Specification - BS602 Automatic Equalisation

Iss 2
23th Jan 2001
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General Description

Maximal Length Sequence (MLS) analysis allows us to measure the magnitude response for auto-EQ.

MLS benefits from good tolerance of poor SNR, so a high level stimulus is not required. MLS analysis uses a Pseudo Random Binary Sequence (PRBS) which is pink-filtered so as to adequately stimulate the LF end of the spectrum without over-driving HF drivers. The stimulus sounds just like pink noise.

The stimulus is ‘played’ over the system, and is synchronously recorded via the measurement microphone into memory on the DSP card.

At the first (primary) microphone position, the main system and the sub system are independently stimulated, and their levels and magnitude responses are measured (see Level Matching). A gain factor is then calculated for the sub system to match the level of the main system. The rest of the auto-EQ process is carried out with both the main system and the sub system active.

Several sequences are repeated, and the result averaged. The recorded sequence is then correlated with the original stimulus in such a way as to derive an impulse response for the system. With knowledge of the parameters of the pink filter etc, an impulse response for the room can be calculated from which the magnitude response parameters can be obtained using an FFT with a window function. The linear-frequency domain FFT data is converted to log-spaced 'bands' for EQ response fitting.

At the first (primary) microphone position, the magnitude response is evaluated (see below) firstly with normal polarity, and then with reverse polarity. The responses are then compared over the range to be EQ’d, and whichever polarity setting has fewer points beyond the Max Boost / Max Cut limits is used for the rest of the auto-EQ process, and is retained for normal operation. If both responses lie within this range, the response with the smallest absolute error is chosen.

The remaining microphone positions are then measured in a similar way, and their magnitude responses averaged.

The resulting response is then inverted to obtain a required EQ response, and smoothed to take out noise and narrow peaks or dips, using moving average filtering. A target curve is then subtracted to compensate (where possible) for the LF response of the Main speakers. The parameters of a bank of Parametric equalisers are then manipulated to give a best-fit to the required response. The mapping of the required response to EQ parameters is done by looking for the frequencies with the worst error, assigning an EQ with the appropriate amount to boost to cancel the error at that frequency, then widening the bandwidth until the error within the range of the filter changes sign (when the skirts of the EQ bell tend to go over the target line). The errors are then reassessed and further filters assigned etc until all filters are used up.

To enable long impulses to be measured, auto-EQ uses a lower sample rate than the normal audio sample rate. This is not a limiting factor for room equalisation, which rarely extends beyond 500Hz.

Specification

Auto-EQ sample rate:	6kHz
MLS sequence length:	4095
Number of averaged sequences:	8
Maximum impulse response length:	682ms
FFT length:	4096
FFT window type:	Raised cosine bell
Log-frequency domain resolution:	1/50th Octave
Number of EQ filters:	12

Main LF Compensation

Level Matching

Level matching is carried out prior to the first AEQ measurement. It is essential that the average level of the sub is accurately matched to the level of the main system so that the combined LF response curve lies within the limits set by the maximum allowed eq cut and boost . The process is carried out in 4 steps: -

1. The DSP is loaded with a patch to realize the system in Fig.1. The main system gain is ramped to a fixed level. The level from the Microphone meter is used to adjust the output gain so as to achieve a reference level at the Mic (-12dBFS). This gain (*MainGainRef)*is saved for later calculations, as is the difference between the final meter reading and the desired target level(*MainRefDiff*). An FFT of the main system is

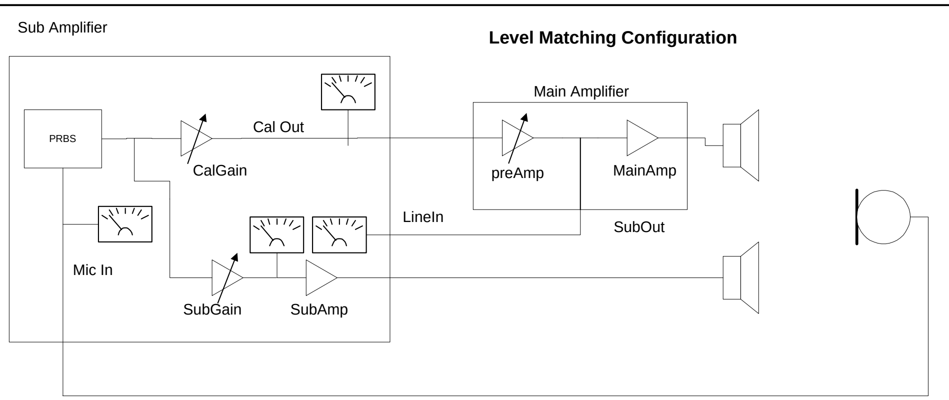


Figure 1

then taken. The average FFT level across a range of frequencies, not affected by room response, is measured (*MainZeroLine).*

