2311 0110 2138
<i>Semiconductors</i>			
SN74LVC823APW TSSOP24 FLIP-FLOP W/ 3 STATE OUTPUTS	1	U1	1074 8230 6115
TMS320D708E001BRFP LPQF-144 (TI) Floating-Point Digital Signal Processors	1	U2	1032 0700 6158

Description	Qty	Ref. Designator	Part Number
<b>DSP-PCB P/N:0099-1280-0001</b>			
HY57V64162OETP-7 TSOP54 Synchronous DRAM Memory 64Mbit	1	U3	1057 6410 8942
S29AL016D70TFI02 TSOP48 16MB FLASH MEMORY	1	U4	1029 0162 0742
FAN1112S SOT-223 LOW DROPOUT REGULATOR	1	U5	1011 1200 1961
DS1818 SOT-23 (DALLAS) ECONO RESET W/ PUSHBUTTON	1	U6	1001 8180 1356
NC7WZ07P6X_NL SC-70 UHS DUAL BUFFER	1	U7	1000 7070 1965
<i>Resistors</i>			
2.2K--0603	1	R1	2401 1222 2203
33Ω--0603	31	R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R16 R17 R18 R19 R20 R21 R22 R23 R29 R30 R31 R32 R33 R34 R35 R36 R37	2401 1223 3003
3.3K±5% 0603	6	R24 R25 R26 R27 R28 R44	2401 1223 3203
1K±5% 0603	2	R38 R41	2401 1221 0203
4.7K±5% 0603	2	R39 R40	2401 1224 7203
<i>Miscellaneous</i>			
2*16P(2.54)(180°)	2	J1 J2	3113 0516 6872
2*7P(2.54)(180°)	1	J3	3102 1007 5802
FB--0805	2	L1 L3	1852 0120 9100
<b>ANALOG I/O PCB P/N:0099-1510-0001</b>			
<i>Capacitors</i>			
47uF/16V--DIP	23	C24 C26 C27 C38 C53 C108 C109 C110 C111 C112 C113 C114 C115 C116 C117 C4 C11 C41 C44 C45 C100 C120 C121	2340 0310 1015
100uF/16V--DIP	3	C42 C56 C64	2311 0310 1015
1uF/25V--DIP	1	C96	2319 0410 1015
47uF/25V--DIP	4	C21 C36 C82 C91	2340 0410 1015
330pF/50V--C_0805	14	C71 C72 C73 C74 C77 C78 C79 C80 C84 C85 C86 C87 C88 C89	2103 5330 0140
2.2uF/50V--DIP(MKS2)	2	C13 C98	2207 4224 0100
10uF/50V--DIP	7	C1 C8 C25 C104 C105 C106 C107	2310 0610 1015
220pF/100V--DIP	2	C14 C28	2217 3221 0243
1000pF/100V--DIP	2	C22 C37	2217 3102 0243
3300pF/100V--DIP	6	C52 C59 C102 C103 C118 C119	2217 3332 0243
0.1uF/50V--C_0805	37	C2 C7 C9 C15 C16 C17 C19 C20 C23 C29 C31 C32 C33 C34 C40 C43 C49 C50 C57 C61 C62 C65 C68 C69 C70 C75 C81 C83 C90 C92 C93 C94 C99 C101 C122 C123 C124 C63	2103 5104 0140
100pF/50V(NPO)--C_0805	2	C47 C55	2103 5101 0145
100pF/50V--C_0805	7	C3 C10 C30 C35 C48 C58 C66	2103 5101 0140
1000pF/50V(NPO)--C_0805	2	C60 C67	2103 5102 0145
150pF/50V--C_0805	2	C39 C51	2103 5151 1400
0.01uF/50V--C_0805	2	C95 C97	2103 5103 0140
1uF/50V--C_0805	1	C5	2103 5105 0140
2.2uF/50V--C_0805	1	C12	2103 5225 0140
680pF/50V(NPO)--C_0805	2	C46 C54	2103 5681 0145
<i>Semiconductors</i>			
BAS16--SOT23	9	D1 D2 D3 D4 D5 D6 D7 D8 D9	1340 0161 0100
LD1117S5.0(SOT-223) ADJ. POSITIVE REGULATORS	1	IC1	1011 1751 1428
NJU7313AM--SDMP30(JRC) ANALOG FUNCTION SWITCH	1	IC2	1007 3130 3160
AD825AR--SOIC8(Analog Device) High Speed JFET Amplifier	2	U10 U12	1000 8250 0438

Description	Qty	Ref. Designator	Part Number
<b>ANALOG I/O PCB P/N:0099-1510-0001</b>			
AK4683EQ--LQFP64(AKM) Multi-Channel Audio CODEC	1	U2	1004 6830 0526
CS5361--SOIC24 Multi-Bit Audio A/D Converter	1	U4	1053 6121 4101
NJM2068M--DMP8(JRC) DUAL OP-AMP	2	U7 U8	1031 2068 1300
NJM5532M--DMP8(JRC) DUAL OP-AMP	4	U1 U3 U6 U11	1031 5532 1300
PCA9555--TSSOP24(Philips) 16-bit I2C and SMBus I/O port with interrupt	1	U9	1009 5550 4915
<i>Resistors</i>			
0R--R_0805	6	R45 R47 R49 R50 R72 R73	2401 8200 0400
1K1%--R_0805	2	R15 R16	2401 8110 2400
1K--R_0805	4	R27 R28 R107 R111	2401 8210 2400
1.78K1%--R_0805	2	R33 R46	2403 0817 8804
2K4--R_0805	2	R57 R59	2401 8224 2400
3K9--R_0805	2	R58 R60	2401 8239 2400
5.1K1%--R_0805	2	R34 R48	2403 0815 1204
5.1R--R_0805	2	R13 R29	2401 0825 1904
7.5K1%--R_0805	2	R63 R66	2402 0817 5904
9.1K1%--R_0805	2	R37 R44	2403 0819 1204
10K1%--R_0805	18	R1 R2 R30 R32 R35 R38 R39 R42 R102 R103 R111 R115 R116 R117 R118 R119 R120 R121	2401 8110 3400
10K--R_0805	10	R36 R43 R69 R70 R26 R51 R54 R55 R62 R67	2401 8210 3400
12K1%--R_0805	1	R12	2402 0811 2304
18K1%--R_0805	2	R6 R11	2402 0811 8304
27K1%--R_0805	2	R4 R24	2402 0812 7304
47K1%--R_0805	4	R21 R64 R65 R113	2414 0847 1004
47K--R_0805	6	R17 R18 R19 R20 R31 R41	2401 8247 3400
47R/1W--DIP	1	R106	2401 0524 7012
47R--R_0805	1	R22	2401 8247 0400
68K--R_0805	14	R74 R75 R76 R77 R83 R84 R85 R86 R87 R94 R95 R96 R97 R104	2401 8268 3400
100R--R_0805	20	R8 R10 R79 R80 R82 R109 R137 R138 R139 R140 R141 R142 R143 R144 R145 R146 R147 R148 R149 R150	2401 8210 1400
220K--R_0805	2	R81 R110	2401 8222 4400
220R--R_0805	14	R89 R90 R91 R92 R93 R98 R99 R100 R101 R105 R122 R123 R124 R125	2401 8222 1400
330K--R_0805	2	R78 R88	2401 8233 4400
330R1%--R_0805	4	R5 R9 R23 R25	2402 0813 3104
360R--R_0805	2	R108 R112	2401 0823 6104
470K1%--R_0805	2	R3 R40	2401 8147 4400
680R--R_0805	2	R68 R71	2401 8268 1400
<i>Miscellaneous</i>			
9P(2.0) --JACK	1	CN1	3100 4090 0200
4P(2.0) --JACK	1	CN2	3100 4040 0200
FB--L_0805	5	L2 L3 L5 L6 L7	1852 0120 9100
AV4-8.4-13/EC--RCA JACK	2	J1 J2	2910 4011 0510
AV6-8.4-13/EC--RCA JACK	1	J3	2910 6011 2031
2x4P2.0(90) --JACK	1	J4	3102 1008 4802
2x13P2.0(90) --JACK	1	J5	3102 0926 7802
JRC-27F1005-M-555	9	K1 K2 K3 K4 K5 K6 K7 K8 K9	4712 2027 0006
<b>PHONO PCB P/N:0099-1210-0002</b>			
<i>Capacitors</i>			
47uF/16V--DIP	2	C27 C28	2340 0310 1015
0.1uF/50V--C_1206	15	C4 C13 C14 C19 C20 C21 C22 C33 C81 C82 C83	2103 5104 0150

Description	Qty	Ref. Designator	Part Number
<b>PHONO PCB P/N:0099-1210-0002</b>			
0.1uF/50V--C_1206		C84 C85 C86 C87	
100uF/16V--DIP	2	C29 C75	2311 0310 1015
2700pF/50V--C_1206	2	C62 C63	2115 5272 0150
1pF/50V--C_1206	2	C35 C36	2103 5109 0150
1uF/50V--C_1206	8	C51 C53 C54 C56 C65 C67 C68 C70	2103 5105 0150
1800pF/100V--DIP	2	C58 C60	2217 3182 0243
4700pF/100V--DIP	2	C48 C50	2217 3472 0243
0.01uF/50V--R_1206	2	C2 C3	2103 5103 0150
10pF/50--C_1206	4	C37 C39 C40 C42	2103 5100 0150
10uF 16V--DIP	4	C30 C34 C61 C64	2310 0310 1015
10uF/50V--DIP	10	C6 C7 C10 C11 C52 C55 C66 C69 C88 C89	2310 0610 1015
22uF/10V(ELCO)--C_1210	2	C38 C41	2103 6221 1620
180pF/100V--DIP	2	C57 C59	2217 2182 0200
220uF/16V--DIP	8	C5 C8 C9 C12 C15 C16 C17 C18	2321 0310 1015
220uF/25V--DIP	2	C90 C91	2321 0410 1015
470uF/16V--DIP	2	C76 C77	2341 0310 3025
330pF/50V--R_1206	6	C23 C24 C25 C26 C31 C32	2103 5331 0150
330uF/25V--DIP	8	C43 C44 C45 C46 C71 C72 C73 C74	2331 0410 1015
680pF/100V--DIP	2	C47 C49	2217 2681 0243
<i>Semiconductors</i>			
LED rouge--1206	2	D1 D2	1403 0100 0007
BAS85--SOD80C(PHILIPS)	4	D5 D6 D7 D8	1300 0850 0101
BZV55/C12(12V)--SMD	4	D3 D4 D9 D10	1301 2555 0100
LM317EMP--SOT223 3 TERM ADJ. REGULATOR	1	IC2	1043 0317 0861
LM337IMP--SOT223	1	IC3	1000 3370 4361
NJU201AM--DMP16(JRC) QUAD SPST ANALOG SWITCH	1	IC1	1000 2010 3160
2sc3265--SOT23(Toshiba)	2	Q61 Q62	1133 2650 0141
DTC343TK--SOT23(ROHM)	4	Q11 Q12 Q13 Q14	1150 3430 0341
2SA1298--SOT23(Toshiba)	2	Q55 Q56	1111 2980 0101
2SA1312--SOT23(Toshiba)	18	Q2 Q4 Q5 Q7 Q31 Q32 Q35 Q36 Q39 Q40 Q43 Q44 Q47 Q49 Q52 Q54 Q57 Q59	1111 3120 0172
2SC3324--SOT23(Toshiba)	18	Q1 Q3 Q6 Q8 Q33 Q34 Q37 Q38 Q41 Q42 Q45 Q46 Q48 Q50 Q51 Q53 Q58Q60	1133 3240 0717
<i>Resistors</i>			
0R--R_1206	7	R138 R144 R38 R122 R125 R126 R129	2401-0920-0005
1.5K1%--R_1206	2	R98 R104	2402 0911 5205
1K1%--R_1206	10	R55 R56 R59 R60 R63 R64 R67 R68 R99 R105	2402 0911 0205
1K--R_1206	2	R146 R151	2401 2210 2500
1M2--R_1206	4	R123 R124 R127 R128	2401 2212 5500
2.7K1%--R_1206	8	R96 R97 R100 R101 R102 R103 R106 R107	2402 0912 7005
2K2--R_1206	2	R136 R142	2401 2222 2500
2K4--R_1206	2	R36 R37	2401 2224 2500
2K7--R_1206	1	R5	2401 2227 2500
3K9--R1206	2	R22 R27	2401 2239 2500
4K7 1%--R_1206	4	R16 R17 R18 R19	2402 0914 7105
6.8K1%--R_1206	4	R33 R108 R109 R149	2402 0916 8205
7.5K1%--R_1206	4	R74 R76 R81 R83	2402 0917 5005
10R1%--R_1206	6	R1 R3 R7 R9 R11 R13	2402 0911 0305
10R--R_1206	8	R21 R24 R26 R29 R54 R61 R62 R69	2401 2210 0500
22R1%--R_1206	4	R6 R8 R10 R12	2402 0912 2005
39K--R_1206	2	R130 R131	2401 2239 3500
39R--R_1206	4	R134 R139 R140 R145	2401 2239 0500
47R1%--R_1206	2	R2 R4	2402 0914 7005
47R--R_1206	4	R30 R31 R75 R82	2401 2247 0500
82K--R_1206	2	R57 R65	2401 2282 3500
100K--R_1206	2	R32 R156	2401 2210 4500



Description	Qty	Ref. Designator	Part Number
<b>PHONO PCB P/N:0099-1210-0002</b>			
100R--R_1206	1	R14	2401 2210 1500
120K--R_1206	2	R58 R66	2401 2212 4500
120R1%--R_1206	4	R112 R114 R118 R120	2402 0911 2005
220R--R_1206	2	R34 R35	2401 2222 1500
300R--R_1206	1	R15	2401 2230 1500
330R1%--R_1206	8	R72 R73 R77 R78 R79 R80 R84 R85	2402 0913 3105
330R--R_1206	4	R132 R133 R152 R153	2401 2233 1500
470K--R_1206	2	R115 R121	2401 2247 4500
470R1%--R_1206	4	R111 R113 R117 R119	2402 0914 7005
560R1%--R_1206	4	R20 R23 R25 R28	2402 0915 6005
<i>Miscellaneous</i>			
HR610675--Wideband RF transformer	1	T1	1061 0672 1801
4P PLUG TO PLUG1533#28X2C 2.0 L=350MM 2.4GND	1		3604 6043 5032
24P (12 x 2 x 2mm)90--JACK	1	J7	3102 1024 4802
AV4-8.4-13/EC--JACK	2	J5 J8	2910 4011 0510
AV-8.4-8/ES--JACK	1	J2	2910 1321 1003
JRC-27F1005-M-555--Relay	1	K1	4712 0000 2700
4P(2.0)--JACK	1	CN1	3100 4040 0200
<b>XLR PCB P/N:0099-1080-0000</b>			
0.1uF/50V--C_0805	6	C1 C2 C3 C4 C13 C14	2103 5104 0140
330pF/50V--C_0805	4	C6 C7 C9 C10	2103 5330 0140
47uF/16V--DIP	4	C5 C8 C11 C12	2340 0310 1015
9P(2.0)--JACK	1	CN1	3100 4090 0200
LX-1604HP-3--JACK	2	JR1 JR2	2990 3330 0320
47K--R_0805	4	R1 R2 R6 R7	2401 8247 3400
100R--R_0805	4	R3 R4 R5 R8	2401 8210 1400
NJM5532M--DMP8(JRC) DUAL OP-AMP	2	U1 U2	1031 5532 1300
9P PLUG TO PLUG 2547#28X4C&2468#26X3C 2.0 L=120mm 2.5GND1346	1		3309 0504 0574
<b>DIGITAL PCB P/N:0099-1162-0000</b>			
<i>Capacitors</i>			
DNE	3	C17 C20 C52	
4.7pF/50V±5% X7R 0805 MLCC	1	C55	2103 5479 0140
10pF/50V±5% X7R 0805 MLCC	2	C53 C54	2103 5100 0140
10uF/25V±10% Y5V 0805 MLCC	4	C1 C35 C66 C86	2103 5106 0140
220pF/50V±5% NPO 0805 MLCC	2	C76 C93	2103 5221 0140
220PF/100V±5% Mylar .CaP	4	C70 C81 C87 C99	2217 3221 0243
330pF/50V±5% X7R 0805 MLCC	2	C10 C11	2103 5330 0140
1000PF/100V±5% Mylar .CaP	4	C71 C82 C88 C100	2217 3102 0243
3300PF/100V±5% Mylar .CaP	4	C14 C15 C25 C26	2217 3332 0243
0.1uF/10V±5% NPO 0805 MLCC	4	C115 C116 C117 C118	2103 6104 1645
0.1uF/50V±5% X7R 0805 MLCC	67	C2 C3 C5 C6 C8 C18 C19 C21 C22 C23 C24 C28	2103 5104 0140
		C29 C32 C33 C34 C36 C37 C38 C39 C40 C41 C42	
		C43 C44 C45 C46 C47 C49 C51 C56 C57 C59 C62	
		C65 C67 C69 C72 C73 C74 C75 C79 C80 C83 C84	
		C89 C90 C91 C92 C95 C97 C98 C101 C102 C105	
		C112 C113 C114 C115 C116 C117 C118 C122 C123	
		C124 C125 C126 C127 C128 C129 C130	
1uF/63V±5%(Metalized polyester	2	C78 C96	2206 2105 1000
47uF/16V(Tan) CS45	2	C77 C94	2340 0310 0009
47uF/16V±20% E.CaP	7	C64 C68 C85 C103 C104 C106 C107	2340 0310 1015
47uF/25V±20% E.CaP	20	C4 C7 C9 C12 C13 C16 C27 C30 C31 C48 C50 C58	2340 0410 1015

Description	Qty	Ref. Designator	Part Number
<b>DIGITAL PCB P/N:0099-1162-0000</b>			
47uF/25V±20% E.CaP		C60 C63 C108 109 C110 C111 C119 C120	
<i>Semiconductors</i>			
2SA1035R SC-59 Panasonic	4	Q5 Q6 Q7 Q8	1111 0350 1101
BSS123 SOT23 (Fairchild) N CHANNEL MOSFET	1	Q4	1180 1230 1011
DTC343TK SOT23 ROHM	2	Q1 Q2	1150 3430 0341
SS8550 SOT23	1	Q3	1310 8008 5502
74HCU04D S0L14 HEX INVERTER	1	U13	1083 9052 0615
JSR1162-002 optical receiver/jack	2	U1 U2	1341 1621 0100
LL4148	1	D1	1301 4148 1500
NJM2068M DMP8 JRC DUAL OP-AMP	1	U3	1031 2068 1300
OP275GS SOIC8 (Analog Device) DUAL JFET OP-AMP	2	U17 U22	1000 2750 0413
OPA2134UA SO-8 (Burr-brown) AUDIO OP-AMP	2	U16 U21	1002 1340 0738
PCA9554APW TSSOP16 PHILIPS 8-BIT I2C AND SMBus I/O EXPANDER	1	U20	1009 5540 4915
SRC4392IPFBT TQFP48 ICS Asynchronous Sample Rate Converter	1	U9	1004 3920 0726
XWM8740EDS SSOP28 (Wolfson) 24-bit, 192kHz Stereo DAC	1	U12	1008 7400 6714
(2*16P2.54)*2 Twin-Row Socket(180)	1	U18	3102 1016 5802
74HC4052D S016 Dual 4-channel analog multiplexer, demultiplexer	2	U6 U7	1004 0520 4913
74LCX125MTC TSSOP14 ST Low Voltage Quad Buffer	2	U4 U5	1074 1250 1915
74LCX139TTR TSSOP16 DUAL 2 TO 4 LINE DECODER/DEMULTIPLEXER	1	U10	1074 1392 0815
AD1955ARS SSOP28 (Analog Device) MULTIBIT DAC	2	U19 U23	1001 9550 0414
AMS1117-1.8 SOT-223 AMS LOW DROPOUT REGULATOR	1	U8	1011 7180 0156
AMS1117-3.3 SOT-223 AMS LOW DROPOUT REGULATOR	1	U15	1011 7330 0128
AMS1117-5.0 SOT-223 AMS LOW DROPOUT REGULATOR	1	U11	1011 7500 0128
<i>Resistors</i>			
DNE	1	R13	
0R±5% 0805	1	R14 R19 R21 R24 R25	2401 8200 0400
1K±5% 0805 film capacitor) MKS2 WIMA	5	R60 R81 R91 R99 R116	2401 8210 2400
2.2K±5% 0805	1	R28	2401 8222 2400
2.7K±5% 0805	10	R79 R82 R86 R89 R93 R97 R100 R104 R114 R11	2401 8227 2400
3.3K±5% 0805	4	R84 R94 R102 R119	2401 8233 2400
1.3K±5% 0805	4	R15 R18 R30 R33	2401 0823 0204
10K±5% 0805	12	R61 R71 R78 R106 R107 R108 R109 R110 R112	2401 8210 3400
		R113 R122 R123	
10R±5% 0805	6	R6 R7 R8 R9 R34 R37	2401 8210 0400
22K±5% 0805	2	R87 R105	2401 8222 3400
24K±5% 0805	8	R38 R41 R42 R45 R47 R50 R51 R54	2401 0824 0204
27K±5% 0805	2	R3 R4	2401 0822 7304
27R±5% 0805	6	R62 R63 R66 R67 R68 R69	2401 8227 0400
47K±5% 0805	17	R16 R17 R31 R32 R39 R40 R43 R44 R46 R48 R49	2401 8247 3400
		R52 R53 R83 R92 R101 R117	
47R±5% 0805	19	R1 R2 R23 R26 R36 R55 R56 R57 R58 R59 R64	2401 8247 0400
		R65 R70 R72 R73 R74 R75 R76 R77	
75R±5% 0805	2	R20 R22	2401 8275 0400
100R±5% 0805	3	R12 R27 R35	2401 8210 1400
150R±5% 0805	1	R28	2401 8215 1400
220R±5% 0805	1	R29	2401 8222 1400
330R±5% 0805	2	R96 R121	2401 8233 1400
470R±5% 0805	2	R10 R11	2401 8247 1400
560R±5% 0805	2	R88 R111	2401 8256 1400
680R±5% 0805	4	R85 R95 R103 R120	2401 8268 1400
FSMD010-1206 PTC	1	PTC1	2410 0901 0205

Description	Qty	Ref. Designator	Part Number
<b>DIGITAL PCB P/N:0099-1162-0000</b>			
<i>Miscellaneous</i>			
FB(0805)1210(TB20129Z601)EMI 100MHz 600R	16	FB1 FB2 FB3 FB4 FB5 FB6 FB7 FB8 FB9 FB10 FB11 FB12 FB13 FB14 FB15 FB16	1852 0120 9100
AV2-8.4-14/EC	1	J2	2910 2322 2141
AV4-8.4-13/EC	1	J1	2910 4211 2131
CKX-3.5-12A 3.5mm DC JACK	2	J3 J7	2801 1335 1203
2*4P2.0(90)Twin-Row Pin	1	J5	3102 1008 4802
2*14P2.0(90)Twin-Row Pin	1	J6	3102 1028 4802
RJ45 10P8C	1	J4	2807 0345 0000
22uH --1812	3	L1 L2 L3	1882 2019 0101
HR610675 Wideband RF transformer (Hanrun)	5	T1 T2 T3 T4 T5	1061 0672 1801
24.576MHz(CS5032)	1	Y2	2705 2457 6026
<b>L&amp;R POWER AMPLIFIER PCB PN : 0099-1070-0003</b>			
<i>Capacitors</i>			
47nF/100V	6	C1 C6 C9 C10 C16 C17	2217 3473 0243
220uF/100V	2	C2 C18	2321 0810 5093
6800uF/80V	4	C3 C4 C12 C13	2362 1410 9093
10nF/250V	4	C5 C8 C14 C15	2223 3103 0400
1000uF/100V	2	C11 C7	2312 0810 7073
1uF/1206	6	C19 C20 C21 C22 C32 C34	2103 5105 0150
47nF/1206	3	C23 C24 C35	2115 5473 0150
270pF(NPO)5%/1206	1	C25	2103 5271 0155
47nF(Mylar)10%	2	C70 C26	2217 3473 0243
3.9pF(NPO)5%/1206	1	C27	2103 5399 0155
330pF/1206	1	C28	2103 5331 0150
10uF/1206	2	C30 C29	2103 5106 0150
47uF/1206	2	C31 C37	2115 5476 0150
2.2uF/1206	1	C33	2103 5225 0150
100nF/1206	1	C36	2103 5104 0150
<i>Semiconductors</i>			
MUR2020	4	D1 D2 D4 D5	1360 0202 0000
GBU8D	1	D3	1361 3000 0080
ZMM16ST(16V)	2	D6 D26	1301 6002 0100
BAS20	6	D7 D8 D14 D15 D25 D27	1340 0200 0100
DL4148	14	D9 D10 D11 D12 D13 D16 D17 D18 D19 D20 D21 D22 D23 D24	1310 4414 8000
MJL1302A	4	Q1 Q2 Q4 Q5	1191 3020 1200
NJL1302D	1	Q3	1191 3020 1210
2SA1837	2	Q6 Q11	1111 8370 0130
MJE15033	1	Q7	1181 5033 1220
2SA1869	1	Q8	1111 8690 0100
2SC4793	2	Q9 Q18	1134 7930 0000
2SC4935	1	Q10	1134 9350 0120
MJL3281A	4	Q12 Q13 Q15 Q16	1183 2810 1200
NJL3281D	1	Q14	1193 2810 1210
MJE15032	1	Q17	1181 5032 1220
MJD253	2	Q20 Q38	1180 2530 1200
2SC3138	5	Q21 Q40 Q41 Q42 Q44	1133 1380 0121
2SA1312	7	Q22 Q23 Q24 Q26 Q27 Q28 Q29	1111 3120 0172
MJD243	2	Q39 Q25	1180 2430 1200
2SC3324	7	Q30 Q31 Q33 Q34 Q35 Q36 Q37	1133 3240 0717
BCP56-16	1	Q32	1185 6160 1400
2SA1255	1	Q43	1111 2550 0101

Description	Qty	Ref. Designator	Part Number
<b>L&amp;R POWER AMPLIFIER PCB PN : 0099-1070-0003</b>			
PC817A PHOTOCOUPLER	2	U2 U1	1000 8170 5501
OPA2134UA AUDIO OP-AMP	1	U3	1002 1340 0738
TL061CD SINGLE JFET OP-AMP	1	U4	1000 0610 6138
<i>Resistors</i>			
HF-115F-048-1ZS3B	2	RL3 RL4	4712 1150 0600
CWF51-104J-3951(100K)	1	RT1	1609 1070 0601
2K2 1W	2	R24 R1	2401 5222 2200
150R 3W	2	R2 R23	2413 0721 5108
22K 3W	3	R3 R13 R15	2413 0722 2310
10K 3W	2	R4 R16	2413 0721 0308
0.33R 5W	10	R5 R6 R7 R8 R9 R17 R18 R19 R20 R21	2413 1023 3808
5R6 1W	1	R10	2401 5225 6900
5R 5W	1	R11	2412 1025 0910
1R 5W	1	R12	2412 1021 0910
30K 3W	1	R14	2413 0723 0310
6K2 1/2W	1	R22	2413 0426 2211
10K/1206	10	R25 R30 R60 R61 R62 R78 R79 R82 R89 R94	2402 0911 0305
0.22R(RF) 2W	2	R26 R27	2410 0622 2815
1K/1206	6	R28 R42 R44 R58 R70 R90	2402 0911 0205
22K/1206	4	R29 R57 R59 R95	2402 0912 2205
1M/1206	2	R31 R32	2402 0911 0505
10R/1206	10	R33 R34 R35 R36 R37 R84 R85 R86 R87 R88	2402 0911 0005
4K3/1206	5	R38 R40 R41 R74 R83	2402 0914 3205
1K8/1206	2	R39 R75	2402 0911 8205
150R 1/4W 1%	2	R43 R76	2402 0311 5111
3K/1206	4	R45 R46 R69 R71	2401 0823 0204
39R/1206	2	R72 R47	2401 2239 0500
12K 1/4W 1%	2	R73 R48	2402 0311 2311
180R/1206	2	R66 R49	2402 0911 8105
330R/1206	4	R50 R51 R63 R64	2402 0913 3105
300R/1206	1	R52	2402 0913 0105
3224W-200R(BOURNS)	1	R53	4402 3324 2000
6K2/1206	1	R54	2402 0916 2205
10K 1/4W 1%	1	R55	2402 0311 0011
270R/1206	2	R65 R56	2402 0912 7105
390R/1206	3	R67 R80 R81	2402 0913 9105
82R/1206	1	R68	2402 0918 2005
68K/1206	1	R77	2402 0916 8305
33K/1206	3	R91 R92 R93	2402 0913 3305
2K4 /2W	2	R96 R97	2413 0622 4213
<i>Miscellaneous</i>			
WCB-403025-M382-T	12	FB1 FB2 FB3 FB4 FB5 FB6 FB7 FB8 FB9 FB10 FB11 FB12	1874 0302 5382
250 TERMINAL	10	JP1 JP2 JP3 JP4 JP5 JP6 JP7 JP8 JP9 JP10	2932 5000 2500
7P * 2mm	1	J1	3100 4070 0200
2.2uH	1	L1	1832 2000 0001
<b>HEADPHONES PCB P/N:0099-1171-0000</b>			
<i>Capacitors</i>			
10uF/16V±20% E.CAP	3	C38 C40 C41	2310 0310 1015
47PF/50V±5% X7R 0603 MLCC	1	C31	2103 5470 0130
100uF/25V±20% E.CAP	2	C9 C10	2311 0410 1015
0.1uF/50V±5% X7R 0603 MLCC	7	C1 C2 C3 C5 C35 C36 C42	2156 1040 0130

Description	Qty	Ref. Designator	Part Number
<b>HEADPHONES PCB P/N:0099-1171-0000</b>			
150PF/50V±5% X7R 0603 MLCC	1	C32	2103 5151 0130
330PF/50V±5% X7R 0603 MLCC	2	C29 C30	2103 5331 0130
470PF/50V±5% X7R 0603 MLCC	1	C7	2103 5471 0130
0.047uF/50V±5% X7R 0603 MLCC	1	C4	2115 6473 0130
<i>Semiconductors</i>			
IN4148	1	D4	1311 1414 8000
NJM2068M SOIC8 JRC DUAL OP-AMP	1	IC5	1031 2068 1300
TPA6120A2 DWP-20 High Fidelity Stereo Headphone Driver	1	IC4	1061 2020 6138
2SC2120Y TO-92 TOSHIBA	1	Q2	1132 1200 0162
<i>Resistors</i>			
1.65K±1% 0603	1	R3	2403 1216 5203
1K±5% 0603	10	R7 R8 R9 R10 R11 R12 R13 R14 R25 R26	2401 1221 0203
2.2K±5% 0603	1	R32	2401 1222 2203
10K±5% 0603	4	R4 R18 R23 R24	2401 1221 0303
10R±5% 0603	3	R1 R2 R15	2401 1221 0003
27K±5% 0603	1	R31	2401 1222 7303
47K±5% 0603	3	R17 R19 R20	2401 1224 7303
100R±5% 0603	2	R29 R30	2401 1221 0103
100k±5% 0603	1	R28	2401 1221 0403
200R±5% 0603	1	R22	2401 1222 0103
JRC-27F/012-M(555)	1	RELAY1	4712 2027 0006
<i>Miscellaneous</i>			
CK-6.35-02 JACK	1	CK1	2822 2200 0100
4P(2.0mm)SOCKET	1	CN13	3100 4040 0200
5P2.5mm SOCKET	1	CN12	3100 5050 0200
<b>PREAMP PCB P/N:0099-1290-0001</b>			
<i>Capacitors</i>			
2200PF/50V±5% X7R 0805 MLCC	2	C17 C19	2103 5220 0140
4700uF/16V±20% E.CAP	2	C63 C72	2342 3106 6000
4700uF/25V±20% E.CAP	2	C62 C71	2342 4105 5000
10UF/16V±20% E.CAP	1	C58	2310 0310 1015
10UF/50V±20% E.CAP	11	C10 C11 C12 C24 C30 C38 C40 C45 C55 C64 C74	2310 0610 1015
47uF/16V±20% E.CAP	6	C3 C6 C9 C13 C31 C34	2340 0310 1015
47uF/25V±20% E.CAP	2	C41 C73	2340 0410 1015
100PF/50V±5% X7R 0805 MLCC	3	C43 C44 C48	2103 5101 0140
0.1uF/50V±5% X7R 0805 MLCC	24	C1 C2 C4 C5 C14 C15 C16 C18 C22 C25 C27 C29	2103 5104 0140
		C32 C35 C37 C51 C57 C65 C68 C69 C75 C77 C81 C82	
100uF/16V(For audio)±20% E.CAP	4	C49 C52 C53 C56	2311 0310 1025
100UF/16V±20% E.CAP	3	C42 C46 C47	2311 0310 1015
220PF/100V±5% Mylar.CaP	2	C7 C8	2203 2221 0244
220uF/10V±20% E.CAP	4	C36 C39 C20 C23	2321 0410 1015
220uF/25V±20% E.CAP	4	C21 C26 C28 C33	2321 0410 1015
470uF/35V±20% E.CAP	2	C50 C54	2341 0510 3015
<i>Semiconductors</i>			
30BQ040TRPbF(SMC IRF)	2	D2 D4	1310 0030 0401
BAS16 SOT23	1	D5	1340 0161 0100
GBU806 Rrectifying Diode	2	D6 D7	1361 3000 0806

Description	Qty	Ref. Designator	Part Number
<b>PREAMP PCB P/N:0099-1290-0001</b>			
L7805CV TO-220 POSITIVE REGULATOR	1	IC1	1007 8050 7027
AMS1085CT TO-220 AMS LOW DROPOUT REGULATOR	1	IC2	1001 1085 0800
TIP31C TO-220 FAIRCHILD NPN TRANSISTOR	1	Q2	1110 0310 6000
TIP32C TO-220 FAIRCHILD PNP TRANSISTOR	1	Q7	1110 0320 6000
2SA1035R (SC-59 Panasonic)	4	Q8 Q9 Q18 Q19	1111 0350 1101
2SC2406R (SC-59 Panasonic)	10	Q1 Q3 Q4 Q5 Q6 Q12 Q13 Q14 Q15 Q17	1132 4060 5000
BSS123 SOT23 N CHANNEL MOSFET	2	Q10 Q20	1180 1230 1011
AD825AR SOIC8 (Analog Device) High Speed JFET Amplifier	2	U2 U3	1000 8250 0438
LM317EMP SOT223 3 TERM ADJ. REGULATOR	1	U5	1043 0317 0861
LM317T-ADJ TO-220 3 TERM ADJ. REGULATOR	1	U6	1000 3170 5427
LM337IMP SOT223 adjustable regulator	1	U8	1000 3370 4361
LM337T-ADJ TO-220 adjustable regulator	1	U9	1000 3370 4349
NJW1159M DMP16 JRC 2 CHAN ELECTRONIC VOLUME	1	U4	1001 1590 3130
PIC18F66J10 TQFP64 FLASH MICROCONTROLLER	1	U17	1001 8662 1326
ULN2003AD(SOL160-P-150-1.27) DARLINGTON TRANSISTOR ARRAYS	1	U15	1002 0030 6138
<i>Resistors</i>			
1.3K±5% 0805	2	R5 R7	2401 8221 3204
1K±5% 0805	6	R19 R20 R38 R50 R51 R59	2401 8210 2400
RF0.22R/0.5W±5%	3	R40 R41 R42	2406 0422 2815
2.4K±5% 0805	2	R30 R37	2401 8224 2400
2.7K±5% 0805	2	R54 R61	2401 8227 2400
4.7K±5% 0805	13	R29 R32 R33 R34 R39 R47 R52 R56 R57 R58 R60 R62 R90	2401 8247 2400
5.6R±5% 0805	2	R23 R24	2401 8256 9400
10K±5% 0805	32	R9 R10 R27 R48 R49 R53 R65 R66 R69 R70 R71 R72 R73 R74 R75 R76 R80 R83 R84 R85 R87 R88 R89 R91 R92 R94 R98 R99 R103 R104 R106 R108	2401 8210 3400
22K±5% 0805	4	R67 R68 R95 R96	2401 8222 3400
27R±5% 0805	4	R78 R79 R81 R82	2401 8227 0400
47K±5% 0805	6	R15 R16 R64 R77 R86 R97	2401 8247 3400
75R±5% 0805	2	R13 R14	2401 8275 0400
100K±5% 0805	6	R45 R46 R101 R102 R105 R107	2401 8210 4400
100R±5% 0805	13	R1 R2 R3 R8 R11 R12 R35 R36 R43 R44 R55 R63 R100	2401 8210 1400
150R±5% 0805	2	R17 R25	2401 8215 1400
220R±5% 0805	2	R28 R31	2401 8222 1400
412R±1% 0805	1	R21	2414 0841 2104
470R±5% 0805	1	R93	2401 8247 1400
680R±5% 0805	2	R18 R26	2401 8268 1400
680R±1% 0805	1	R22	2414 0868 0104
910R±5% 0805	2	R4 R6	2401 8291 1400
<i>Miscellaneous</i>			
TSAB-3 (H=5mm) PUSHBUTTON	1	SW1	4502 4000 3100
7P PLUG TO PLUG 2468#26X5C&2547#28X1C 2.0 L=180MM	2		3307 0504 0282
6P PLUG TO PHOUSING 2468#26X6C 2.0 L=380MM	1		3306 0504 0385
5P PLUG TO PLUG 2468#26X5C 2.5 L=300MM	1		3304 0505 0302
4P PLUG TO PLUG2468#26X4C 2.0 L=60MM	1		3304 0504 0064
3P PLUG TO HOUSING2468#26X3C 2.0 L=60MM	1		3303 0504 0063
FB(0805) 1210(TB20129Z601)EMI 100MHz 600R	7	FB1 FB2 FB3 FB4 FB5 FB6 FB7	1852 0120 9100
2*4P2.0(180)Twin-Row Socket	2	J4 J5	3107 0404 6602
2*13P2.0(180)Twin-Row Socket	1	J6	3102 0926 6802
2*12P2.0(180)Twin-Row Socket	1	J7	3107 0412 6662
2*14P2.0(180)Twin-Row Socket	1	J8	3102 0928 6802

Description	Qty	Ref. Designator	Part Number
<b>PREAMP PCB P/N:0099-1290-0001</b>			
6P 2.5mm(180)Single Row pin	1	J9	3106 0506 0802
4P(2.0mm)Socket	1	J14	3100 4040 0200
5P(2.5mm)Socket	2	J11 J13	3100 5050 0200
6P(2.0mm)Socket	1	J12	3100 4060 0200
7P(2.0mm)Socket	2	J2 J3	3100 4070 0200
AV2-8.4-14/EC	1	JK1	2910 2191 0200
JRC-27F/005-M(555)	3	K1 K3 K4	4712 0000 2700
3P(2.0mm)Socket	1	CN1	3100 4030 0200

**Hex inverter****74HCU04****FEATURES**

- Output capability: standard
- I<sub>CC</sub> 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<sub>amb</sub> = 25 °C; t<sub>r</sub> = t<sub>f</sub> = 6 ns

SYMBOL	PARAMETER	CONDITIONS	TYP.	UNIT
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay nA to nY	C <sub>L</sub> = 15 pF; V <sub>CC</sub> = 5 V	5	ns
C <sub>I</sub>	input capacitance		3.5	pF
C <sub>PD</sub>	power dissipation capacitance per inverter	note 1	10	pF

**Note**

1. C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):

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

f<sub>i</sub> = input frequency in MHz

f<sub>o</sub> = output frequency in MHz

C<sub>L</sub> = output load capacitance in pF

V<sub>CC</sub> = supply voltage in V

∑ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = 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 <sub>CC</sub>	positive supply voltage

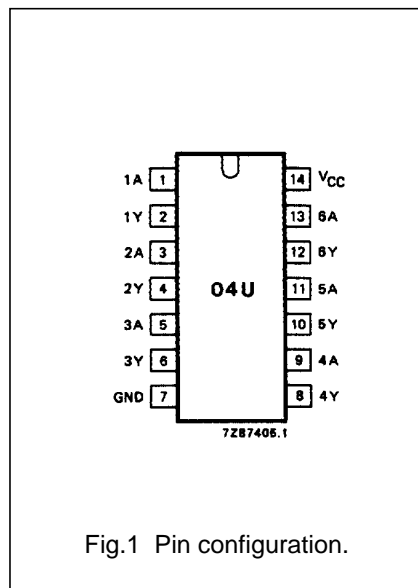


Fig.1 Pin configuration.

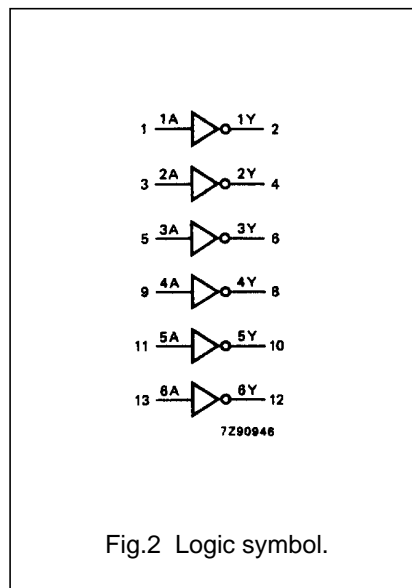


Fig.2 Logic symbol.

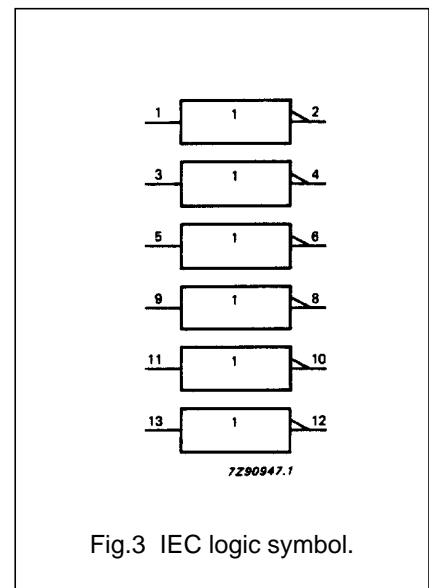


Fig.3 IEC logic symbol.

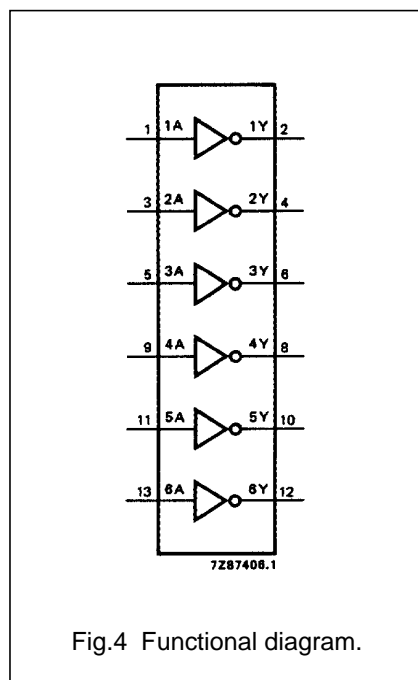


Fig.4 Functional diagram.

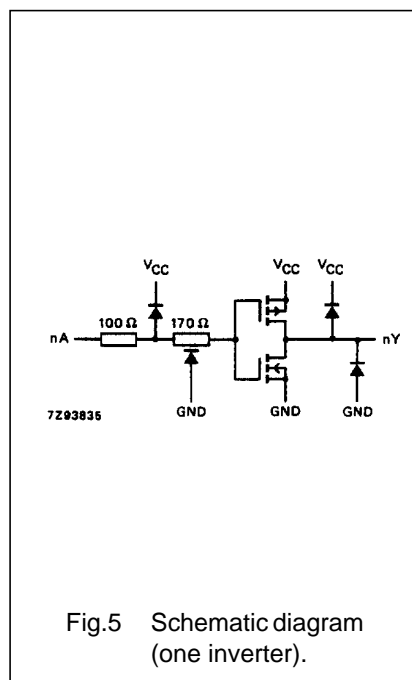


Fig.5 Schematic diagram (one inverter).

## Dual 4-channel analog multiplexer, demultiplexer

## 74HC4052; 74HCT4052

### FEATURES

- Wide analog input voltage range from  $-5\text{ V}$  to  $+5\text{ V}$
- Low ON-resistance:
  - $80\ \Omega$  (typical) at  $V_{CC} - V_{EE} = 4.5\text{ V}$
  - $70\ \Omega$  (typical) at  $V_{CC} - V_{EE} = 6.0\text{ V}$
  - $60\ \Omega$  (typical) at  $V_{CC} - V_{EE} = 9.0\text{ V}$
- Logic level translation: to enable  $5\text{ V}$  logic to communicate with  $\pm 5\text{ V}$  analog signals
- Typical “break before make” built in
- Complies with JEDEC standard no. 7A
- ESD protection:
  - HBM EIA/JESD22-A114-B exceeds  $2000\text{ V}$
  - MM EIA/JESD22-A115-A exceeds  $200\text{ V}$ .
- Specified from  $-40\text{ }^\circ\text{C}$  to  $+85\text{ }^\circ\text{C}$  and  $-40\text{ }^\circ\text{C}$  to  $+125\text{ }^\circ\text{C}$ .

### APPLICATIONS

- Analog multiplexing and demultiplexing
- Digital multiplexing and demultiplexing
- Signal gating.

### DESCRIPTION

The 74HC4052 and 74HCT4052 are high-speed Si-gate CMOS devices and are pin compatible with the HEF4052B. They are specified in compliance with JEDEC standard no. 7A.

The 74HC4052 and 74HCT4052 are dual 4-channel analog multiplexers or demultiplexers with common select logic. Each multiplexer has four independent inputs/outputs (pins nY0 to nY3) and a common input/output (pin nZ). The common channel select logics include two digital select inputs (pins S0 and S1) and an active LOW enable input (pin  $\bar{E}$ ). When pin  $\bar{E} = \text{LOW}$ , one of the four switches is selected (low-impedance ON-state) with pins S0 and S1. When pin  $\bar{E} = \text{HIGH}$ , all switches are in the high-impedance OFF-state, independent of pins S0 and S1.

$V_{CC}$  and GND are the supply voltage pins for the digital control inputs (pins S0, S1, and  $\bar{E}$ ). The  $V_{CC}$  to GND ranges are  $2.0\text{ V}$  to  $10.0\text{ V}$  for 74HC4052 and  $4.5\text{ V}$  to  $5.5\text{ V}$  for 74HCT4052. The analog inputs/outputs (pins nY0 to nY3 and nZ) can swing between  $V_{CC}$  as a positive limit and  $V_{EE}$  as a negative limit.  $V_{CC} - V_{EE}$  may not exceed  $10.0\text{ V}$ .

For operation as a digital multiplexer/demultiplexer,  $V_{EE}$  is connected to GND (typically ground).

### FUNCTION TABLE

INPUT <sup>(1)</sup>			CHANNEL BETWEEN
$\bar{E}$	S1	S0	
L	L	L	nY0 and nZ
L	L	H	nY1 and nZ
L	H	L	nY2 and nZ
L	H	H	nY3 and nZ
H	X	X	none

### Note

1. H = HIGH voltage level  
L = LOW voltage level  
X = don't care.

Dual 4-channel analog multiplexer, demultiplexer

74HC4052; 74HCT4052

PINNING

PIN	SYMBOL	DESCRIPTION
1	2Y0	independent input or output
2	2Y2	independent input or output
3	2Z	common input or output
4	2Y3	independent input or output
5	2Y1	independent input or output
6	$\bar{E}$	enable input (active LOW)
7	$V_{EE}$	negative supply voltage
8	GND	ground (0 V)
9	S1	select logic input
10	S0	select logic input
11	1Y3	independent input or output
12	1Y0	independent input or output
13	1Z	common input or output
14	1Y1	independent input or output
15	1Y2	independent input or output
16	$V_{CC}$	positive supply voltage

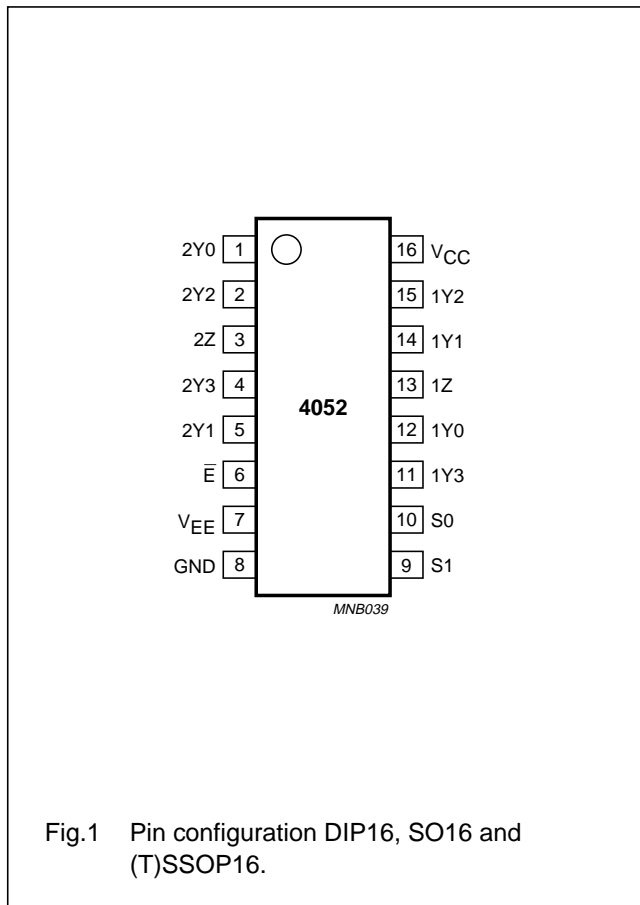
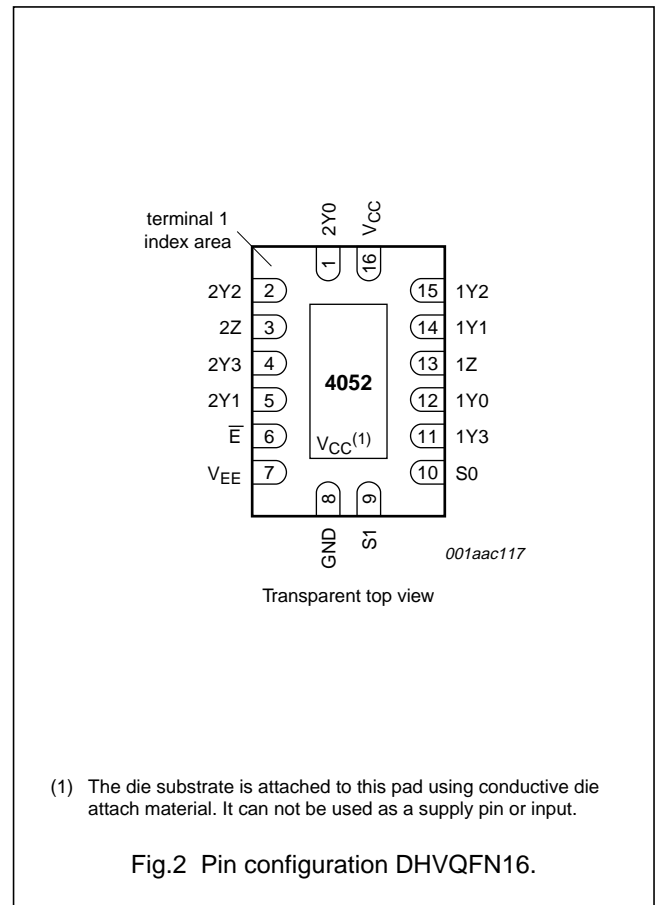


Fig.1 Pin configuration DIP16, SO16 and (T)SSOP16.



(1) The die substrate is attached to this pad using conductive die attach material. It can not be used as a supply pin or input.

Fig.2 Pin configuration DHVQFN16.

Dual 4-channel analog multiplexer, demultiplexer

74HC4052; 74HCT4052

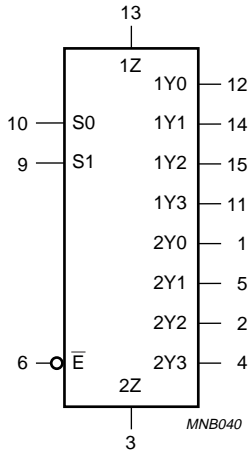


Fig.3 Logic symbol.

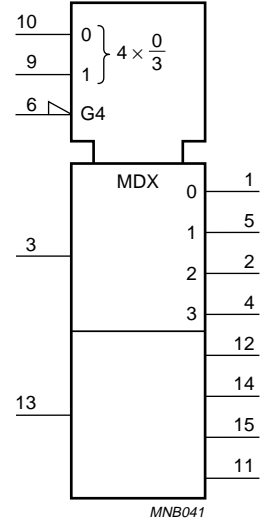


Fig.4 IEC logic symbol.

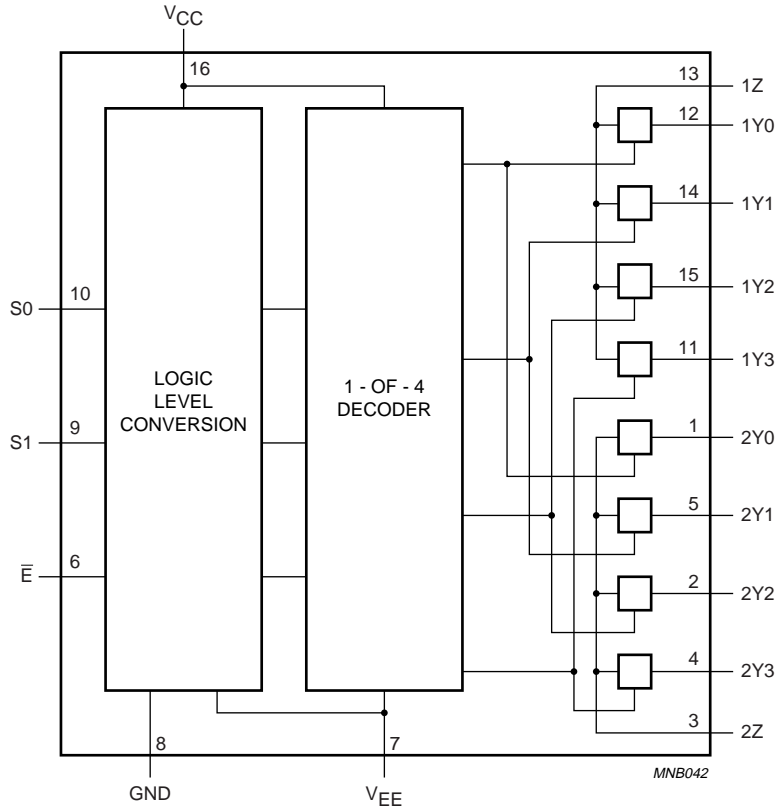


Fig.5 Functional diagram.



November 2004

LM137/LM337 3-Terminal Adjustable Negative Regulators

# LM137/LM337

## 3-Terminal Adjustable Negative Regulators

### General Description

The LM137/LM337 are adjustable 3-terminal negative voltage regulators capable of supplying in excess of -1.5A over an output voltage range of -1.2V to -37V. These regulators are exceptionally easy to apply, requiring only 2 external resistors to set the output voltage and 1 output capacitor for frequency compensation. The circuit design has been optimized for excellent regulation and low thermal transients. Further, the LM137 series features internal current limiting, thermal shutdown and safe-area compensation, making them virtually blowout-proof against overloads.

The LM137/LM337 serve a wide variety of applications including local on-card regulation, programmable-output voltage regulation or precision current regulation. The LM137/LM337 are ideal complements to the LM117/LM317 adjustable positive regulators.

### Features

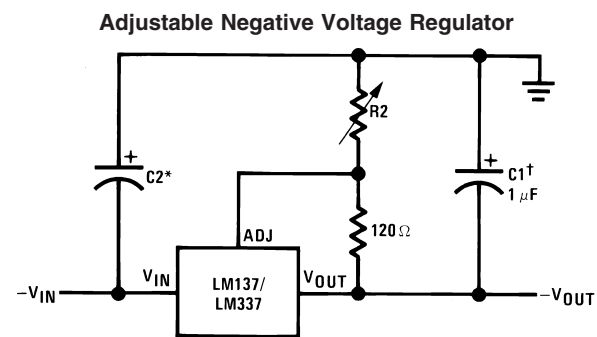
- Output voltage adjustable from -1.2V to -37V
- 1.5A output current guaranteed, -55°C to +150°C
- Line regulation typically 0.01%/V
- Load regulation typically 0.3%

- Excellent thermal regulation, 0.002%/W
- 77 dB ripple rejection
- Excellent rejection of thermal transients
- 50 ppm/°C temperature coefficient
- Temperature-independent current limit
- Internal thermal overload protection
- P+ Product Enhancement tested
- Standard 3-lead transistor package
- Output is short circuit protected

### LM137 Series Packages and Power Capability

Device	Package	Rated Power Dissipation	Design Load Current
LM137/337	TO-3 (K)	20W	1.5A
	TO-39 (H)	2W	0.5A
LM337	TO-220 (T)	15W	1.5A
LM337	SOT-223 (MP)	2W	1A

### Typical Applications



00906701

Full output current not available at high input-output voltages

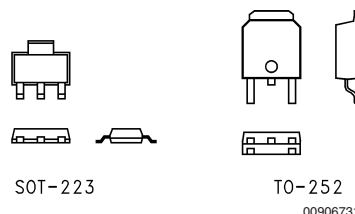
$$-V_{OUT} = -1.25V \left( 1 + \frac{R2}{120} \right) + (-I_{ADJ} \times R2)$$

†C1 = 1 μF solid tantalum or 10 μF aluminum electrolytic required for stability

\*C2 = 1 μF solid tantalum is required only if regulator is more than 4" from power-supply filter capacitor

Output capacitors in the range of 1 μF to 1000 μF of aluminum or tantalum electrolytic are commonly used to provide improved output impedance and rejection of transients

### Comparison between SOT-223 and D-Pak (TO-252) Packages



Scale 1:1

00906731

JST1162/JSR1162

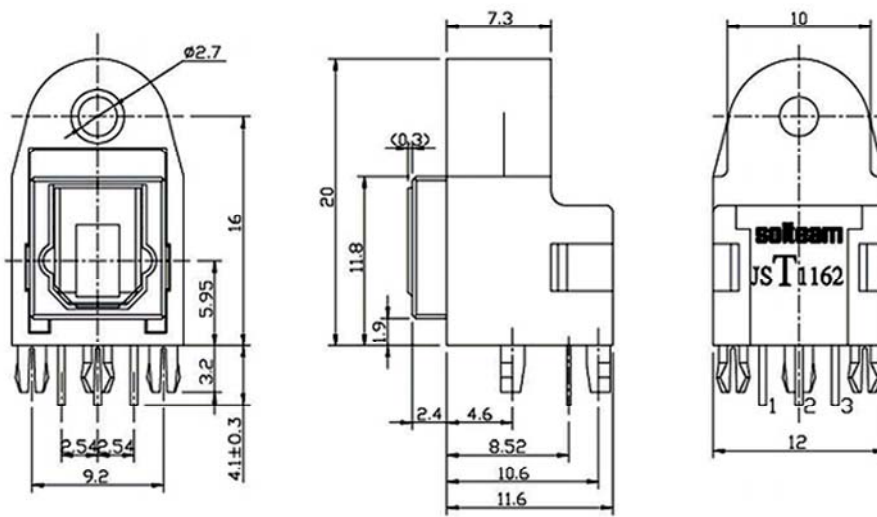
HOME > Products > Optical > standard type

JST1162/JSR1162

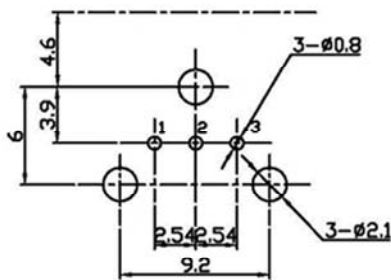


- Shutter type
- Screw use holder
- Offer TX/RX (Transmitter / Receiver)
- TX: Gray / RX: Black
- 16/25/50 Mbps optical transmitting option
- Application: DVD Player, audio amplifier

DIMENSIONS: in mm



PCB LAYOUT



PIN FUNCTION: 1.GND  
2.Vcc  
3.Vin

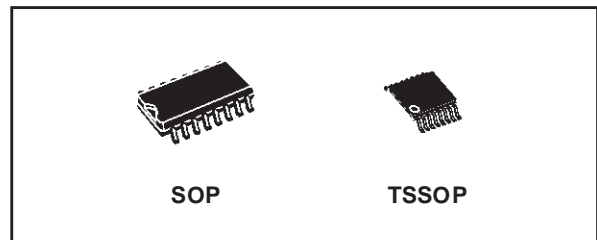
- Notes:
1. All dimensions are in millimeters
  2. General Tolerance: ±0.2mm
  3. Shutter Color: GRAY
  4. Meet ROHS/SONY SS-00259/JPGSSI



# 74LCX139

## LOW VOLTAGE CMOS DUAL 2 TO 4 DECODER/DEMULTIPLEXER

- 5V TOLERANT INPUTS
- HIGH SPEED :  
 $t_{PD} = 6.2ns$  (MAX.) at  $V_{CC} = 3V$
- POWER DOWN PROTECTION ON INPUTS AND OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 24mA$  (MIN) at  $V_{CC} = 3V$
- PCI BUS LEVELS GUARANTEED AT 24 mA
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}(OPR) = 2.0V$  to  $3.6V$  (1.5V Data Retention)
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 139
- LATCH-UP PERFORMANCE EXCEEDS 500mA (JESD 17)
- ESD PERFORMANCE:  
 HBM > 2000V (MIL STD 883 method 3015);  
 MM > 200V



### ORDER CODES

PACKAGE	TUBE	T & R
SOP	74LCX139M	74LCX139MTR
TSSOP		74LCX139TTR

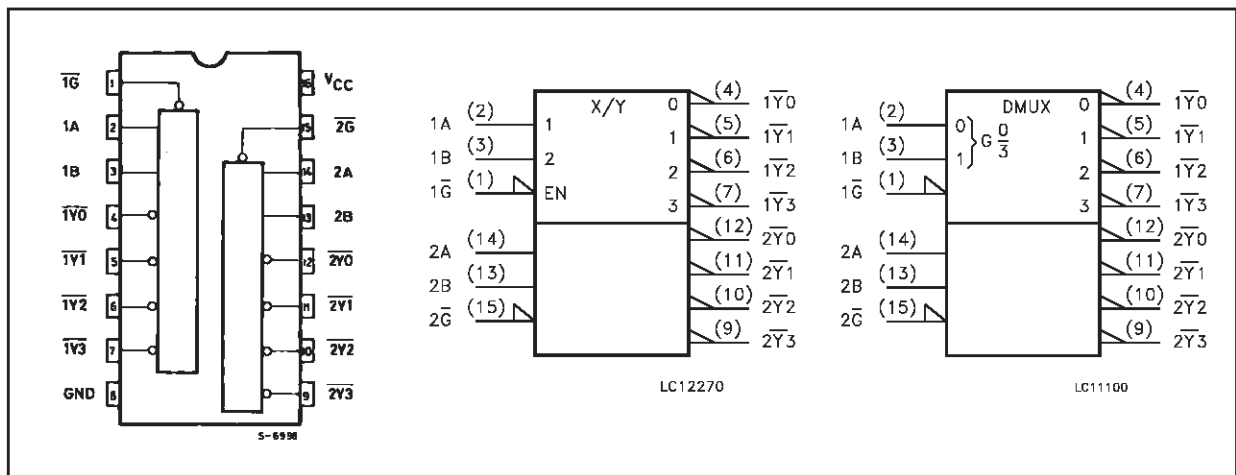
### DESCRIPTION

The 74LCX139 is a low voltage CMOS DUAL 2 TO 4 LINE DECODER/DEMULTIPLEXER fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology. It is ideal for low power and high speed 3.3V applications; it can be interfaced to 5V signal environment for inputs.

The active low enable input can be used for gating or as a data input for demultiplexing applications. While the enable input is held high, all four outputs are high independently of the other inputs. It has same speed performance at 3.3V than 5V AC/ACT family, combined with a lower power consumption.

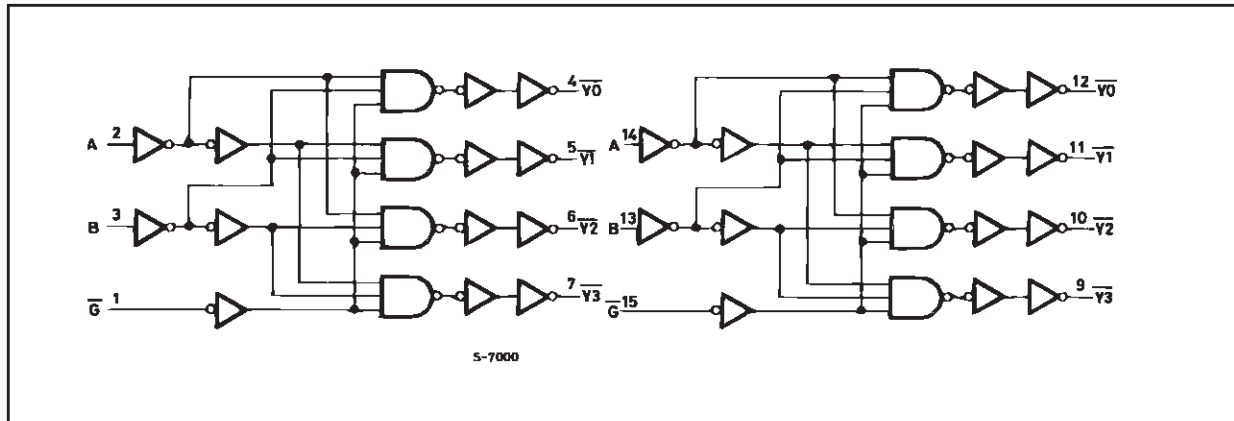
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



74LCX139

LOGIC DIAGRAM



This logic diagram has not be used to estimate propagation delays

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	-0.5 to +7.0	V
$V_I$	DC Input Voltage	-0.5 to +7.0	V
$V_O$	DC Output Voltage ( $V_{CC} = 0V$ )	-0.5 to +7.0	V
$V_O$	DC Output Voltage (High or Low State) (note 1)	-0.5 to $V_{CC} + 0.5$	V
$I_{IK}$	DC Input Diode Current	- 50	mA
$I_{OK}$	DC Output Diode Current (note 2)	- 50	mA
$I_O$	DC Output Current	$\pm 50$	mA
$I_{CC}$	DC Supply Current per Supply Pin	$\pm 100$	mA
$I_{GND}$	DC Ground Current per Supply Pin	$\pm 100$	mA
$T_{stg}$	Storage Temperature	-65 to +150	$^{\circ}C$
$T_L$	Lead Temperature (10 sec)	300	$^{\circ}C$

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied

1)  $I_O$  absolute maximum rating must be observed

2)  $V_O < GND$

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage (note 1)	2.0 to 3.6	V
$V_I$	Input Voltage	0 to 5.5	V
$V_O$	Output Voltage ( $V_{CC} = 0V$ )	0 to 5.5	V
$V_O$	Output Voltage (High or Low State)	0 to $V_{CC}$	V
$I_{OH}, I_{OL}$	High or Low Level Output Current ( $V_{CC} = 3.0$ to $3.6V$ )	$\pm 24$	mA
$I_{OH}, I_{OL}$	High or Low Level Output Current ( $V_{CC} = 2.7V$ )	$\pm 12$	mA
$T_{op}$	Operating Temperature	-55 to 125	$^{\circ}C$
dt/dv	Input Rise and Fall Time (note 2)	0 to 10	ns/V

1) Truth Table guaranteed: 1.5V to 3.6V

2)  $V_{IN}$  from 0.8V to 2V at  $V_{CC} = 3.0V$







March 1995  
Revised February 2005

# 74LCX125

## Low Voltage Quad Buffer with 5V Tolerant Inputs and Outputs

### General Description

The LCX125 contains four independent non-inverting buffers with 3-STATE outputs. The inputs tolerate voltages up to 7V allowing the interface of 5V systems to 3V systems. The 74LCX125 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

### Features

- 5V tolerant inputs and outputs
- 2.3V–3.6V  $V_{CC}$  specifications provided
- 6.0 ns  $t_{PD}$  max ( $V_{CC} = 3.3V$ ), 10  $\mu A$   $I_{CC}$  max
- Power down high impedance inputs and outputs
- Supports live insertion/withdrawal (Note 1)
- $\pm 24$  mA output drive ( $V_{CC} = 3.0V$ )
- Implements patented noise/EMI reduction circuitry
- Latch-up performance exceeds JEDEC 78 conditions
- ESD performance:
  - Human body model > 2000V
  - Machine model > 100V
- Leadless Pb-Free DQFN package

**Note 1:** To ensure the high-impedance state during power up or down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pull-up resistor: the minimum value of the resistor is determined by the current-sourcing capability of the driver.

### Ordering Code:

Order Number	Package Number	Package Description
74LCX125M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74LCX125MX_NL (Note 3)	M14A	Pb-Free 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74LCX125SJ	M14D	Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74LCX125BQX (Note 2)	MLP014A	Pb-Free 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm
74LCX125MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74LCX125MTCX_NL (Note 3)	MTC14	Pb-Free 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

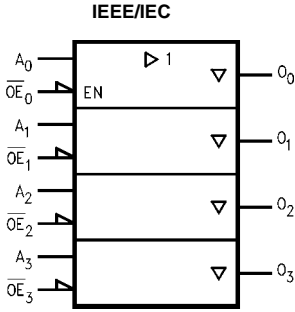
Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.  
Pb-Free package per JEDEC J-STD-020B.

**Note 2:** DQFN package available in Tape and Reel only.

**Note 3:** "\_NL" indicates Pb-Free package (per JEDEC J-STD-020B). Device available in Tape and Reel only.

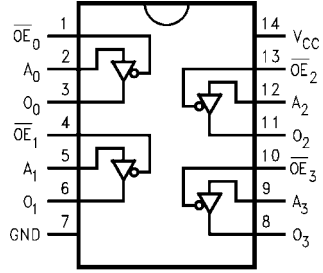
74LCX125 Low Voltage Quad Buffer with 5V Tolerant Inputs and Outputs

**Logic Symbol**



**Connection Diagrams**

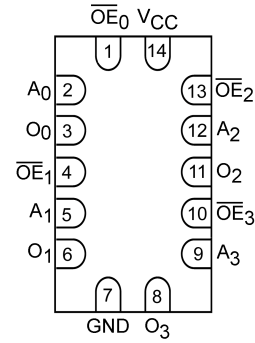
Pin Assignments for SOIC, SOP, and TSSOP



**Pin Descriptions**

Pin Names	Description
$A_n$	Inputs
$\overline{OE}_n$	Output Enable Inputs
$O_n$	Outputs

Pad Assignments for DQFN

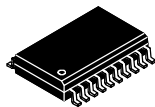


(Top View)

**Truth Table**

Inputs		Output
$\overline{OE}_n$	$A_n$	$O_n$
L	L	L
L	H	H
H	X	Z

H = HIGH Voltage Level      Z = High Impedance  
 L = LOW Voltage Level      X = Immaterial



## HIGH FIDELITY HEADPHONE AMPLIFIER

### FEATURES

- 80 mW into 600  $\Omega$  From a  $\pm 12$ -V Supply at 0.00014% THD + N
- Current-Feedback Architecture
- Greater than 120 dB of Dynamic Range
- SNR of 120 dB
- Output Voltage Noise of 5  $\mu$ Vrms at Gain = 2 V/V
- Power Supply Range:  $\pm 5$  V to  $\pm 15$  V
- 1300 V/ $\mu$ s Slew Rate
- Differential Inputs
- Independent Power Supplies for Low Crosstalk
- Short Circuit and Thermal Protection

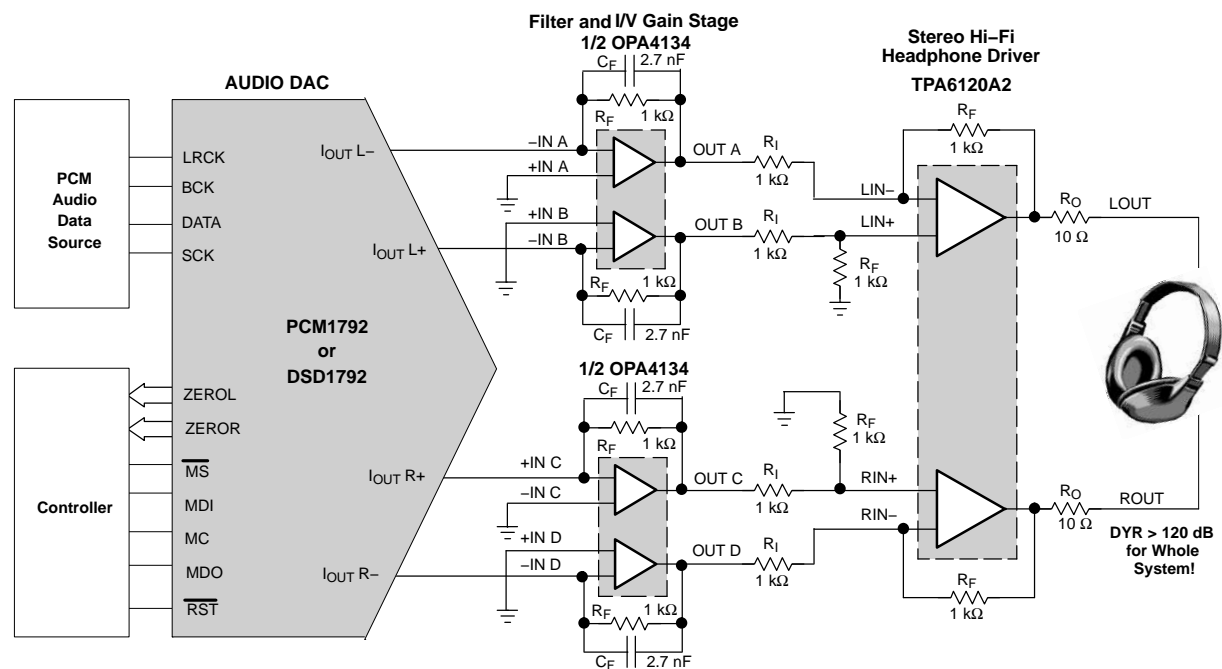
### APPLICATIONS

- Professional Audio Equipment
- Mixing Boards
- Headphone Distribution Amplifiers
- Headphone Drivers
- Microphone Preamplifiers

### DESCRIPTION

The TPA6120A2 is a high fidelity audio amplifier built on a current-feedback architecture. This high bandwidth, extremely low noise device is ideal for high performance equipment. The better than 120 dB of dynamic range exceeds the capabilities of the human ear, ensuring that nothing audible is lost due to the amplifier. The solid design and performance of the TPA6120A2 ensures that music, not the amplifier, is heard.

Three key features make current-feedback amplifiers outstanding for audio. The first feature is the high slew rate that prevents odd order distortion anomalies. The second feature is current-on-demand at the output that enables the amplifier to respond quickly and linearly when necessary without risk of output distortion. When large amounts of output power are suddenly needed, the amplifier can respond extremely quickly without raising the noise floor of the system and degrading the signal-to-noise ratio. The third feature is the gain-independent frequency response that allows the full bandwidth of the amplifier to be used over a wide range of gain settings. The excess loop gain does not deteriorate at a rate of 20 dB/decade.

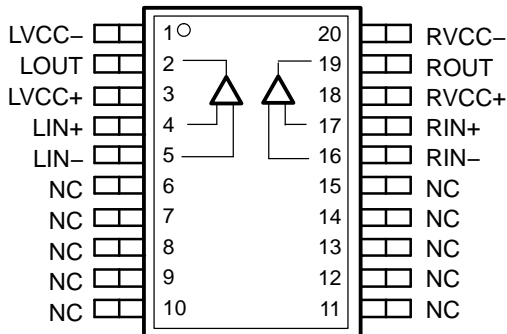


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PowerPAD is a trademark of Texas Instruments.

**DEVICE INFORMATION**

Thermally Enhanced SOIC (DWP)  
PowerPAD™ Package  
Top View



NC – No internal connection

**TERMINAL FUNCTIONS**

PIN NAME	PIN NUMBER	I/O	DESCRIPTION
LVCC-	1	I	Left channel negative power supply – must be kept at the same potential as RVCC-.
LOUT	2	O	Left channel output
LVCC+	3	I	Left channel positive power supply
LIN+	4	I	Left channel positive input
LIN-	5	I	Left channel negative input
NC	6,7,8,9,10,11,12,13,14,15	-	Not internally connected
RIN-	16	I	Right channel negative input
RIN+	17	I	Right channel positive input
RVCC+	18	I	Right channel positive power supply
ROUT	19	O	Right channel output
RVCC-	20	I	Right channel negative power supply - must be kept at the same potential as LVCC-.
Thermal Pad	-	-	Connect to ground. The thermal pad must be soldered down in all applications to properly secure device on the PCB.

## Features

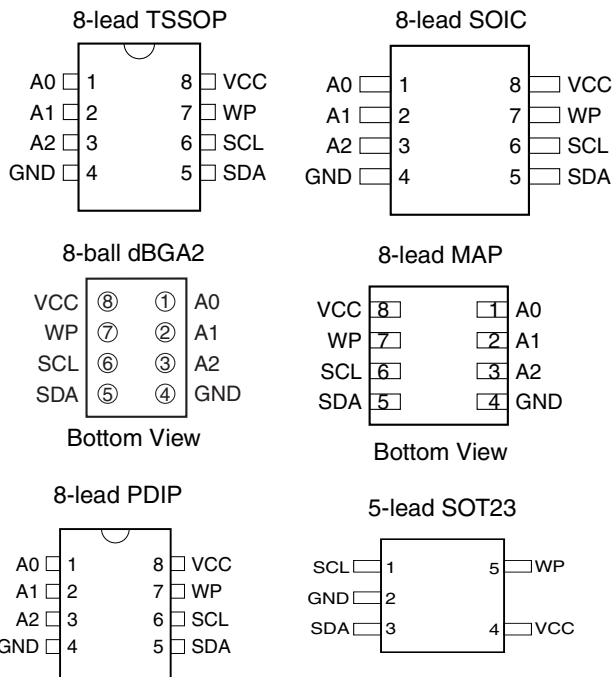
- **Low-voltage and Standard-voltage Operation**
  - 2.7 (V<sub>CC</sub> = 2.7V to 5.5V)
  - 1.8 (V<sub>CC</sub> = 1.8V to 5.5V)
- **Internally Organized 128 x 8 (1K), 256 x 8 (2K), 512 x 8 (4K), 1024 x 8 (8K) or 2048 x 8 (16K)**
- **Two-wire Serial Interface**
- **Schmitt Trigger, Filtered Inputs for Noise Suppression**
- **Bidirectional Data Transfer Protocol**
- **100 kHz (1.8V) and 400 kHz (2.5V, 2.7V, 5V) Compatibility**
- **Write Protect Pin for Hardware Data Protection**
- **8-byte Page (1K, 2K), 16-byte Page (4K, 8K, 16K) Write Modes**
- **Partial Page Writes Allowed**
- **Self-timed Write Cycle (5 ms max)**
- **High-reliability**
  - **Endurance: 1 Million Write Cycles**
  - **Data Retention: 100 Years**
- **Automotive Grade, Extended Temperature and Lead-free/Halogen-free Devices Available**
- **8-lead PDIP, 8-lead JEDEC SOIC, 8-lead MAP, 5-lead SOT23, 8-lead TSSOP and 8-ball dBGAA2 Packages**
- **Die Sales: Wafer Form, Waffle Pack and Bumped Wafers**

## Description

The AT24C01A/02/04/08/16 provides 1024/2048/4096/8192/16384 bits of serial electrically erasable and programmable read-only memory (EEPROM) organized as 128/256/512/1024/2048 words of 8 bits each. The device is optimized for use in many industrial and commercial applications where low-power and low-voltage operation are essential. The AT24C01A/02/04/08/16 is available in space-saving 8-lead PDIP, 8-lead JEDEC SOIC, 8-lead MAP, 5-lead SOT23 (AT24C01A/AT24C02/AT24C04), 8-lead TSSOP, and 8-ball dBGAA2 packages and is accessed via a Two-wire serial interface. In addition, the entire family is available in 2.7V (2.7V to 5.5V) and 1.8V (1.8V to 5.5V) versions.

**Table 1. Pin Configuration**

Pin Name	Function
A0 - A2	Address Inputs
SDA	Serial Data
SCL	Serial Clock Input
WP	Write Protect
NC	No Connect
GND	Ground
VCC	Power Supply



## Two-wire Serial EEPROM

1K (128 x 8)

2K (256 x 8)

4K (512 x 8)

8K (1024 x 8)

16K (2048 x 8)

**AT24C01A**

**AT24C02**

**AT24C04**

**AT24C08<sup>(1)</sup>**

**AT24C16<sup>(2)</sup>**

- Note: 1. This device is not recommended for new designs. Please refer to AT24C08A.
2. This device is not recommended for new designs. Please refer to AT24C16A.





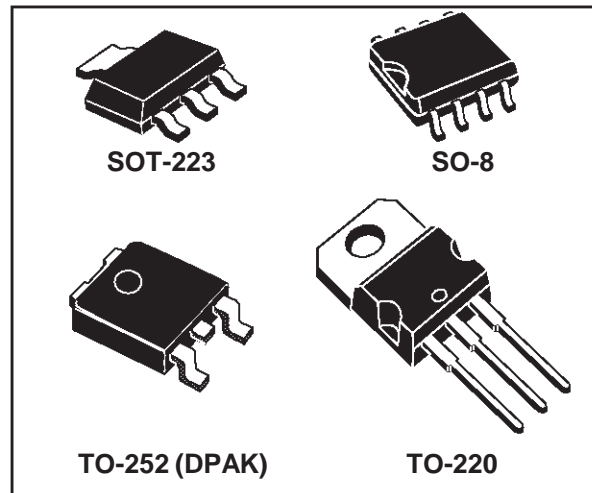
# LD1117 SERIES

## LOW DROP FIXED AND ADJUSTABLE POSITIVE VOLTAGE REGULATORS

- LOW DROPOUT VOLTAGE (1V TYP)
- 2.85V DEVICE PERFORMANCES ARE SUITABLE FOR SCSI-2 ACTIVE TERMINATION
- OUTPUT CURRENT UP TO 800mA
- FIXED OUTPUT VOLTAGE OF: 1.8V, 2.5V, 2.85V, 3.0V, 3.3V, 5.0V
- ADJUSTABLE VERSION AVAILABILITY ( $V_{ref}=1.25V$ )
- INTERNAL CURRENT AND THERMAL LIMIT
- AVAILABLE IN  $\pm 1\%$  (AT 25°C) AND 2% IN FULL TEMPERATURE RANGE
- SUPPLY VOLTAGE REJECTION : 75 dB (TYP)
- TEMPERATURE RANGE : 0°C TO 125°C

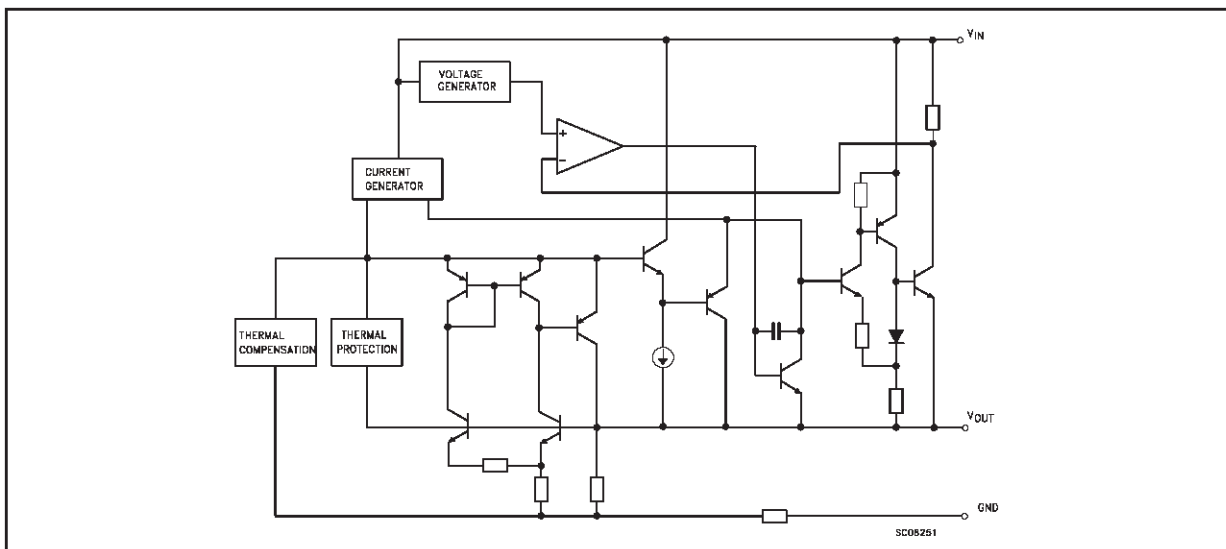
### DESCRIPTION

The LD1117 is a LOW DROP Voltage Regulator able to provide up to 800mA of Output Current, available even in adjustable version ( $V_{ref}=1.25V$ ). Concerning fixed versions, are offered the following Output Voltages: 2.5V, 2.85V, 3.0V 3.3V and 5.0V. The 2.85V type is ideal for SCSI-2 lines active termination. The device is supplied in: SOT-223, DPAK, SO-8 and TO-220. The SOT-223 and DPAK surface mount packages optimize the thermal characteristics even offering a relevant space saving effect. High efficiency is assured by NPN



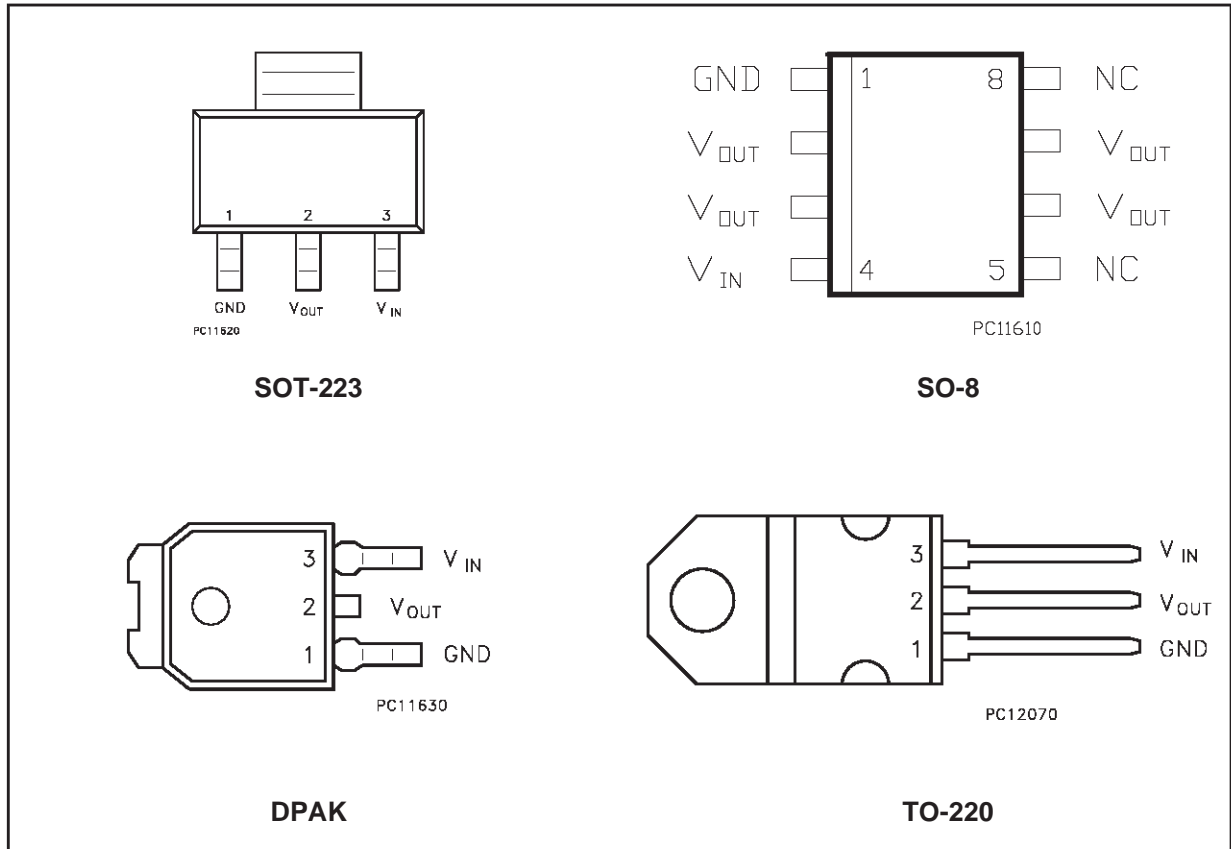
pass transistor. In fact in this case, unlike than PNP one, the Quiescent Current flows mostly into the load. Only a very common 10 $\mu$ F minimum capacitor is needed for stability. On chip trimming allows the regulator to reach a very tight output voltage tolerance, within  $\pm 1\%$  at 25 °C. The ADJUSTABLE LD1117 is pin to pin compatible with the other standard Adjustable voltage regulators maintaining the better performances in terms of Drop and Tolerance.

### BLOCK DIAGRAM



**LD1117 SERIES**

**CONNECTION DIAGRAM AND ORDERING NUMBERS (top view)**



SOT-223	SO-8	DPAK	TO-220	Output Voltage
LD1117S18	LD1117D18	LD1117DT18	LD1117V18	1.8V
LD1117S18C	LD1117D18C	LD1117DT18C	LD1117V18C	1.8V
LD1117S25	LD1117D25	LD1117DT25	LD1117V25	2.5V
LD1117S25C	LD1117D25C	LD1117DT25C	LD1117V25C	2.5V
LD1117S28	LD1117D28	LD1117DT28	LD1117V28	2.85V
LD1117S30	LD1117D30	LD1117DT30	LD1117V30	3V
LD1117S30C	LD1117D30C	LD1117DT30C	LD1117V30C	3V
LD1117S33	LD1117D33	LD1117DT33	LD1117V33	3.3V
LD1117S33C	LD1117D33C	LD1117DT33C	LD1117V33C	3.3V
LD1117S50	LD1117D50	LD1117DT50	LD1117V50	5V
LD1117S50C	LD1117D50C	LD1117DT50C	LD1117V50C	5V
LD1117S	LD1117D	LD1117DT	LD1117V	ADJUSTABLE FROM 1.25 TO 15V




**MICROCHIP**

# PIC18F87J10 FAMILY

## 64/80-Pin, High-Performance, 1-Mbit Flash Microcontrollers with nanoWatt Technology

### Special Microcontroller Features:

- Operating voltage range: 2.0V to 3.6V
- 5.5V tolerant input (digital pins only)
- On-chip 2.5V regulator
- Low-power, high-speed CMOS Flash technology
- C compiler optimized architecture:
  - Optional extended instruction set designed to optimize re-entrant code
- Priority levels for interrupts
- 8 x 8 Single-Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT):
  - Programmable period from 4 ms to 131s
- Single-Supply In-Circuit Serial Programming™ (ICSP™) via two pins
- In-Circuit Debug (ICD) with three Break points via two pins
- Power-Managed modes:
  - Run: CPU on, peripherals on
  - Idle: CPU off, peripherals on
  - Sleep: CPU off, peripherals off

### Flexible Oscillator Structure:

- Two Crystal modes, up to 40 MHz
- 4x Phase Lock Loop (PLL)
- Two External Clock modes, up to 40 MHz
- Internal 31 kHz oscillator
- Secondary oscillator using Timer1 @ 32 kHz
- Two-Speed Oscillator Start-up
- Fail-Safe Clock Monitor:
  - Allows for safe shutdown if peripheral clock stops

### Peripheral Highlights:

- High-current sink/source 25 mA/25 mA (PORTB and PORTC)
- Four programmable external interrupts
- Four input change interrupts
- Two Capture/Compare/PWM (CCP) modules
- Three Enhanced Capture/Compare/PWM (ECCP) modules:
  - One, two or four PWM outputs
  - Selectable polarity
  - Programmable dead time
  - Auto-Shutdown and Auto-Restart
- Two Master Synchronous Serial Port (MSSP) modules supporting 3-wire SPI™ (all 4 modes) and I<sup>2</sup>C™ Master and Slave modes
- Two Enhanced Addressable USART modules:
  - Supports RS-485, RS-232 and LIN 1.2
  - Auto-Wake-up on Start bit
  - Auto-Baud Detect
- 10-bit, up to 15-channel Analog-to-Digital Converter module (A/D):
  - Auto-acquisition capability
  - Conversion available during Sleep
  - Self-calibration feature
- Dual analog comparators with input multiplexing

### External Memory Bus (PIC18F8XJ10/8XJ15 only):

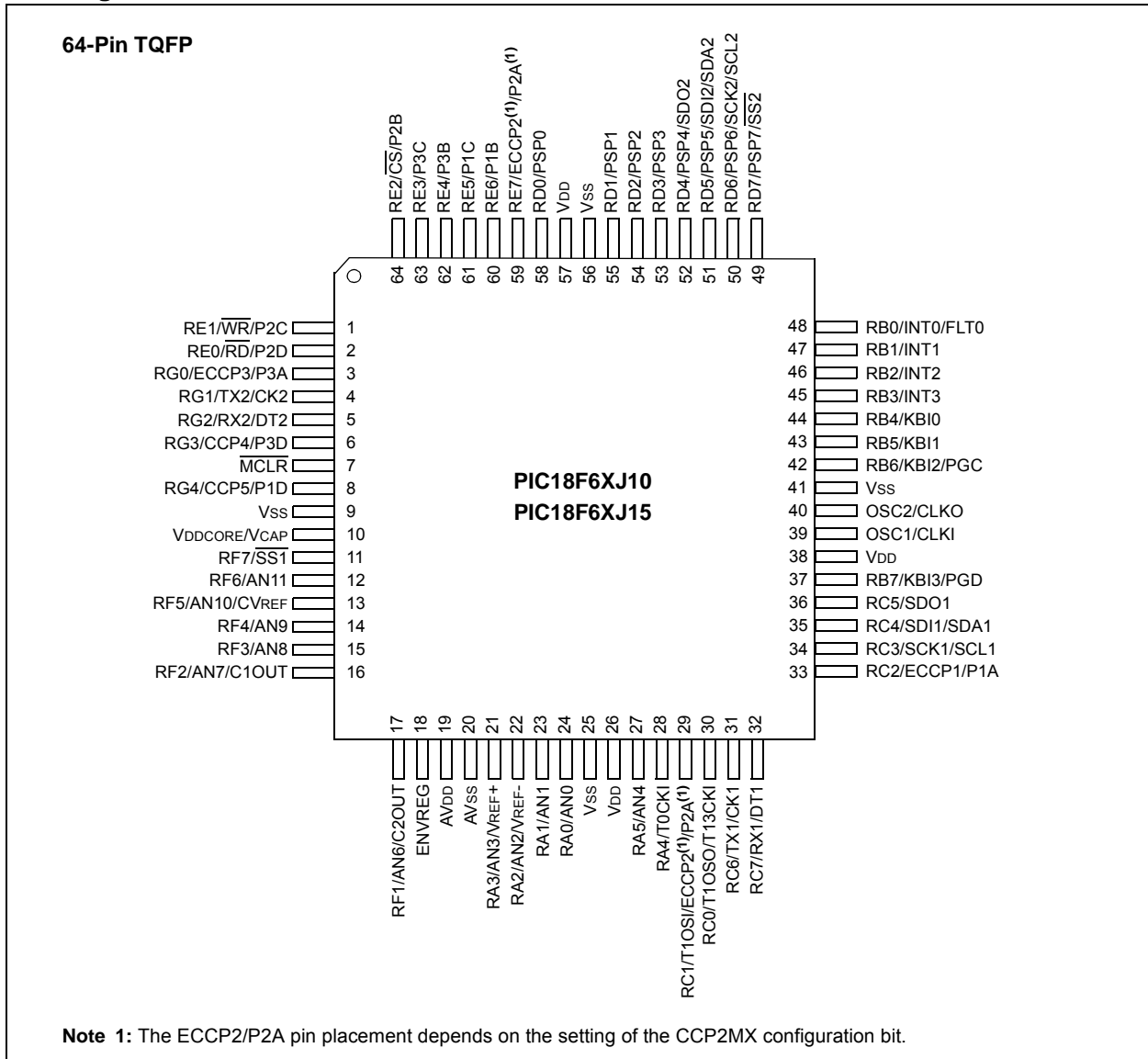
- Address capability of up to 2 Mbytes
- 8-bit or 16-bit interface
- 12-bit, 16-bit and 20-bit Addressing modes



# PIC18F87J10 FAMILY

Device	Program Memory		SRAM Data Memory (bytes)	I/O	10-bit A/D (ch)	CCP/ ECCP (PWM)	MSSP		EUSART	Comparators	Timers 8/16-bit	External Bus	
	Flash (bytes)	# Single-Word Instructions					SPI™	Master I <sup>2</sup> C™					
PIC18F65J10	32K	16384	2048	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F65J15	48K	24576	2048	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F66J10	64K	32768	2048	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F66J15	96K	49152	3936	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F67J10	128K	65536	3936	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F85J10	32K	16384	2048	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F85J15	48K	24576	2048	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F86J10	64K	32768	2048	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F86J15	96K	49152	3936	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F87J10	128K	65536	3936	66	15	2/3	2	Y	Y	2	2	2/3	Y