2. The Sub LP crossover is temporarily extended from 100Hz to 500Hz. The sub output gain is then ramped to a pre-determined level. The Output gain is then adjusted as before, to achieve a reference level at the Mic. This gain (*SubGainRef)* is stored, as is the difference between the final meter reading and the desired target level(*SubRefDiff*). An FFT is then carried out on the Sub and the average level is stored (*SubZeroLine*).

3. Pink noise is passed through 20Hz to 100Hz crossovers and into the main system amplifier. The Cal output gains are ramped to the level stored in Step 1. The difference between the level measured at the input (Fed from main amp "Sub Out") and the output level is stored as *MainSysGain* and is a measure of the position of the Volume control on the users amplifier. The signal is band-limited to ensure that an amplifier with a band-limited sub output will read the same as an amplifier that does not band-limit it's sub output.

4. When the above steps are complete, enough data has been obtained to set the final output gain for the sub so that when both systems are excited from the main amplifier, (fig. 3) the mean sub level is at the same amplitude as the reference level in the main response.

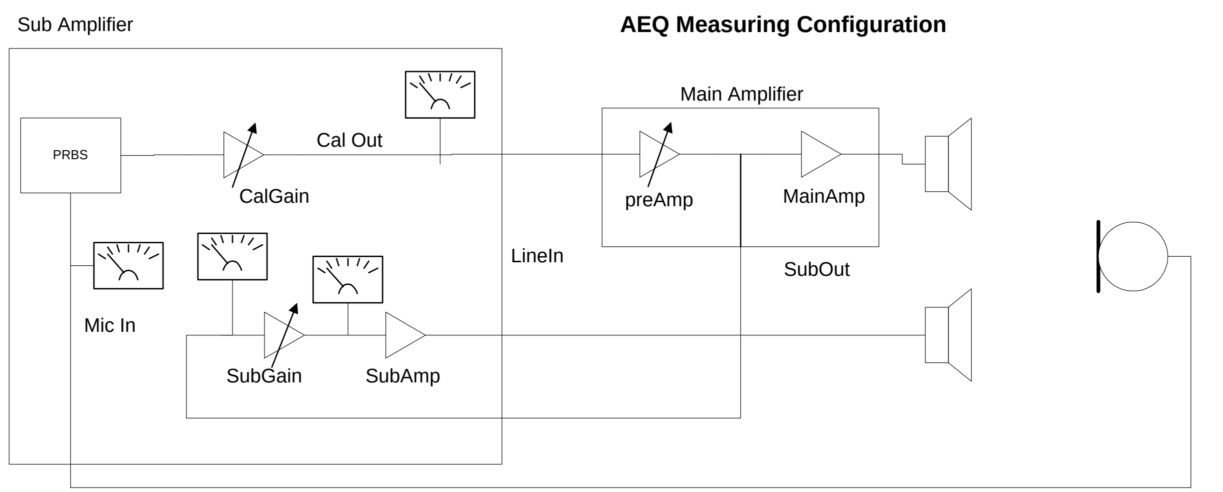
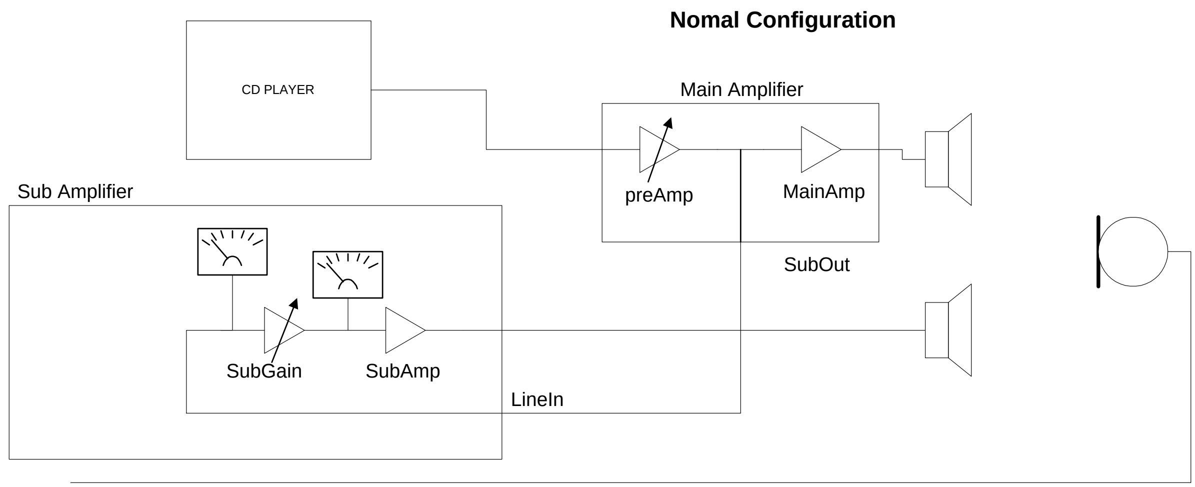