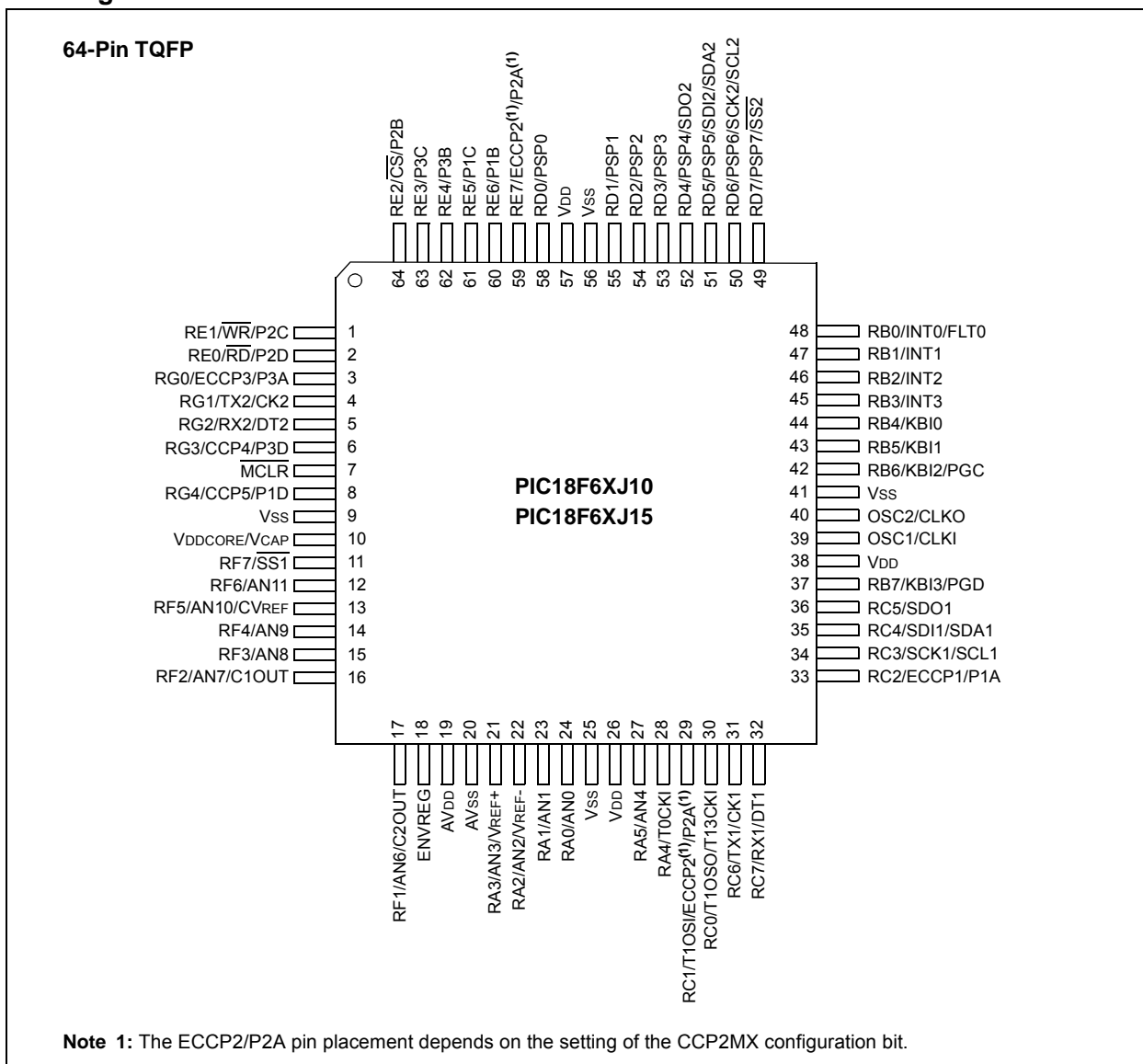
## Pin Diagrams



# PIC18F66J10 FAMILY

Device	Program Memory		SRAM Data Memory (bytes)	I/O	10-bit A/D (ch)	CCP/ ECCP (PWM)	MSSP		EUSART	Comparators	Timers 8/16-bit	External Bus	
	Flash (bytes)	# Single-Word Instructions					SPI™	Master I <sup>2</sup> C™					
PIC18F65J10	32K	16384	2048	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F65J15	48K	24576	2048	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F66J10	64K	32768	2048	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F66J15	96K	49152	3936	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F67J10	128K	65536	3936	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F85J10	32K	16384	2048	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F85J15	48K	24576	2048	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F86J10	64K	32768	2048	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F86J15	96K	49152	3936	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F87J10	128K	65536	3936	66	15	2/3	2	Y	Y	2	2	2/3	Y

## Pin Diagrams





# High Density Mounting Type Photocoupler

## LTV-817 Series

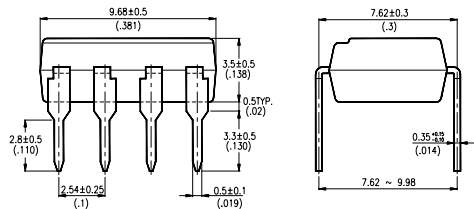
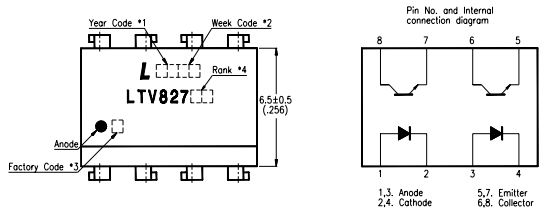
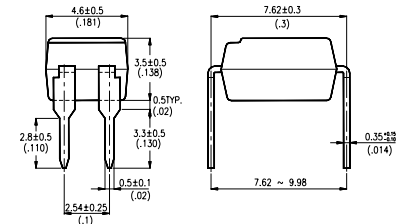
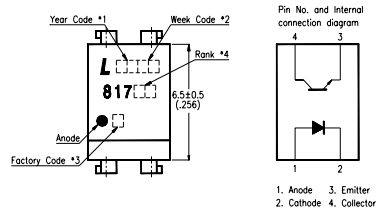
### Features

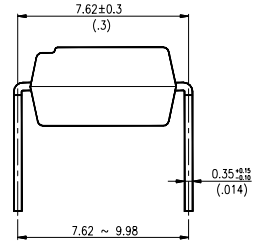
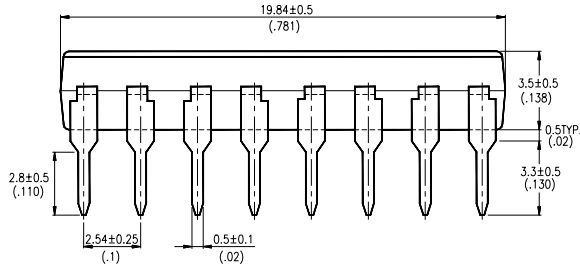
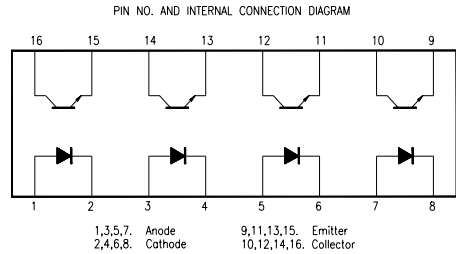
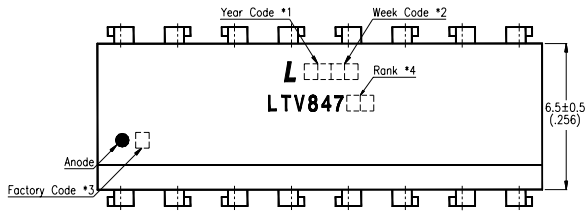
- Current transfer ratio  
(CTR : MIN. 50% at  $I_F=5mA$ ,  $V_{CE}=5V$ )
- High input-output isolation voltage:  
(Viso : 5,000V<sub>rms</sub>)
- Compact dual-in-line package  
LTV-817 : 1-channel type  
LTV-827 : 2-channel type  
LTV-847 : 4-channel type
- UL approved (No. E113898)
- TUV approved (No. R9653630)
- CSA approved (No. CA91533-1)
- FIMKO approved (No. 202634)
- NEMKO approved (No. P98101945)
- DEMKO approved (No. 307857)
- SEMKO approved (No. 9832157/01-03)
- VDE approved (No. 094722)
- Options available :  
-Leads with 0.4"(10.16mm)spacing (M Type)  
-Leads bends for surface mounting(S Type)  
-Tape and Reel of Type I for SMD(Add"-TA"Suffix)  
-Tape and Reel of Type II for SMD(Add"-TA1"Suffix)  
-VDE 0884 approvals (Add"-V"Suffix)

### Applications

1. Computer terminals.
2. System appliances, measuring instruments.
3. Registers, copiers, automatic vending machines.
4. Electric home appliances such as fan heaters, etc.
5. Signal transmission between circuits of different potentials and impedances.

### Package Dimensions





Note:

1. Year date code.
2. 2-digit work week.
3. Factory code shall be marked (Z : Taiwan, Y : Thailand).
4. Rank shall be or shall not be marked.
5. All dimensions are in millimeters (inches).
6. Tolerance is  $\pm 0.25\text{mm}$  (.010") unless otherwise noted.
7. Specifications are subject to change without notice.

Ordering Information

Part Number	Package	Safety Standard Approval	Application part number
LTV-817 LTV-817M LTV-817S LTV-817S-TA LTV-817S-TA1	4-pin DIP 4-pin (leads with 0.4" spacing) 4-pin (lead bends for surface mount) 4-pin (tape and reel packaging of type I) 4-pin (tape and reel packaging of type II)	<ul style="list-style-type: none"> <li>• UL approved</li> <li>• TUV approved</li> <li>• CSA approved</li> <li>• FIMKO approved</li> <li>• NEMKO approved</li> <li>• SEMKO approved</li> <li>• DEMKO approved</li> </ul>	LTV-817
LTV-827 LTV-827M LTV-827S LTV-827S-TA LTV-827S-TA1	8-pin DIP 8-pin (leads with 0.4" spacing) 8-pin (lead bends for surface mount) 8-pin (tape and reel packaging of type I) 8-pin (tape and reel packaging of type II)		LTV-827
LTV-847 LTV-847M LTV-847S LTV-847S-TA LTV-847S-TA1	16-pin DIP 16-pin (leads with 0.4" spacing) 16-pin (lead bends for surface mount) 16-pin (tape and reel packaging of type I) 16-pin (tape and reel packaging of type II)		LTV-847
LTV817-V LTV817M-V LTV817S-V LTV817STA-V LTV817STA1-V	4-pin DIP 4-pin (leads with 0.4" spacing) 4-pin (lead bends for surface mount) 4-pin (tape and reel packaging of type I) 4-pin (tape and reel packaging of type II)	<ul style="list-style-type: none"> <li>• VDE approved</li> </ul>	LTV-817
LTV827-V LTV827M-V LTV827S-V LTV827STA-V LTV827STA1-V	8-pin DIP 8-pin (leads with 0.4" spacing) 8-pin (lead bends for surface mount) 8-pin (tape and reel packaging of type I) 8-pin (tape and reel packaging of type II)		LTV-827
LTV847-V LTV847M-V LTV847S-V LTV847STA-V LTV847STA1-V	16-pin DIP 16-pin (leads with 0.4" spacing) 16-pin (lead bends for surface mount) 16-pin (tape and reel packaging of type I) 16-pin (tape and reel packaging of type II)		LTV-847

PHOTOCOUPLER



## +5V-Powered, Multichannel RS-232 Drivers/Receivers

### General Description

The MAX220–MAX249 family of line drivers/receivers is intended for all EIA/TIA-232E and V.28/V.24 communications interfaces, particularly applications where  $\pm 12V$  is not available.

These parts are especially useful in battery-powered systems, since their low-power shutdown mode reduces power dissipation to less than  $5\mu W$ . The MAX225, MAX233, MAX235, and MAX245/MAX246/MAX247 use no external components and are recommended for applications where printed circuit board space is critical.

### Applications

Portable Computers  
Low-Power Modems  
Interface Translation  
Battery-Powered RS-232 Systems  
Multidrop RS-232 Networks

### Features

#### Superior to Bipolar

- ◆ Operate from Single +5V Power Supply (+5V and +12V—MAX231/MAX239)
- ◆ Low-Power Receive Mode in Shutdown (MAX223/MAX242)
- ◆ Meet All EIA/TIA-232E and V.28 Specifications
- ◆ Multiple Drivers and Receivers
- ◆ 3-State Driver and Receiver Outputs
- ◆ Open-Line Detection (MAX243)

### Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX220CPE	0°C to +70°C	16 Plastic DIP
MAX220CSE	0°C to +70°C	16 Narrow SO
MAX220CWE	0°C to +70°C	16 Wide SO
MAX220C/D	0°C to +70°C	Dice*
MAX220EPE	-40°C to +85°C	16 Plastic DIP
MAX220ESE	-40°C to +85°C	16 Narrow SO
MAX220EWE	-40°C to +85°C	16 Wide SO
MAX220EJE	-40°C to +85°C	16 CERDIP
MAX220MJE	-55°C to +125°C	16 CERDIP

Ordering Information continued at end of data sheet.

\*Contact factory for dice specifications.

### Selection Table

Part Number	Power Supply (V)	No. of RS-232 Drivers/Rx	No. of Ext. Caps	Nominal Cap. Value ( $\mu F$ )	SHDN & Three-State	Rx Active in SHDN	Data Rate (kbps)	Features
MAX220	+5	2/2	4	0.1	No	—	120	Ultra-low-power, industry-standard pinout
MAX222	+5	2/2	4	0.1	Yes	—	200	Low-power shutdown
MAX223 (MAX213)	+5	4/5	4	1.0 (0.1)	Yes	✓	120	MAX241 and receivers active in shutdown
MAX225	+5	5/5	0	—	Yes	✓	120	Available in SO
MAX230 (MAX200)	+5	5/0	4	1.0 (0.1)	Yes	—	120	5 drivers with shutdown
MAX231 (MAX201)	+5 and +7.5 to +13.2	2/2	2	1.0 (0.1)	No	—	120	Standard +5/+12V or battery supplies; same functions as MAX232
MAX232 (MAX202)	+5	2/2	4	1.0 (0.1)	No	—	120 (64)	Industry standard
MAX232A	+5	2/2	4	0.1	No	—	200	Higher slew rate, small caps
MAX233 (MAX203)	+5	2/2	0	—	No	—	120	No external caps
MAX233A	+5	2/2	0	—	No	—	200	No external caps, high slew rate
MAX234 (MAX204)	+5	4/0	4	1.0 (0.1)	No	—	120	Replaces 1488
MAX235 (MAX205)	+5	5/5	0	—	Yes	—	120	No external caps
MAX236 (MAX206)	+5	4/3	4	1.0 (0.1)	Yes	—	120	Shutdown, three state
MAX237 (MAX207)	+5	5/3	4	1.0 (0.1)	No	—	120	Complements IBM PC serial port
MAX238 (MAX208)	+5	4/4	4	1.0 (0.1)	No	—	120	Replaces 1488 and 1489
MAX239 (MAX209)	+5 and +7.5 to +13.2	3/5	2	1.0 (0.1)	No	—	120	Standard +5/+12V or battery supplies; single-package solution for IBM PC serial port
MAX240	+5	5/5	4	1.0	Yes	—	120	DIP or flatpack package
MAX241 (MAX211)	+5	4/5	4	1.0 (0.1)	Yes	—	120	Complete IBM PC serial port
MAX242	+5	2/2	4	0.1	Yes	✓	200	Separate shutdown and enable
MAX243	+5	2/2	4	0.1	No	—	200	Open-line detection simplifies cabling
MAX244	+5	8/10	4	1.0	No	—	120	High slew rate
MAX245	+5	8/10	0	—	Yes	✓	120	High slew rate, int. caps, two shutdown modes
MAX246	+5	8/10	0	—	Yes	✓	120	High slew rate, int. caps, three shutdown modes
MAX247	+5	8/9	0	—	Yes	✓	120	High slew rate, int. caps, nine operating modes
MAX248	+5	8/8	4	1.0	Yes	✓	120	High slew rate, selective half-chip enables
MAX249	+5	6/10	4	1.0	Yes	✓	120	Available in quad flatpack package



Maxim Integrated Products

For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at [www.maxim-ic.com](http://www.maxim-ic.com).

# +5V-Powered, Multichannel RS-232 Drivers/Receivers

**MAX220-MAX249**

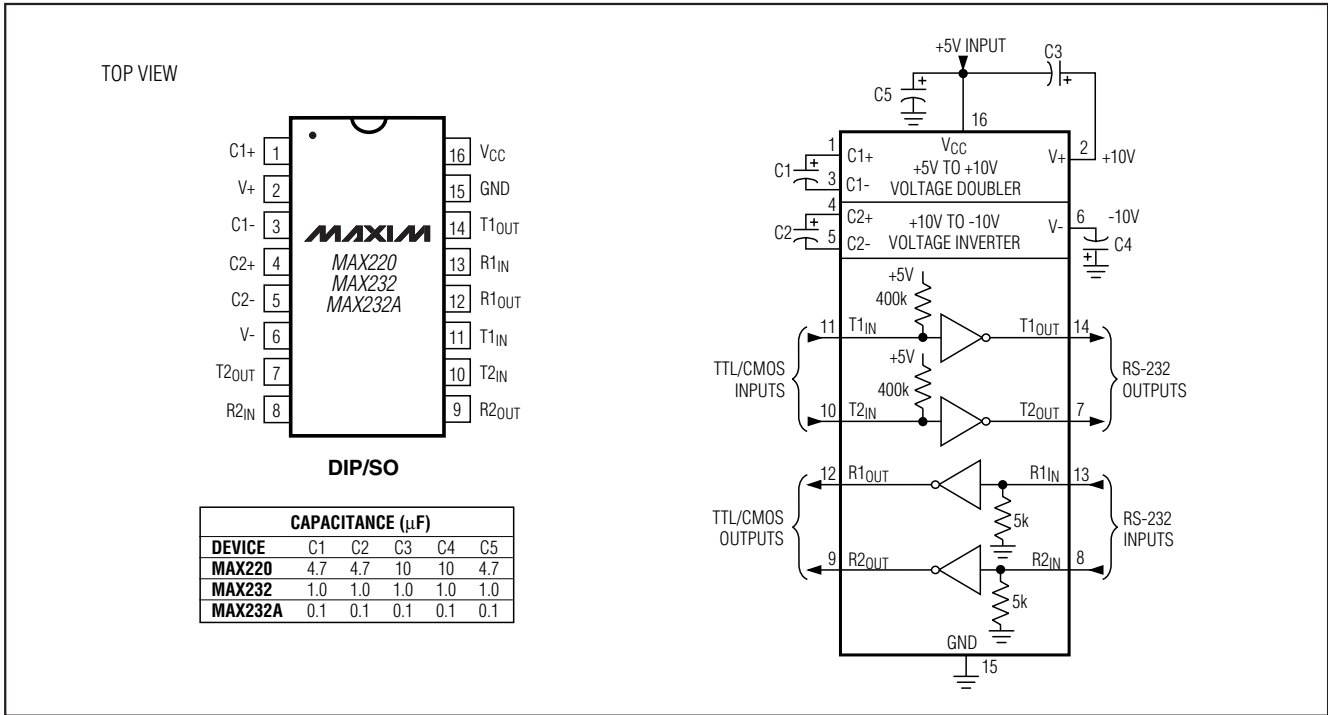


Figure 5. MAX220/MAX232/MAX232A Pin Configuration and Typical Operating Circuit

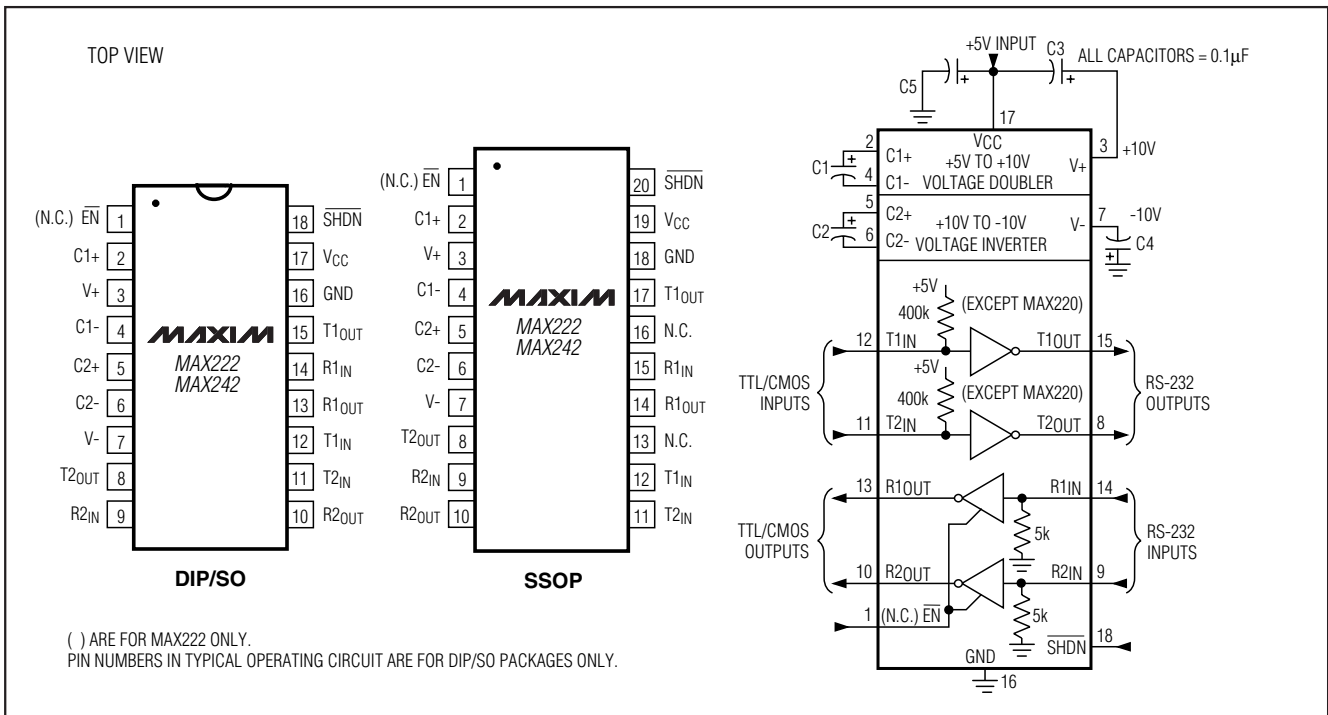


Figure 6. MAX222/MAX242 Pin Configurations and Typical Operating Circuit



# DS1818

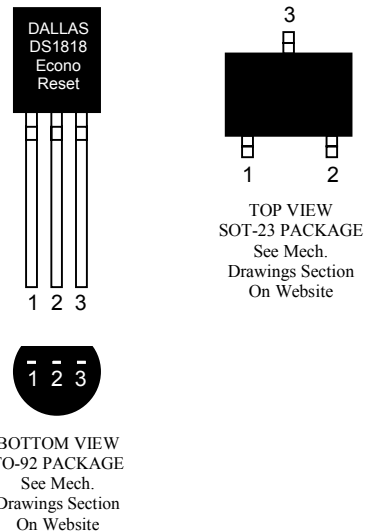
## 3.3V EconoReset with Pushbutton

[www.maxim-ic.com](http://www.maxim-ic.com)

### FEATURES

- Automatically restarts a microprocessor after power failure
- Monitors pushbutton for external override
- Maintains reset for 150 ms after  $V_{CC}$  returns to an in-tolerance condition
- Reduces need for discrete components
- Precision temperature-compensated voltage reference and voltage sensor
- Accurate 5%, 10% or 20% power monitoring
- Low-cost TO-92 or space saving surface mount SOT-23 packages available
- Efficient open-drain output with internal 5.5 k $\Omega$  pull-up resistor
- Operating temperature -40°C to +85°C

### PIN ASSIGNMENT



### PIN DESCRIPTION

#### TO-92

1	$\overline{RST}$	Active Low Reset Output
2	$V_{CC}$	Power Supply
3	GND	Ground

#### SOT-23

1	$\overline{RST}$	Active Low Reset Output
2	$V_{CC}$	Power Supply
3	GND	Ground

### DESCRIPTION

The DS1818 EconoReset uses a precision temperature-compensated reference and comparator circuit to monitor the status of the power supply ( $V_{CC}$ ). When an out-of-tolerance condition is detected, an internal power-fail signal is generated which forces reset to the active state. When  $V_{CC}$  returns to an in-tolerance condition, the reset signal is kept in the active state for approximately 150 ms to allow the power supply and processor to stabilize.

The DS1818 also monitors a pushbutton on the reset output. If the reset line is pulled low, a reset is generated upon release and the DS1818 output will be held in reset output low for typically 150 ms.

# FAN1112

## 1A 1.2V Low Dropout Linear Regulator

### Features

- Low dropout voltage
- Load regulation: 0.05% typical
- Trimmed current limit
- On-chip thermal limiting
- Standard SOT-223 and TO-252 packages
- Three-terminal fixed 1.2V

### Applications

- Post regulator for switching supplies
- Supply for low-voltage processors

### Description

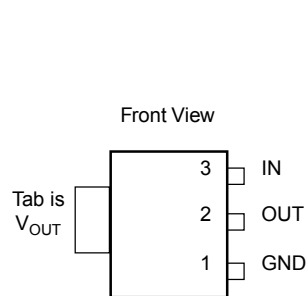
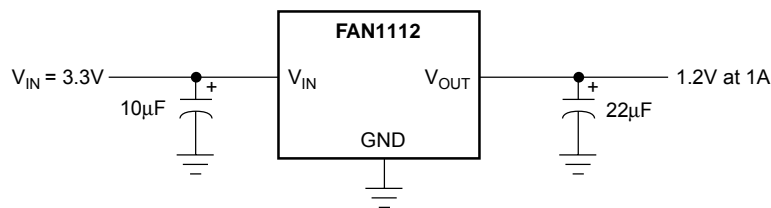
The FAN1112 is a 1.2V low dropout three-terminal regulator with 1A output current capability. The device has been optimized for low voltage where transient response and minimum input voltage are critical.

Current limit is trimmed to ensure specified output current and controlled short-circuit current. On-chip thermal limiting provides protection against any combination of overload and ambient temperatures that would create excessive junction temperatures.

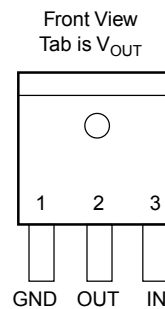
Unlike PNP type regulators where up to 10% of the output current is wasted as quiescent current, the quiescent current of the FAN1112 flows into the load, increasing efficiency.

The FAN1112 regulator is available in the industry-standard SOT-223 and TO-252 (DPAK) power packages.

### Typical Application



4-Lead Plastic SOT-223  
 $\theta_{JC} = 15^{\circ}\text{C/W}^*$



3-Lead Plastic TO-252  
 $\theta_{JC} = 3^{\circ}\text{C/W}^*$





## 64Mb Synchronous DRAM based on 1M x 4Bank x16 I/O

### Document Title

4Bank x 1M x 16bits Synchronous DRAM

### Revision History

Revision No.	History	Draft Date	Remark
1.0	First Version Release	Nov. 2004	
	1. Changed tOH: 2.0 --> 2.5 [tCK = 7 & 7.5 (CL3) Product]		
1.1	1. Changed Input High/Low Voltage (Page 08) 2. Changed DC characteristics (Page 09) - IDD2NS: 18mA -> 15mA - IDD5:210 / 195 / 180mA -> 170 / 160 / 150mA [Speed 200 / 166 / 143 / 133MHz] 3. Changed Clock High / Low pulse width Time (Page 11) 4. Changed tAC Time (Page11) 5. Changed tRRD Time (Page12)	Dec. 2004	
1.2	1. Corrected Revision No.: 2.0 -> 1.1 2. Deleted Remark at Revision History 3. Corrected AC OPERATING CONDITION - CL 50pF -> 30pF 4. Changed DC OPERATING CONDITION - VIH MAX VDDQ+2.0 -> VDDQ+0.3 and Typ 3.3 -> 3.0 - VIL MIN VSSQ-2.0 -> -0.3	Dec. 2004	
1.3	1. Modified note for Super Low Power in ORDERING INFORMATION	Jan. 2005	
1.4	1. Corrected PIN ASSIGNMENT A12 to NC	Jan. 2005	
1.5	1. Corrected comments for overshoot and undershoot	Feb. 2005	

This document is a general product description and is subject to change without notice. Hynix does not assume any responsibility for use of circuits described. No patent licenses are implied.

Rev. 1.5 / Feb. 2005



Synchronous DRAM Memory 64Mbit (4Mx16bit)  
HY57V641620E(L/S)T(P)-xI Series

**DESCRIPTION**

The Hynix HY57V641620E(L/S)T(P) series is a 67,108,864bit CMOS Synchronous DRAM, ideally suited for the memory applications which require wide data I/O and high bandwidth. HY57V641620E(L/S)T(P) is organized as 4banks of 1,048,576x16.

HY57V641620E(L/S)T(P) is offering fully synchronous operation referenced to a positive edge of the clock. All inputs and outputs are synchronized with the rising edge of the clock input. The data paths are internally pipelined to achieve very high bandwidth. All input and output voltage levels are compatible with LVTTTL.

Programmable options include the length of pipeline (Read latency of 2 or 3), the number of consecutive read or write cycles initiated by a single control command (Burst length of 1,2,4,8 or full page), and the burst count sequence(sequential or interleave). A burst of read or write cycles in progress can be terminated by a burst terminate command or can be interrupted and replaced by a new burst read or write command on any cycle. (This pipelined design is not restricted by a '2N' rule)

**FEATURES**

- Voltage: VDD, VDDQ 3.3V supply voltage
- All device pins are compatible with LVTTTL interface
- 54 Pin TSOPII (Lead or Lead Free Package)
- All inputs and outputs referenced to positive edge of system clock
- Data mask function by UDQM, LDQM
- Internal four banks operation
- Auto refresh and self refresh
- 4096 Refresh cycles / 64ms
- Programmable Burst Length and Burst Type
  - 1, 2, 4, 8 or full page for Sequential Burst
  - 1, 2, 4 or 8 for Interleave Burst
- Programmable  $\overline{\text{CAS}}$  Latency; 2, 3 Clocks
- Burst Read Single Write operation

**ORDERING INFORMATION**

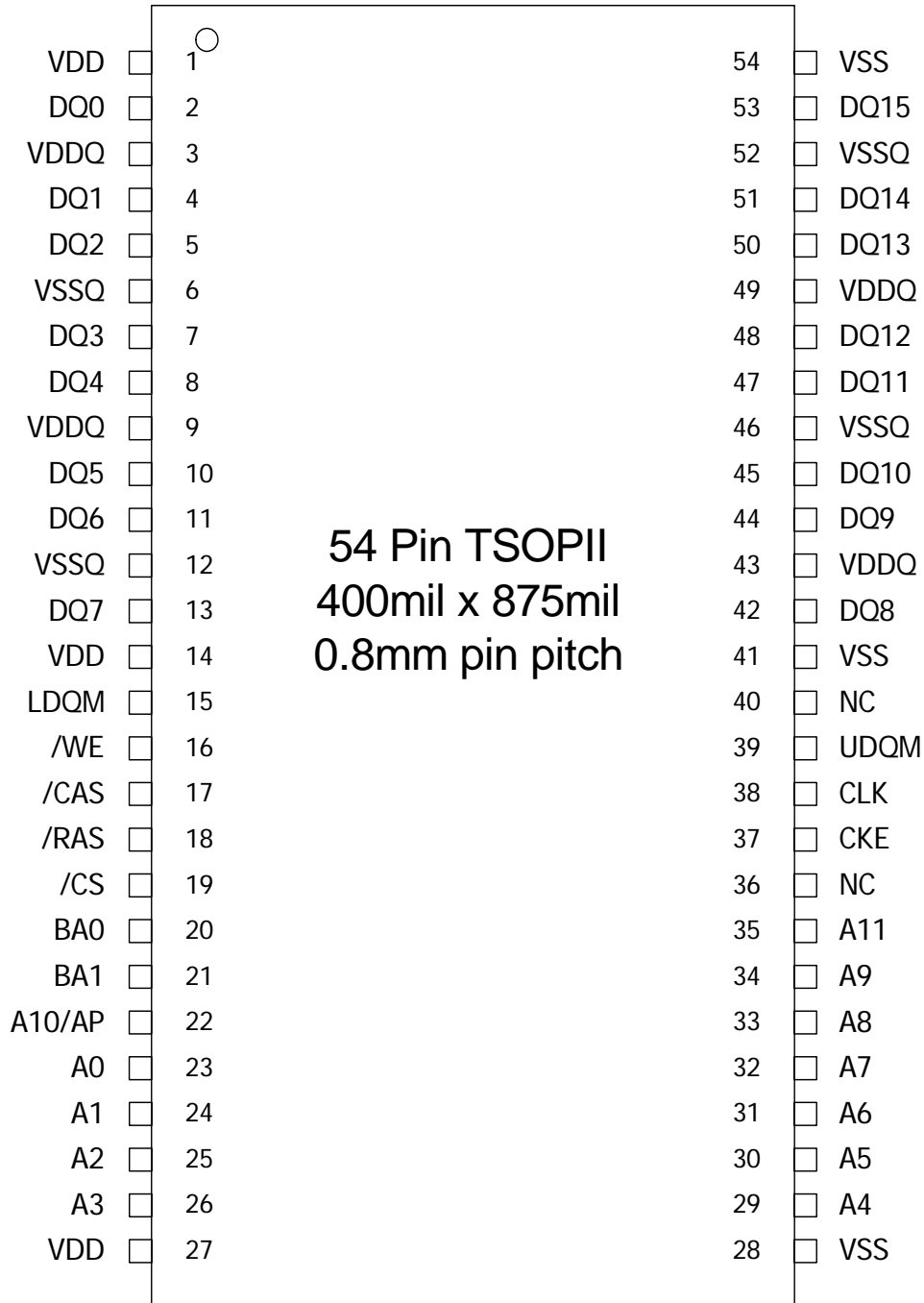
Part No.	Clock Frequency	Organization	Interface	Package
HY57V641620E(L/S)T(P)-5I	200MHz	4Banks x 1Mbits x16	LVTTTL	54 Pin TSOPII
HY57V641620E(L/S)T(P)-6I	166MHz			
HY57V641620E(L/S)T(P)-7I	143MHz			
HY57V641620E(L/S)T(P)-HI	133MHz			

- Note:**
1. HY57V641620ET-xI Series: Normal power, Leaded.
  2. HY57V641620ELT-xI Series: Low power, Leaded.
  3. HY57V641620EST-xI Series: Super Low power, Leaded.
  4. HY57V641620ETP-xI Series: Normal power, Lead Free.
  5. HY57V641620ELTP-xI Series: Low power, Lead Free.
  6. HY57V641620ESTP-xI Series: Super Low Power, Lead Free



Synchronous DRAM Memory 64Mbit (4Mx16bit)  
 HY57V641620E(L/S)T(P)-xI Series

**PIN ASSIGNMENTS**





Synchronous DRAM Memory 64Mbit (4Mx16bit)  
HY57V641620E(L/S)T(P)-xI Series

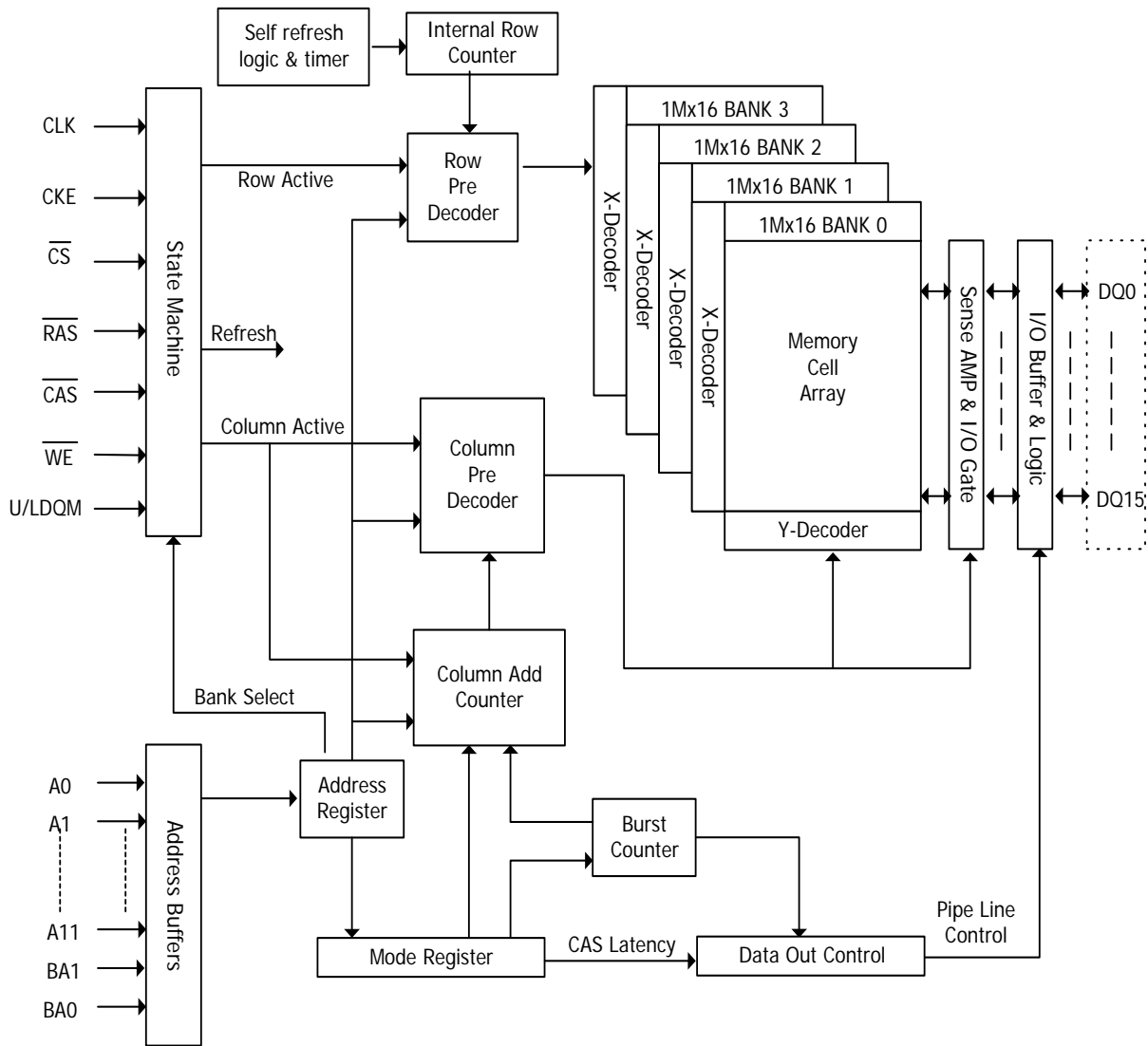
## PIN DESCRIPTION

SYMBOL	TYPE	DESCRIPTION
CLK	Clock	The system clock input. All other inputs are registered to the SDRAM on the rising edge of CLK
CKE	Clock Enable	Controls internal clock signal and when deactivated, the SDRAM will be one of the states among power down, suspend or self refresh
$\overline{\text{CS}}$	Chip Select	Enables or disables all inputs except CLK, CKE, UDQM and LDQM
BA0, BA1	Bank Address	Selects bank to be activated during $\overline{\text{RAS}}$ activity Selects bank to be read/written during $\overline{\text{CAS}}$ activity
A0 ~ A11	Address	Row Address: RA0 ~ RA11, Column Address: CA0 ~ CA7 Auto-precharge flag: A10
$\overline{\text{RAS}}$ , $\overline{\text{CAS}}$ , $\overline{\text{WE}}$	Row Address Strobe, Column Address Strobe, Write Enable	$\overline{\text{RAS}}$ , $\overline{\text{CAS}}$ and $\overline{\text{WE}}$ define the operation Refer function truth table for details
UDQM, LDQM	Data Input/Output Mask	Controls output buffers in read mode and masks input data in write mode
DQ0 ~ DQ15	Data Input / Output	Multiplexed data input / output pin
VDD / VSS	Power Supply / Ground	Power supply for internal circuits and input buffers
VDDQ / VSSQ	Data Output Power / Ground	Power supply for output buffers
NC	No Connection	No connection



Synchronous DRAM Memory 64Mbit (4Mx16bit)  
 HY57V641620E(L/S)T(P)-xI Series

**FUNCTIONAL BLOCK DIAGRAM**  
 1Mbit x 4banks x 16 I/O Synchronous DRAM





March 1999  
Revised February 2005

NC7WZ07 TinyLogic® UHS Dual Buffer (Open Drain Outputs)

# NC7WZ07

## TinyLogic® UHS Dual Buffer (Open Drain Outputs)

### General Description

The NC7WZ07 is a dual buffer with open drain outputs from Fairchild's Ultra High Speed Series of TinyLogic® in the space saving SC70 6-lead package. The device is fabricated with advanced CMOS technology to achieve ultra high speed with high output drive while maintaining low static power dissipation over a very broad V<sub>CC</sub> operating range. The device is specified to operate over the 1.65V to 5.5V V<sub>CC</sub> range. The inputs and outputs are high impedance when V<sub>CC</sub> is 0V. Inputs tolerate voltages up to 7V independent of V<sub>CC</sub> operating voltage.

### Features

- Space saving SC70 6-lead package
- Ultra small MicroPak™ Pb-Free leadless package
- Ultra High Speed: t<sub>PZL</sub> 2.3 ns Typ into 50 pF at 5V V<sub>CC</sub>
- High I<sub>OL</sub> Output Drive: +24 mA at 3V V<sub>CC</sub>
- Broad V<sub>CC</sub> Operating Range: 1.65V to 5.5V
- Matches the performance of LCX when operated at 3.3V V<sub>CC</sub>
- Power down high impedance inputs/outputs
- Overvoltage tolerant inputs facilitate 5V to 3V translation
- Patented noise/EMI reduction circuitry implemented

### Ordering Code:

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
NC7WZ07P6X	MAA06A	Z07	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
NC7WZ07P6X_NL (Note 1)	MAA06A	Z07	Pb-Free 6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
NC7WZ07L6X	MAC06A	D3	Pb-Free 6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

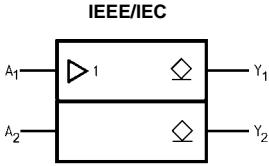
Pb-Free package per JEDEC J-STD-020B.

**Note 1:** "\_NL" indicates Pb-Free product (per JEDEC J-STD-020B). Device is available in Tape and Reel only.

TinyLogic® is a registered trademark of Fairchild Semiconductor Corporation.  
MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

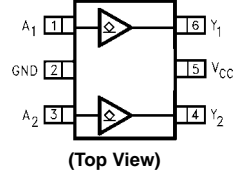
NC7WZ07

**Logic Symbol**

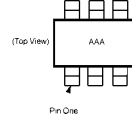


**Connection Diagrams**

**Pin Assignments for SC70**



**Pin One Orientation Diagram**



AAA represents Product Code Top Mark - see ordering code

**Note:** Orientation of Top Mark determines Pin One location. Read the top product code mark left to right, Pin One is the lower left pin (see diagram).

**Pin Descriptions**

Pin Names	Description
A <sub>1</sub> , A <sub>2</sub>	Data Inputs
Y <sub>1</sub> , Y <sub>2</sub>	Output

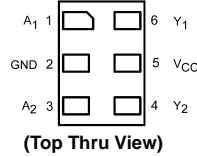
**Function Table**

$Y = A$

Input	Output
A	Y
L	L
H	Z

H = HIGH Logic Level  
L = LOW Logic Level

**Pad Assignments for MicroPak**



# S29AL016D

16 Megabit (2 M x 8-Bit/1 M x 16-Bit)

CMOS 3.0 Volt-only Boot Sector Flash Memory



## Data Sheet

PRELIMINARY

## Distinctive Characteristics

### Architectural Advantages

- **Single power supply operation**
  - Full voltage range: 2.7 to 3.6 volt read and write operations for battery-powered applications
- **Manufactured on 200nm process technology**
  - Fully compatible with 0.23  $\mu\text{m}$  Am29LV160D and MBM29LV160E devices
- **Flexible sector architecture**
  - One 16 Kbyte, two 8 Kbyte, one 32 Kbyte, and thirty-one 64 Kbyte sectors (byte mode)
  - One 8 Kword, two 4 Kword, one 16 Kword, and thirty-one 32 Kword sectors (word mode)
- **Sector Protection features**
  - A hardware method of locking a sector to prevent any program or erase operations within that sector
  - Sectors can be locked in-system or via programming equipment
  - Temporary Sector Unprotect feature allows code changes in previously locked sectors
- **Unlock Bypass Program Command**
  - Reduces overall programming time when issuing multiple program command sequences
- **Top or bottom boot block configurations available**
- **Compatibility with JEDEC standards**
  - Pinout and software compatible with single-power supply Flash
  - Superior inadvertent write protection

### Performance Characteristics

- **High performance**
  - Access times as fast as 70 ns

- **Ultra low power consumption (typical values at 5 MHz)**
  - 200 nA Automatic Sleep mode current
  - 200 nA standby mode current
  - 9 mA read current
  - 20 mA program/erase current
- **Cycling endurance: 1,000,000 cycles per sector typical**
- **Data retention: 20 years typical**

### Package Options

- **48-ball FBGA**
- **48-pin TSOP**
- **44-pin SOP**

### Software Features

- **CFI (Common Flash Interface) compliant**
  - Provides device-specific information to the system, allowing host software to easily reconfigure for different Flash devices
- **Erase Suspend/Erase Resume**
  - Suspends an erase operation to read data from, or program data to, a sector that is not being erased, then resumes the erase operation
- **Data# Polling and toggle bits**
  - Provides a software method of detecting program or erase operation completion

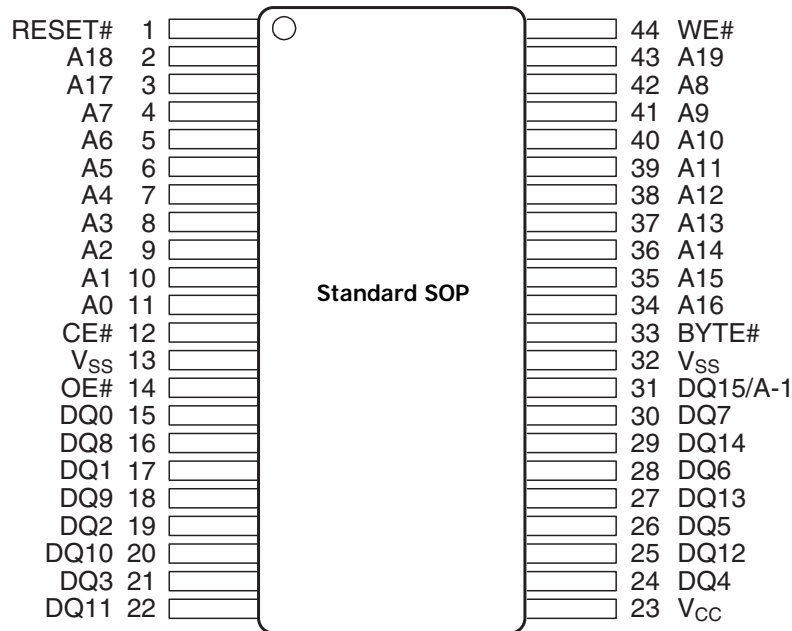
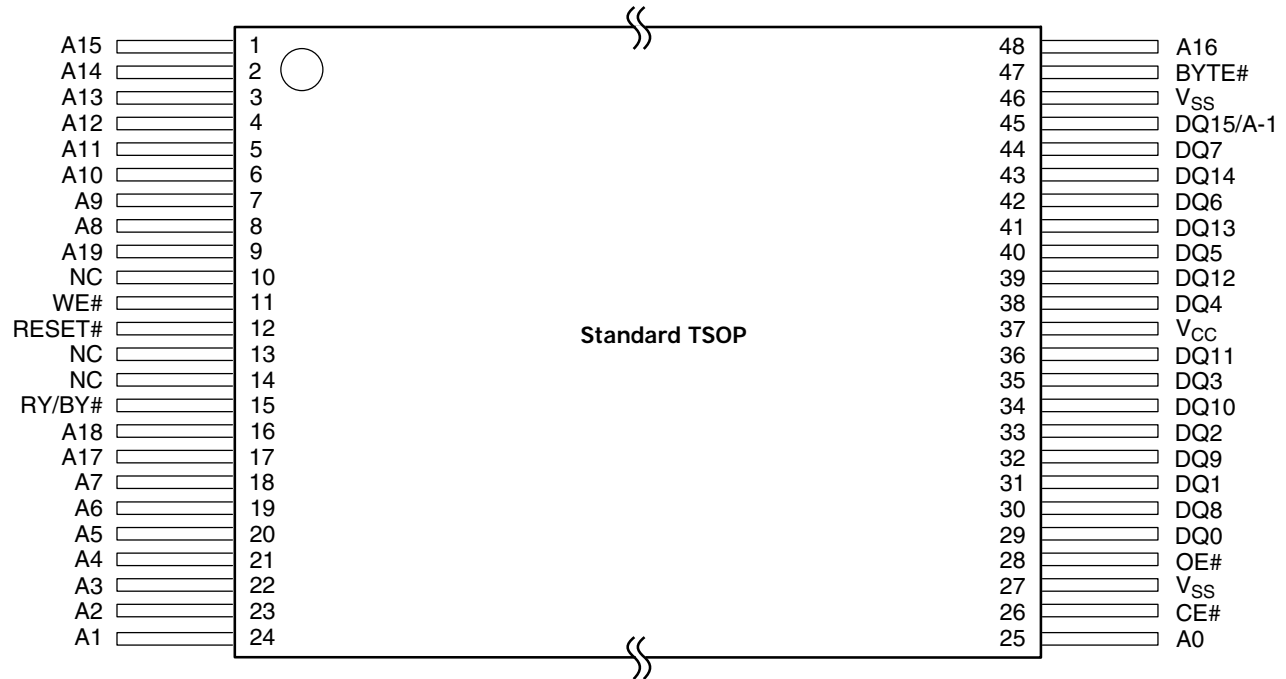
### Hardware Features

- **Ready/Busy# pin (RY/BY#)**
  - Provides a hardware method of detecting program or erase cycle completion



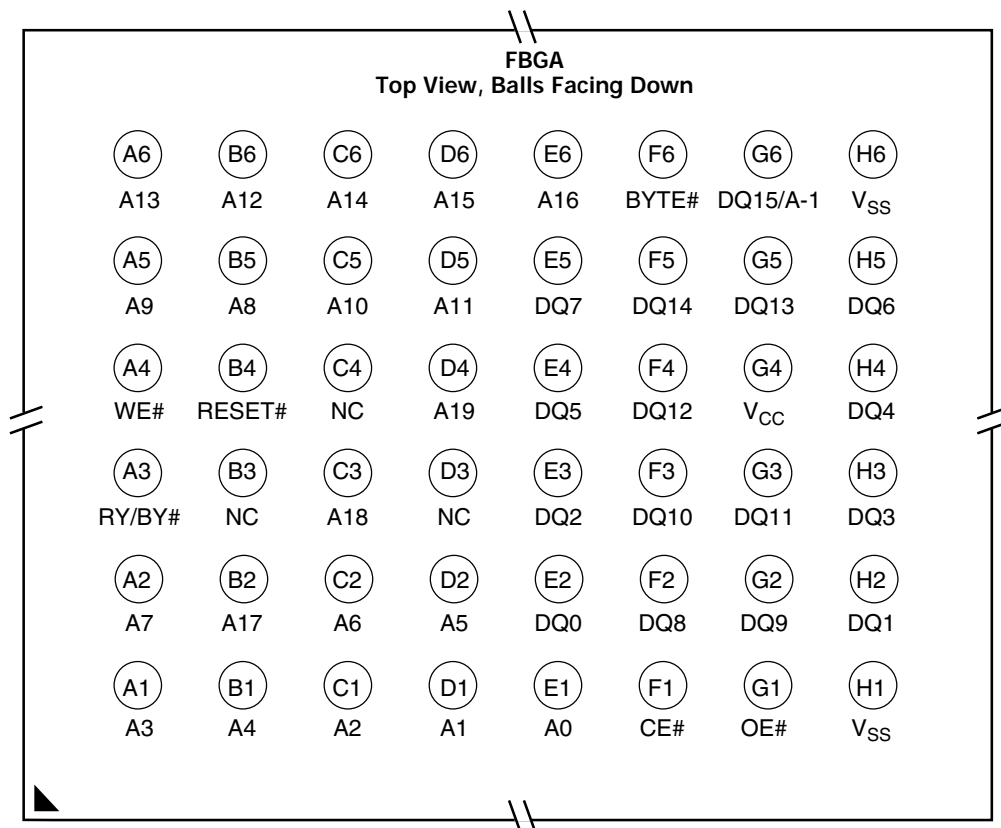


### Connection Diagrams





## Connection Diagrams



## Special Handling Instructions

Special handling is required for Flash Memory products in FBGA packages.

Flash memory devices in FBGA packages may be damaged if exposed to ultrasonic cleaning methods. The package and/or data integrity may be compromised if the package body is exposed to temperatures above 150°C for prolonged periods of time.

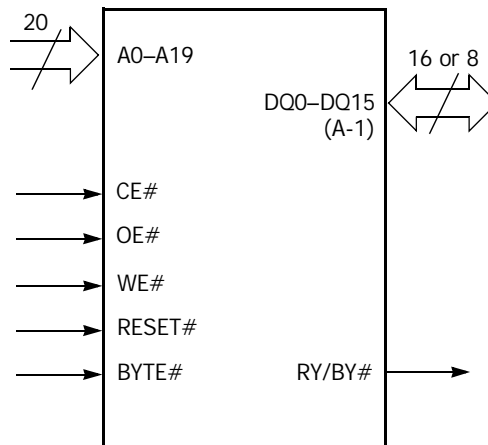


Preliminary

## Pin Configuration

A0–A19	=	20 addresses
DQ0–DQ14	=	15 data inputs/outputs
DQ15/A-1	=	DQ15 (data input/output, word mode), A-1 (LSB address input, byte mode)
BYTE#	=	Selects 8-bit or 16-bit mode
CE#	=	Chip enable
OE#	=	Output enable
WE#	=	Write enable
RESET#	=	Hardware reset pin
RY/BY#	=	Ready/Busy output
V <sub>CC</sub>	=	3.0 volt-only single power supply (see Product Selector Guide for speed options and voltage supply tolerances)
V <sub>SS</sub>	=	Device ground
NC	=	Pin not connected internally

## Logic Symbol





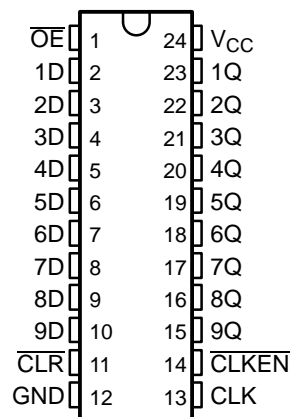
## SN74LVC823A 9-BIT BUS-INTERFACE FLIP-FLOP WITH 3-STATE OUTPUTS

SCAS305I–MARCH 1993–REVISED FEBRUARY 2005

### FEATURES

- Operates From 1.65 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max  $t_{pd}$  of 7.9 ns at 3.3 V
- Typical  $V_{OLP}$  (Output Ground Bounce)  $<0.8$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot)  $>2$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Supports Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V  $V_{CC}$ )
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

DB, DGV, DW, NS, OR PW PACKAGE  
(TOP VIEW)



### DESCRIPTION/ORDERING INFORMATION

This 9-bit bus-interface flip-flop is designed for 1.65-V to 3.6-V  $V_{CC}$  operation.

The SN74LVC823A is designed specifically for driving highly capacitive or relatively low-impedance loads. It is particularly suitable for implementing wider buffer registers, I/O ports, bidirectional bus drivers with parity, and working registers.

With the clock-enable ( $\overline{\text{CLKEN}}$ ) input low, the nine D-type edge-triggered flip-flops enter data on the low-to-high transitions of the clock. Taking  $\overline{\text{CLKEN}}$  high disables the clock buffer, latching the outputs. This device has noninverting data (D) inputs. Taking the clear ( $\overline{\text{CLR}}$ ) input low causes the nine Q outputs to go low, independently of the clock.

### ORDERING INFORMATION

$T_A$	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SOIC – DW	Tube of 25	SN74LVC823ADW	LVC823A
		Reel of 2000	SN74LVC823ADWR	
	SOP – NS	Reel of 2000	SN74LVC823ANSR	LVC823A
	SSOP – DB	Reel of 2000	SN74LVC823ADBR	LC823A
	TSSOP – PW	Tube of 60	SN74LVC823APW	LC823A
		Reel of 2000	SN74LVC823APWR	
		Reel of 250	SN74LVC823APWT	
	TVSOP – DGV	Reel of 2000	SN74LVC823ADGVR	LC823A

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

**SN74LVC823A**  
**9-BIT BUS-INTERFACE FLIP-FLOP**  
**WITH 3-STATE OUTPUTS**



SCAS305I—MARCH 1993—REVISED FEBRUARY 2005

**DESCRIPTION/ORDERING INFORMATION (CONTINUED)**

A buffered output-enable ( $\overline{OE}$ ) input can be used to place the nine outputs in either a normal logic state (high or low logic levels) or the high-impedance state.  $\overline{OE}$  does not affect the internal operations of the latch. Previously stored data can be retained or new data can be entered while the outputs are in the high-impedance state.

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of these devices as translators in a mixed 3.3-V/5-V system environment.

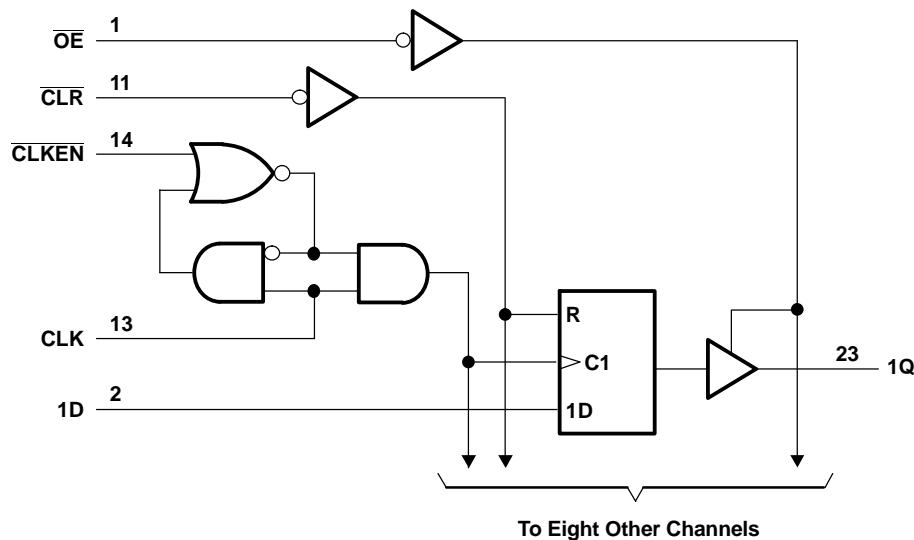
This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

**FUNCTION TABLE**  
**(EACH FLIP-FLOP)**

INPUTS					OUTPUT Q
$\overline{OE}$	$\overline{CLR}$	$\overline{CLKEN}$	CLK	D	
L	L	X	X	X	L
L	H	L	↑	H	H
L	H	L	↑	L	L
L	H	H	X	X	$Q_0$
H	X	X	X	X	Z

**LOGIC DIAGRAM (POSITIVE LOGIC)**



## 1 Second Generation Aureus™ DSPs

### 1.1 Features

- DA708/B/DA788B: 32-/64-Bit 250-/266-MHz Floating-Point DSP
- Upgrades to C67x+ CPU From DA6xx Family:
  - 2X CPU Registers [64 General-Purpose]
  - New Audio-Specific Instructions
  - Compatible With the DA6xx C67x CPU
- Enhanced Memory System
  - 256K-Byte Unified Program/Data RAM
  - 768K-Byte Unified Program/Data ROM
  - Single-Cycle Data Access From CPU
  - Large Program Cache (32K-Byte) Supports RAM, ROM, and External Memory
- External Memory Interface (EMIF) Supports:
  - 100-/133-MHz SDRAM (16-Bit)
  - Async NOR Flash, SRAM (8- or 16-Bit)
  - NAND Flash (8- or 16-Bit)
- Enhanced I/O System
  - High-Performance Crossbar Switch
  - Dedicated McASP DMA Bus
  - Deterministic I/O Performance
- dMAX Dual Data Movement Accelerator:
  - Memory-to-Memory Transfers
  - Memory-to-Peripheral Transfers
  - Packing/Unpacking Delay Data
  - Circular Addressing
  - Non-Sequential Addressing for Reverb
- Three Multichannel Audio Serial Ports
  - Transmit/Receive Clocks up to 50 MHz
  - Five Clock Zones and 16 Serial Data Pins
  - Supports TDM, I2S, and Similar Formats
  - DIT Only (McASP2)
- Two 10-MHz SPI Ports With 3-, 4-, and 5-Pin Options
- Two Inter-Integrated Circuit (I2C) Ports
- Real-Time Interrupt Counter/Watchdog
- Oscillator- and Software-Controlled PLL
- Commercial or Extended Temperature
- 144-Pin, 0.5-mm, PowerPAD™ Thin Quad Flatpack (TQFP) [RFP Suffix]
- Security Features Available



- Applications
  - A/V and DVD Receiver
  - Multizone A/V Receiver
  - HDD Jukebox
  - Navigation Systems
  - High-Speed Encode With Simultaneous Multichannel Decode
- Software Support
  - Dolby® Digital, Dolby® Digital EX, Dolby® Digital Plus, Dolby® TrueHD, Dolby® Pro Logic® IIx, Dolby® Headphone, Dolby® Virtual Surround,
  - DTS®5.1, DTS-ES™ 6.1, DTS Neo:6™, DTS 96/24™, DTS-ES 96/24™, DTS-HD™ (DA788B only)
  - MPEG-2 AAC LC Decode
  - MPEG-4 AAC LC Encode/Decode
  - THX® Select 2, THX® Ultra 2, Neural-THX® Surround
  - MP3 Encode, MP3 Decode
  - WMA8 Encode, WMA9 Decode
  - HDCD® Decode
  - ATRAC3plus® Encode, ATRAC3plus® Decode
  - Audyssey MultEQ XT®, MultEQ®, PrevEQ®, 2EQ®
  - SRS® Circle Surround™ II (CS II)
  - TI Bass Boost
  - TI Perfect Playback™ Compressed Audio Enhancer
  - TI Virtualizer/Headphone
  - TI Effects Library
  - TI DSD-to-PCM Decode
  - TI Filter Library
  - TI Performance Audio Framework (PA/F)
  - TI DSP/BIOS™
  - Chip Support Library and DSP Library

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# Aureus TMS320DA708, TMS320DA708B, TMS320DA788B Floating-Point Digital Signal Processors



SPRS297E—JULY 2005—REVISED JULY 2007

## 2.13 Pin Maps

Figure 2-2 shows the pin assignments on the 144-pin RFP package.

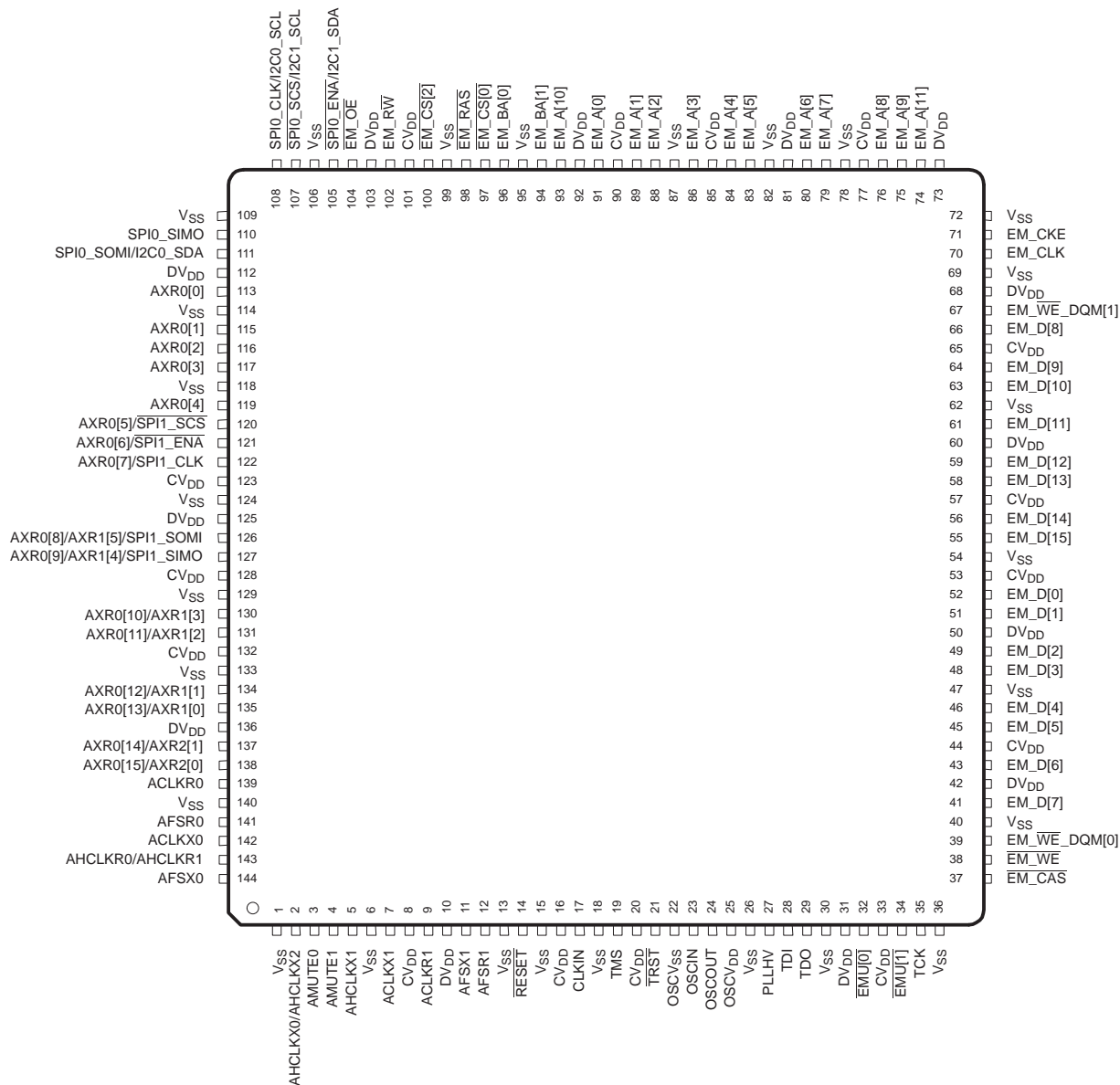


Figure 2-2. 144-Pin Low-Profile Quad Flatpack (RFP Suffix)—Top View



# Low Cost, General-Purpose High Speed JFET Amplifier

## AD825

### FEATURES

#### High speed

- 41 MHz,  $-3$  dB bandwidth
- 125 V/ $\mu$ s slew rate
- 80 ns settling time

Input bias current of 20 pA and noise current of 10 fA/ $\sqrt{\text{Hz}}$

Input voltage noise of 12 nV/ $\sqrt{\text{Hz}}$

Fully specified power supplies:  $\pm 5$  V to  $\pm 15$  V

Low distortion:  $-76$  dB at 1 MHz

#### High output drive capability

- Drives unlimited capacitance load
- 50 mA min output current

No phase reversal when input is at rail

Available in 8-lead SOIC

### APPLICATIONS

CCDs

Low distortion filters

Mixed gain stages

Audio amplifiers

Photo detector interfaces

ADC input buffers

DAC output buffers

### GENERAL DESCRIPTION

The AD825 is a superbly optimized operational amplifier for high speed, low cost, and dc parameters, making it ideally suited for a broad range of signal conditioning and data acquisition applications. The ac performance, gain, bandwidth, slew rate, and drive capability are all very stable over temperature. The AD825 also maintains stable gain under varying load conditions.

The unique input stage has ultralow input bias current and input current noise. Signals that go to either rail on this high performance input do not cause phase reversals at the output. These features make the AD825 a good choice as a buffer for MUX outputs, creating minimal offset and gain errors.

The AD825 is fully specified for operation with dual  $\pm 5$  V and  $\pm 15$  V supplies. This power supply flexibility, and the low supply current of 6.5 mA with excellent ac characteristics under all supply conditions, makes the AD825 well-suited for many demanding applications.

#### Rev. F

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### CONNECTION DIAGRAMS

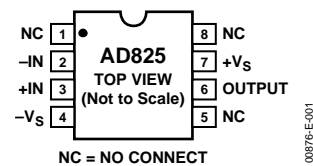


Figure 1. 8-Lead Plastic SOIC (R) Package

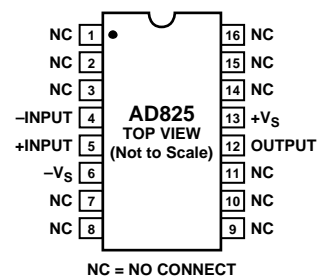


Figure 2. 16-Lead Plastic SOIC (R-16) Package

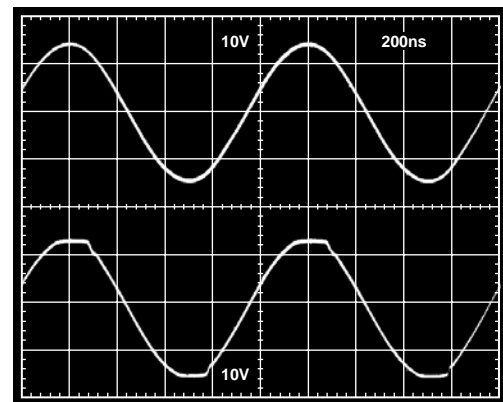


Figure 3. Performance with Rail-to-Rail Input Signals



ASAHI KASEI

[AK4683]

 <div style="display: inline-block; vertical-align: middle; text-align: right;"> <h1 style="margin: 0;">AK4683</h1> <h2 style="margin: 0;">Asynchronous Multi-Channel Audio CODEC with DIR/T</h2> </div>
---

<b>GENERAL DESCRIPTION</b>
----------------------------

The AK4683 is a single chip CODEC that includes two channels of ADC and four channels of DAC. The ADC outputs 24bit data and the DAC accepts up to 24bit input data. The ADC has the Enhanced Dual Bit architecture with wide dynamic range. The DAC introduces the new developed Advanced Multi-Bit architecture, and achieves wider dynamic range and lower outband noise. The also has digital audio receiver (DIR) and transmitter (DIT) compatible with 192kHz, 24bits. The DIR can automatically detect a Non-PCM bit stream such as Dolby Digital (AC-3)\*.

The AK4683 has a dynamic range of 100dB for ADC, 106dB for DAC and is well suited for digital TV and home theater system.

\* Dolby Digital (AC-3) is a trademark of Dolby Laboratories.

<b>FEATURES</b>
-----------------

- ADC/DAC part**
  - Asynchronous ADC/DAC Operation**
  - 6:1 Input Selector with Pre-amp**
  - 2ch 24bit ADC**
    - 64x Oversampling
    - Sampling Rate up to 96kHz
    - Linear Phase Digital Anti-Alias Filter
    - Single-Ended Input
    - S/(N+D): 90dB
    - Dynamic Range, S/N: 100dB
    - Digital HPF for Offset Cancellation
    - Channel Independent Digital Volume (+24/-103dB, 0.5dB/step)
    - Soft Mute
    - Overflow Flag
  - 4ch 24bit DAC**
    - 128x Oversampling
    - Sampling Rate up to 192kHz
    - 24bit 8 times Digital Filter
    - Single-Ended Outputs
    - S/(N+D): 90dB
    - Dynamic Range, S/N: 106dB
    - Channel Independent Digital Volume (+12/-115dB, 0.5dB/step)
    - Soft Mute
    - De-emphasis Filter (32kHz, 44.1kHz, 48kHz)
    - Zero Detect Function
  - Stereo Headphone Amp with Volume**
    - 50mW at 16ohm
    - Click-noise free at Power on/off
  - High Jitter Tolerance**

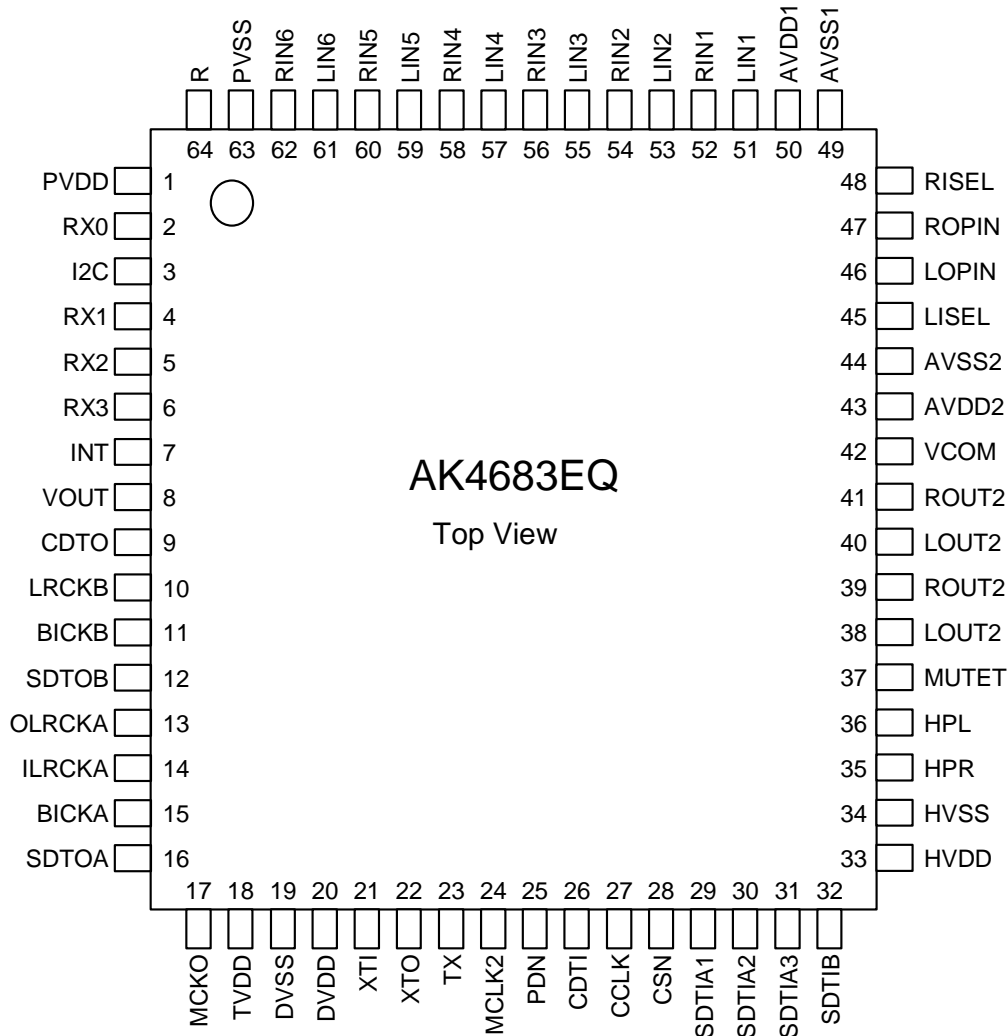
ASAHI KASEI

[AK4683]

■ Ordering Guide

AK4683EQ -20 ~ +85°C 64pin LQFP (0.5mm pitch)  
 AKD4683 Eval uation Board for AK4683

■ Pin Layout



■ Compatibility with AK4588

Functions A	K4588	AK4683
DAC, ADC Asynchronous operation	NOT Available	Available
DAC ch#	8ch	4ch
HP-Amp -		2ch
ADC Input selector	-	6:1

ASAHI KASEI

[AK4683]

## PIN/FUNCTION

No. Pin	Pin Name	I/O	Function
1	VDD	-	PLL Power supply Pin, 4.5V~5.5V
2	RX0	I	Receiver Channel 0 Pin (Internal biased pin. Internally biased at PVDD/2)
3	2C	I	Control Mode Select Pin. “L”: 4-wire Serial, “H”: I <sup>2</sup> C Bus
4	RX1	I	Receiver Channel 1 Pin
5	RX2	I	Receiver Channel 2 Pin
6	RX3	I	Receiver Channel 3 Pin
7	NT	O	Interrupt Pin
8	VOUT	O	V-bit Output Pin for Receiver Input
	DZF O		Zero Input Detect Pin When the input data of DAC follow total 8192 LRCK cycles with “0” input data, this pin goes to “H”. And when RSTN1 bit is “0”, PWDA bit is “0”, this pin goes to “H”.
	OVF O		Analog Input Overflow Detect Pin This pin goes to “H” if the analog input of Lch or Rch overflows.
9	CDTO	O	Control Data Output Pin in Serial Mode and I2C pin = “L”.
10	LRCKB	I/O	Channel Clock B Pin
11	BICKB	I/O	Audio Serial Data Clock B Pin
12	SDTOB	O	Audio Serial Data Output B Pin
13	OLRCKA	I/O	Output Channel Clock A Pin
14	ILRCKA	I/O	Input Channel Clock A Pin
15	BICKA	I/O	Audio Serial Data Clock A Pin
16	SDTOA	O	Audio Serial Data Output A Pin
17	MCKO	O	Master Clock Output Pin
18	TVDD	-	Output Buffer Power Supply Pin, 2.7V~5.5V
19	DVSS	-	Digital Ground Pin, 0V
20	DVDD	-	Digital Power Supply Pin, 4.5V~5.5V
21	XTI	I	X'tal Input Pin
22	XTO	O	X'tal Output Pin
23	TX	O	Transmit Channel Output pin When DIT bit = “0”, RX0~3 Through. When DIT bit = “1”, Internal DIT Output.
24	MCLK2	I	Master Clock Input Pin
25	DN	I	Power-Down Mode & Reset Pin When “L”, the AK4683 is powered-down, all registers are reset. And then all digital output pins go “L”. The AK4683 must be reset once upon power-up.
26	CDTI	I	Control Data Input Pin in Serial Mode and I2C pin = “L”.
	SDA	I/O	Control Data Pin in Serial Mode and I2C pin = “H”.
27	CCLK	I	Control Data Clock Pin in Serial Mode and I2C pin = “L”
	SCL	I	Control Data Clock Pin in Serial Mode and I2C pin = “H”
28	CSN	I	Chip Select Pin in Serial Mode and I2C pin = “L”.
	TEST	I	This pin should be connected to DVSS in Serial Mode and I2C pin = “H”.
29	SDTIA1	I	Audio Serial Data Input A1 Pin
30	SDTIA2	I	Audio Serial Data Input A2 Pin
31	SDTIA3	I	Audio Serial Data Input A3 Pin
32	SDTIB	I	Audio Serial Data Input B Pin
33	HVDD	-	HP Power Supply Pin, 4.5V~5.5V
34	HVSS	-	HP Ground Pin, 0V
35	HPR	O	HP Rch Output Pin
36	HPL	O	HP Lch Output Pin
37	MUTET	-	HP Common Voltage Output Pin 1μF capacitor should be connected to HVSS externally.

ASAHI KASEI

[AK4683]

No. Pin	Pin Name	I/O	Function
38	LOUT2	O	DAC2 Lch Positive Analog Output Pin
39	ROUT2	O	DAC2 Rch Positive Analog Output Pin
40	LOUT1	O	DAC1 Lch Positive Analog Output Pin
41	ROUT1	O	DAC1 Rch Positive Analog Output Pin
42	VCOM	-	DAC/ADC Common Voltage Output Pin 2.2μF capacitor should be connected to AVSS2 externally.
43	A VDD2	-	DAC Power Supply Pin, 4.5V~5.5V
44	A VSS2	-	DAC Ground Pin, 0V
45	LISEL	O	Lch Feedback Resistor Output Pin
46	LOPIN	O	Lch Feedback Resistor Input Pin. 0.5 x AVDD1.
47	ROPIN	O	Rch Feedback Resistor Input Pin. 0.5 x AVDD1.
48	RISEL	O	Rch Feedback Resistor Output Pin
49	A VSS1	-	ADC Ground Pin, 0V
50	A VDD1	-	ADC Power Supply Pin, 4.5V~5.5V
51	LIN1	I	Lch Input 1 Pin
52	RIN1	I	Rch Input 1 Pin
53	LIN2	I	Lch Input 2 Pin
54	RIN2	I	Rch Input 2 Pin
55	LIN3	I	Lch Input 3 Pin
56	RIN3	I	Rch Input 3 Pin
57	LIN4	I	Lch Input 4 Pin
58	RIN4	I	Rch Input 4 Pin
59	LIN5	I	Lch Input 5 Pin
60	RIN5	I	Rch Input 5 Pin
61	LIN6	I	Lch Input 6 Pin
62	RIN6	I	Rch Input 6 Pin
63	P VSS	-	PLL Ground pin
64	R	-	External Resistor Pin 12kΩ +/-1% resistor should be connected to PVSS externally.

Note: All input pins except internal biased pin (RX0) and analog input pins (LIN1-6, RIN1-6) should not be left floating.

■ Handling of Unused Pin

The unused I/O pins should be processed appropriately as below.

Classification	Pin Name	Setting
Analog	RX0, LOUT1-2, ROUT1-2, LIN1-6, RIN1-6	These pins should be open.
Digital	INT, XTO, MCKO, VOUT/DZF/OVF, SDTOA-B, CDTO, TX	These pins should be open.
	RX1-3, CSN, CCLK, CDTI, XTI, MCLK2, OLRCKA, ILRCKA, BICKA, SDTIA1-3, LRCKB, BICKB, SDTIB	These pins should be connected to DVSS.

# CS5361

## 114 dB, 192 kHz, Multi-Bit Audio A/D Converter

### Features

- Advanced Multi-bit Delta-sigma Architecture
- 24-bit Conversion
- 114 dB Dynamic Range
- -105 dB THD+N
- System Sampling Rates up to 192 kHz
- 135 mW Power Consumption
- High-pass Filter and DC Offset Calibration
- Supports Logic Levels Between 5 and 2.5 V
- Differential Analog Architecture
- Overflow Detection
- Pin-compatible with the CS5381

### General Description

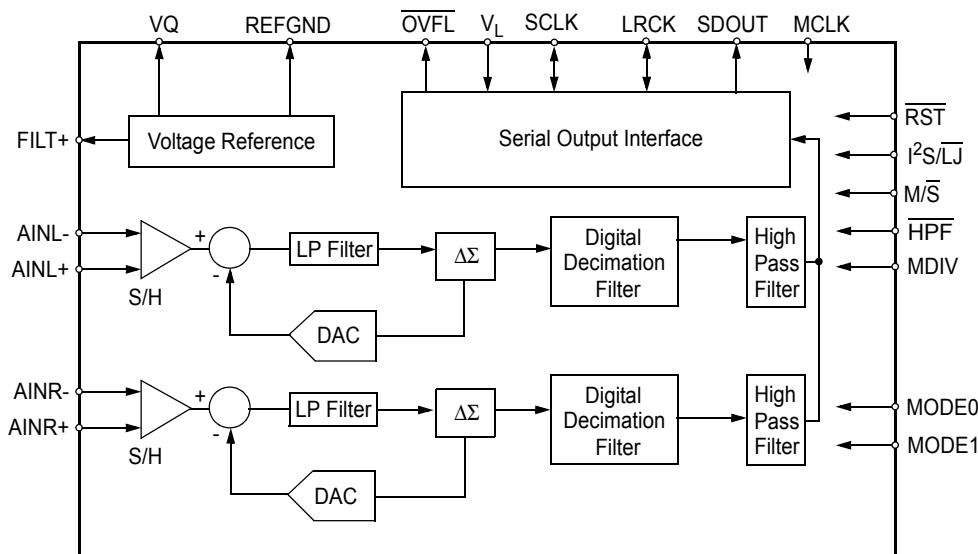
The CS5361 is a complete analog-to-digital converter for digital audio systems. It performs sampling, analog-to-digital conversion, and anti-alias filtering. The CS5361 generates 24-bit values for both left and right inputs in serial form at sample rates up to 192 kHz per channel.

The CS5361 uses a 5th-order, multi-bit, delta-sigma modulator followed by digital filtering and decimation. This removes the need for an external anti-alias filter. The ADC uses a differential architecture which provides excellent noise rejection.

The CS5361 is ideal for audio systems requiring wide dynamic range, negligible distortion, and low noise. These applications include A/V receivers, DVD-R, CD-R, digital mixing consoles, and effects processors.

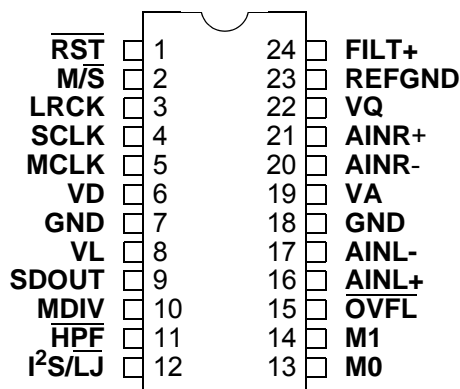
### ORDERING INFORMATION

CS5361-KSZ	-10° to 70° C 24-pin SOIC	Lead Free
CS5361-KZZ	-10° to 70° C 24-pin TSSOP	Lead Free
CS5361-DZZ	-40° to 85° C 24-pin TSSOP	Lead Free
CDB5361		Evaluation Board



## CS5361

## 2.0 PIN DESCRIPTIONS



Pin Name	#	Pin Description
$\overline{\text{RST}}$	1	<b>Reset (Input)</b> - The device enters a low power mode when low.
$\overline{\text{M/S}}$	2	<b>Master/Slave Mode (Input)</b> - Selects operation as either clock master or slave.
$\text{LRCK}$	3	<b>Left Right Clock (Input/Output)</b> - Determines which channel, Left or Right, is currently active on the serial audio data line.
$\text{SCLK}$	4	<b>Serial Clock (Input/Output)</b> - Serial clock for the serial audio interface.
$\text{MCLK}$	5	<b>Master Clock (Input)</b> - Clock source for the delta-sigma modulator and digital filters.
$\text{VD}$	6	<b>Digital Power (Input)</b> - Positive power supply for the digital section.
$\text{GND}$	7, 18	<b>Ground (Input)</b> - Ground reference. Must be connected to analog ground.
$\text{VL}$	8	<b>Logic Power (Input)</b> - Positive power for the digital input/output.
$\text{SDOUT}$	9	<b>Serial Audio Data Output (Output)</b> - Output for two' s complement serial audio data.
$\text{MDIV}$	10	<b>MCLK Divider (Input)</b> - Enables a master clock divide by two function.
$\text{HPF}$	11	<b>High-pass Filter Enable (Input)</b> - Enables the Digital High-Pass Filter.
$\text{I}^2\text{S/LJ}$	12	<b>Serial Audio Interface Format Select (Input)</b> -Selects either the left-justified or $\text{I}^2\text{S}$ format for the SAI.
$\text{M0}$ $\text{M1}$	13, 14	<b>Mode Selection (Input)</b> - Determines the operational mode of the device.
$\overline{\text{OVFL}}$	15	<b>Overflow (Output, open drain)</b> - Detects an overflow condition on both left and right channels.
$\text{AINL+}$ $\text{AINL-}$	16, 17	<b>Differential Left Channel Analog Input (Input)</b> - Signals are presented differentially to the delta-sigma modulators via the $\text{AINL+/-}$ pins.
$\text{VA}$	19	<b>Analog Power (Input)</b> - Positive power supply for the analog section.
$\text{AINR-}$ $\text{AINR+}$	20, 21	<b>Differential Right Channel Analog Input (Input)</b> -Signals are presented differentially to the delta-sigma modulators via the $\text{AINR+/-}$ pins.
$\text{VQ}$	22	<b>Quiescent Voltage (Output)</b> - Filter connection for the internal quiescent reference voltage.
$\text{REF\_GND}$	23	<b>Reference Ground (Input)</b> - Ground reference for the internal sampling circuits.
$\text{FILT+}$	24	<b>Positive Voltage Reference (Output)</b> - Positive reference voltage for the internal sampling circuits.



NJM2068

LOW-NOISE DUAL OPERATIONAL AMPLIFIER

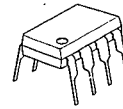
■ GENERAL DESCRIPTION

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

■ PACKAGE OUTLINE



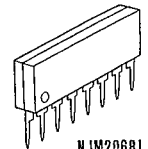
NJM2068D



NJM2068M

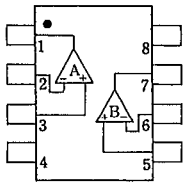


NJM2068V

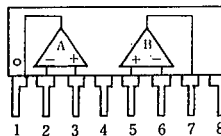


NJM2068L

■ PIN CONFIGURATION



NJM2068D  
NJM2068M  
NJM2068V

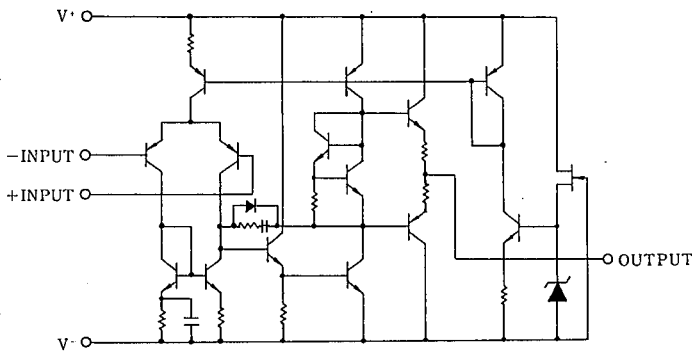


NJM2068L

PIN FUNCTION

1. A OUTPUT
2. A-IN INPUT
3. A+ INPUT
4. V<sup>-</sup>
5. B+ INPUT
6. B-IN INPUT
7. B OUTPUT
8. V<sup>+</sup>

■ EQUIVALENT CIRCUIT (1/2 Shown)



4



**HIGH PERFORMANCE LOW-NOISE DUAL OPERATIONAL AMPLIFIER**

■ **GENERAL DESCRIPTION**

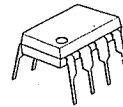
The NJM5532 is a high performance dual low noise operational amplifier. Compared to the standard dual operational amplifiers, such as the NJM1458, it shows better noise performance, improved output drive capability, and considerably higher small-signal and power bandwidths.

This makes the device especially suitable for application in high quality and professional audio equipment, instrumentation, control circuits, and telephone channel amplifiers. The op amp is internally compensated for gains equal to one. If very low noise is of prime importance, version B is used which has guaranteed noise specifications.

■ **FEATURES**

- Operating Voltage (±3V ~ ±20V)
- Small Signal Bandwidth (10MHz typ.)
- Output Drive Capability (600Ω, 10Vrms typ.)
- Input Noise Voltage (5nV/√Hz typ.)
- Power Bandwidth (140kHz typ.)
- Slew Rate (8V/μs typ.)
- Package Outline DIP8, DMP8, SIP8
- Bipolar Technology

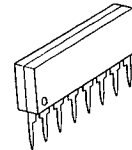
■ **PACKAGE OUTLINE**



NJM5532D

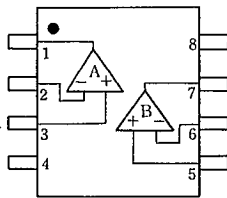


NJM5532M

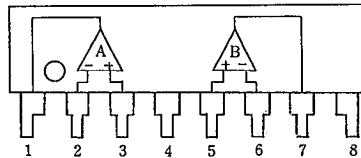


NJM5532L

■ **PIN CONFIGURATION**



NJM5532D  
NJM5532M



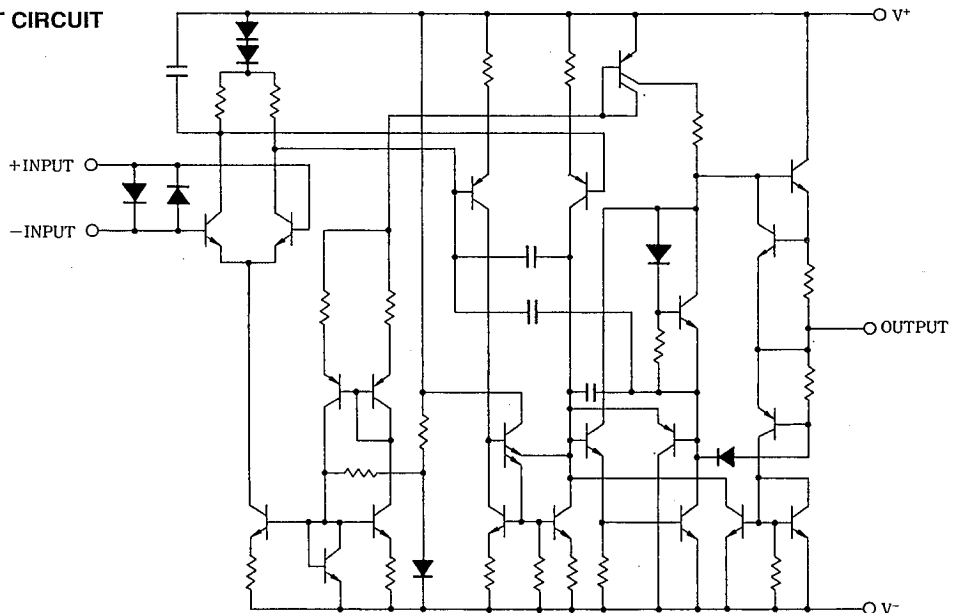
NJM5532L

**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)



100

4





NJU7313A

ANALOG FUNCTION SWITCH

■ GENERAL DESCRIPTION

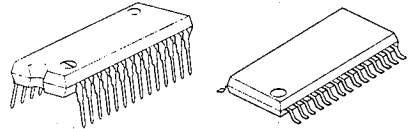
The NJU7313A is a dual 4-channel and quad 2-channel analog function switch, especially suitable for input selector of audio equipments.

The high break down voltage analog switch controlled by 14-bit serial data based on logic operating voltage (5V) can ON and OFF of  $\pm 15V$  signal.

The analog switch is realized superior linearity of on-resistance in all voltage range, low distortion and wide dynamic range.

Furthermore, the both of single and dual power supply application provides easy designing.

■ PACKAGE OUTLINE



NJU7313AL

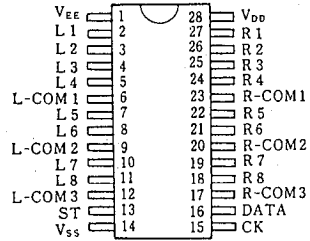
NJU7313AM

6

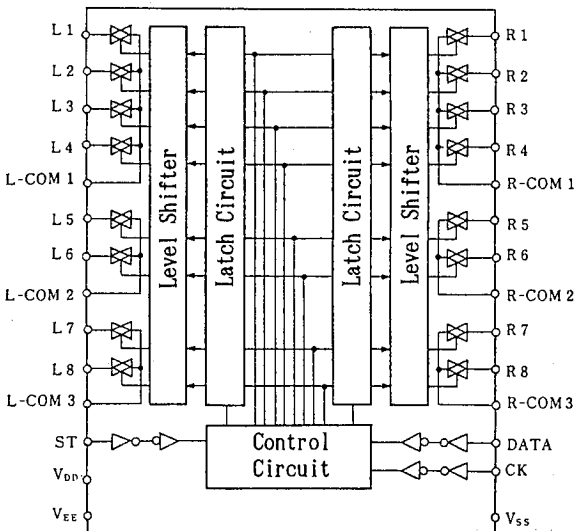
■ FEATURES

- Analog switch: dual 3 channel and quad 2 channel.
- High Break Down Voltage -----  $\pm 15V$ .
- Low Distortion ----- THD: 0.002% (typ).
- Superior Linearity of ON Resistance.
- Serial Data Control.
- Package Outline SDIP 28 / DMP 30
- C-MOS Technology

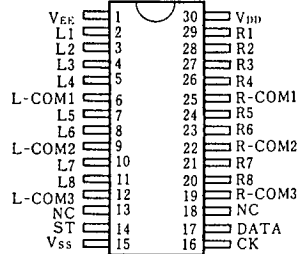
■ PIN CONFIGURATION



■ BLOCK DIAGRAM



NJU7313AL



NJU7313AM



# Dual Bipolar/JFET, Audio Operational Amplifier

## OP275\*

### FEATURES

**Excellent Sonic Characteristics**

**Low Noise:**  $6 \text{ nV}/\sqrt{\text{Hz}}$

**Low Distortion:** 0.0006%

**High Slew Rate:**  $22 \text{ V}/\mu\text{s}$

**Wide Bandwidth:** 9 MHz

**Low Supply Current:** 5 mA

**Low Offset Voltage:** 1 mV

**Low Offset Current:** 2 nA

**Unity Gain Stable**

**SOIC-8 Package**

**PDIP-8 Package**

### APPLICATIONS

**High Performance Audio**

**Active Filters**

**Fast Amplifiers**

**Integrators**

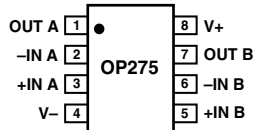
### GENERAL DESCRIPTION

The OP275 is the first amplifier to feature the Butler Amplifier front end. This new front end design combines both bipolar and JFET transistors to attain amplifiers with the accuracy and low noise performance of bipolar transistors, and the speed and sound quality of JFETs. Total Harmonic Distortion plus Noise equals that of previous audio amplifiers, but at much lower supply currents.

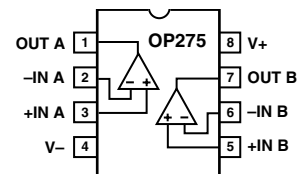
A very low  $1/f$  corner of below 6 Hz maintains a flat noise density response. Whether noise is measured at either 30 Hz or 1 kHz, it is only  $6 \text{ nV}/\sqrt{\text{Hz}}$ . The JFET portion of the input stage gives the OP275 its high slew rates to keep distortion low, even when large output swings are required, and the  $22 \text{ V}/\mu\text{s}$  slew rate of the OP275 is the fastest of any standard audio amplifier. Best of all, this low noise and high speed are accomplished using less than 5 mA of supply current, lower than any standard audio amplifier.

### PIN CONNECTIONS

**8-Lead Narrow-Body SOIC  
(S Suffix)**



**8-Lead PDIP  
(P Suffix)**



Improved dc performance is also provided with bias and offset currents greatly reduced over purely bipolar designs. Input offset voltage is guaranteed at 1 mV and is typically less than  $200 \mu\text{V}$ . This allows the OP275 to be used in many dc-coupled or summing applications without the need for special selections or the added noise of additional offset adjustment circuitry.

The output is capable of driving  $600 \Omega$  loads to 10 V rms while maintaining low distortion. THD + Noise at 3 V rms is a low 0.0006%.

The OP275 is specified over the extended industrial ( $-40^\circ\text{C}$  to  $+85^\circ\text{C}$ ) temperature range. OP275s are available in both plastic DIP and SOIC-8 packages. SOIC-8 packages are available in 2500-piece reels. Many audio amplifiers are not offered in SOIC-8 surface-mount packages for a variety of reasons; however, the OP275 was designed so that it would offer full performance in surface-mount packaging.

\*Protected by U.S. Patent No. 5,101,126.