Figure 2



Nomal Configuration
CD PLAYER
Main Amplifier
preAmp
MainAmp
Sub Amplifier
SubOut
SubGain
SubAmp
LineIn

Figure 3

DRAWING NUMBER ISSUE

S-C267BS-02

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TITLE: BS600-1 (ANALOG I/P)

SHEET 1 OF 1

FILENAME: S-B267BS-02.SCH

DRAWN: BPV

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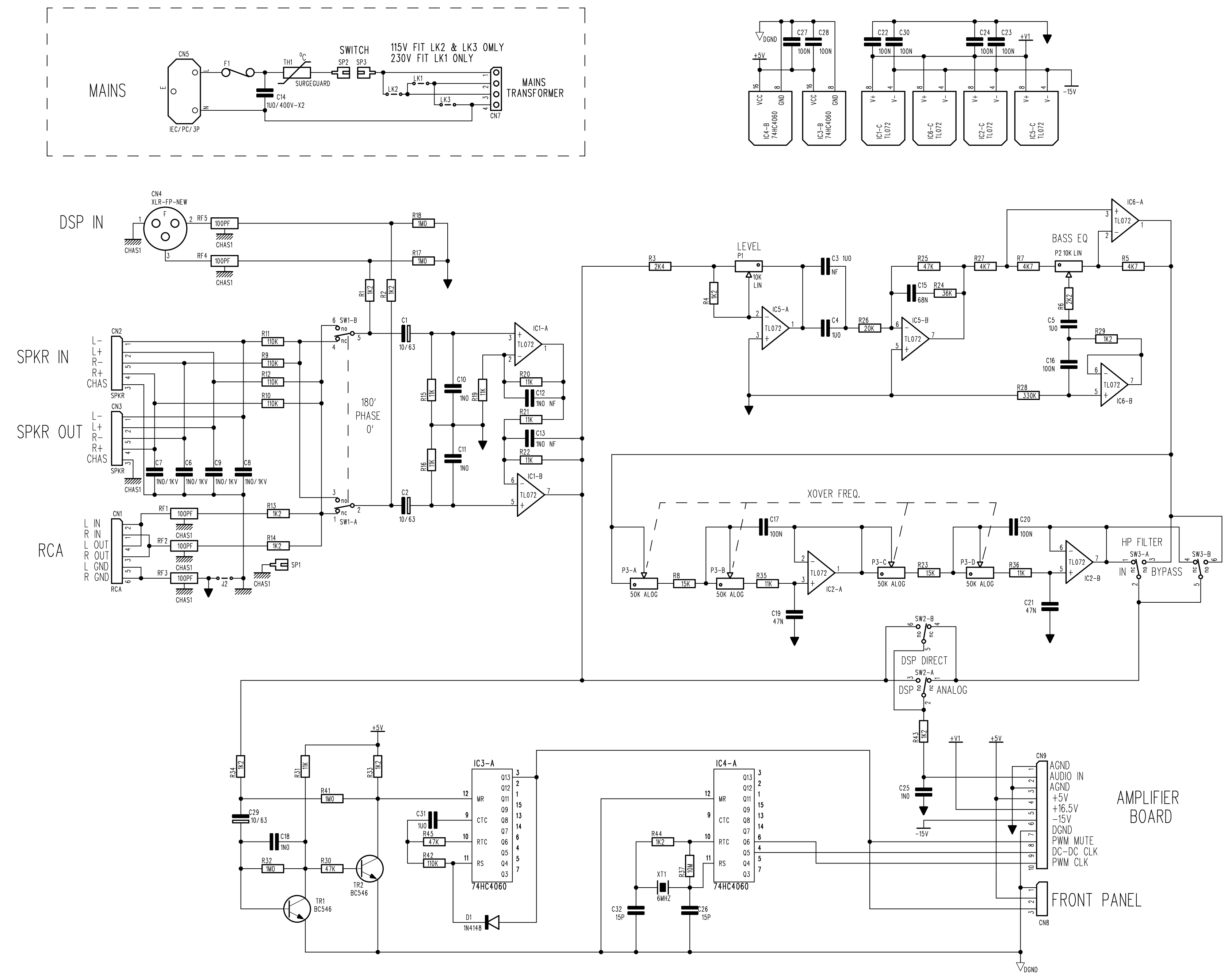