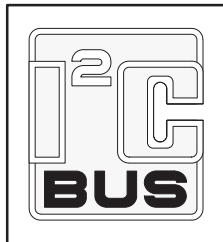
REV. C

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## 16-bit I<sup>2</sup>C and SMBus I/O port with interrupt

## PCA9555



### FEATURES

- Operating power supply voltage range of 2.3 V to 5.5 V
- 5 V tolerant I/Os
- Polarity inversion register
- Active-LOW interrupt output
- Low stand-by current
- Noise filter on SCL/SDA inputs
- No glitch on power-up
- Internal power-on reset
- 16 I/O pins which default to 16 inputs
- 0 kHz to 400 kHz clock frequency
- ESD protection exceeds 2000 V HBM per JESD22-A114, 200 V MM per JESD22-A115, and 1000 V CDM per JESD22-C101
- Latch-up testing is done to JESDEC Standard JESD78 which exceeds 100 mA
- Five packages offered: DIP24, SO24, SSOP24, TSSOP24, and HVQFN24

### ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	ORDER CODE	TOPSIDE MARK	DRAWING NUMBER
24-Pin Plastic DIP	-40 °C to +85 °C	PCA9555N	PCA9555	SOT101-1
24-Pin Plastic SO	-40 °C to +85 °C	PCA9555D	PCA9555D	SOT137-1
24-Pin Plastic SSOP	-40 °C to +85 °C	PCA9555DB	PCA9555	SOT340-1
24-Pin Plastic TSSOP	-40 °C to +85 °C	PCA9555PW	PCA9555	SOT355-1
24-Pin Plastic HVQFN	-40 °C to +85 °C	PCA9555BS	9555	SOT616-1

Standard packing quantities and other packaging data are available at [www.standardproducts.philips.com/packaging](http://www.standardproducts.philips.com/packaging).

I<sup>2</sup>C is a trademark of Philips Semiconductors Corporation.

SMBus as specified by the Smart Battery System Implementers Forum is a derivative of the Philips I<sup>2</sup>C patent.

### DESCRIPTION

The PCA9555 is a 24-pin CMOS device that provide 16 bits of General Purpose parallel Input/Output (GPIO) expansion for I<sup>2</sup>C/SMBus applications and was developed to enhance the Philips family of I<sup>2</sup>C I/O expanders. The improvements include higher drive capability, 5 V I/O tolerance, lower supply current, individual I/O configuration, and smaller packaging. I/O expanders provide a simple solution when additional I/O is needed for ACPI power switches, sensors, pushbuttons, LEDs, fans, etc.

The PCA9555 consist of two 8-bit Configuration (Input or Output selection); Input, Output and Polarity inversion (Active-HIGH or Active-LOW operation) registers. The system master can enable the I/Os as either inputs or outputs by writing to the I/O configuration bits. The data for each Input or Output is kept in the corresponding Input or Output register. The polarity of the read register can be inverted with the Polarity Inversion Register. All registers can be read by the system master. Although pin-to-pin and I<sup>2</sup>C address compatible with the PCF8575, software changes are required due to the enhancements and are discussed in *Application Note AN469*.

The PCA9555 open-drain interrupt output is activated when any input state differs from its corresponding input port register state and is used to indicate to the system master that an input state has changed. The power-on reset sets the registers to their default values and initializes the device state machine.

Three hardware pins (A0, A1, A2) vary the fixed I<sup>2</sup>C address and allow up to eight devices to share the same I<sup>2</sup>C/SMBus. The fixed I<sup>2</sup>C address of the PCA9555 is the same as the PCA9554 allowing up to eight of these devices in any combination to share the same I<sup>2</sup>C/SMBus.

16-bit I<sup>2</sup>C and SMBus I/O port with interrupt

PCA9555

PIN CONFIGURATION — DIP, SO, SSOP, TSSOP

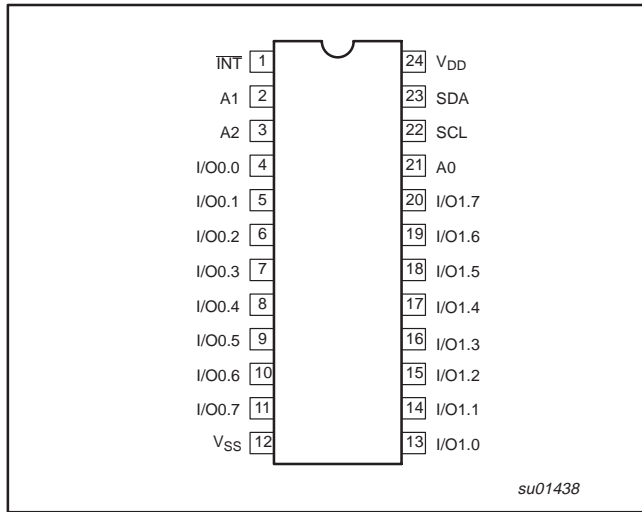


Figure 1. Pin configuration — DIP, SO, SSOP, TSSOP

PIN CONFIGURATION — HVQFN

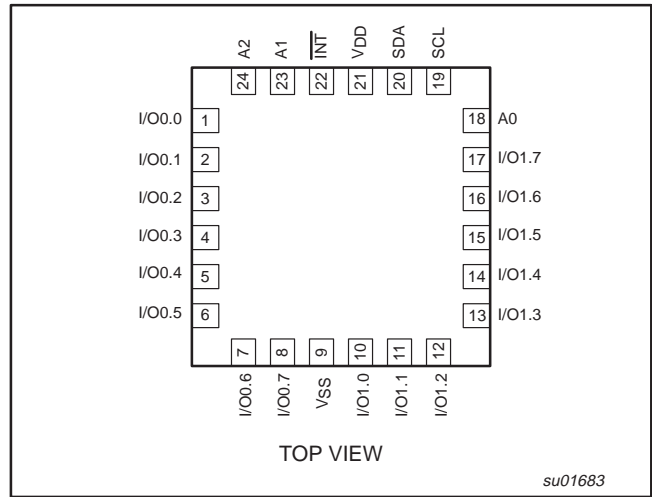


Figure 2. Pin configuration — HVQFN

PIN DESCRIPTION

PIN NUMBER		SYMBOL	FUNCTION
DIP, SO, SSOP, TSSOP	HVQFN		
1	22	INT	Interrupt output (open-drain)
2	23	A1	Address input 1
3	24	A2	Address input 2
4–11	1–8	I/O0.0–I/O0.7	I/O0.0 to I/O0.7
12	9	V <sub>SS</sub>	Supply ground
13–20	10–17	I/O1.0–I/O1.7	I/O1.0 to I/O1.7
21	18	A0	Address input 0
22	19	SCL	Serial clock line
23	20	SDA	Serial data line
24	21	V <sub>DD</sub>	Supply voltage

16-bit I<sup>2</sup>C and SMBus I/O port with interrupt

PCA9555

BLOCK DIAGRAM

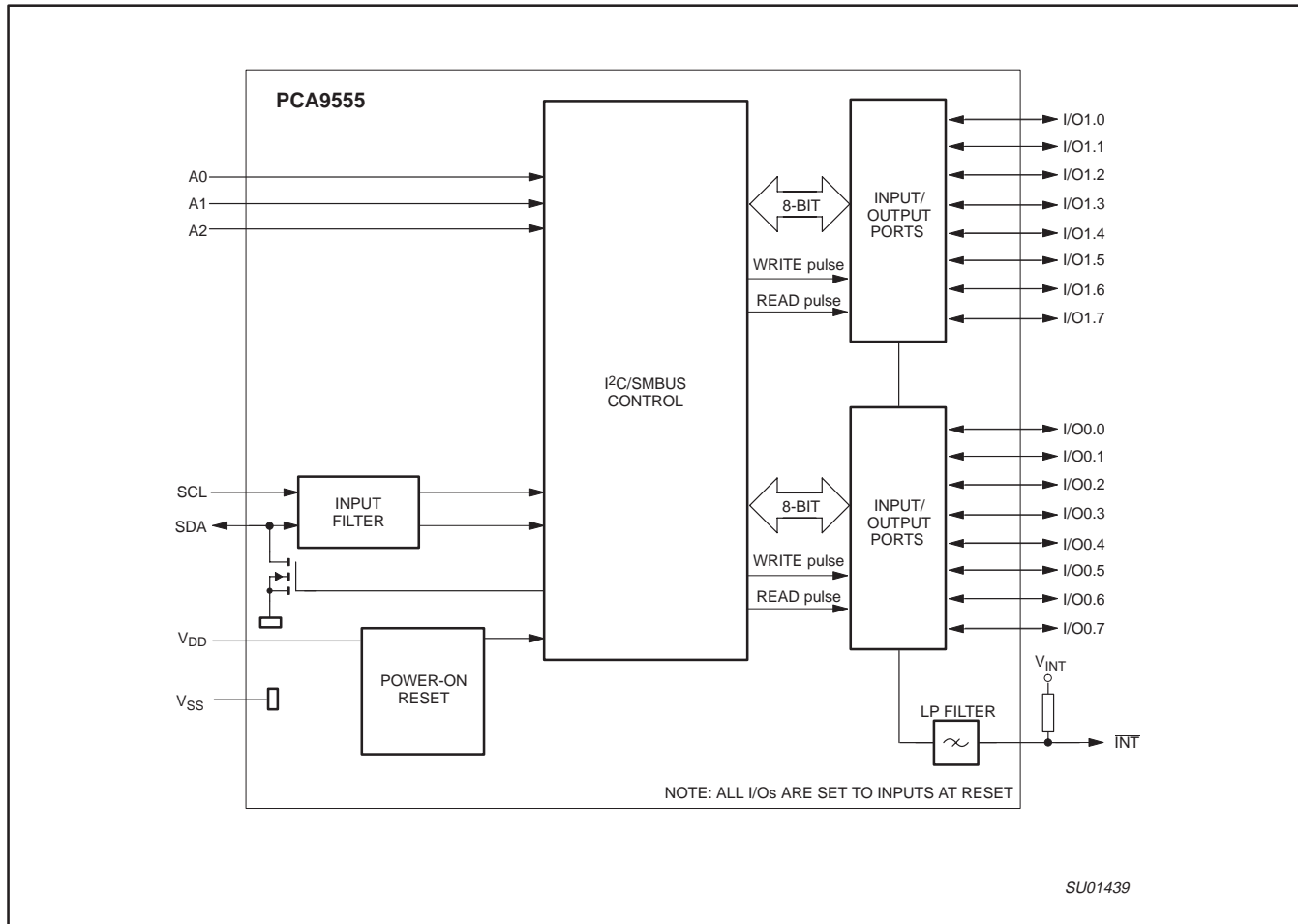


Figure 3. Block diagram



NJU201A

C-MOS QUAD SPST ANALOG SWITCH

■ GENERAL DESCRIPTION

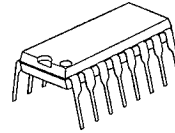
The NJU201A is a quad break-before-make SPST analog switch protected up to 44V operating voltage.

All switches are controlled by TTL or C-MOS compatible input.

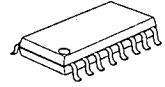
The low on-state resistance is about half compare with the NJU7301.

The NJU201A is functionally and pin-to-pin compatible with SILICONIX DG201A.

■ PACKAGE OUTLINE



NJU201AD

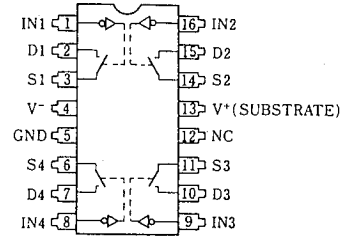


NJU201AM

■ FEATURES

- High Break Down Voltage -- 44V
- Low On-state Resistance
- Package Outline -- DIP/DMP 16
- C-MOS Technology

■ PIN CONFIGURATION

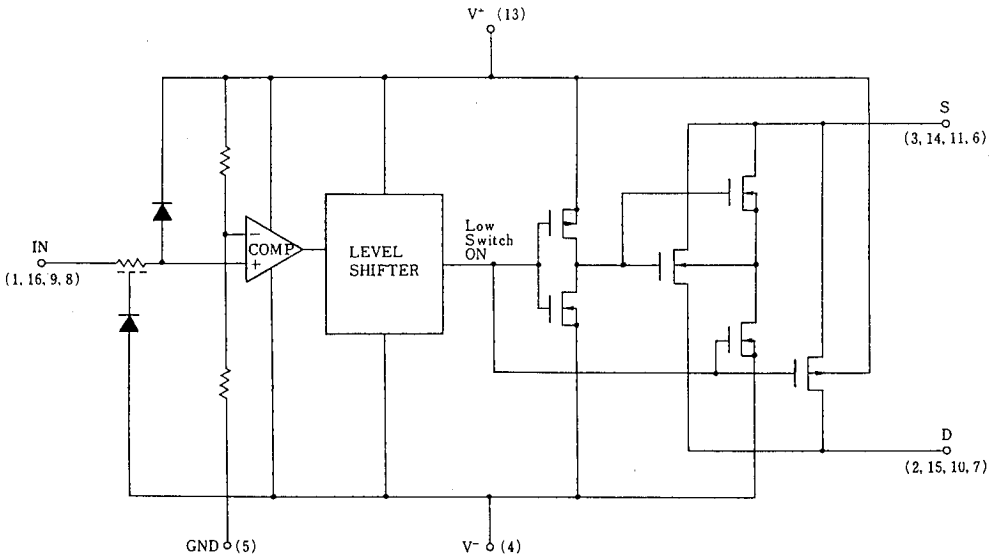


6

■ TRUTH TABLE

Logic (In)	Switch
0	ON
1	OFF

■ EQUIVALENT CIRCUIT



\* Logic input threshold voltage  $V_{TH}$  is about  $V^+ \times 0.128(V)$ .  
When the designing, enough margin is required.

## TL061, TL061A, TL061B, TL061Y, TL062, TL062A TL062B, TL062Y, TL064, TL064A, TL064B, TL064Y LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS

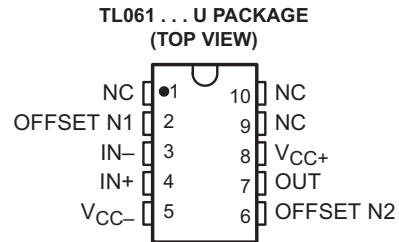
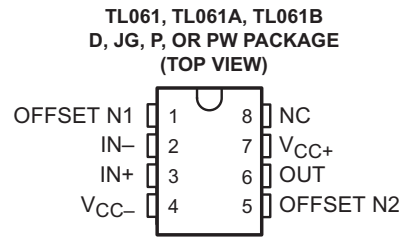
SLOS078F – NOVEMBER 1978 – REVISED JANUARY 1999

- **Very Low Power Consumption**
- **Typical Supply Current . . . 200  $\mu$ A (Per Amplifier)**
- **Wide Common-Mode and Differential Voltage Ranges**
- **Low Input Bias and Offset Currents**
- **Common-Mode Input Voltage Range Includes  $V_{CC+}$**
- **Output Short-Circuit Protection**
- **High Input Impedance . . . JFET-Input Stage**
- **Internal Frequency Compensation**
- **Latch-Up-Free Operation**
- **High Slew Rate . . . 3.5 V/ $\mu$ s Typ**

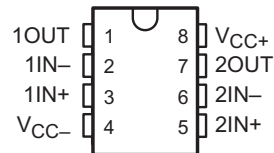
**description**

The JFET-input operational amplifiers of the TL06\_ series are designed as low-power versions of the TL08\_ series amplifiers. They feature high input impedance, wide bandwidth, high slew rate, and low input offset and input bias currents. The TL06\_ series feature the same terminal assignments as the TL07\_ and TL08\_ series. Each of these JFET-input operational amplifiers incorporates well-matched, high-voltage JFET and bipolar transistors in a monolithic integrated circuit.

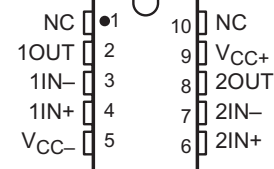
The C-suffix devices are characterized for operation from 0°C to 70°C. The I-suffix devices are characterized for operation from -40°C to 85°C, and the M-suffix devices are characterized for operation over the full military temperature range of -55°C to 125°C.



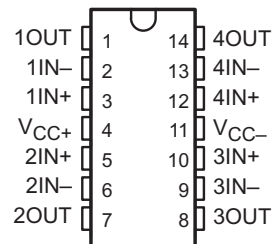
**TL062, TL062A, TL062B  
D, JG, P, OR PW PACKAGE  
(TOP VIEW)**



**TL062 . . . U PACKAGE  
(TOP VIEW)**



**TL064 . . . D, J, N, PW, OR W PACKAGE  
TL064A, TL064B . . . D OR N PACKAGE  
(TOP VIEW)**



NC – No internal connection



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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POST OFFICE BOX 655303 • DALLAS, TEXAS 75265



# High Performance Multibit $\Sigma$ - $\Delta$ DAC with SACD Playback

## AD1955ARS

### FEATURES

5 V Power Supply Stereo Audio DAC System

Accepts 16-/18-/20-/24-Bit Data

Supports 24-Bit, 192 kHz Sample Rate PCM Audio Data

Supports SACD Bit Stream and External Digital Filter Interface

Accepts a Wide Range of PCM Sample Rates Including:  
32 kHz, 44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz, and  
192 kHz

Multibit Sigma-Delta Modulator with "Perfect Differential Linearity Restoration" for Reduced Idle Tones and Noise Floor

Data Directed Scrambling DAC—Low Sensitivity to Jitter

Supports SACD Playback with "Bit Expansion" Filter

Differential Current Output for Optimum Performance

8.64 mA p-p Differential Output

120 dB SNR/DNR (not muted) at 48 kHz Sample Rate  
(A-Weighted Stereo)

123 dB SNR/DNR (Mono)

-110 dB THD + N

110 dB Stop-Band Attenuation with  $\pm 0.0002$  dB

Pass-Band Ripple

8 $\times$  Oversampling Digital Filter

On-Chip Clickless Volume Control

Supports SACD-Mute Pattern Detection

Supports 64  $f_s$ /128  $f_s$  DSD SACD with Phase Mode

Internal Digital Filter Pass-Through for External Filter

Master Clock: 256  $f_s$ , 512  $f_s$ , 768  $f_s$

Hardware and Software Controllable Clickless Mute

Serial (SPI) Control for Serial Mode, Number of Bits,

Sample Rate, Volume, Mute, De-Emphasis, Mono Mode

Digital De-Emphasis for 32 kHz, 44.1 kHz, and 48 kHz

Sample Rates

Flexible Serial Data Port with Right-Justified, Left-

Justified, I<sup>2</sup>S, and DSP Modes

28-Lead SSOP Plastic Package

### APPLICATIONS

High End DVD Audio

SACD

CD

Home Theater Systems

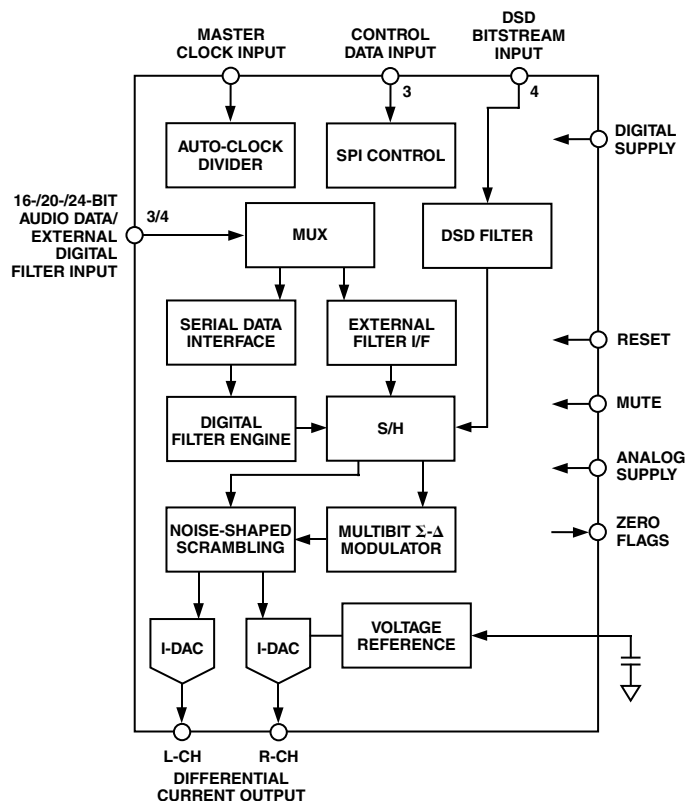
Automotive Audio Systems

Sampling Musical Keyboards

Digital Mixing Consoles

Digital Audio Effects Processors

### FUNCTIONAL BLOCK DIAGRAM



### PRODUCT OVERVIEW

The AD1955 is a complete, high performance, single-chip, stereo digital audio playback system. It is comprised of a multibit sigma-delta modulator, high performance digital interpolation filters, and continuous-time differential current output DACs. Other features include an on-chip clickless stereo attenuator and mute capability, programmed through an SPI compatible serial control port. The AD1955 is fully compatible with all known DVD audio formats including 192 kHz as well as 96 kHz sample frequencies and 24 bits. It is also backward compatible by supporting 50  $\mu$ s/15  $\mu$ s digital de-emphasis intended for "redbook" compact discs, as well as de-emphasis at 32 kHz and 48 kHz sample rates.

The AD1955 has a very flexible serial data input port that allows for glueless interconnection to a variety of ADCs, DSPs, SACD decoders, external digital filters, AES/EBU receivers, and

(continued on page 12)

REV. 0

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Fax: 781/326-8703  
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AD1955ARS

**ABSOLUTE MAXIMUM RATINGS\***

Parameter	Min	Max	Unit
DV <sub>DD</sub> to DGND	-0.3	6	V
AV <sub>DD</sub> to AGND	-0.3	6	V
Digital Inputs	DGND - 0.3	DV <sub>DD</sub> + 0.3	V
Analog Outputs	AGND - 0.3	AV <sub>DD</sub> + 0.3	V
AGND to DGND	-0.3	+0.3	V
Reference Voltage		(AV <sub>DD</sub> + 0.3)/2	
Soldering		300	°C
		10	sec

**PACKAGE CHARACTERISTICS**

Package	Typ	Unit
θ <sub>JA</sub> (Thermal Resistance [Junction-to-Ambient])	109.0	°C/W
θ <sub>JC</sub> (Thermal Resistance [Junction-to-Case])	39.0	°C/W

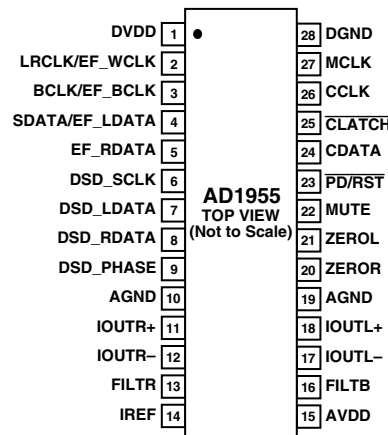
\*Stresses greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**ORDERING GUIDE**

Model	Temperature	Package Description	Package Option*
AD1955ARS	-40°C to +85°C	28-Lead SSOP	RS-28
AD1955ARSRL	-40°C to +85°C	28-Lead SSOP	RS-28 on 13" Reels
EVAL-AD1955EB		Evaluation Board	

\*RS = Shrink Small Outline Package

**PIN CONFIGURATION**



**CAUTION**

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the AD1955 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



# Advanced Monolithic Systems

# AMS1117

## 1A LOW DROPOUT VOLTAGE REGULATOR

### FEATURES

- Three Terminal Adjustable or Fixed Voltages\*  
1.5V, 1.8V, 2.5V, 2.85V, 3.3V and 5.0V
- Output Current of 1A
- Operates Down to 1V Dropout
- Line Regulation: 0.2% Max.
- Load Regulation: 0.4% Max.
- SOT-223, TO-252 and SO-8 package available

### APPLICATIONS

- High Efficiency Linear Regulators
- Post Regulators for Switching Supplies
- 5V to 3.3V Linear Regulator
- Battery Chargers
- Active SCSI Terminators
- Power Management for Notebook
- Battery Powered Instrumentation

### GENERAL DESCRIPTION

The AMS1117 series of adjustable and fixed voltage regulators are designed to provide 1A output current and to operate down to 1V input -to-output differential. The dropout voltage of the device is guaranteed maximum 1.3V at maximum output current, decreasing at lower load currents.

On-chip trimming adjusts the reference voltage to 1%. Current limit is also trimmed, minimizing the stress under overload conditions on both the regulator and power source circuitry.

The AMS1117 devices are pin compatible with other three -terminal SCSI regulators and are offered in the low profile surface mount SOT-223 package, in the 8L SOIC package and in the TO-252 (DPAK) plastic package.

### ORDERING INFORMATION:

PACKAGE TYPE			OPERATING JUNCTION TEMPERATURE RANGE
TO-252	SOT-223	8L SOIC	
AMS1117CD	AMS1117	AMS1117CS	-40 to 125° C
AMS1117CD-1.5	AMS1117-1.5	AMS1117CS-1.5	-40 to 125° C
AMS1117CD-1.8	AMS1117-1.8	AMS1117CS-1.8	-40 to 125° C
AMS1117CD-2.5	AMS1117-2.5	AMS1117CS-2.5	-40 to 125° C
AMS1117CD-2.85	AMS1117-2.85	AMS1117CS-2.85	-40 to 125° C
AMS1117CD-3.3	AMS1117-3.3	AMS1117CS-3.3	-40 to 125° C
AMS1117CD-5.0	AMS1117-5.0	AMS1117CS-5.0	-40 to 125° C

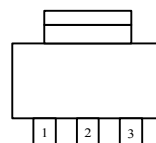
\*For additional available fixed voltages contact factory.

### PIN CONNECTIONS

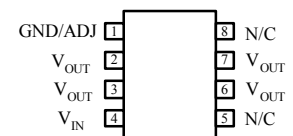
#### 3 PIN FIXED/ADJUSTABLE VERSION

- 1- Ground/Adjust
- 2-  $V_{OUT}$
- 3-  $V_{IN}$

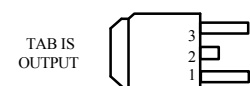
SOT-223 Top View



8L SOIC Top View



TO-252 FRONT VIEW





# BSS123

## N-CHANNEL ENHANCEMENT MODE FIELD EFFECT TRANSISTOR

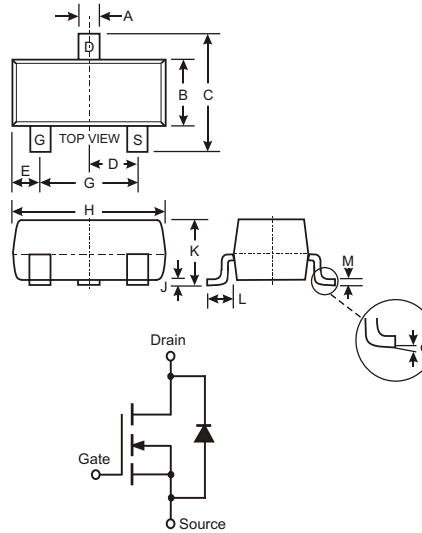
NEW PRODUCT

### Features

- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- High Drain-Source Voltage Rating

### Mechanical Data

- Case: SOT-23, Molded Plastic
- Case material - UL Flammability Rating 94V-0
- Moisture sensitivity: Level 1 per J-STD-020A
- Terminals: Solderable per MIL-STD-202, Method 208
- Terminal Connections: See Diagram
- Marking: K23 (See Page 3)
- Ordering & Date Code Information: See Page 3
- Weight: 0.008 grams (approx.)



SOT-23		
Dim	Min	Max
A	0.37	0.51
B	1.20	1.40
C	2.30	2.50
D	0.89	1.03
E	0.45	0.60
G	1.78	2.05
H	2.80	3.00
J	0.013	0.10
K	0.903	1.10
L	0.45	0.61
M	0.085	0.180
$\alpha$	0°	8°
All Dimensions in mm		

### Maximum Ratings @ T<sub>A</sub> = 25°C unless otherwise specified

Characteristic	Symbol	BSS123	Units
Drain-Source Voltage	V <sub>DSS</sub>	100	V
Drain-Gate Voltage R <sub>GS</sub> ≤ 20KΩ	V <sub>DGR</sub>	100	V
Gate-Source Voltage	V <sub>GS</sub>	±20	V
Drain Current (Note 1)	I <sub>D</sub>	170	mA
	I <sub>DM</sub>	680	
Total Power Dissipation (Note 1)	P <sub>d</sub>	300	mW
Thermal Resistance, Junction to Ambient (Note 1)	R <sub>θJA</sub>	417	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

Note: 1. Part mounted on FR-4 board with recommended pad layout, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.



Integrated  
Circuit  
Systems, Inc.

# ICS83905

## LOW SKEW, 1:6 CRYSTAL INTERFACE-TO-LVCMOS / LVTTTL FANOUT BUFFER

### GENERAL DESCRIPTION

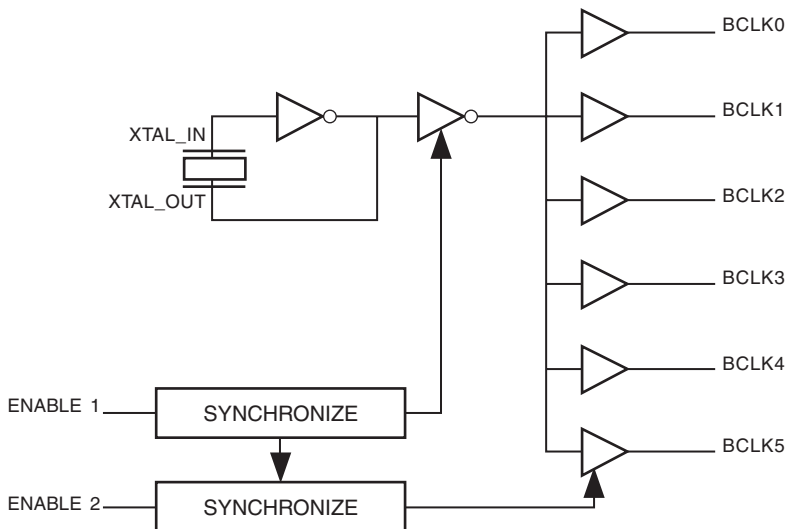
The ICS83905 is a low skew, 1-to-6 LVCMOS / LVTTTL Fanout Buffer and a member of the HiPerClockS™ family of High Performance Clock Solutions from ICS. The ICS83905 single ended clock input accepts LVCMOS or LVTTTL input levels. The low impedance LVCMOS/LVTTTL outputs are designed to drive 50Ω series or parallel terminated transmission lines. The effective fanout can be increased from 6 to 12 by utilizing the ability of the outputs to drive two series terminated lines.

The ICS83905 is characterized at full 3.3V, 2.5V, and 1.8V, mixed 3.3V/2.5V, 3.3V/1.8V and 2.5V/1.8V output operating supply mode. Guaranteed output and part-to-part skew characteristics along with the 1.8V output capabilities makes the ICS83905 ideal for high performance, single ended applications that also require a limited output voltage.

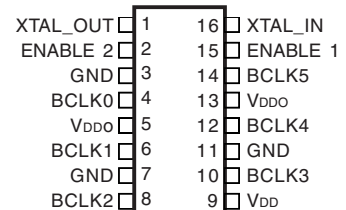
### FEATURES

- 6 LVCMOS / LVTTTL outputs
- Crystal oscillator interface
- Output frequency range: 10MHz to 50MHz
- Crystal input frequency range: 10MHz to 50MHz
- Output skew: 10ps (typical)
- 5V tolerant enable inputs
- Synchronous output enables
- Operating supply modes: Full 3.3V, 2.5V and 1.8V, mixed 3.3Vcore/2.5V or 1.8V operating supply, and mixed 2.5V core/1.8V operating supply
- 0°C to 70°C ambient operating temperature
- Lead-Free package fully RoHS compliant
- Pin compatible to MPC905
- Industrial version available upon request

### BLOCK DIAGRAM



### PIN ASSIGNMENT



#### ICS83905

##### 16-Lead SOIC

3.9mm x 9.9mm x 1.38mm body package

##### M Package

Top View

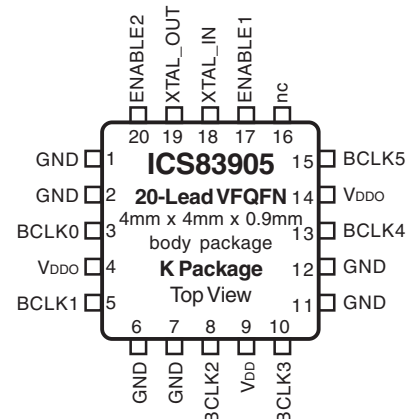
#### ICS83905

##### 16-Lead TSSOP

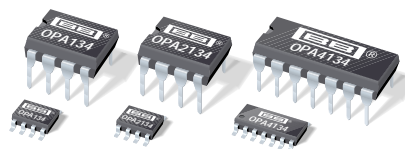
4.4mm x 3.0mm x 0.92mm body package

##### G Package

Top View



The Preliminary Information presented herein represents a product in prototyping or pre-production. The noted characteristics are based on initial product characterization. Integrated Circuit Systems, Incorporated (ICS) reserves the right to change any circuitry or specifications without notice.



**OPA134  
OPA2134  
OPA4134**

*SoundPLUS*™ High Performance  
**AUDIO OPERATIONAL AMPLIFIERS**

**FEATURES**

- SUPERIOR SOUND QUALITY
- ULTRA LOW DISTORTION: 0.00008%
- LOW NOISE:  $8nV/\sqrt{Hz}$
- TRUE FET-INPUT:  $I_b = 5pA$
- HIGH SPEED:
  - SLEW RATE:  $20V/\mu s$
  - BANDWIDTH: 8MHz
- HIGH OPEN-LOOP GAIN: 120dB (600Ω)
- WIDE SUPPLY RANGE:  $\pm 2.5V$  to  $\pm 18V$
- SINGLE, DUAL, AND QUAD VERSIONS

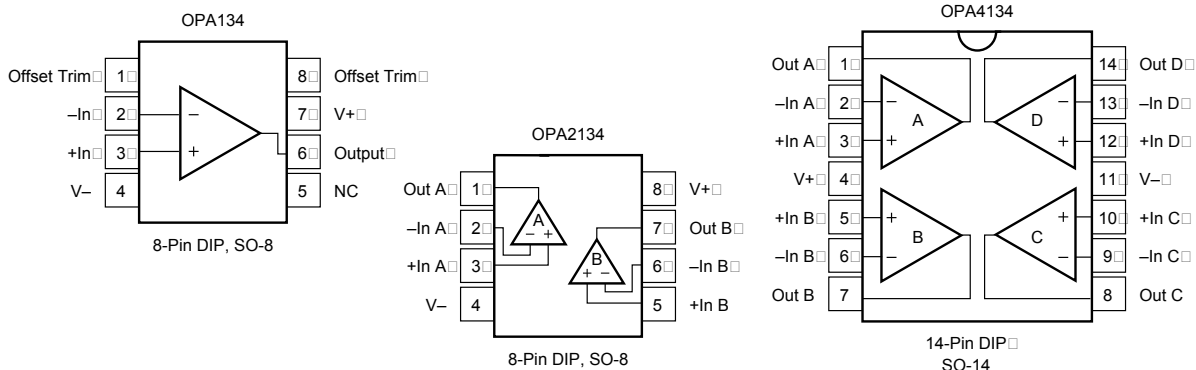
**APPLICATIONS**

- PROFESSIONAL AUDIO AND MUSIC
- LINE DRIVERS
- LINE RECEIVERS
- MULTIMEDIA AUDIO
- ACTIVE FILTERS
- PREAMPLIFIERS
- INTEGRATORS
- CROSSOVER NETWORKS

**DESCRIPTION**

The OPA134 series are ultra-low distortion, low noise operational amplifiers fully specified for audio applications. A true FET input stage was incorporated to provide superior sound quality and speed for exceptional audio performance. This in combination with high output drive capability and excellent dc performance allows use in a wide variety of demanding applications. In addition, the OPA134's wide output swing, to within 1V of the rails, allows increased headroom making it ideal for use in any audio circuit. OPA134 op amps are easy to use and free from phase inversion and overload problems often found in common FET-input op amps. They can be operated from  $\pm 2.5V$  to  $\pm 18V$  power supplies. Input cascode circuitry provides excellent common-mode rejection and maintains low input bias current over its wide input voltage range, minimizing distortion. OPA134 series op amps are unity-gain stable and provide excellent dynamic behavior over a wide range of load conditions, including high load capacitance. The dual and quad versions feature completely independent circuitry for lowest crosstalk and freedom from interaction, even when overdriven or overloaded.

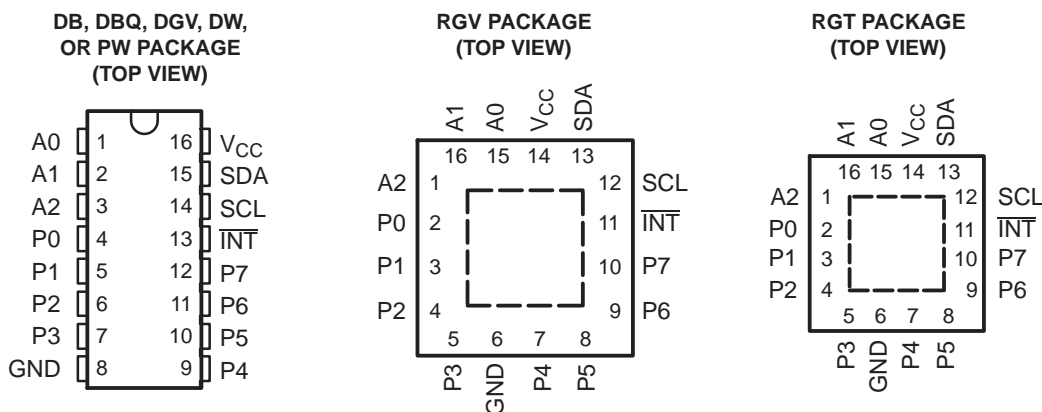
Single and dual versions are available in 8-pin DIP and SO-8 surface-mount packages in standard configurations. The quad is available in 14-pin DIP and SO-14 surface mount packages. All are specified for  $-40^{\circ}C$  to  $+85^{\circ}C$  operation. A SPICE macromodel is available for design analysis.



International Airport Industrial Park • Mailing Address: PO Box 11400, Tucson, AZ 85734 • Street Address: 6730 S. Tucson Blvd., Tucson, AZ 85706 • Tel: (520) 746-1111 • Twx: 910-952-1111  
Internet: <http://www.burr-brown.com/> • FAXLine: (800) 548-6133 (US/Canada Only) • Cable: BBRCORP • Telex: 066-6491 • FAX: (520) 889-1510 • Immediate Product Info: (800) 548-6132

## FEATURES

- I<sup>2</sup>C to Parallel Port Expander
- Open-Drain Active-Low Interrupt Output
- Operating Power-Supply Voltage Range of 2.3 V to 5.5 V
- 5-V Tolerant I/Os
- 400-kHz Fast I<sup>2</sup>C Bus
- Three Hardware Address Pins Allow up to Eight Devices on the I<sup>2</sup>C/SMBus
- Input/Output Configuration Register
- Polarity Inversion Register
- Internal Power-On Reset
- Power-Up With All Channels Configured as Inputs
- No Glitch on Power-Up
- Latched Outputs With High-Current Drive Maximum Capability for Directly Driving LEDs
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)



## DESCRIPTION/ORDERING INFORMATION

This 8-bit I/O expander for the two-line bidirectional bus (I<sup>2</sup>C) is designed for 2.3-V to 5.5-V V<sub>CC</sub> operation. It provides general-purpose remote I/O expansion for most microcontroller families via the I<sup>2</sup>C interface [serial clock (SCL), serial data (SDA)].

The PCA9554A consists of one 8-bit Configuration (input or output selection), Input, Output, and Polarity Inversion (active high or active low) registers. At power-on, the I/Os are configured as inputs with a weak pull up to V<sub>CC</sub>. However, the system master can enable the I/Os as either inputs or outputs by writing to the I/O configuration bits. The data for each input or output is kept in the corresponding Input or Output register. The polarity of the Input Port register can be inverted with the Polarity Inversion register. All registers can be read by the system master.

The system master can reset the PCA9554A in the event of a timeout or other improper operation by utilizing the power-on reset feature which puts the registers in their default state and initializes the I<sup>2</sup>C/SMBus state machine.

The PCA9554A open-drain interrupt ( $\overline{\text{INT}}$ ) output is activated when any input state differs from its corresponding Input Port register state and is used to indicate to the system master that an input state has changed.

$\overline{\text{INT}}$  can be connected to the interrupt input of a microcontroller. By sending an interrupt signal on this line, the remote I/O can inform the microcontroller if there is incoming data on its ports without having to communicate via the I<sup>2</sup>C bus. Thus, the PCA9554A can remain a simple slave device.

The device's outputs (latched) have high-current drive capability for directly driving LEDs and low current consumption.

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SRC4392

SBFS029C—DECEMBER 2005—REVISED SEPTEMBER 2007

## Two-Channel, Asynchronous Sample Rate Converter with Integrated Digital Audio Interface Receiver and Transmitter

### FEATURES

- **Two-Channel Asynchronous Sample Rate Converter (SRC)**
  - Dynamic Range with –60dB Input (A-Weighted): 144dB typical
  - Total Harmonic Distortion and Noise (THD+N) with Full-Scale Input: –140dB typical
  - Supports Audio Input and Output Data Word Lengths Up to 24 Bits
  - Supports Input and Output Sampling Frequencies Up to 216kHz
  - Automatic Detection of the Input-to-Output Sampling Ratio
  - Wide Input-to-Output Conversion Range: 16:1 to 1:16 Continuous
  - Excellent Jitter Attenuation Characteristics
  - Digital De-Emphasis Filtering for 32kHz, 44.1kHz, and 48kHz Input Sampling Rates
  - Digital Output Attenuation and Mute Functions
  - Output Word Length Reduction
  - Status Registers and Interrupt Generation for Sampling Ratio and Ready Flags
- **Digital Audio Interface Transmitter (DIT)**
  - Supports Sampling Rates Up to 216kHz
  - Includes Differential Line Driver and CMOS Buffered Outputs
  - Block-Sized Data Buffers for Both Channel Status and User Data
  - Status Registers and Interrupt Generation for Flag and Error Conditions
- **User-Selectable Serial Host Interface: SPI or Philips I<sup>2</sup>C™**
  - Provides Access to On-Chip Registers and Data Buffers
- **Digital Audio Interface Receiver (DIR)**
  - PLL Lock Range Includes Sampling Rates from 20kHz to 216kHz
  - Includes Four Differential Input Line Receivers and an Input Multiplexer
  - Bypass Multiplexer Routes Line Receiver Outputs to Line Driver and Buffer Outputs
  - Block-Sized Data Buffers for Both Channel Status and User Data
  - Automatic Detection of Non-PCM Audio Streams (DTS CD/LD and IEC 61937 formats)
  - Audio CD Q-Channel Sub-Code Decoding and Data Buffer
  - Status Registers and Interrupt Generation for Flag and Error Conditions
  - Low Jitter Recovered Clock Output
- **Two Audio Serial Ports (Ports A and B)**
  - Synchronous Serial Interface to External Signal Processors, Data Converters, and Logic
  - Slave or Master Mode Operation with Sampling Rates up to 216kHz
  - Supports Left-Justified, Right-Justified, and Philips I<sup>2</sup>S™ Data Formats
  - Supports Audio Data Word Lengths Up to 24 Bits
- **Four General-Purpose Digital Outputs**
  - Multifunction Programmable Via Control Registers
- **Extensive Power-Down Support**
  - Functional Blocks May Be Disabled Individually When Not In Use
- **Operates From +1.8V Core and +3.3V I/O Power Supplies**
- **Small TQFP-48 Package, Compatible with the SRC4382 and DIX4192**

U.S. Patent No. 7,262,716

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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

Figure 59 shows a simplified functional block diagram for the SRC4392. Additional details for each function block will be covered in respective sections of this datasheet.

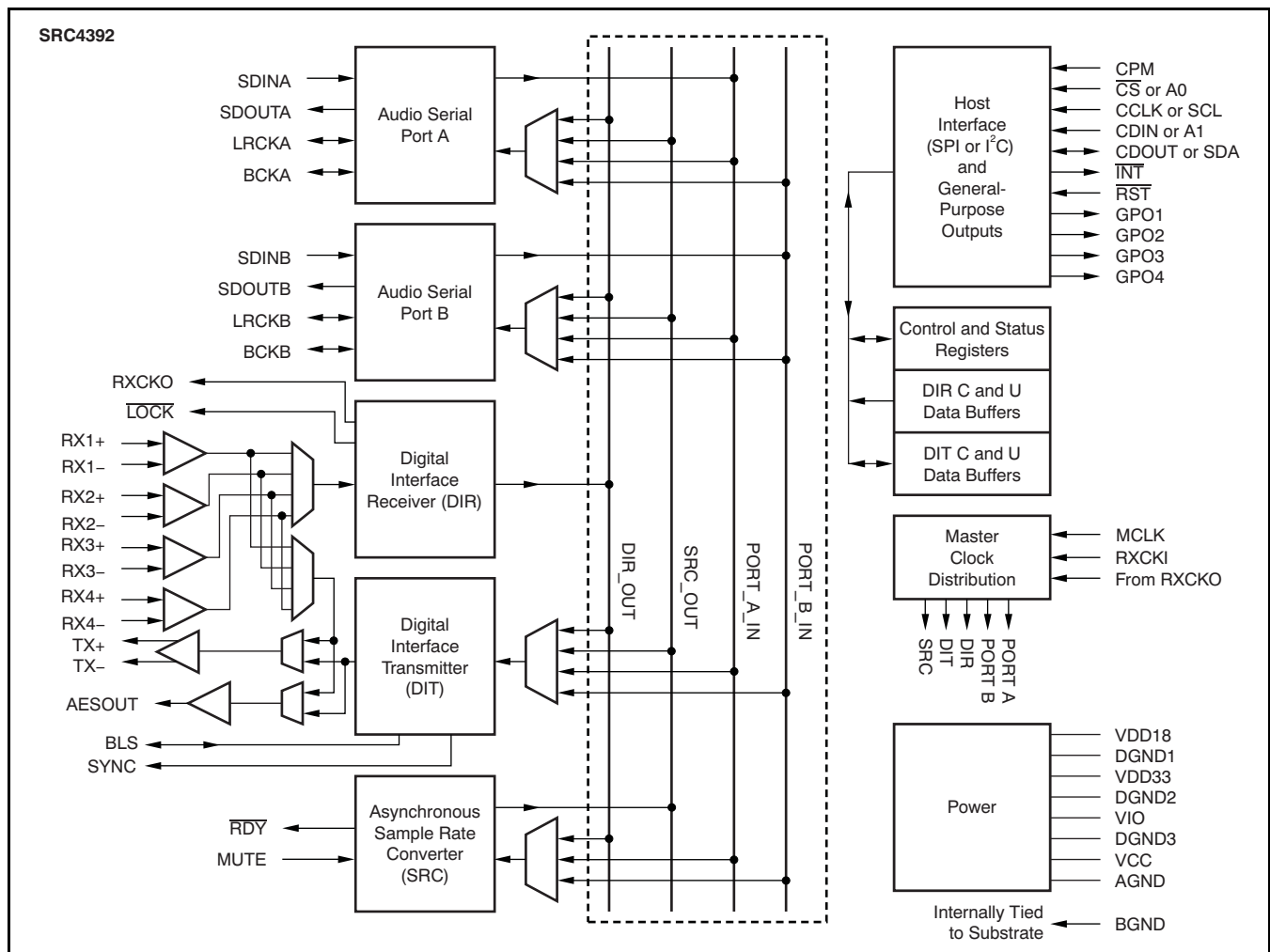


Figure 59. Functional Block Diagram

### RESET OPERATION

The SRC4392 includes an asynchronous active low reset input,  $\overline{RST}$  (pin 24), which may be used to initialize the internal logic at any time. The reset sequence forces all registers and buffers to their default settings. The reset low pulse width must be a minimum of 500ns in length. The user should not attempt a write or read operation using either the SPI or I<sup>2</sup>C port for at least 500µs after the rising edge of  $\overline{RST}$ . See Figure 60 for the reset timing sequence of the SRC4392.

In addition to reset input, the RESET bit in control register 0x01 may be used to force an internal reset, whereby all registers and buffers are forced to their default settings. Refer to the Control Registers section for details regarding the RESET bit function.

Upon reset initialization, all functional blocks of the SRC4392 default to the power-down state, with the exception of the SPI or I<sup>2</sup>C host interface and the corresponding control registers. The user may then program the SRC4392 to the desired configuration, and release the desired function blocks from the power-down state utilizing the corresponding bits in control register 0x01.

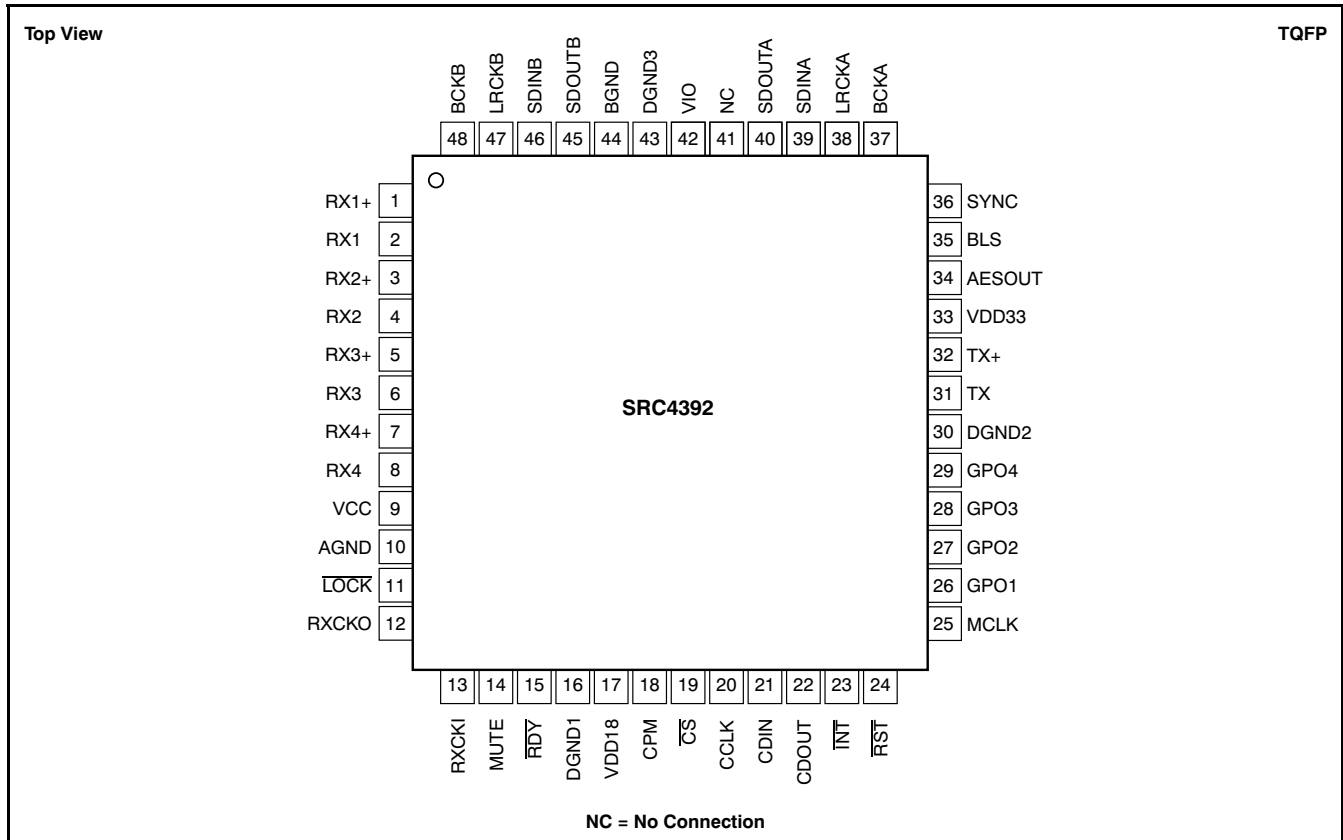


SRC4392

SBFS029B – DECEMBER 2005 – REVISED APRIL 2006

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PIN CONFIGURATION



PIN DESCRIPTIONS

NAME	PIN NUMBER	I/O	DESCRIPTION
RX1+	1	Input	Line Receiver 1, Noninverting Input
RX1-	2	Input	Line Receiver 1, Inverting Input
RX2+	3	Input	Line Receiver 2, Noninverting Input
RX2-	4	Input	Line Receiver 2, Inverting Input
RX3+	5	Input	Line Receiver 3, Noninverting Input
RX3-	6	Input	Line Receiver 3, Inverting Input
RX4+	7	Input	Line Receiver 4, Noninverting Input
RX4-	8	Input	Line Receiver 4, Inverting Input
VCC	9	Power	DIR Comparator and PLL Power Supply, +3.3V Nominal
AGND	10	Ground	DIR Comparator and PLL Power-Supply Ground
LOCK	11	Output	DIR PLL Lock Flag (active Low)
RXCKO	12	Output	DIR Recovered Master Clock (tri-state output)
RXCKI	13	Input	DIR Reference Clock
MUTE	14	Input	SRC Output Mute (active High)
RDY	15	Output	SRC Ready Flag (active Low)
DGND1	16	Ground	Digital Core Ground
VDD18	17	Power	Digital Core Supply, +1.8V Nominal
CPM	18	Input	Control Port Mode, 0 = SPI Mode, 1 = I <sup>2</sup> C Mode
CS or A0	19	Input	Chip Select (active Low) for SPI Mode or Programmable Slave Address for I <sup>2</sup> C Mode
CCLK or SCL	20	Input	Serial Data Clock for SPI Mode or I <sup>2</sup> C Mode
CDIN or A1	21	Input	SPI Port Serial Data input or Programmable Slave Address for I <sup>2</sup> C Mode
CDOUT or SDA	22	I/O	SPI Port Serial Data Output (tri-state output) or Serial Data I/O for I <sup>2</sup> C Mode

**PIN DESCRIPTIONS (continued)**

NAME	PIN NUMBER	I/O	DESCRIPTION
INT	23	Output	Interrupt Flag (open-drain, active Low)
RST	24	Input	Reset (active Low)
MCLK	25	Input	Master Clock
GPO1	26	Output	General-Purpose Output 1
GPO2	27	Output	General-Purpose Output 2
GPO3	28	Output	General-Purpose Output 3
GPO4	29	Output	General-Purpose Output 4
DGND2	30	Ground	DIR Line Receiver Bias and DIT Line Driver Digital Ground
TX–	31	Output	DIT Line Driver Inverting Output
TX+	32	Output	DIT Line Driver Noninverting Output
VDD33	33	Power	DIR Line Receiver Bias and DIT Line Driver Supply, +3.3V Nominal
AESOUT	34	Output	DIT Buffered AES3-Encoded Data
BLS	35	I/O	DIT Block Start Clock
SYNC	36	Output	DIT internal Sync Clock
BCKA	37	I/O	Audio Serial Port A Bit Clock
LRCKA	38	I/O	Audio Serial Port A Left/Right Clock
SDINA	39	Input	Audio Serial Port A Data Input
SDOUTA	40	Output	Audio Serial Port A Data Output
NC	41	—	No Internal Signal Connection, Internally Bonded to ESD Pad
VIO	42	Power	Logic I/O Supply, +1.65V to +3.6V
DGND3	43	Ground	Logic I/O Ground
BGND	44	Ground	Substrate Ground, Connect to AGND (pin 10)
SDOUTB	45	Output	Audio Serial Port B Data Output
SDINB	46	Input	Audio Serial Port B Data Input
LRCKB	47	I/O	Audio Serial Port B Left/Right Clock
BCKB	48	I/O	Audio Serial Port B Bit Clock



# WM8740

## 24-bit, High Performance 192kHz Stereo DAC

Advanced Information, July 2000, Rev 1.7

### DESCRIPTION

The WM8740 is a very high performance stereo DAC designed for audio applications such as CD, DVD, home theatre systems, set top boxes and digital TV. The WM8740 supports data input word lengths from 16 to 24-bits and sampling rates up to 192kHz. The WM8740 consists of a serial interface port, digital interpolation filter, multi-bit sigma delta modulator and stereo DAC in a small 28-pin SSOP package. The WM8740 also includes a digitally controllable mute and attenuator function on each channel.

The internal digital filter has two selectable roll-off characteristics. A sharp or slow roll-off can be selected dependent on application requirements. Additionally, the internal digital filter can be by-passed and the WM8740 used with an external digital filter.

The WM8740 supports two connection schemes for audio DAC control. The SPI-compatible serial control port provides access to a wide range of features including on-chip mute, attenuation and phase reversal. A hardware controllable interface is also available.

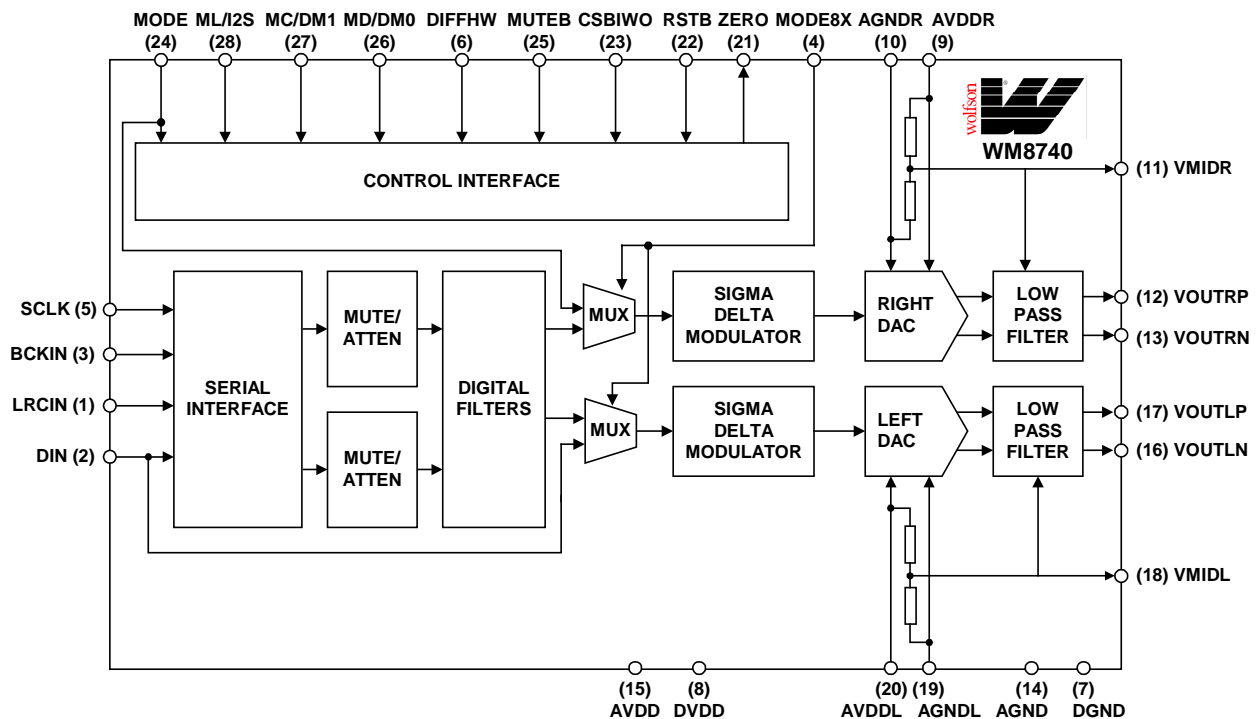
### FEATURES

- 120dB SNR ('A' weighted mono @48kHz), THD+N: -104dB @ FS
- 117dB SNR ('A' weighted stereo @48kHz), THD+N: -104dB @ FS
- Sampling frequency: 8kHz to 192kHz
- Selectable digital filter roll-off
- Optional interface to industry standard external filters
- Differential mono mode needing no glue logic
- Input data word: 16 to 24-bit
- Hardware or SPI compatible serial port control modes:
  - Hardware mode: mute, de-emphasis, audio format control
  - Serial mode: mute, de-emphasis, attenuation (256 steps), phase reversal
- Fully differential voltage outputs

### APPLICATIONS

- CD, DVD audio
- Home theatre systems
- Professional audio systems

### BLOCK DIAGRAM



**WOLFSON MICROELECTRONICS LTD**  
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 http://www.wolfson.co.uk

Advanced Information data sheets contain preliminary data on new products in the preproduction phase of development. Supplementary data will be published at a later date.

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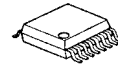
# NJW1159M

## 2-CHANNEL ELECTRONIC VOLUME

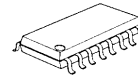
### ■ GENERAL DESCRIPTION

**NJW1159** is a two channel electronic volume IC. It is included output buffer amplifier and also resistor output terminal for using external amplifier to customize for your application. These functions are controlled by three-wired serial data. And the chip selector is available for using four chips on same serial bus line. It's available for two-channel stereo and or multi-channel audio volume.

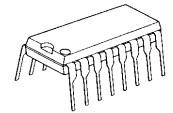
### ■ PACKAGE OUTLINE



NJW1159V



NJW1159M

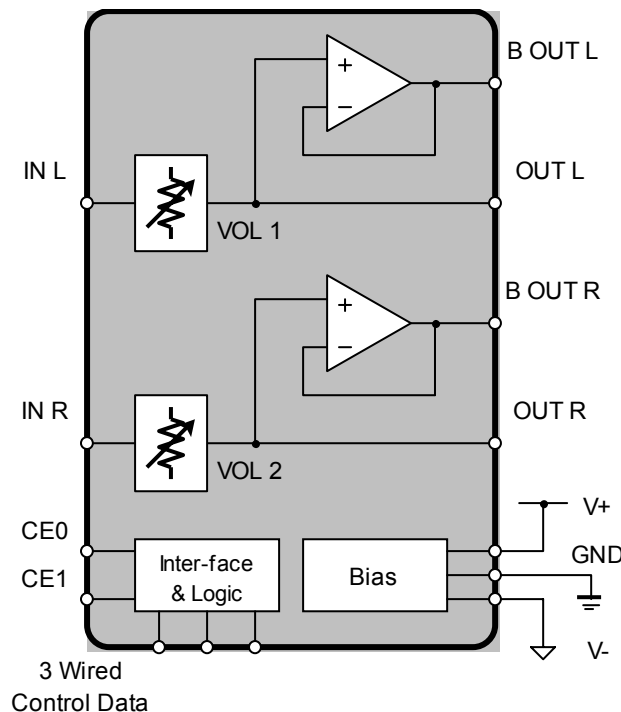


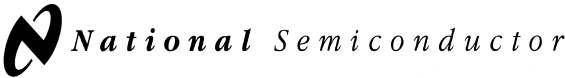
NJW1159D

### ■ FEATURES

- Operating Voltage ±4.5 to ±7.5V
- Three-Wired Serial Data Control
- Chip Selector available for using four chips on same serial bus line.
- Volume 0 to -95dB/1dBstep, MUTE
- Bi-CMOS Technology
- Package Outline SSOP16, DMP16, DIP16

### ■ BLOCK DIAGRAM





# LM117/LM317A/LM317

## 3-Terminal Adjustable Regulator

### General Description

The LM117 series of adjustable 3-terminal positive voltage regulators is capable of supplying in excess of 1.5A over a 1.2V to 37V output range. They are exceptionally easy to use and require only two external resistors to set the output voltage. Further, both line and load regulation are better than standard fixed regulators. Also, the LM117 is packaged in standard transistor packages which are easily mounted and handled.

In addition to higher performance than fixed regulators, the LM117 series offers full overload protection available only in IC's. Included on the chip are current limit, thermal overload protection and safe area protection. All overload protection circuitry remains fully functional even if the adjustment terminal is disconnected.

Normally, no capacitors are needed unless the device is situated more than 6 inches from the input filter capacitors in which case an input bypass is needed. An optional output capacitor can be added to improve transient response. The adjustment terminal can be bypassed to achieve very high ripple rejection ratios which are difficult to achieve with standard 3-terminal regulators.

Besides replacing fixed regulators, the LM117 is useful in a wide variety of other applications. Since the regulator is "floating" and sees only the input-to-output differential volt-

age, supplies of several hundred volts can be regulated as long as the maximum input to output differential is not exceeded, i.e., avoid short-circuiting the output.

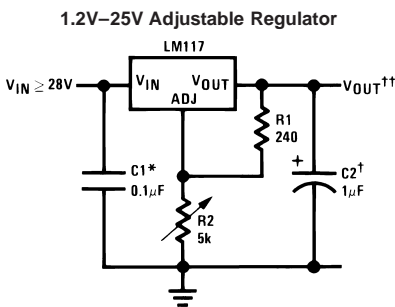
Also, it makes an especially simple adjustable switching regulator, a programmable output regulator, or by connecting a fixed resistor between the adjustment pin and output, the LM117 can be used as a precision current regulator. Supplies with electronic shutdown can be achieved by clamping the adjustment terminal to ground which programs the output to 1.2V where most loads draw little current.

For applications requiring greater output current, see LM150 series (3A) and LM138 series (5A) data sheets. For the negative complement, see LM137 series data sheet.

### Features

- Guaranteed 1% output voltage tolerance (LM317A)
- Guaranteed max. 0.01%/V line regulation (LM317A)
- Guaranteed max. 0.3% load regulation (LM117)
- Guaranteed 1.5A output current
- Adjustable output down to 1.2V
- Current limit constant with temperature
- P+ Product Enhancement tested
- 80 dB ripple rejection
- Output is short-circuit protected

### Typical Applications



DS009063-1

Full output current not available at high input-output voltages

\*Needed if device is more than 6 inches from filter capacitors.

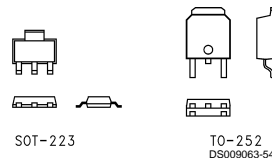
†Optional — improves transient response. Output capacitors in the range of 1 µF to 1000 µF of aluminum or tantalum electrolytic are commonly used to provide improved output impedance and rejection of transients.

$$\dagger\dagger V_{OUT} = 1.25V \left( 1 + \frac{R_2}{R_1} \right) + I_{ADJ}(R_2)$$

### LM117 Series Packages

Part Number Suffix	Package	Design Load Current
K	TO-3	1.5A
H	TO-39	0.5A
T	TO-220	1.5A
E	LCC	0.5A
S	TO-263	1.5A
EMP	SOT-223	1A
MDT	TO-252	0.5A

### SOT-223 vs D-Pak (TO-252) Packages



SOT-223

TO-252  
DS009063-4

Scale 1:1

**L7805CV**

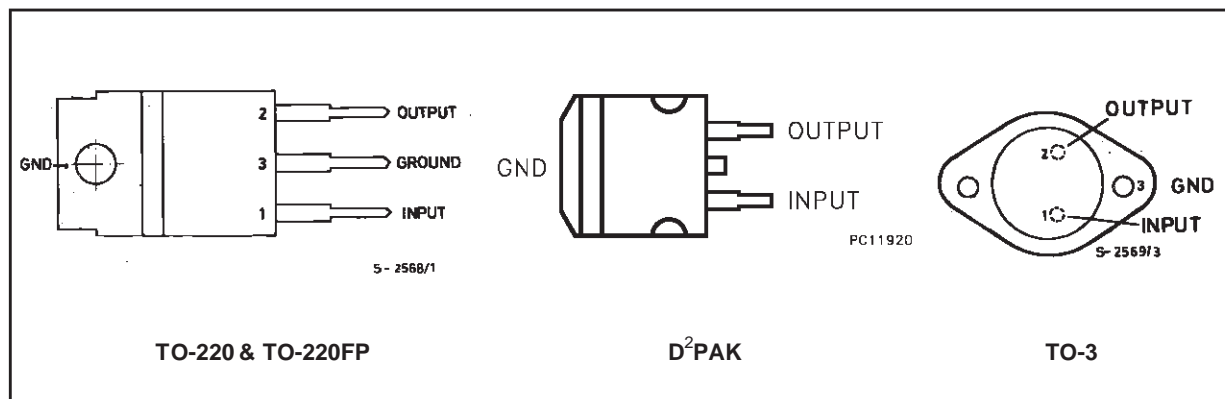
**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>i</sub>	DC Input Voltage (for V <sub>O</sub> = 5 to 18V) (for V <sub>O</sub> = 20, 24V)	35	V
		40	V
I <sub>o</sub>	Output Current	Internally limited	
P <sub>tot</sub>	Power Dissipation	Internally limited	
T <sub>op</sub>	Operating Junction Temperature Range (for <b>L7800</b> ) (for <b>L7800C</b> )	-55 to 150	°C
		0 to 150	°C
T <sub>stg</sub>	Storage Temperature Range	-65 to 150	°C

**THERMAL DATA**

Symbol	Parameter	D <sup>2</sup> PAK	TO-220	TO-220FP	TO-3	Unit
R <sub>thj-case</sub>	Thermal Resistance Junction-case Max	3	3	5	4	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient Max	62.5	50	60	35	°C/W

**CONNECTION DIAGRAM AND ORDERING NUMBERS (top view)**



Type	TO-220	D <sup>2</sup> PAK (*)	TO-220FP	TO-3	Output Voltage
L7805				L7805T	5V
L7805C	L7805CV	L7805CD2T	L7805CP	L7805CT	5V
L7852C	L7852CV	L7852CD2T	L7852CP	L7852CT	5.2V
L7806				L7806T	6V
L7806C	L7806CV	L7806CD2T	L7806CP	L7806CT	6V
L7808				L7808T	8V
L7808C	L7808CV	L7808CD2T	L7808CP	L7808CT	8V
L7885C	L7885CV	L7885CD2T	L7885CP	L7885CT	8.5V
L7809C	L7809CV	L7809CD2T	L7809CP	L7809CT	9V
L7812				L7812T	12V
L7812C	L7812CV	L7812CD2T	L7812CP	L7812CT	12V
L7815				L7815T	15V
L7815C	L7815CV	L7815CD2T	L7815CP	L7815CT	15V
L7818				L7818T	18V
L7818C	L7818CV	L7818CD2T	L7818CP	L7818CT	18V
L7820				L7820T	20V
L7820C	L7820CV	L7820CD2T	L7820CP	L7820CT	20V
L7824				L7824T	24V
L7824C	L7824CV	L7824CD2T	L7824CP	L7824CT	24V

(\*) AVAILABLE IN TAPE AND REEL WITH "TR" SUFFIX



# Advanced Monolithic Systems

# AMS1085CT

## 3A LOW DROPOUT VOLTAGE REGULATOR

### FEATURES

- Three Terminal Adjustable or Fixed Voltages 1.5V, 2.5V, 2.85V, 3.0V, 3.3V, 3.5V and 5.0V
- Output Current of 3A
- Operates Down to 1V Dropout
- Load Regulation: 0.1%
- Line Regulation: 0.015%
- TO-220, TO-263 and TO-252 packages available

### APPLICATIONS

- High Efficiency Linear Regulators
- Post Regulators for Switching Supplies
- Microprocessor Supply
- Battery Chargers
- Constant Current Regulators
- Notebook/Personal Computer Supplies
- Portable Instrumentation

### GENERAL DESCRIPTION

The AMS1085 series of adjustable and fixed voltage regulators are designed to provide 3A output current and to operate down to 1V input-to-output differential. The dropout voltage of the device is guaranteed maximum 1.5V at maximum output current, decreasing at lower load currents.

On-chip trimming adjusts the reference voltage to 1%. Current limit is also trimmed, minimizing the stress under overload conditions on both the regulator and power source circuitry.

The AMS1085 devices are pin compatible with older three-terminal regulators and are offered in 3 lead TO-220 package, 3 and 2 lead TO-263 (Plastic DD) and TO-252 (D PAK) package.

### ORDERING INFORMATION:

PACKAGE TYPE			OPERATING JUNCTION TEMPERATURE RANGE
3 LEAD TO-220	2&3 LEAD TO-263	TO-252	
AMS1085CT	AMS1085CM	AMS1085CD	0 to 125° C
AMS1085CT-1.5	AMS1085CM-1.5	AMS1085CD-1.5	0 to 125° C
AMS1085CT-2.5	AMS1085CM-2.5	AMS1085CD-2.5	0 to 125° C
AMS1085CT-2.85	AMS1085CM-2.85	AMS1085CD-2.85	0 to 125° C
AMS1085CT-3.0	AMS1085CM-3.0	AMS1085CD-3.0	0 to 125° C
AMS1085CT-3.3	AMS1085CM-3.3	AMS1085CD-3.3	0 to 125° C
AMS1085CT-3.5	AMS1085CM-3.5	AMS1085CD-3.5	0 to 125° C
AMS1085CT-5.0	AMS1085CM-5.0	AMS1085CD-5.0	0 to 125° C

### PIN CONNECTIONS

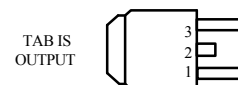
#### FIXED VERSION

- 1- Ground
- 2-  $V_{OUT}$
- 3-  $V_{IN}$

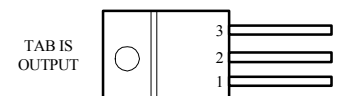
#### ADJUSTABLE VERSION

- 1- Adjust
- 2-  $V_{OUT}$
- 3-  $V_{IN}$

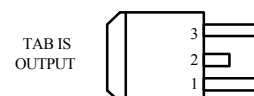
TO-252 FRONT VIEW



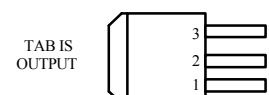
TO-220 FRONT VIEW



2L TO-263 FRONT VIEW



3L TO-263 FRONT VIEW



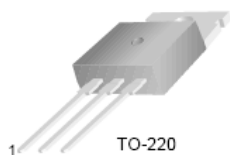


# TIP31/TIP31A/TIP31B/TIP31C

## NPN Epitaxial Silicon Transistor

### Features

- Complementary to TIP32/TIP32A/TIP32B/TIP32C



1. Base 2. Collector 3. Emitter

### Absolute Maximum Ratings $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Value	Units
$V_{CBO}$	Collector-Base Voltage : TIP31	40	V
	: TIP31A	60	V
	: TIP31B	80	V
	: TIP31C	100	V
$V_{CEO}$	Collector-Emitter Voltage : TIP31	40	V
	: TIP31A	60	V
	: TIP31B	80	V
	: TIP31C	100	V
$V_{EBO}$	Emitter-Base Voltage	5	V
$I_C$	Collector Current (DC)	3	A
$I_{CP}$	Collector Current (Pulse)	5	A
$I_B$	Base Current	1	A
$P_C$	Collector Dissipation ( $T_C=25^\circ\text{C}$ )	40	W
	Collector Dissipation ( $T_a=25^\circ\text{C}$ )	2	W
$T_J$	Junction Temperature	150	$^\circ\text{C}$
$T_{STG}$	Storage Temperature	- 65 ~ 150	$^\circ\text{C}$

TIP31/TIP31A/TIP31B/TIP31C — NPN Epitaxial Silicon Transistor



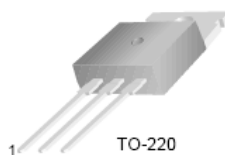


# TIP32/TIP32A/TIP32B/TIP32C

## PNP Epitaxial Silicon Transistor

### Features

- Complementary to TIP31/TIP31A/TIP31B/TIP31C



1. Base 2. Collector 3. Emitter

### Absolute Maximum Ratings $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Value	Units
$V_{CBO}$	Collector-Base Voltage : TIP32	- 40	V
	: TIP32A	- 60	V
	: TIP32B	- 80	V
	: TIP32C	- 100	V
$V_{CEO}$	Collector-Emitter Voltage : TIP32	- 40	V
	: TIP32A	- 60	V
	: TIP32B	- 80	V
	: TIP32C	- 100	V
$V_{EBO}$	Emitter-Base Voltage	- 5	V
$I_C$	Collector Current (DC)	- 3	A
$I_{CP}$	Collector Current (Pulse)	- 5	A
$I_B$	Base Current	- 3	A
$P_C$	Collector Dissipation ( $T_C=25^\circ\text{C}$ )	40	W
	Collector Dissipation ( $T_a=25^\circ\text{C}$ )	2	W
$T_J$	Junction Temperature	150	$^\circ\text{C}$
$T_{STG}$	Storage Temperature	- 65 ~ 150	$^\circ\text{C}$

TIP32/TIP32A/TIP32B/TIP32C — PNP Epitaxial Silicon Transistor

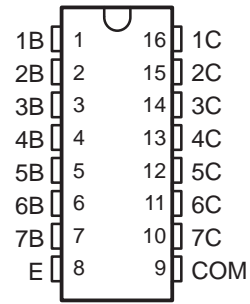
## ULN2001A, ULN2002A, ULN2003A, ULN2004A DARLINGTON TRANSISTOR ARRAYS

SLRS027 – DECEMBER 1976 – REVISED APRIL 1993

### HIGH-VOLTAGE HIGH-CURRENT DARLINGTON TRANSISTOR ARRAYS

- 500-mA Rated Collector Current (Single Output)
- High-Voltage Outputs . . . 50 V
- Output Clamp Diodes
- Inputs Compatible With Various Types of Logic
- Relay Driver Applications
- Designed to Be Interchangeable With Sprague ULN2001A Series

D OR N PACKAGE  
(TOP VIEW)

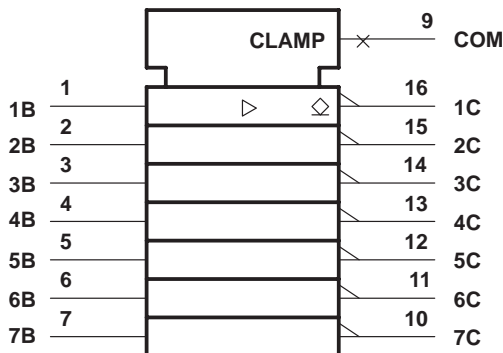


#### description

The ULN2001A, ULN2002A, ULN2003A, and ULN2004A are monolithic high-voltage, high-current Darlington transistor arrays. Each consists of seven npn Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of a single Darlington pair is 500 mA. The Darlington pairs may be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers. For 100-V (otherwise interchangeable) versions, see the SN75465 through SN75469.

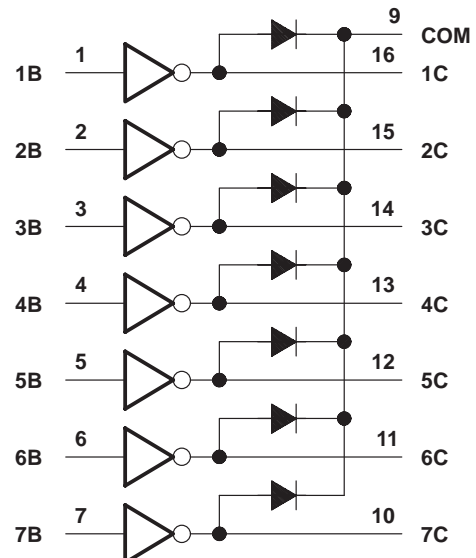
The ULN2001A is a general-purpose array and can be used with TTL and CMOS technologies. The ULN2002A is specifically designed for use with 14- to 25-V PMOS devices. Each input of this device has a zener diode and resistor in series to control the input current to a safe limit. The ULN2003A has a 2.7-k $\Omega$  series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices. The ULN2004A has a 10.5-k $\Omega$  series base resistor to allow its operation directly from CMOS devices that use supply voltages of 6 to 15 V. The required input current of the ULN2004A is below that of the ULN2003A, and the required voltage is less than that required by the ULN2002A.

#### logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

#### logic diagram



# PC817 Series

## High Density Mounting Type Photocoupler

\* Lead forming type ( I type ) and taping reel type ( P type ) are also available. ( PC817I/PC817P )  
 \*\* TÜV ( VDE0884 ) approved type is also available as an option.

### ■ Features

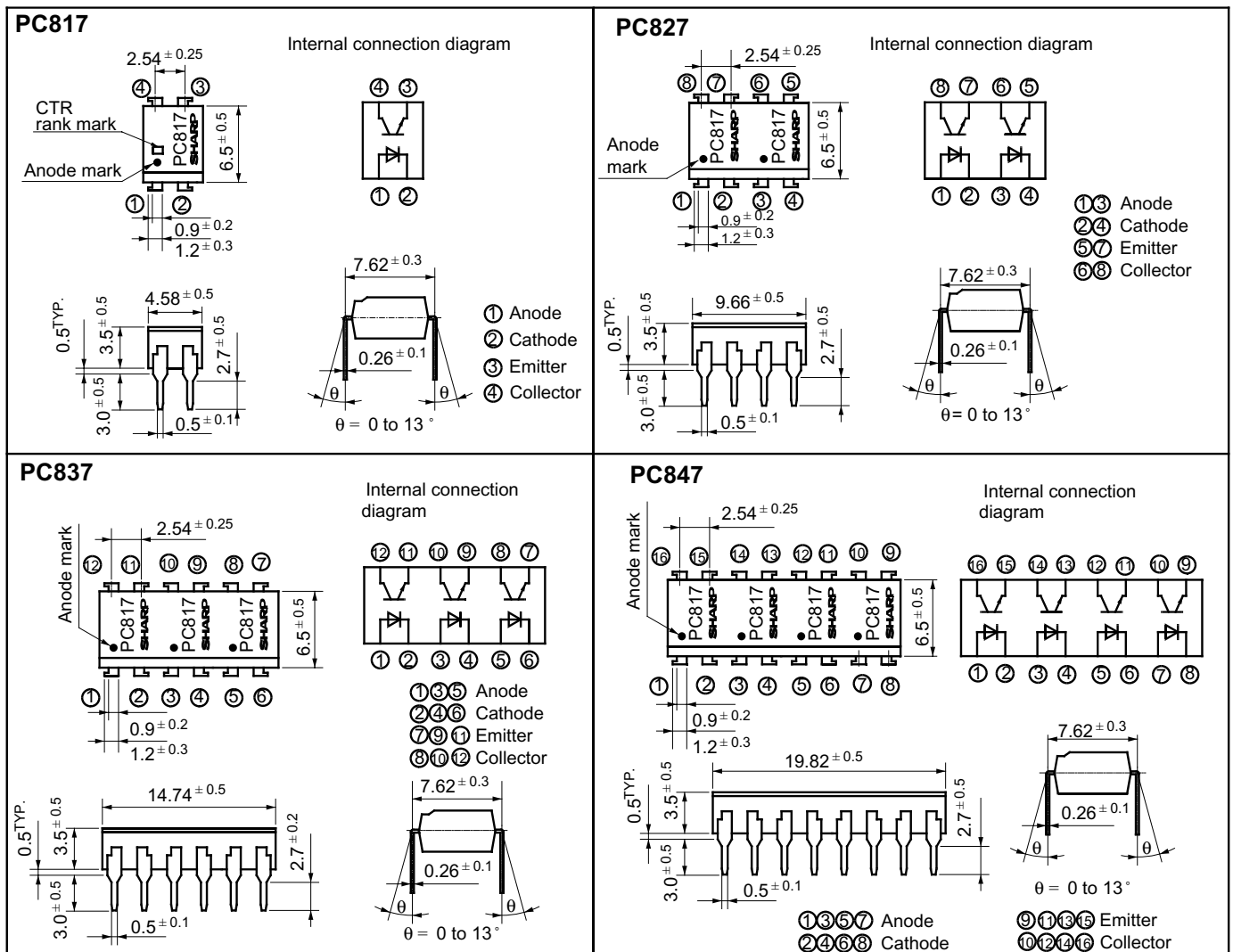
1. Current transfer ratio  
 (CTR: MIN. 50% at  $I_F = 5\text{mA}$ ,  $V_{CE} = 5\text{V}$ )
2. High isolation voltage between input and output ( $V_{iso} : 5\,000\text{V}_{rms}$ )
3. Compact dual-in-line package  
**PC817** : 1-channel type  
**PC827** : 2-channel type  
**PC837** : 3-channel type  
**PC847** : 4-channel type
4. Recognized by UL, file No. E64380

### ■ Applications

1. Computer terminals
2. System appliances, measuring instruments
3. Registers, copiers, automatic vending machines
4. Electric home appliances, such as fan heaters, etc.
5. Signal transmission between circuits of different potentials and impedances

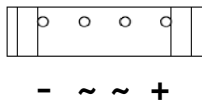
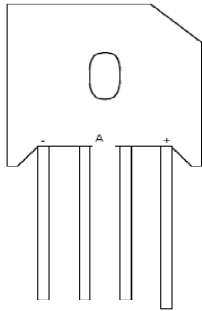
### ■ Outline Dimensions

( Unit : mm )

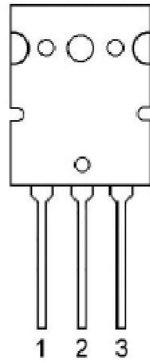


" In the absence of confirmation by device specification sheets, SHARP takes no responsibility for any defects that occur in equipment using any of SHARP's devices, shown in catalogs, data books, etc. Contact SHARP in order to obtain the latest version of the device specification sheets before using any SHARP's device."

**GBU8D**

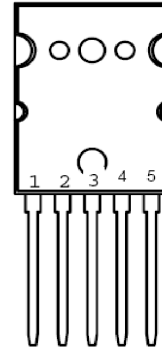


**MJL3281A (NPN)  
MJL1302A (PNP)**



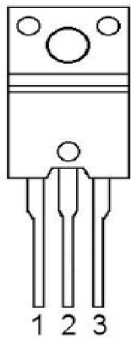
- 1. BASE
- 2. COLLECTOR
- 3. EMITTER

**NJL3281D (NPN)  
NJL1302D (PNP)**



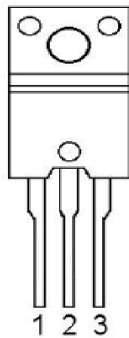
- 1. BASE
- 2. EMITTER
- 3. COLLECTOR
- 4. ANODE
- 5. CATHODE

**2SC4935 (NPN)  
2SA1869 (PNP)**



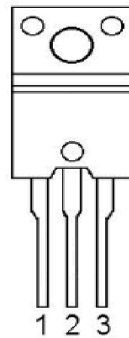
- 1. BASE
- 2. COLLECTOR
- 3. EMITTER

**2SC4793 (NPN)  
2SA1837 (PNP)**



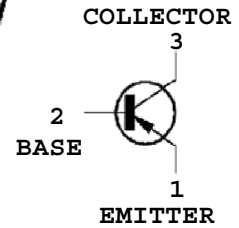
- 1. BASE
- 2. COLLECTOR
- 3. EMITTER

**MJE15032 (NPN)  
MJE15033 (PNP)**

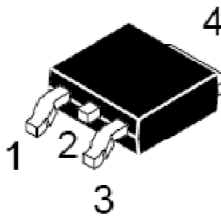


- 1. BASE
- 2. COLLECTOR
- 3. EMITTER

**SS8550**

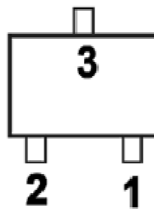


**MJD243 (NPN)  
MJD253 (PNP)**



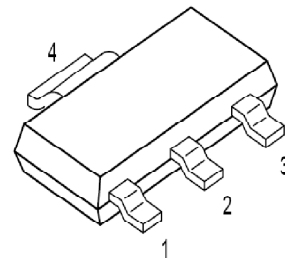
- 1. BASE
- 2. COLLECTOR
- 3. EMITTER
- 4. COLLECTOR

**2SC3138 (NPN)  
2SA1255 (PNP)  
2SC3324 (NPN)  
2SA1312 (PNP)**

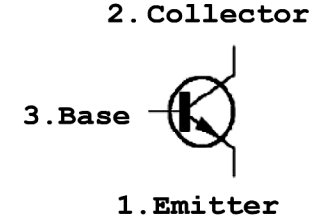
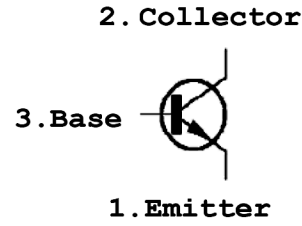
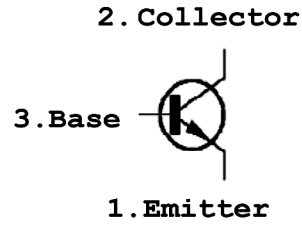
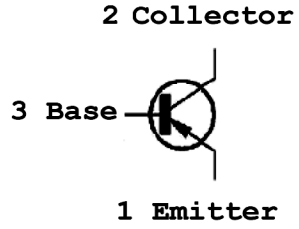


- 1. EMITTER
- 2. BASE
- 3. COLLECTOR

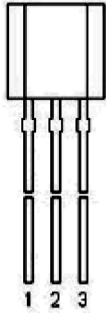
**BCP56-16 (NPN)**



- 1. BASE
- 2. COLLECTOR
- 3. EMITTER
- 4. COLLECTOR

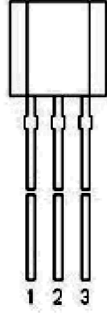


2SA1015



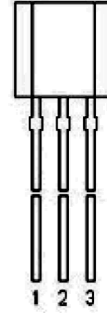
- 1. Emitter
- 2. Collector
- 3. Base

2SC2120



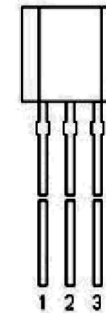
- 1. Emitter
- 2. Collector
- 3. Base

2SC2235



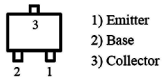
- 1. Emitter
- 2. Collector
- 3. Base

2SC1815



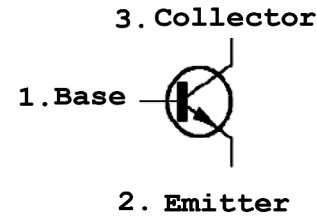
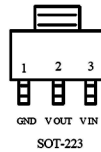
- 1. Emitter
- 2. Collector
- 3. Base

- 2SA1298 PNP
- 2SA1312 PNP
- DTC343TK NPN
- 2SC3324 NPN
- 2SC3265 NPN
- 2SC1035 NPN

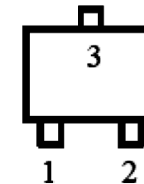


- 1) Emitter
- 2) Base
- 3) Collector

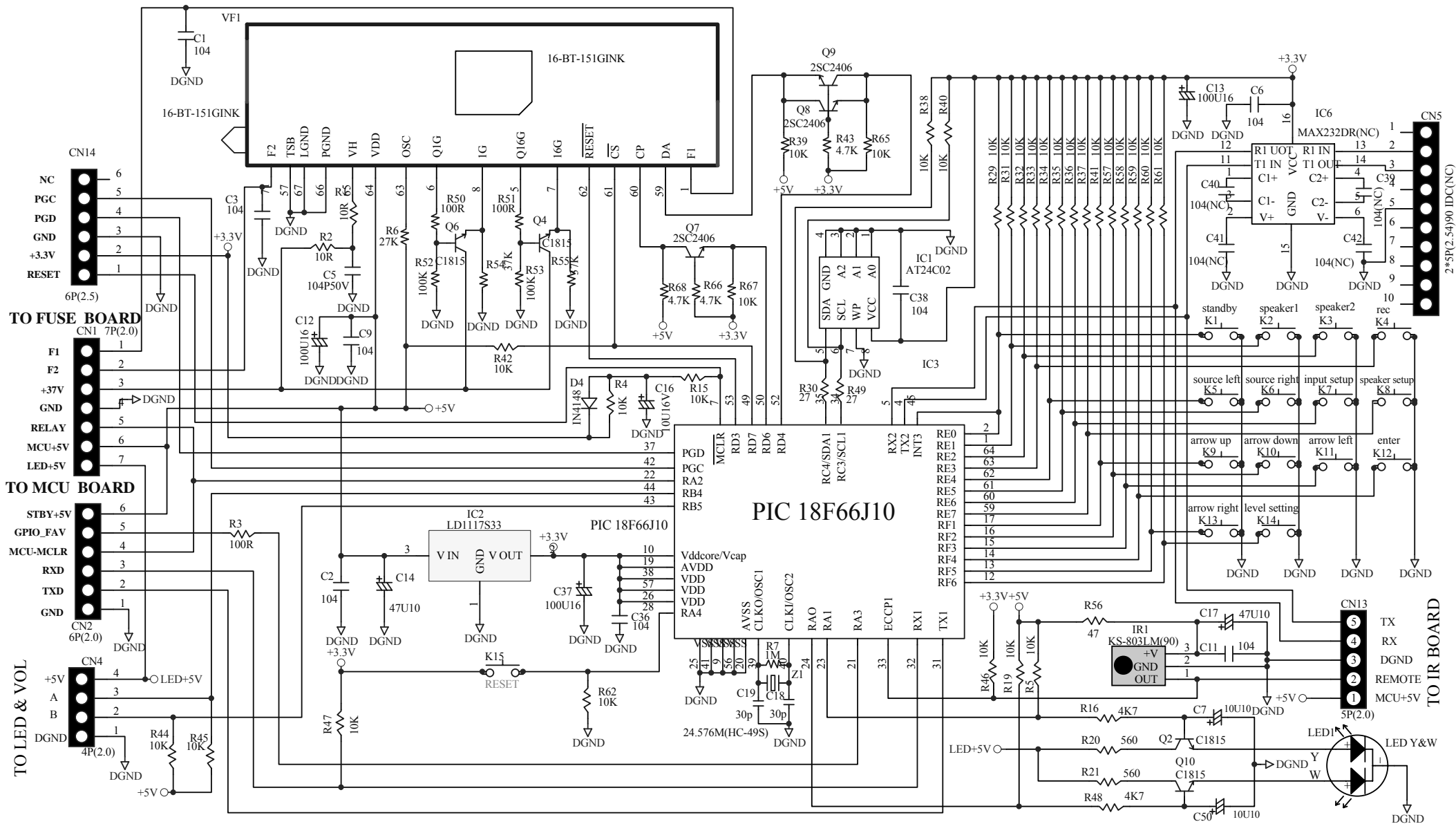
3-Pin Regulator IC  
LD1117S5.0

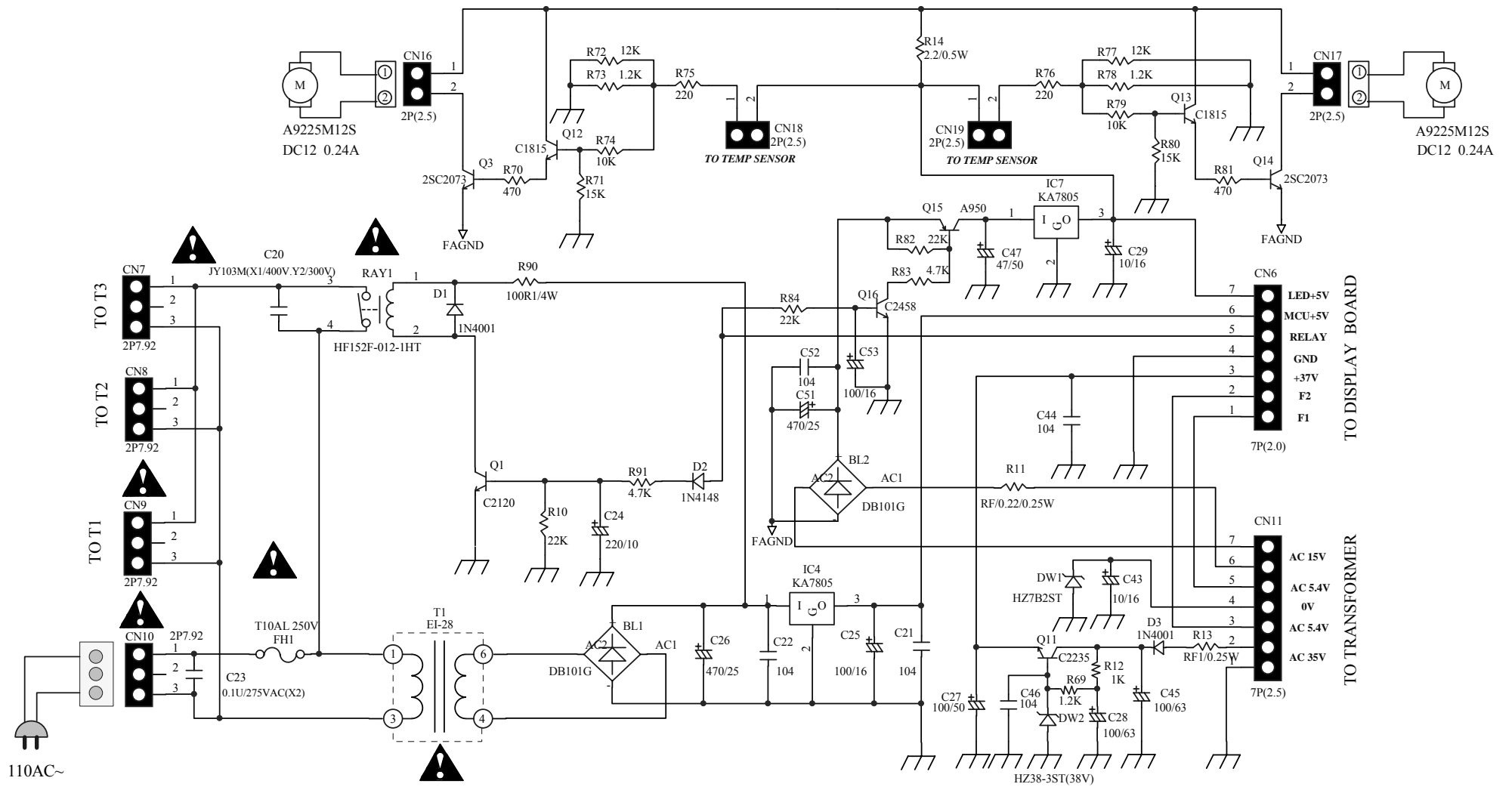


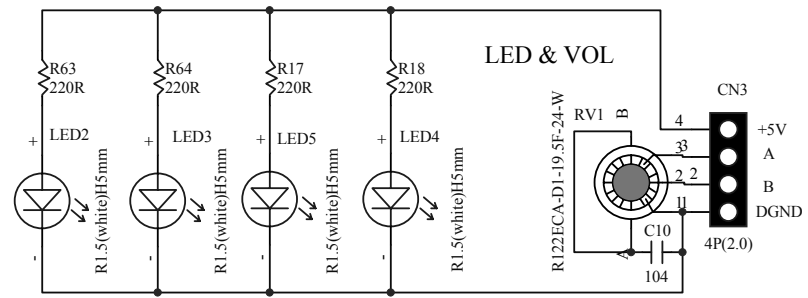
2SC2406



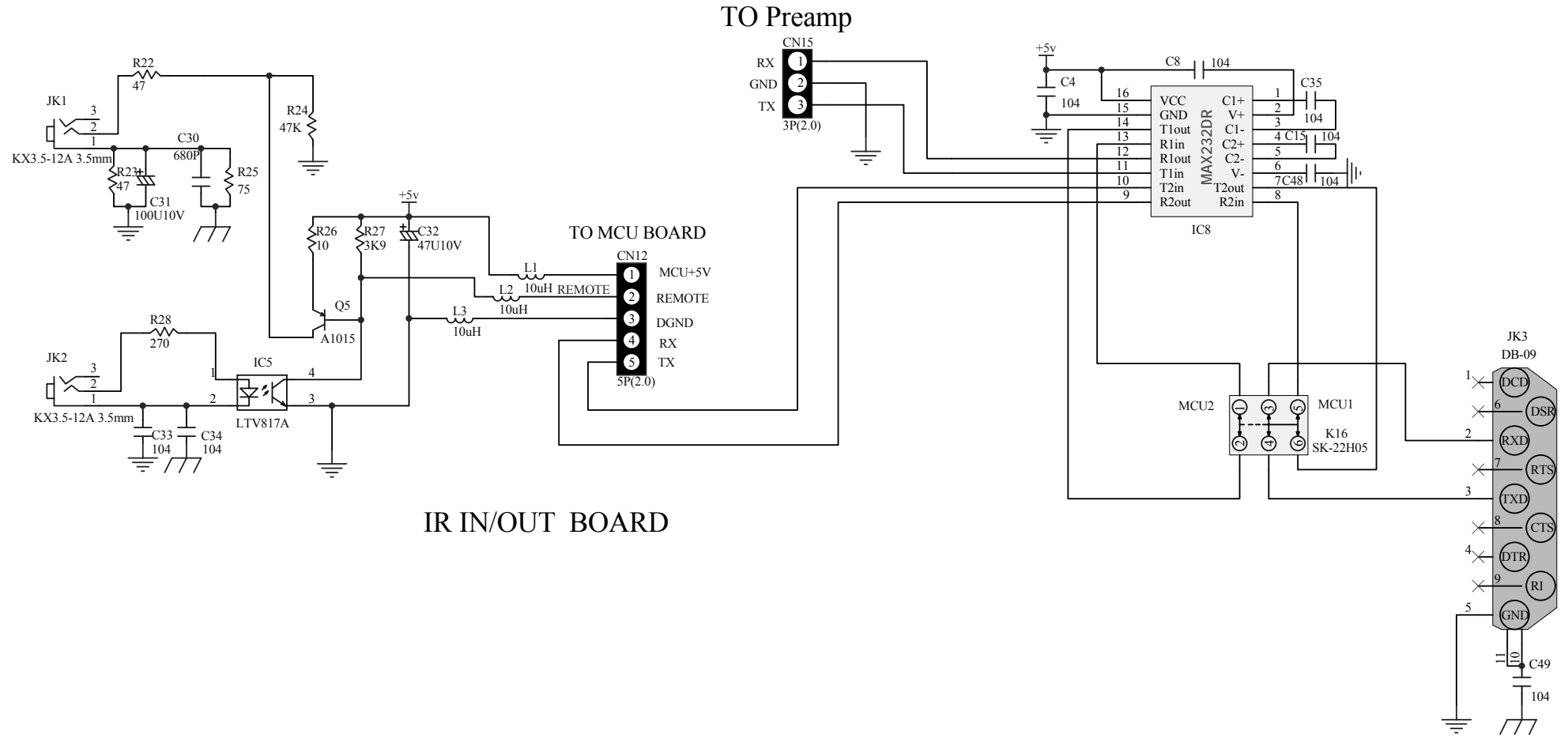
- 1) Base
- 2) Emitter
- 3) Collector

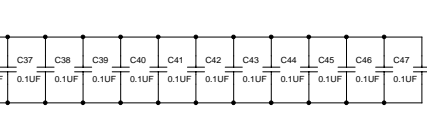
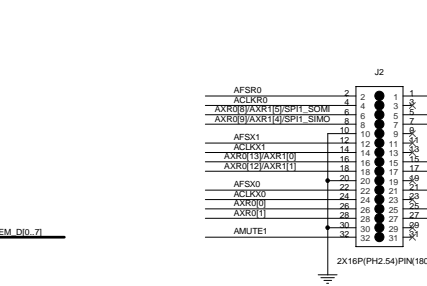
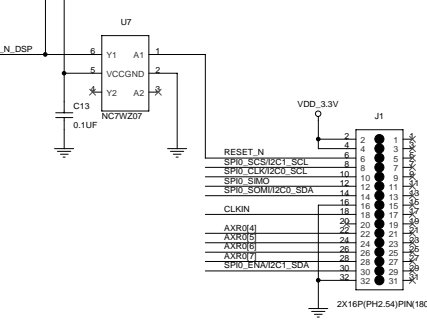
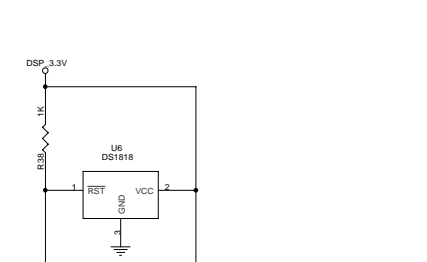
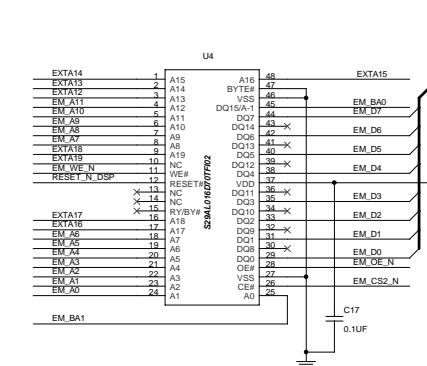
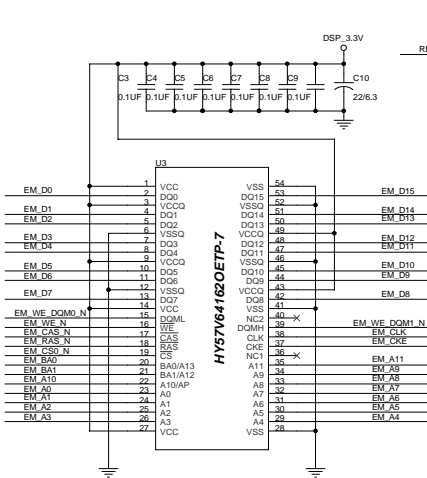
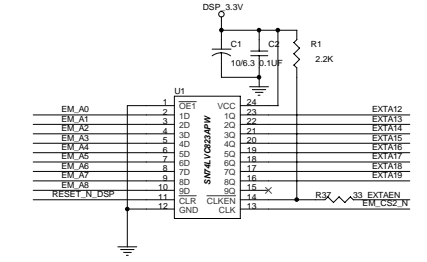
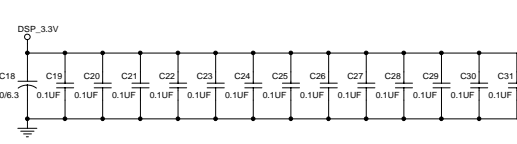
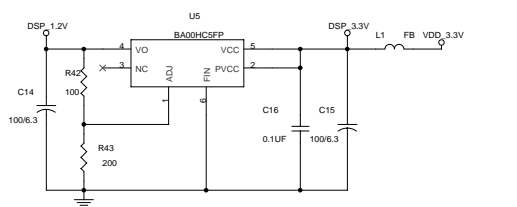
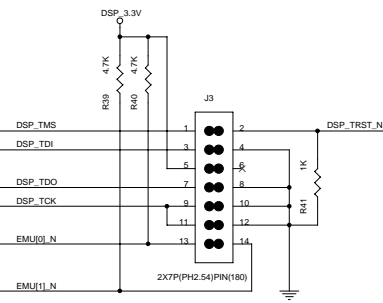
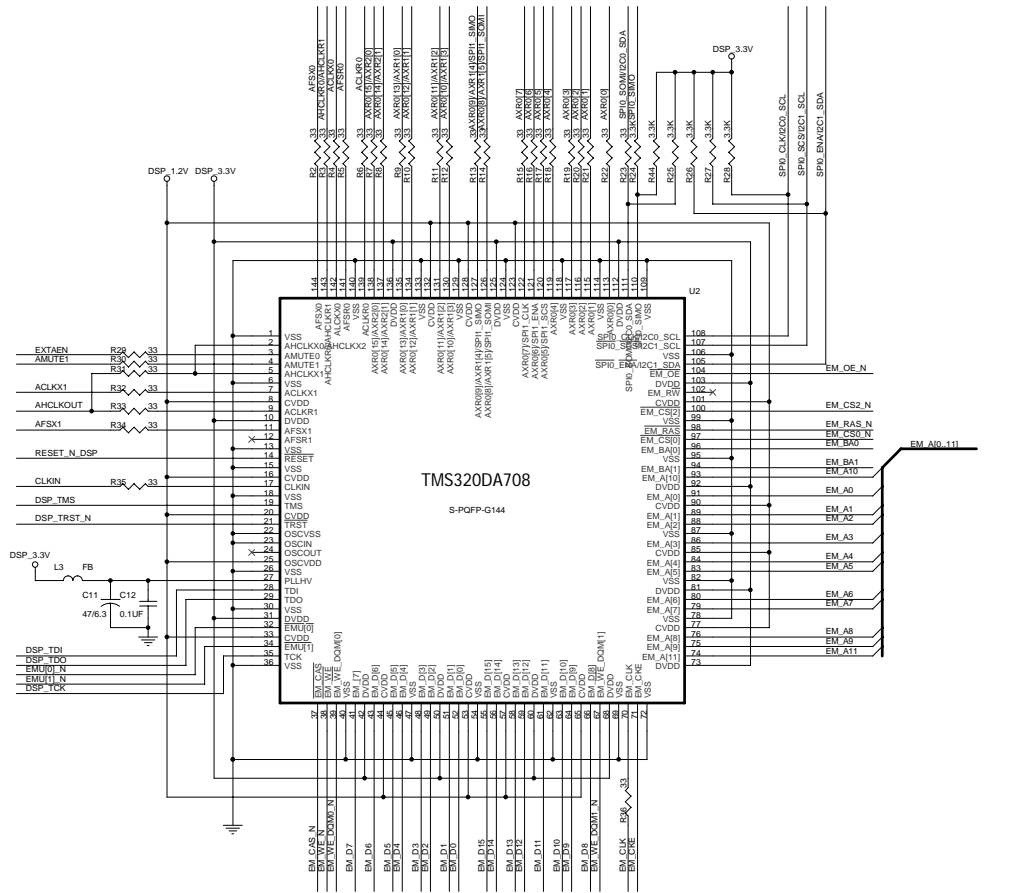


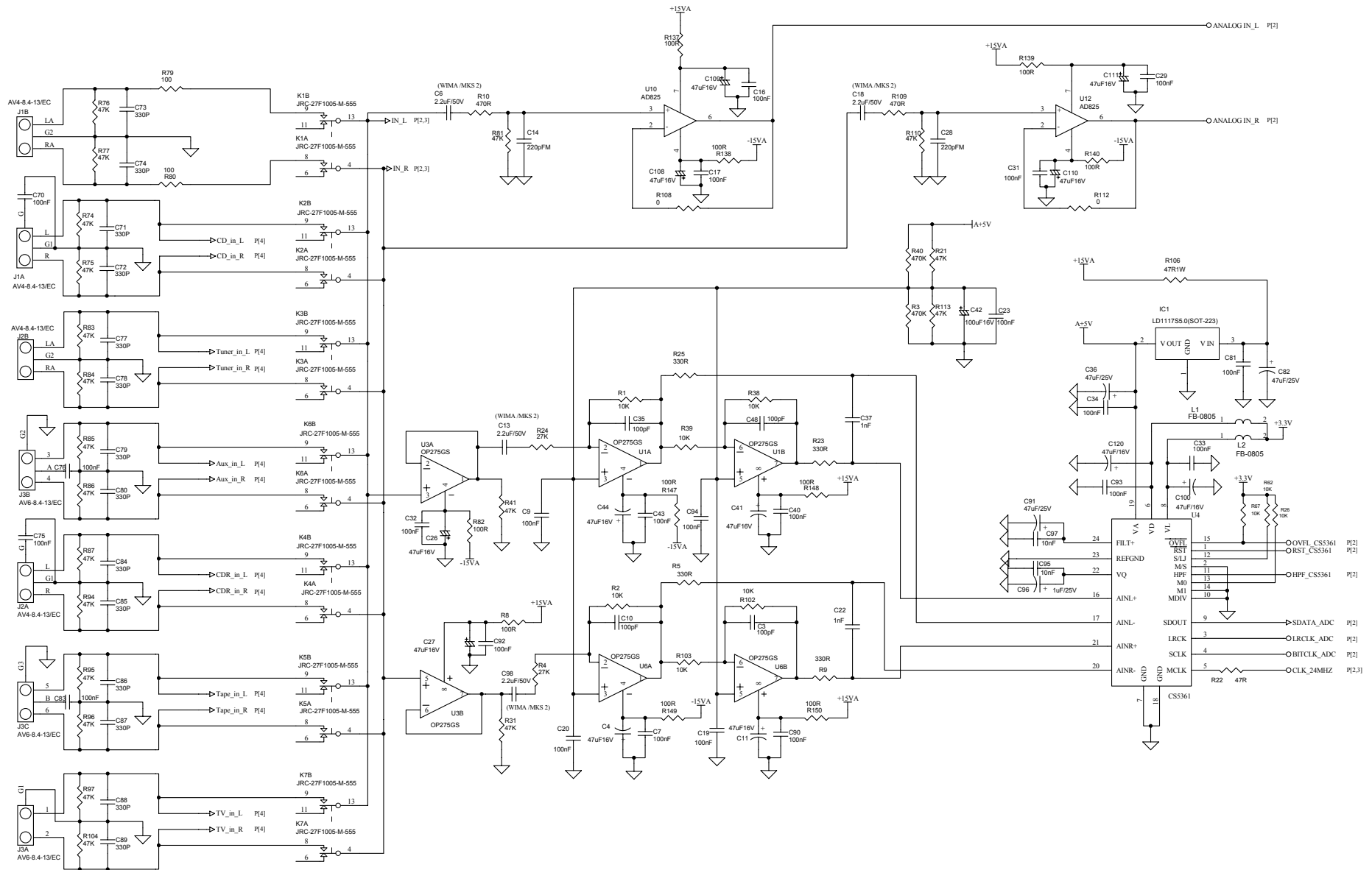


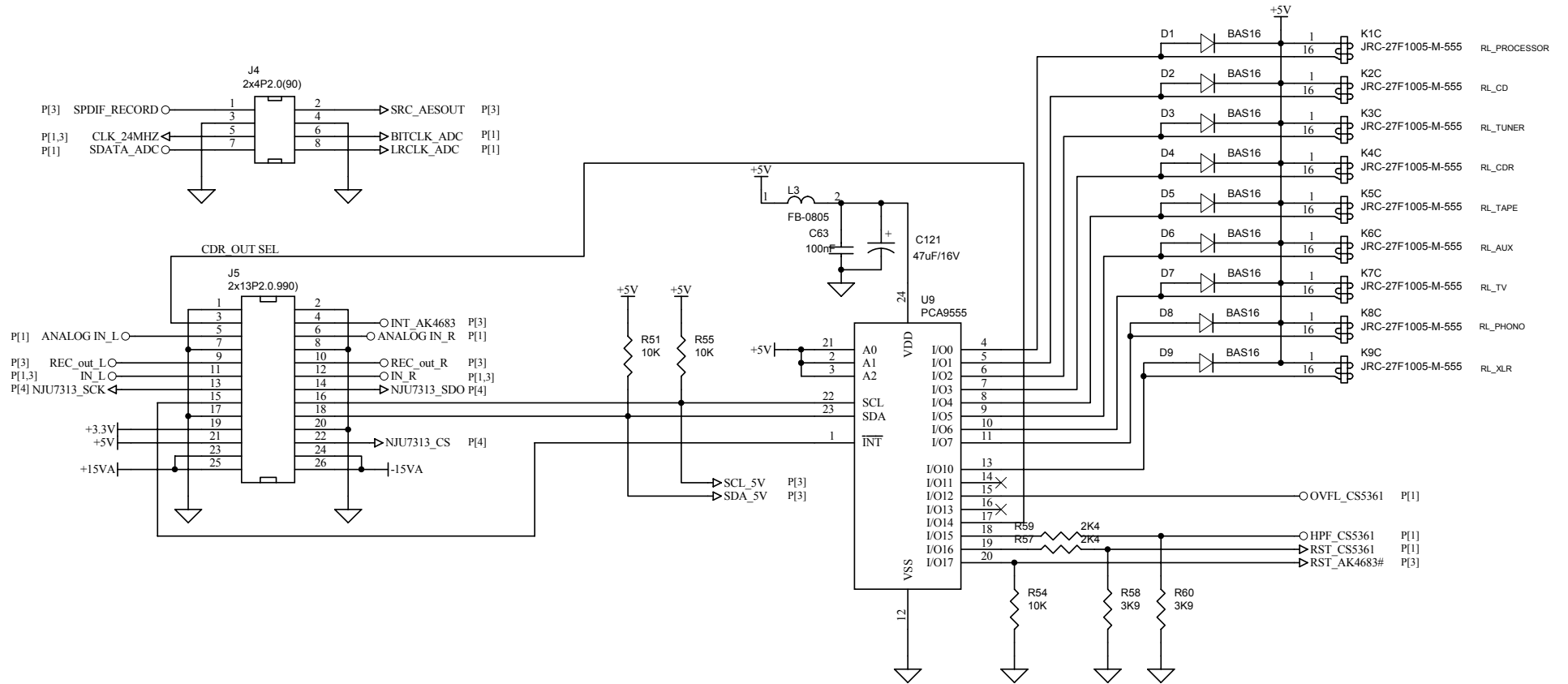


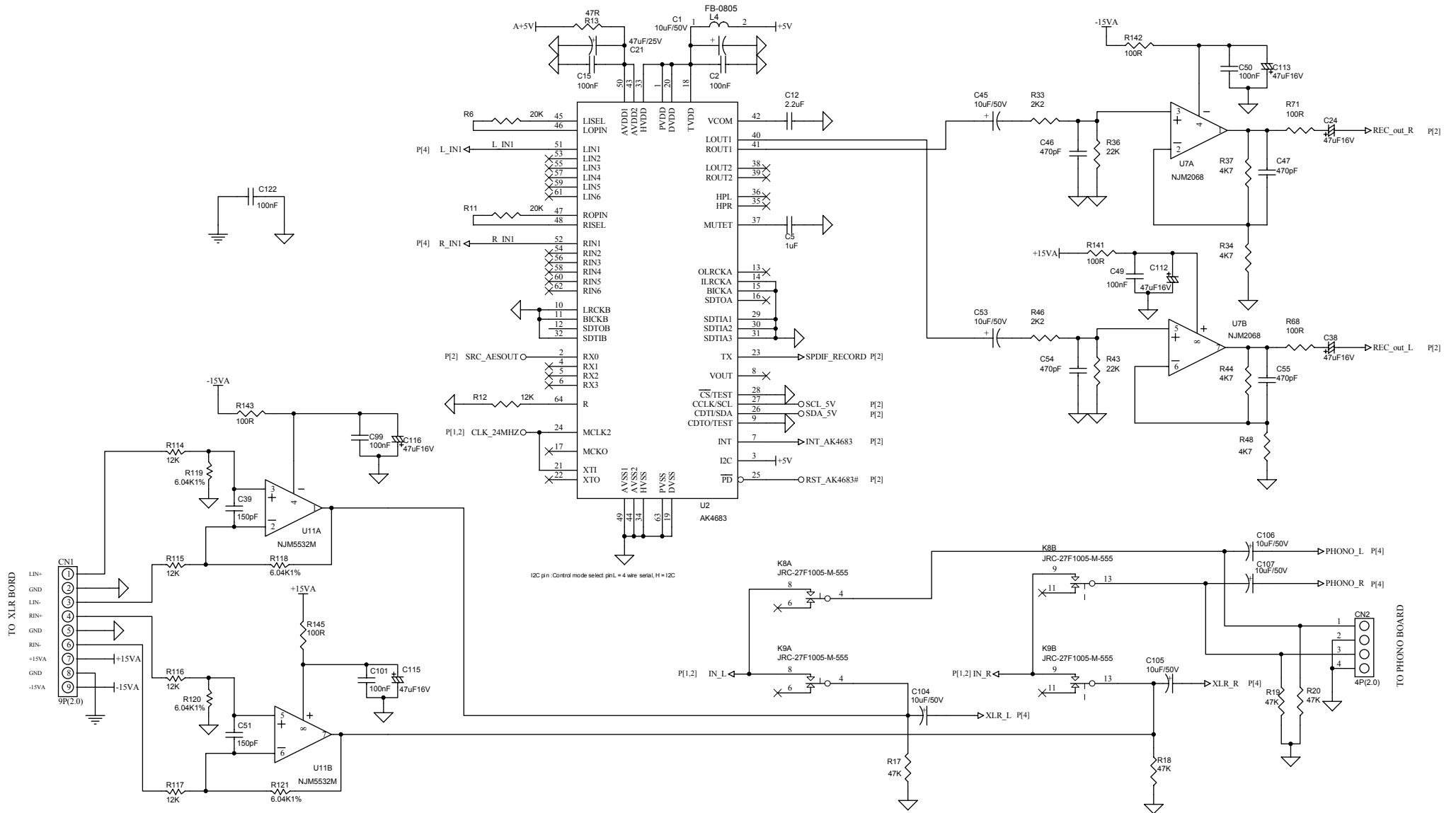


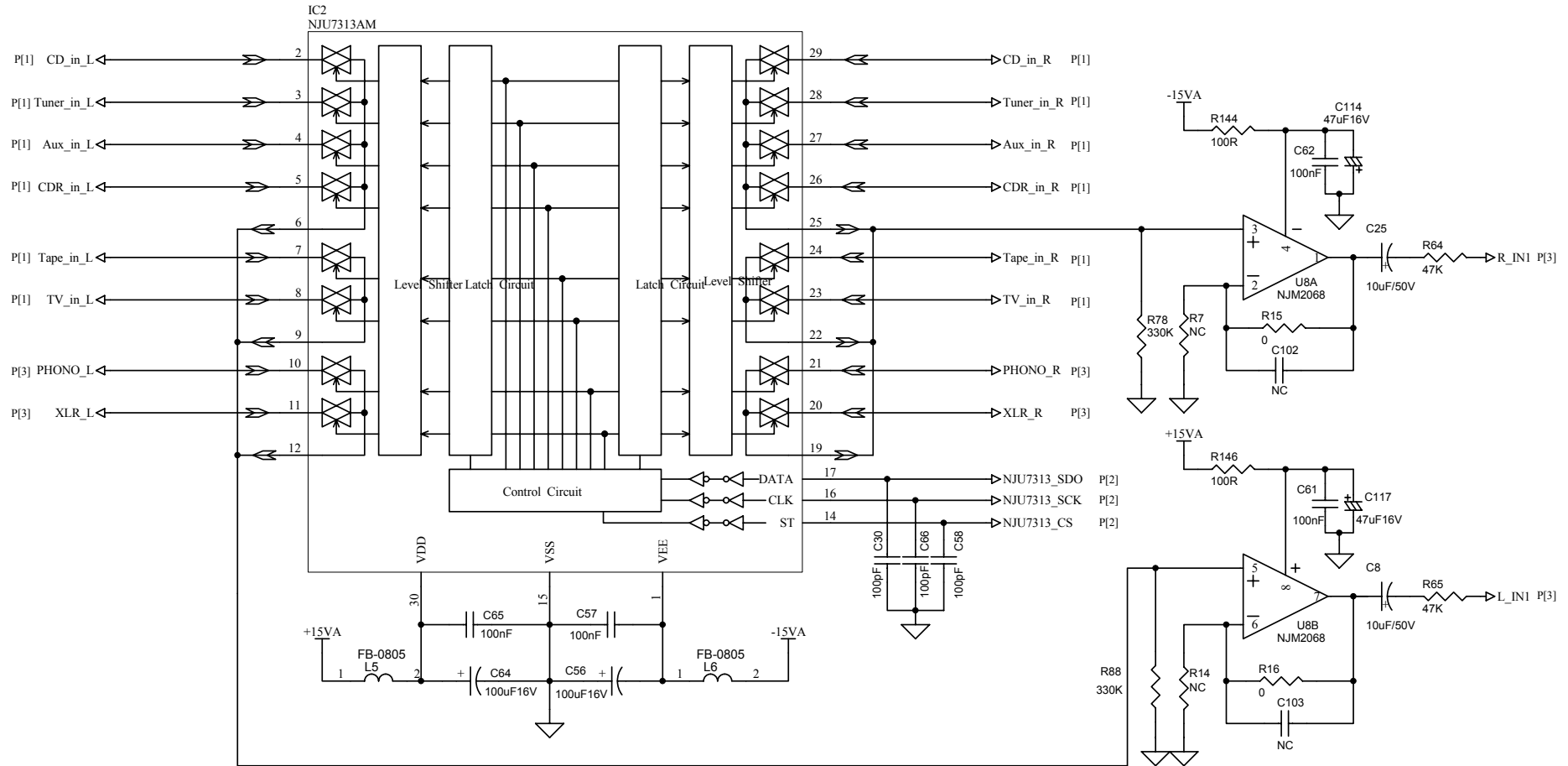


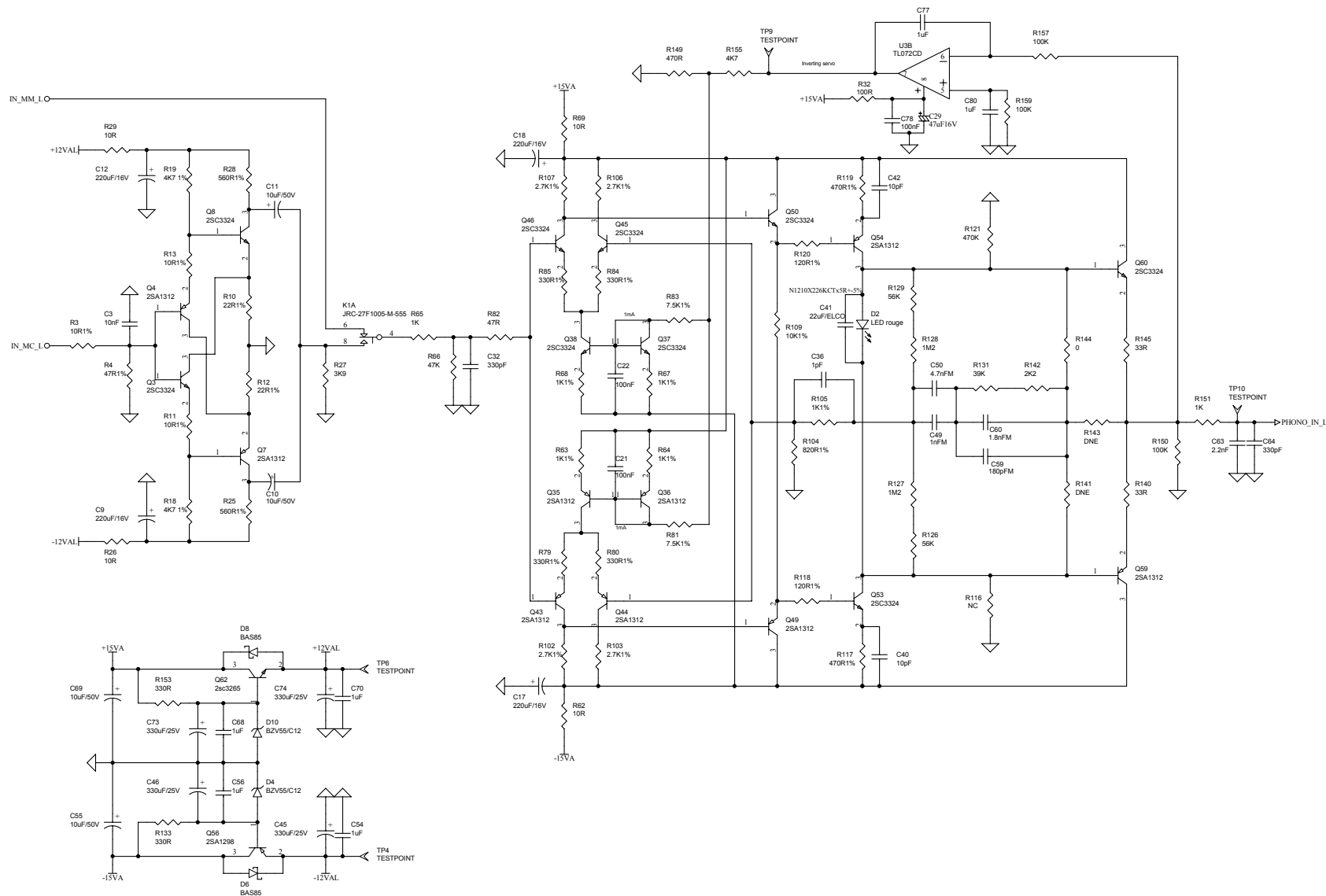


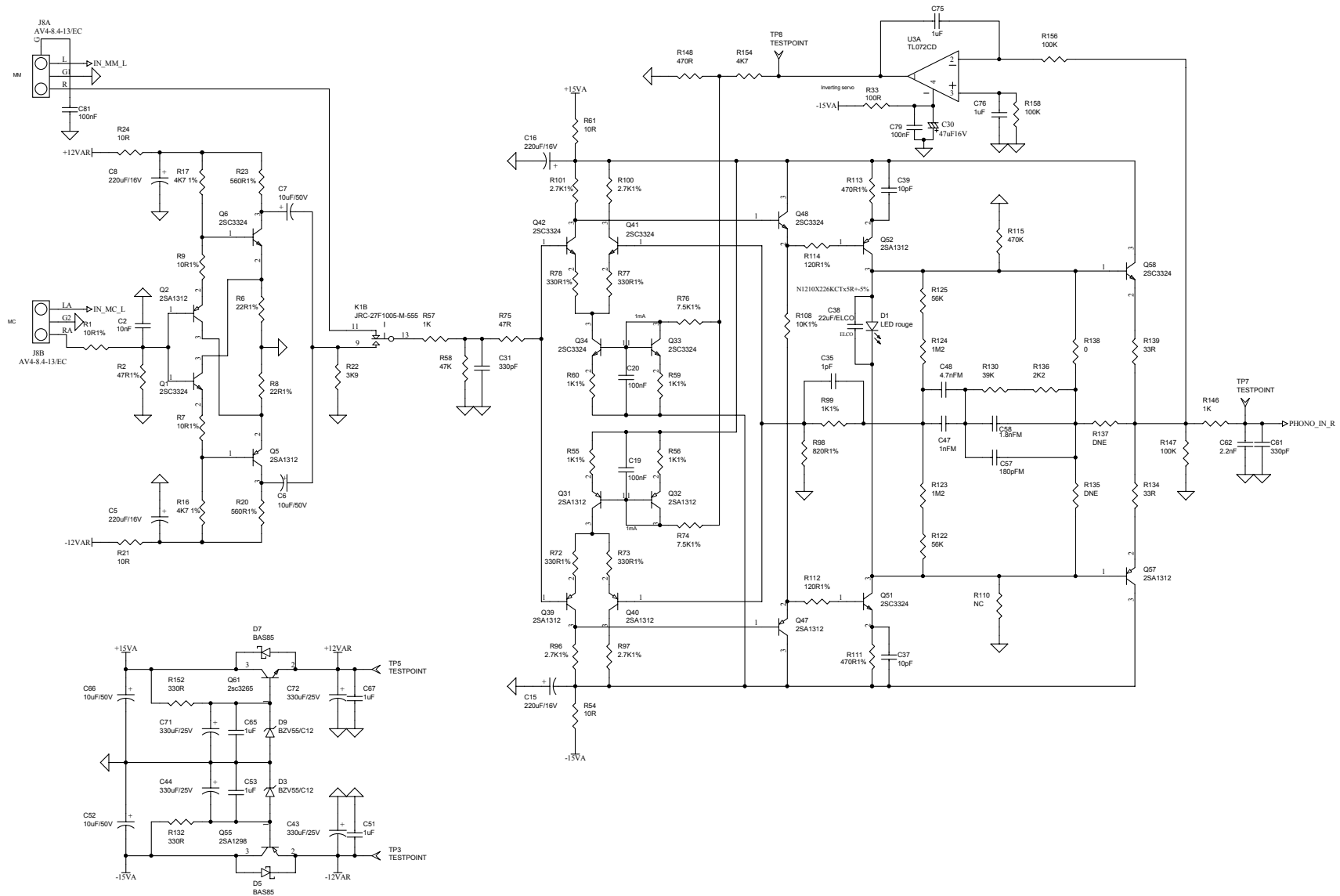




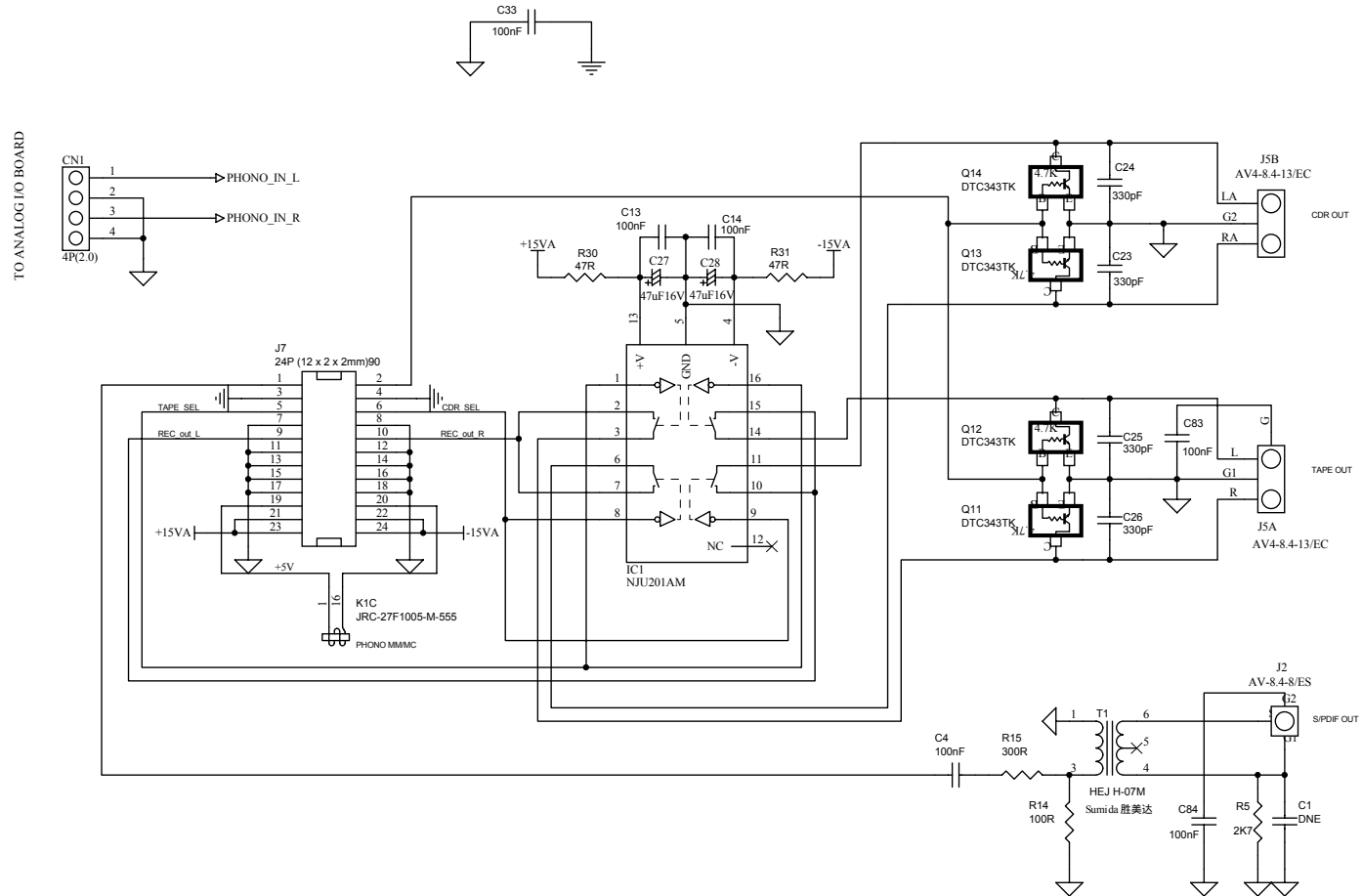


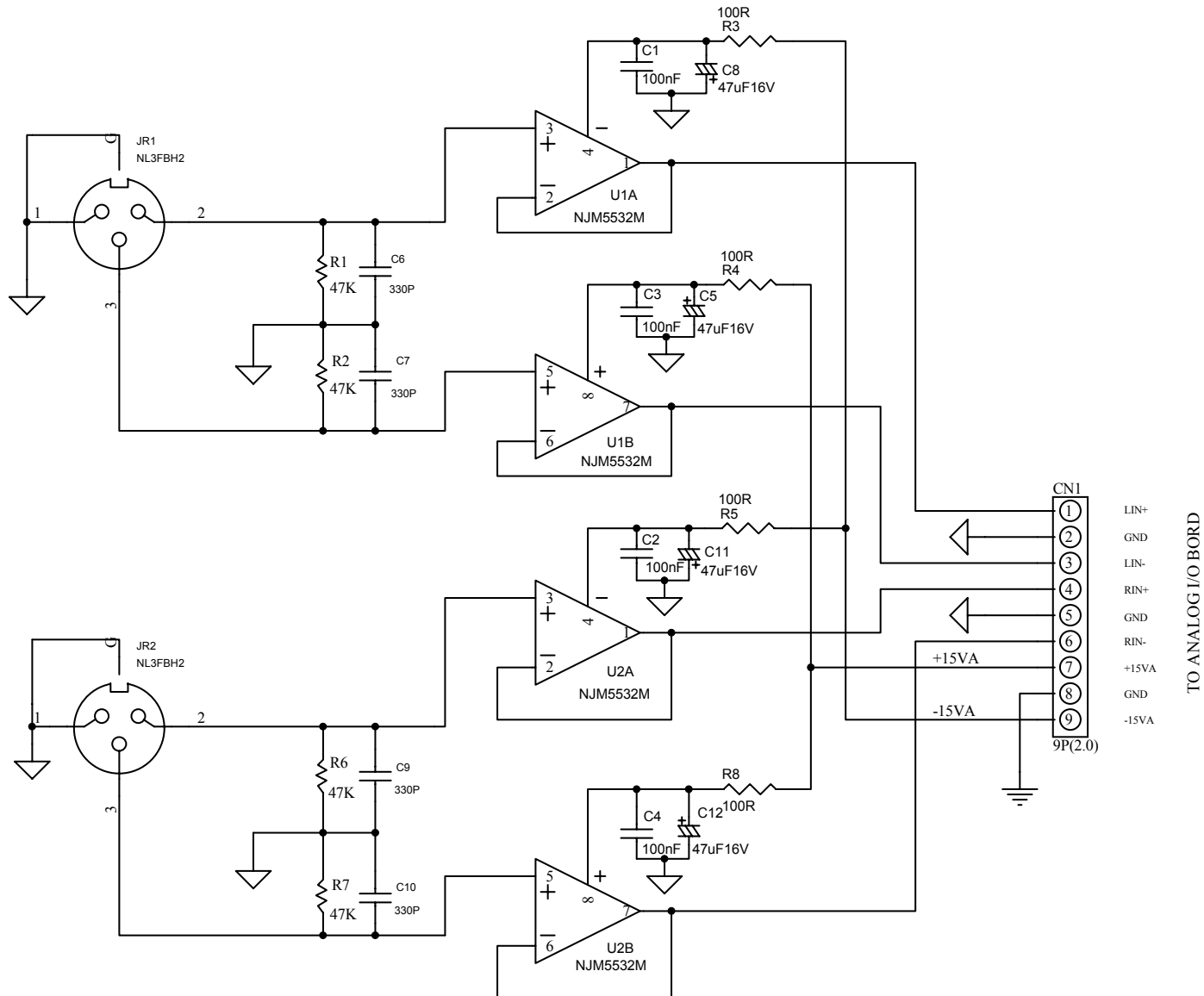


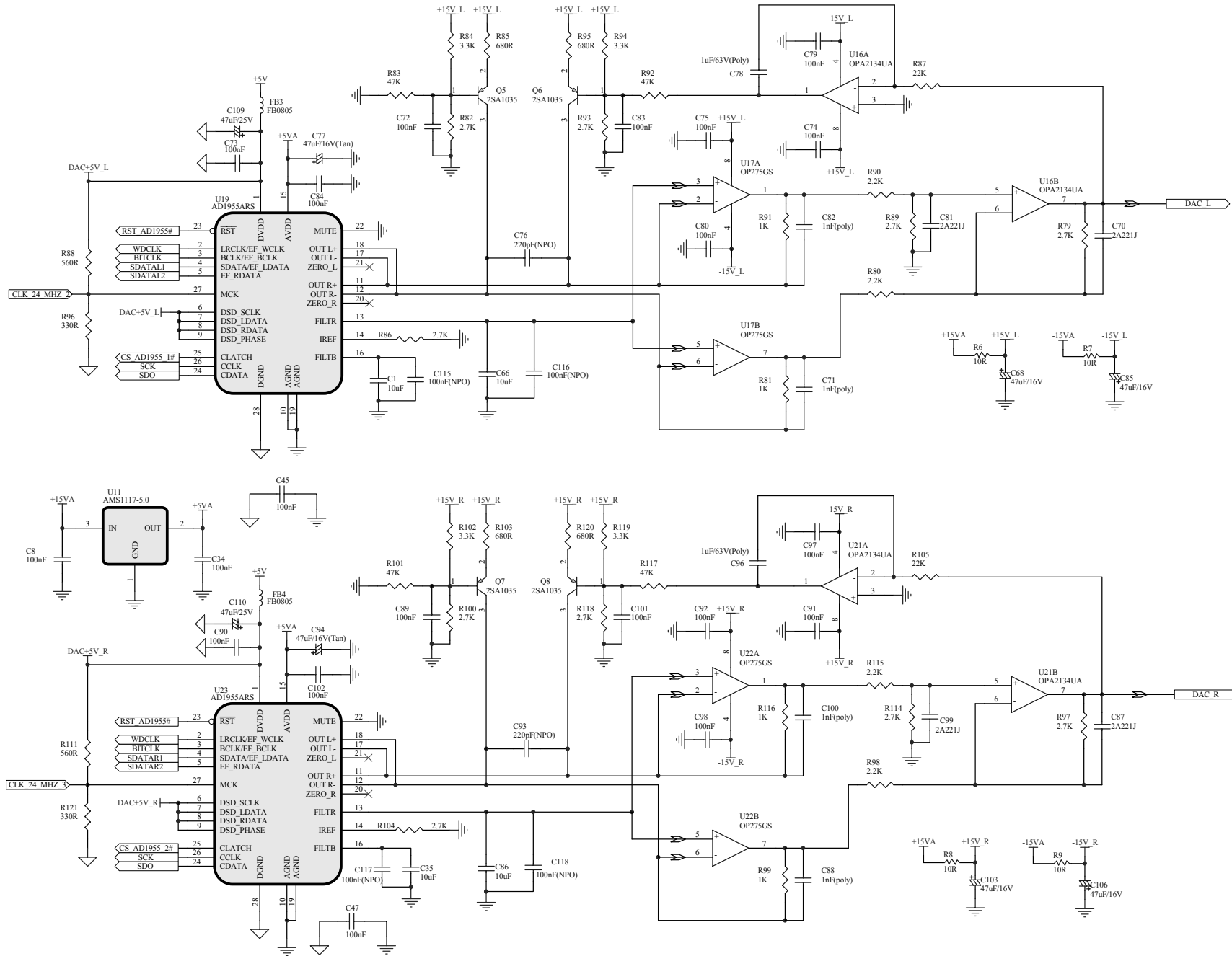


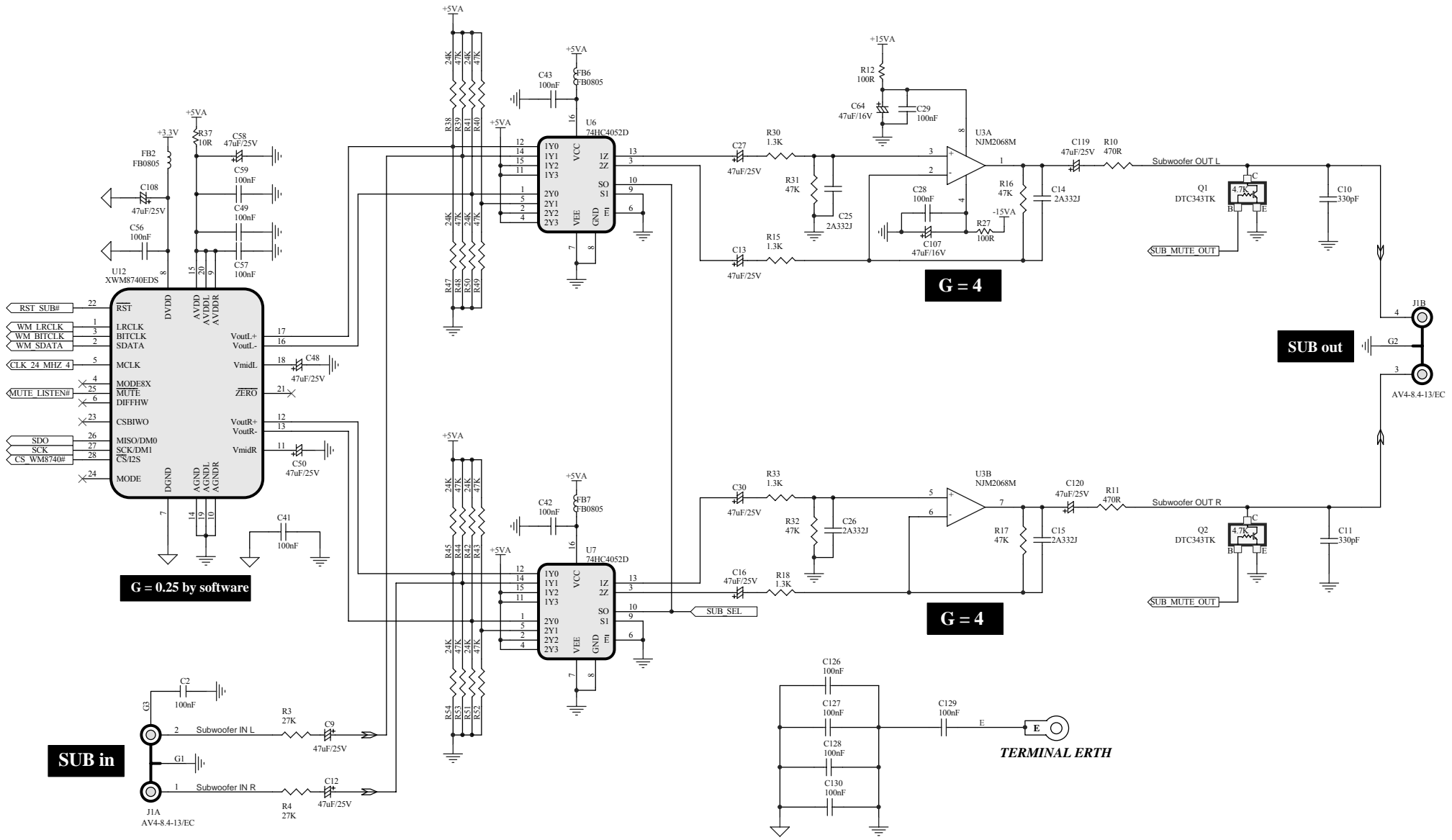


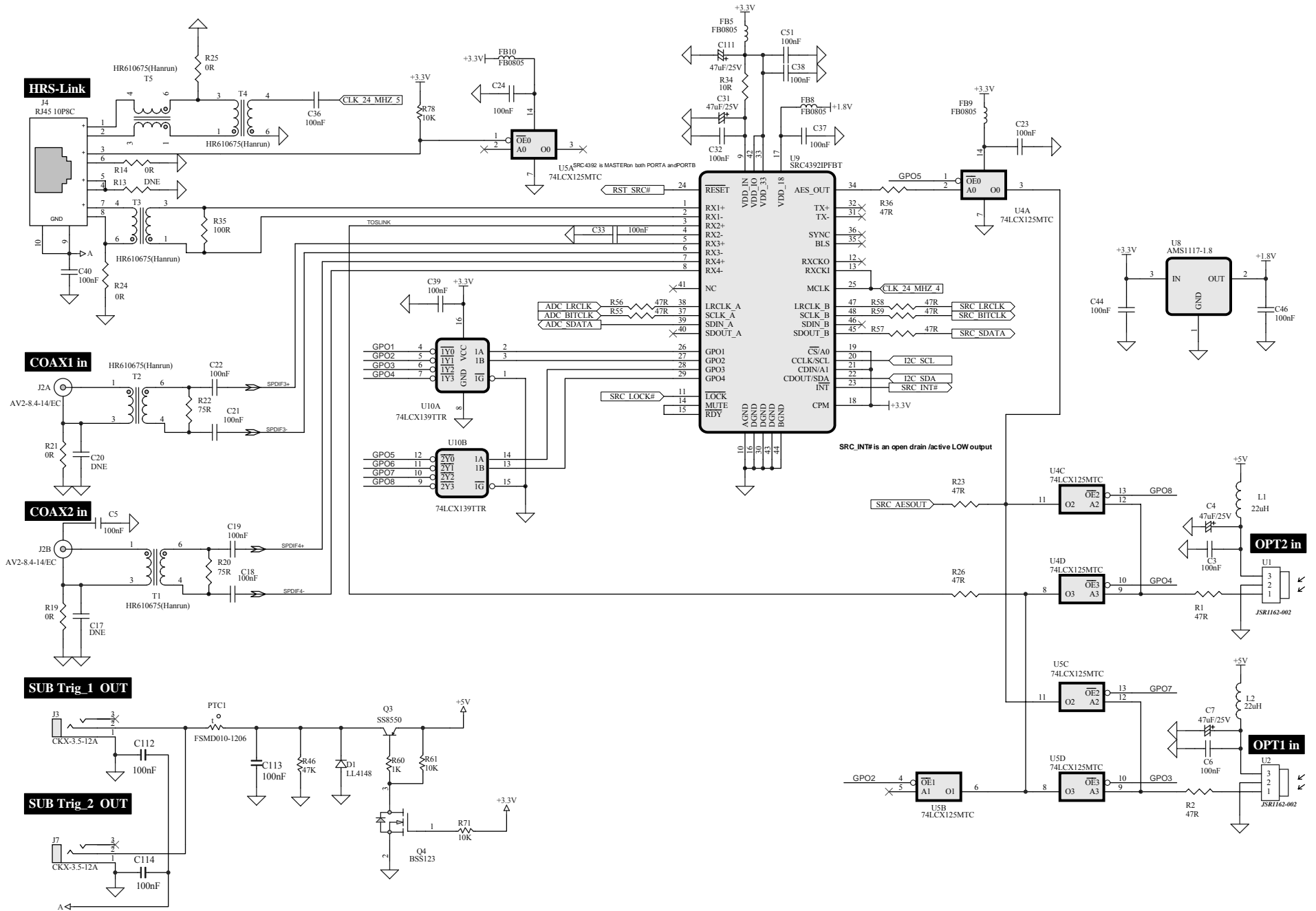


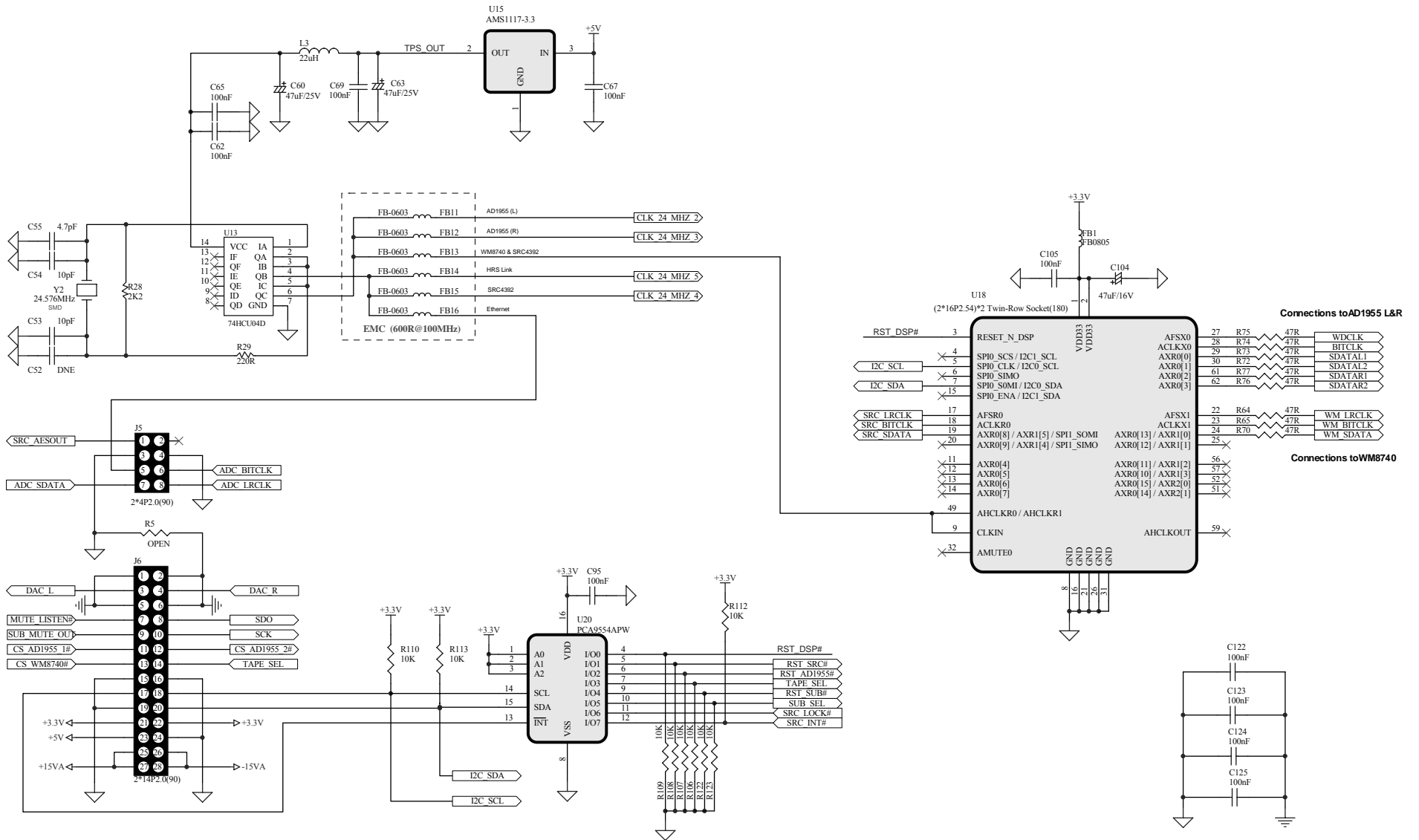


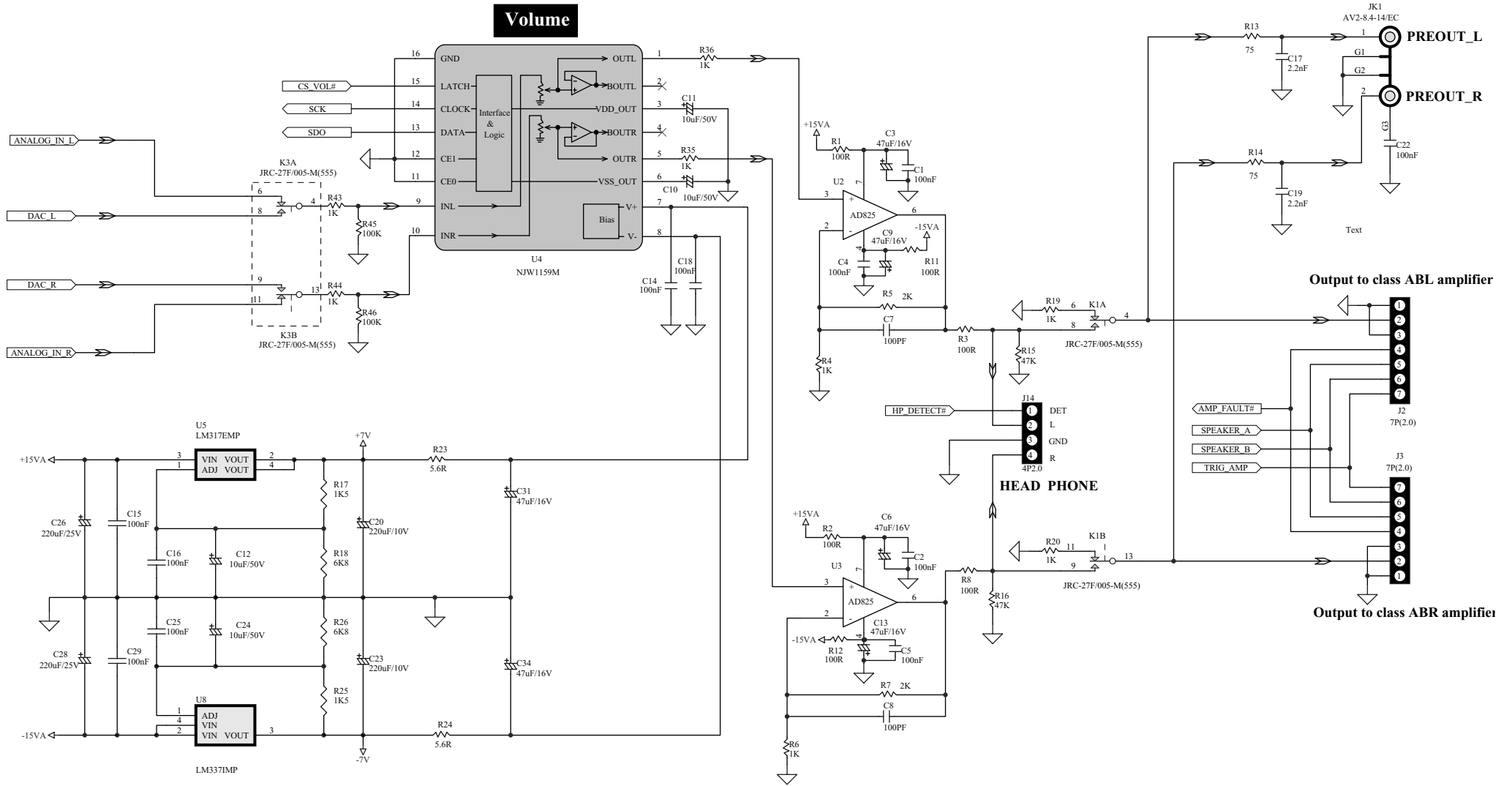


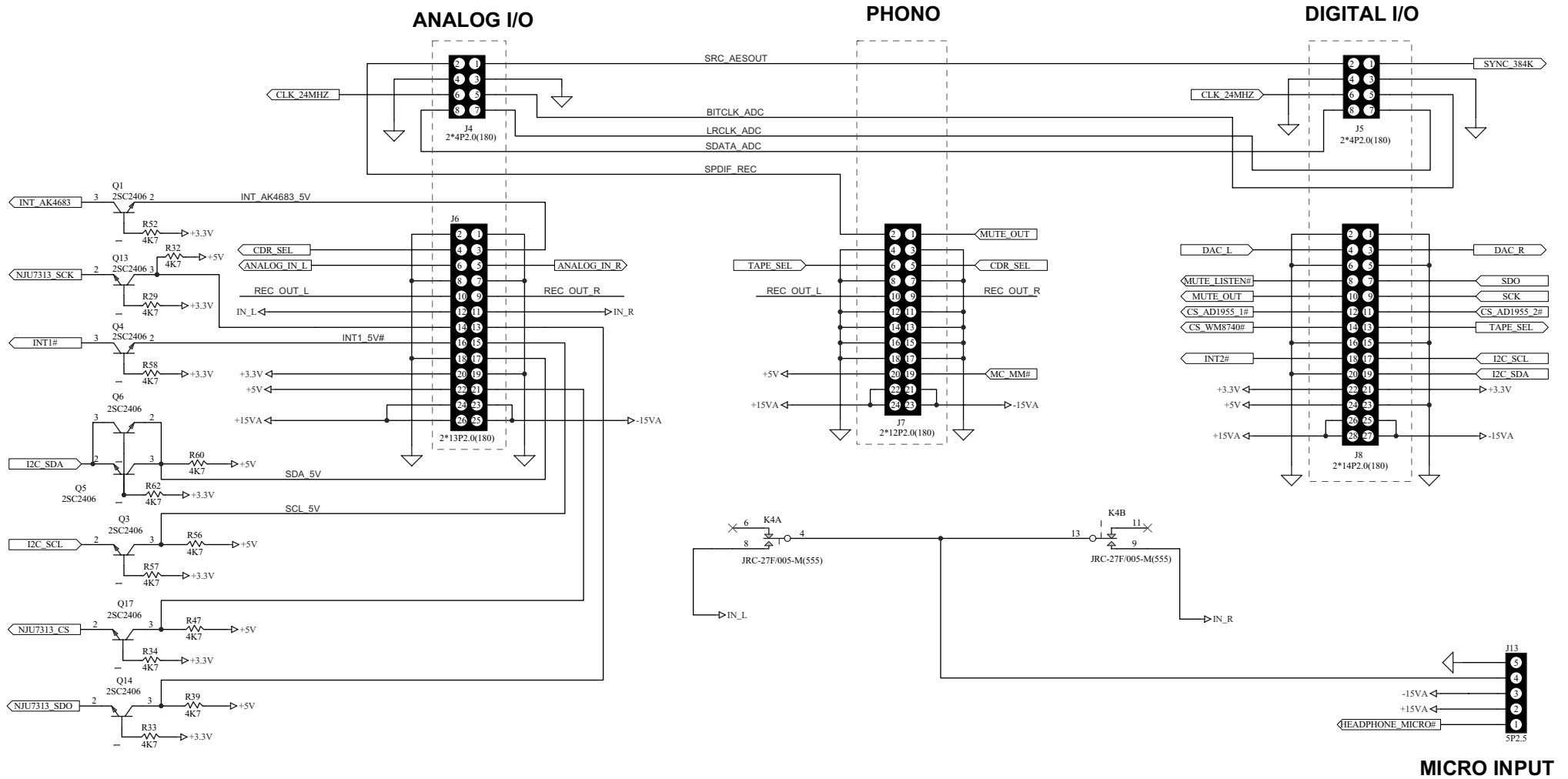




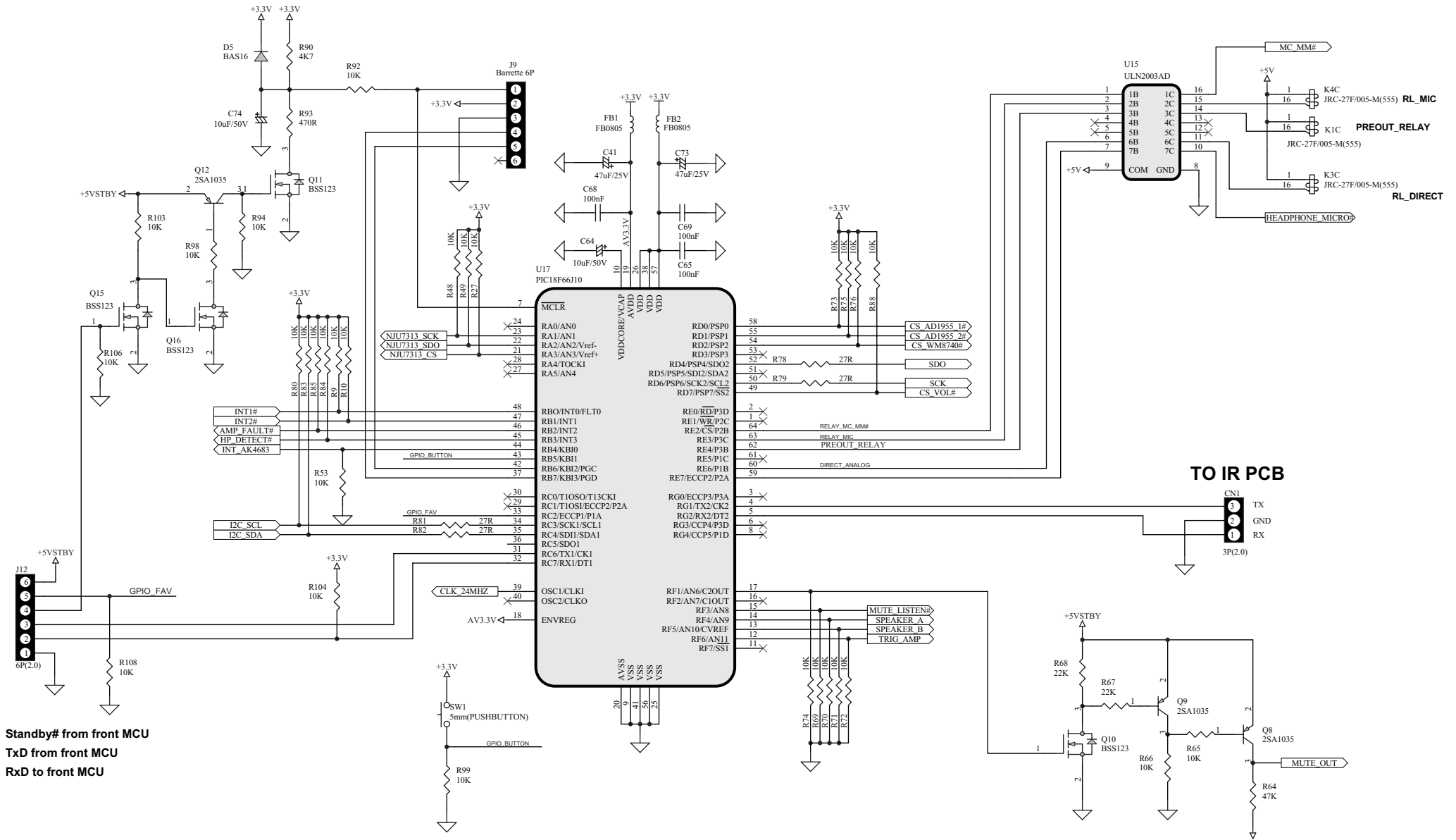






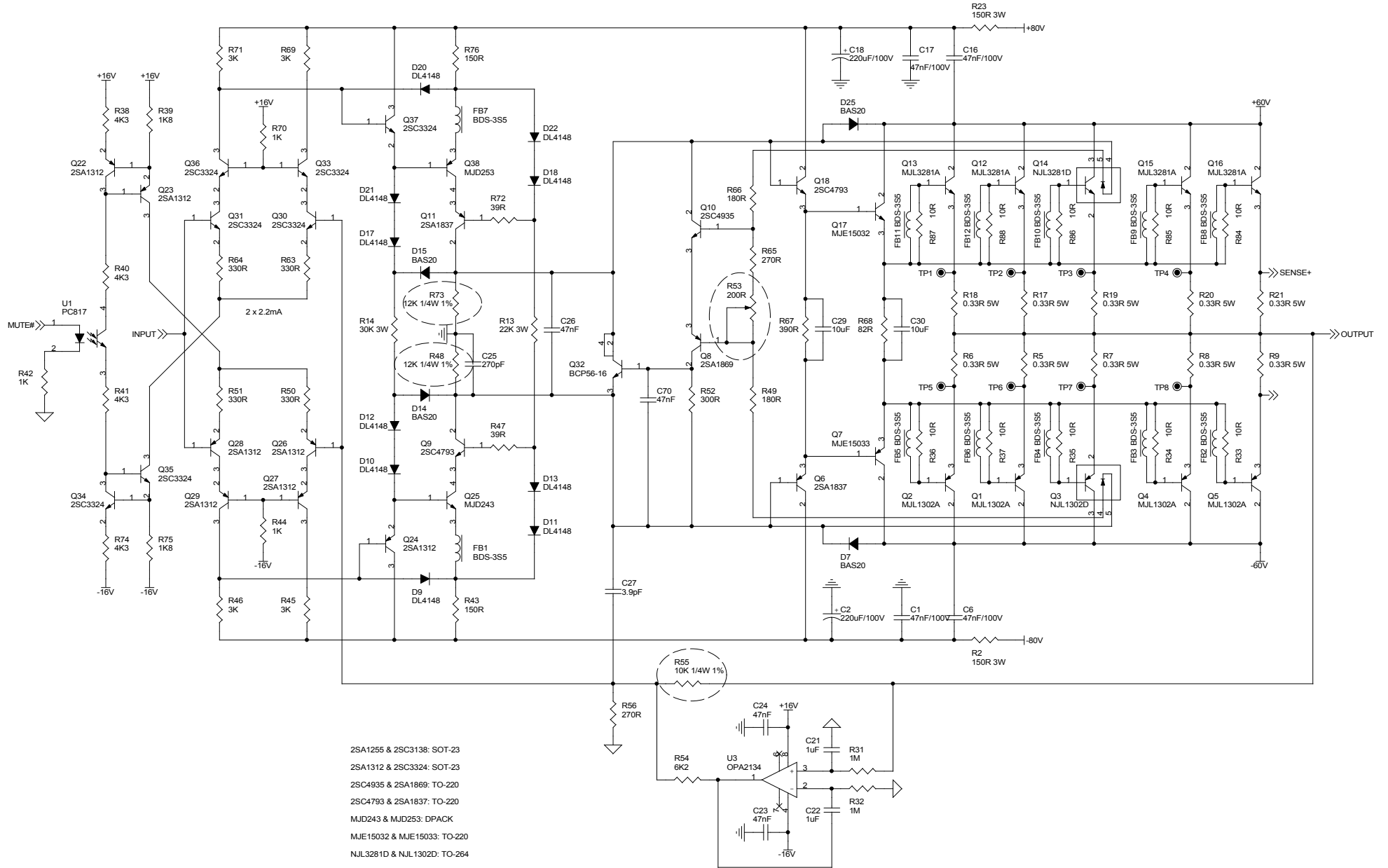


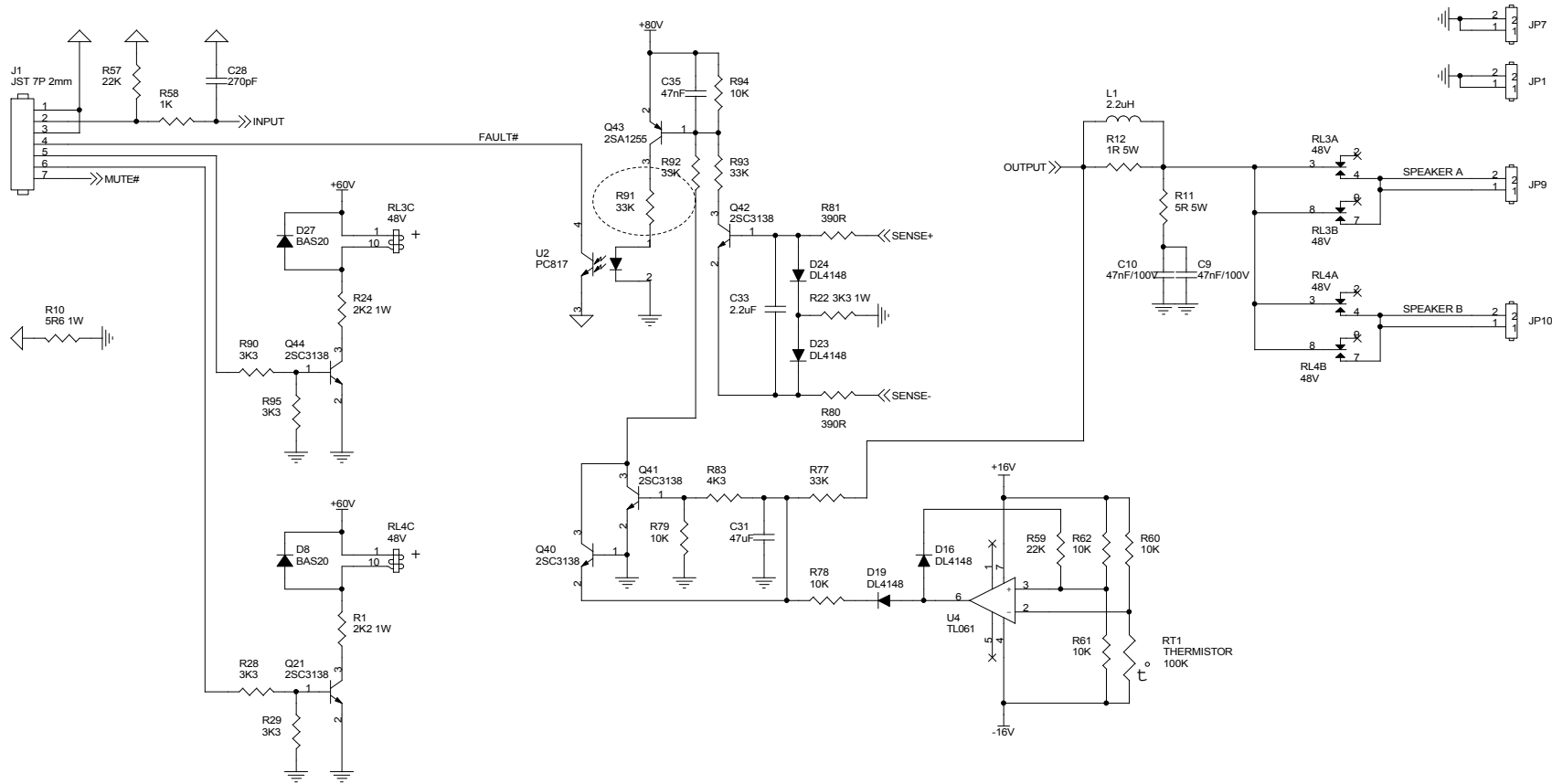
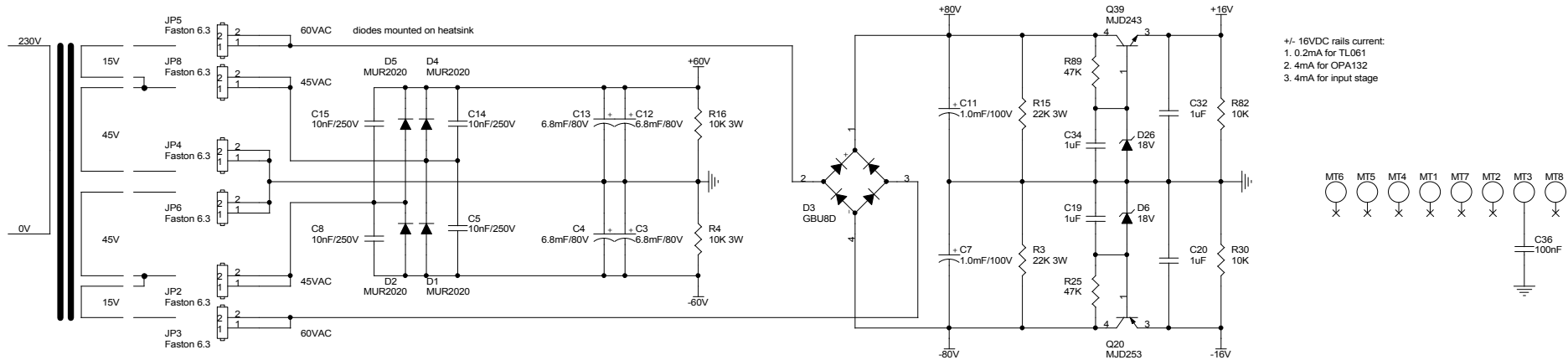


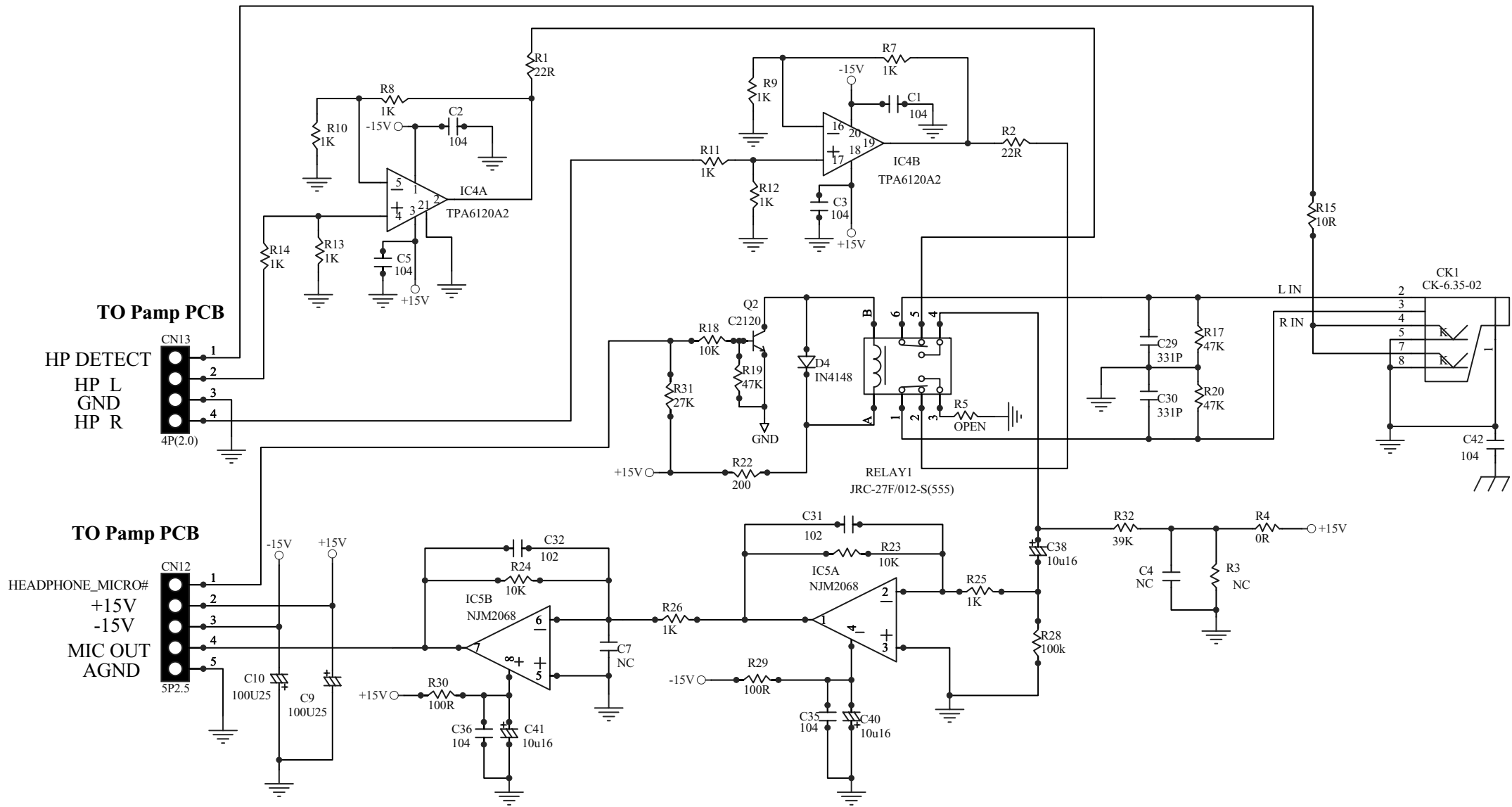


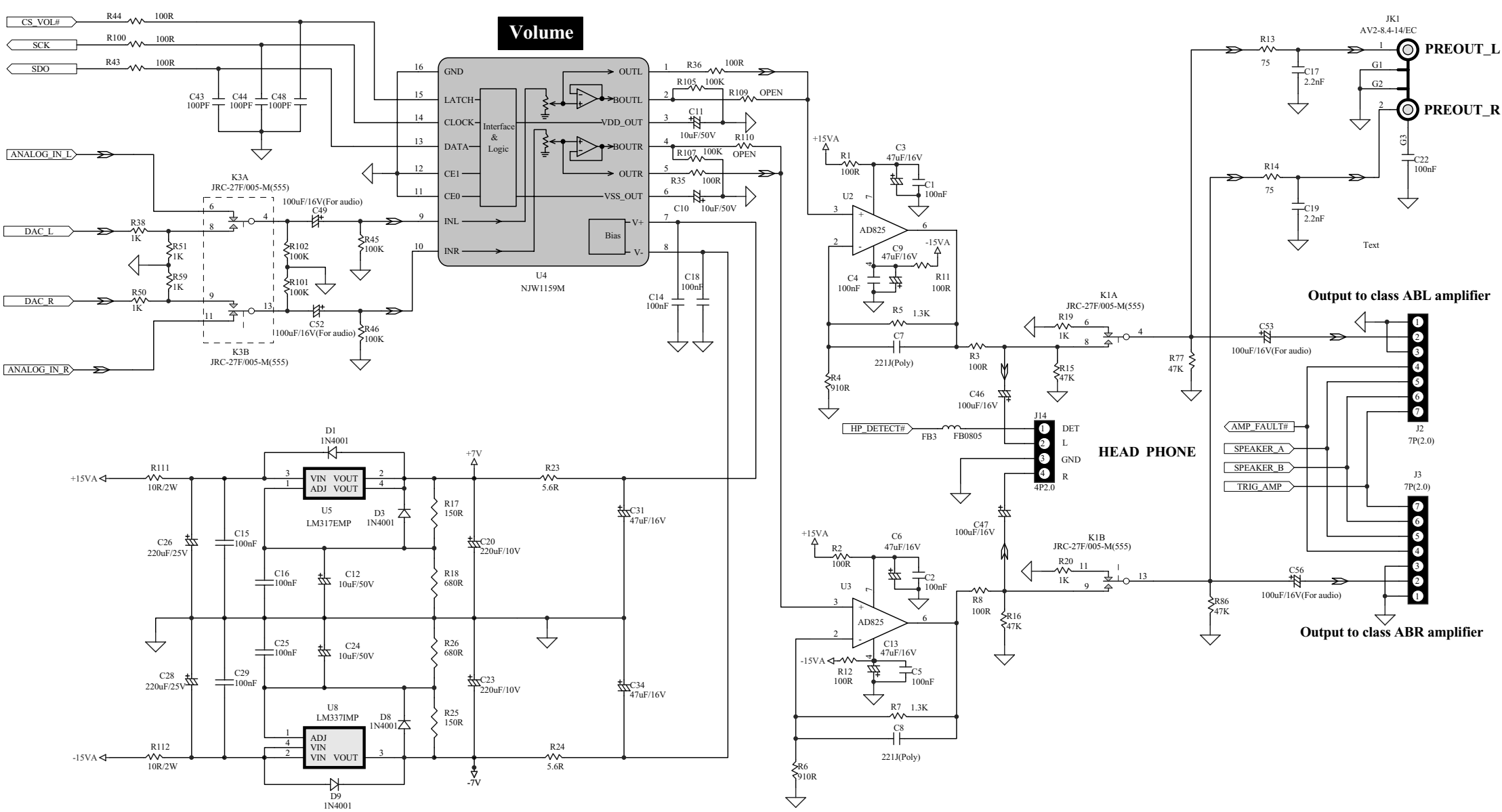
Standby# from front MCU  
 TxD from front MCU  
 RxD from front MCU







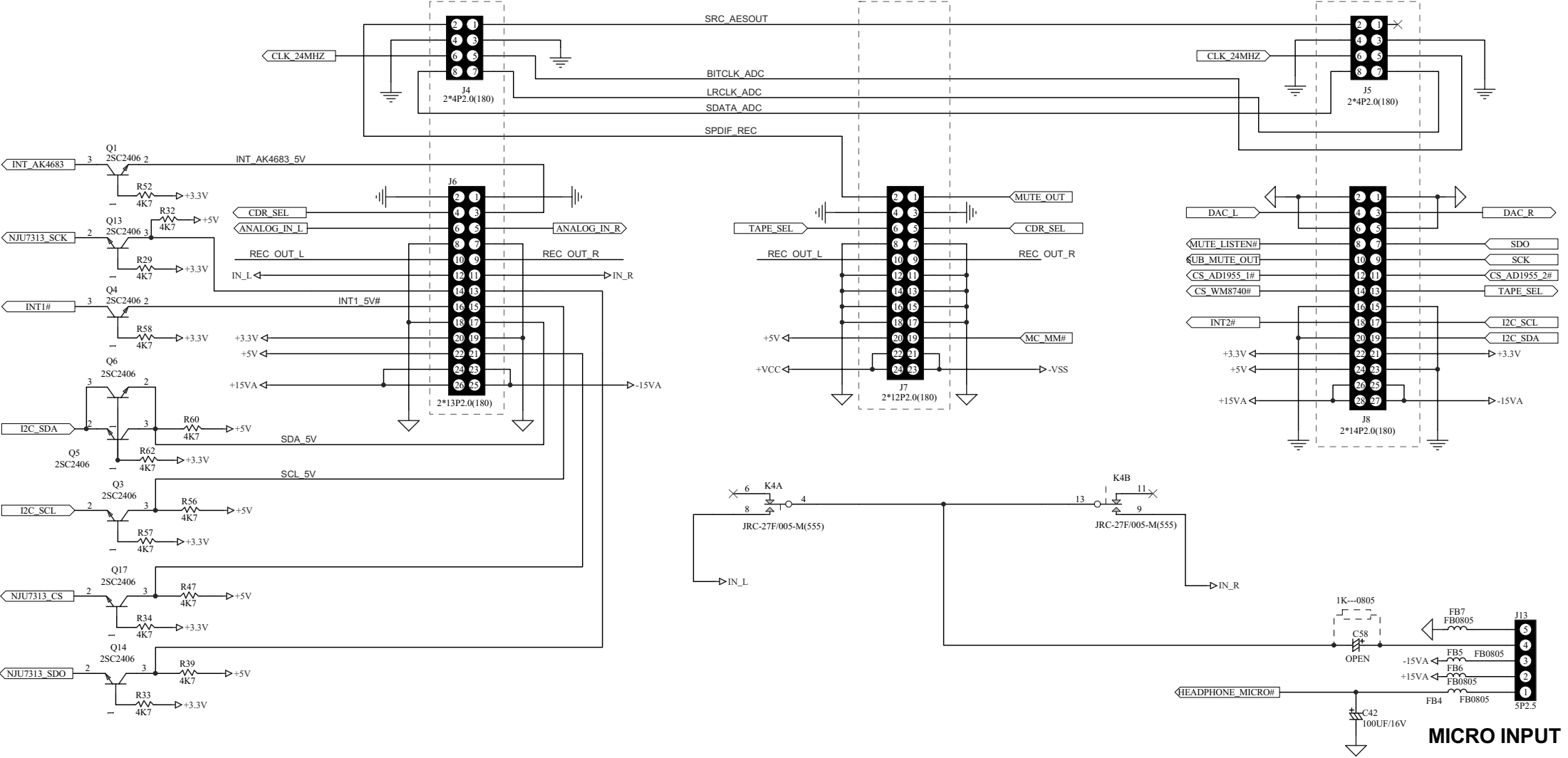


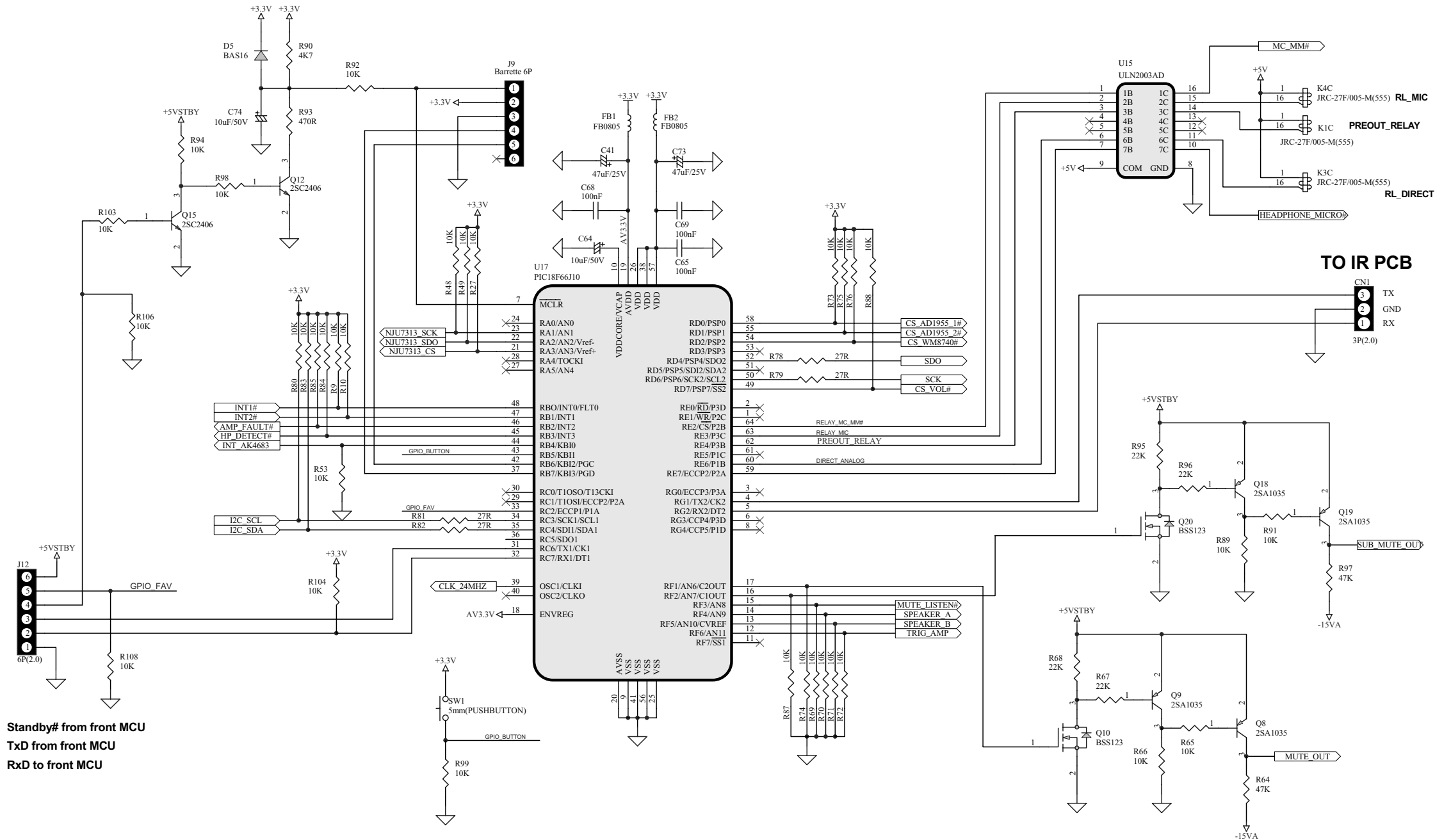


**ANALOG I/O**

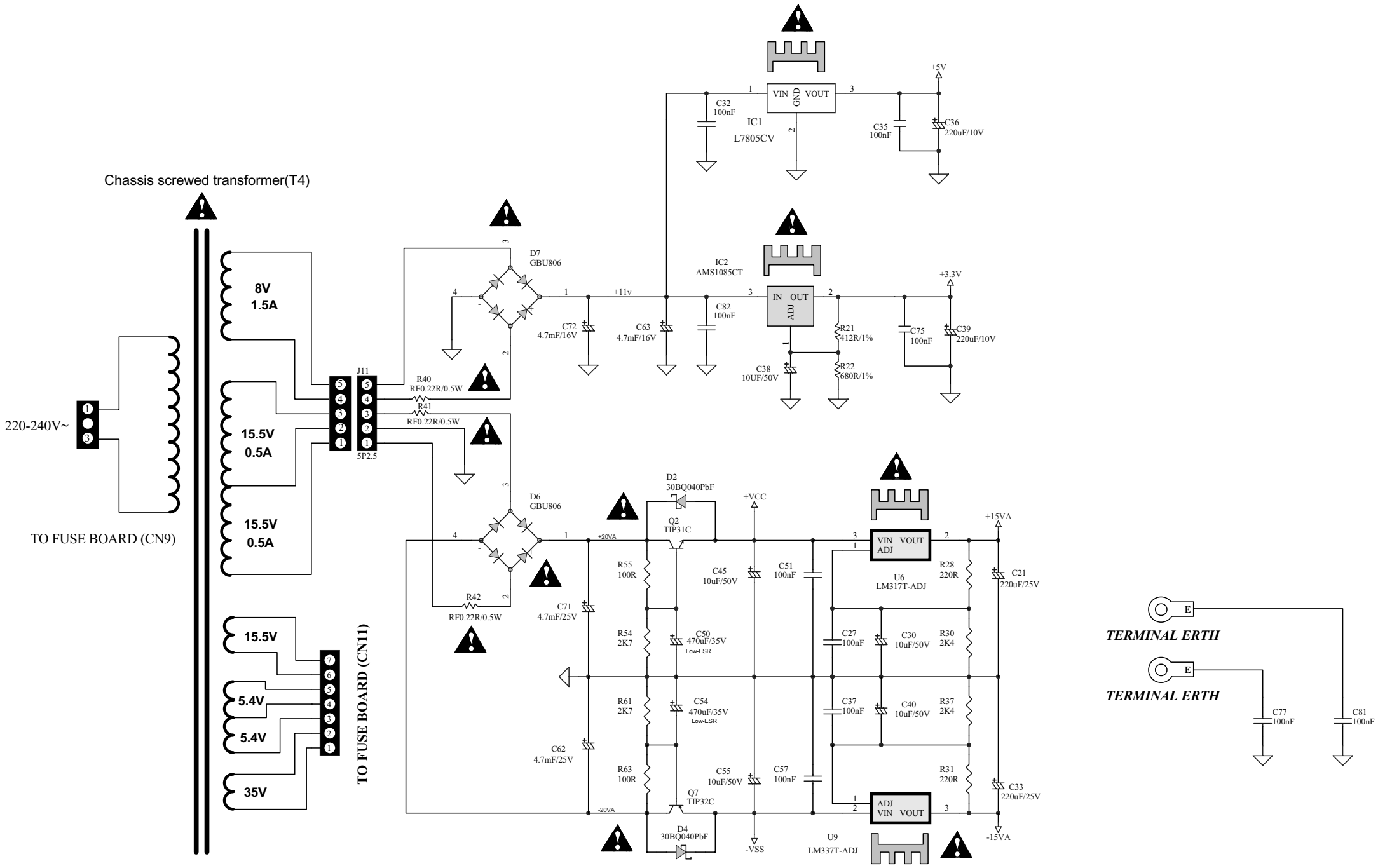
**PHONO**

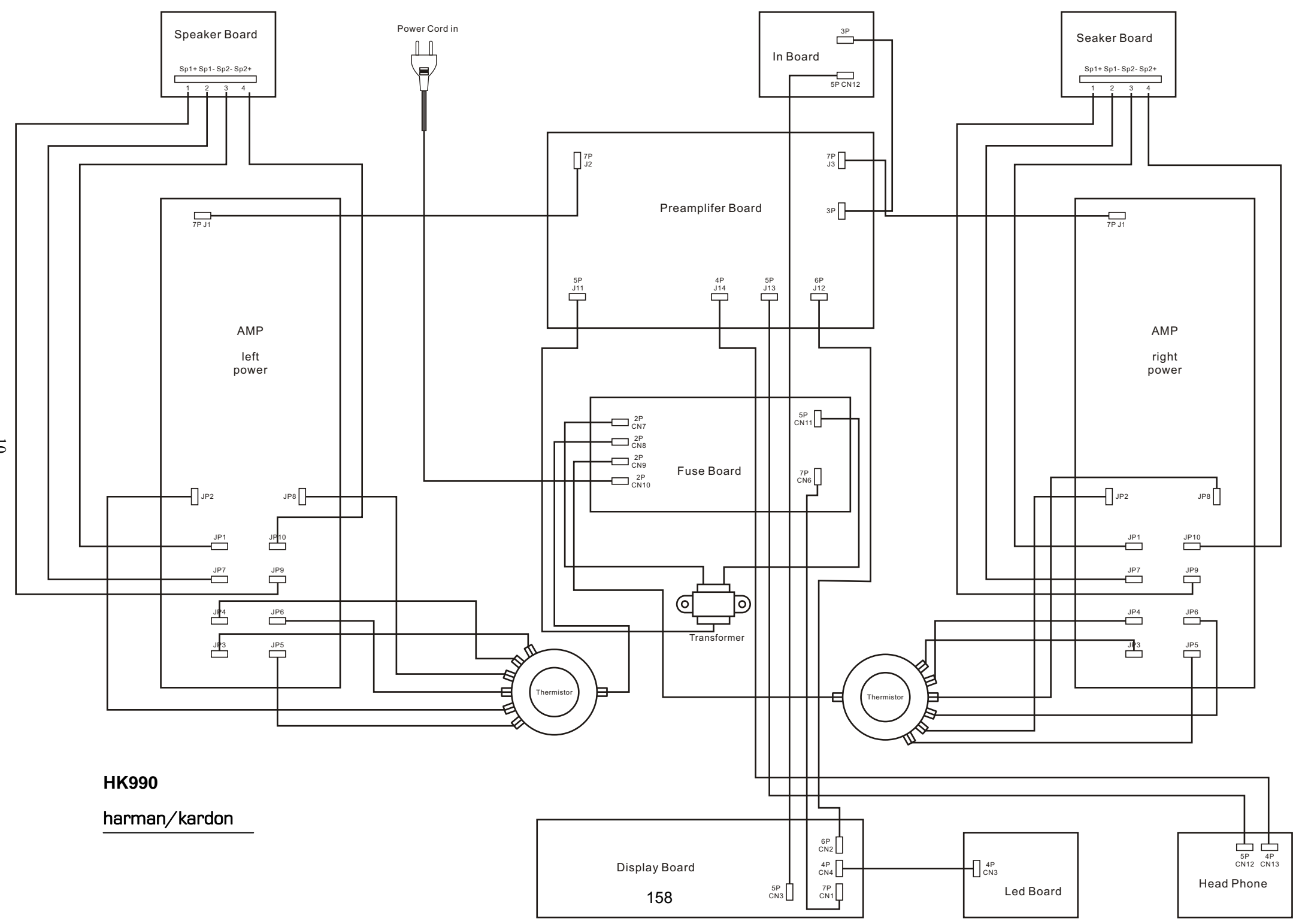
**DIGITAL I/O**











**HK990**

**harman/kardon**