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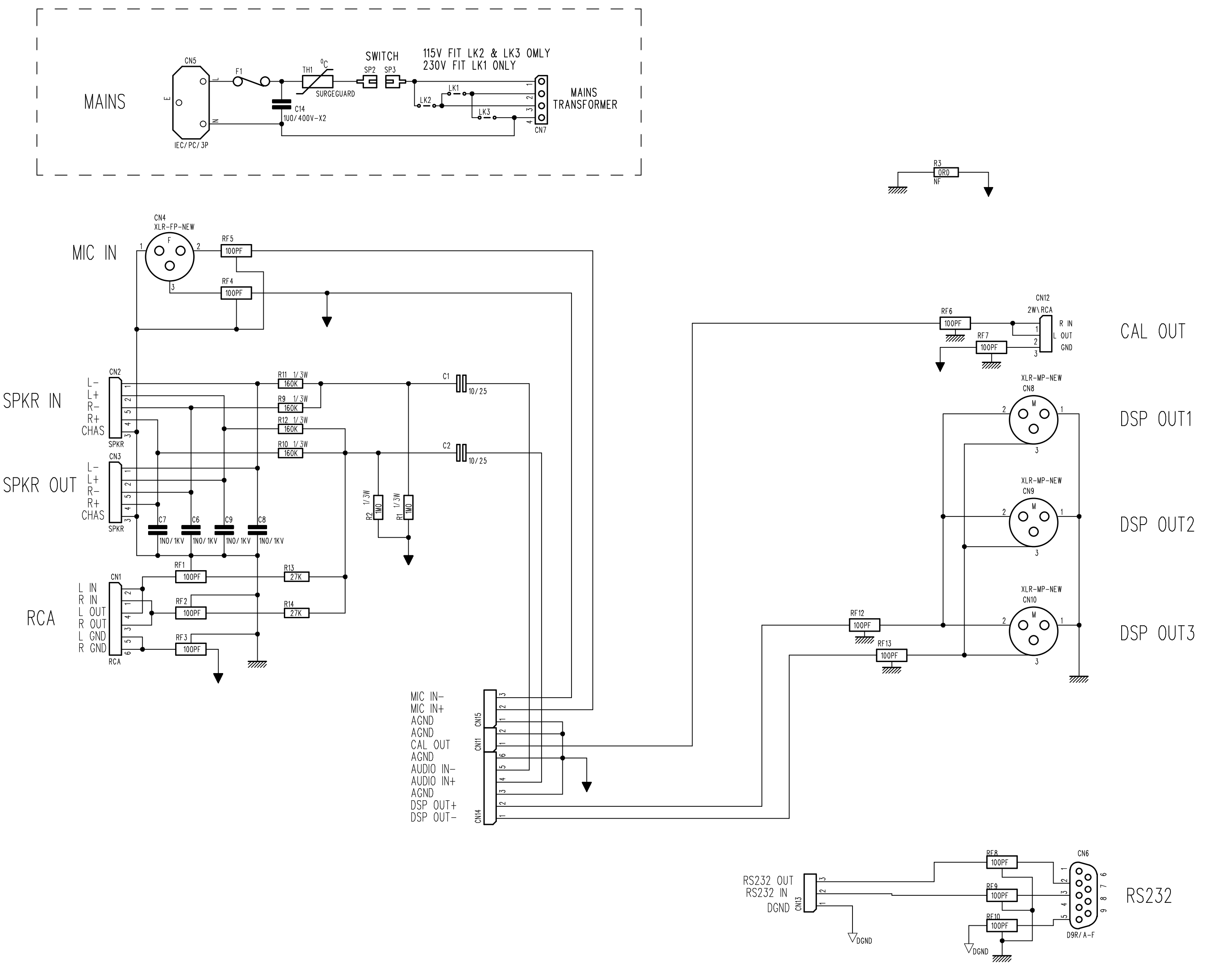

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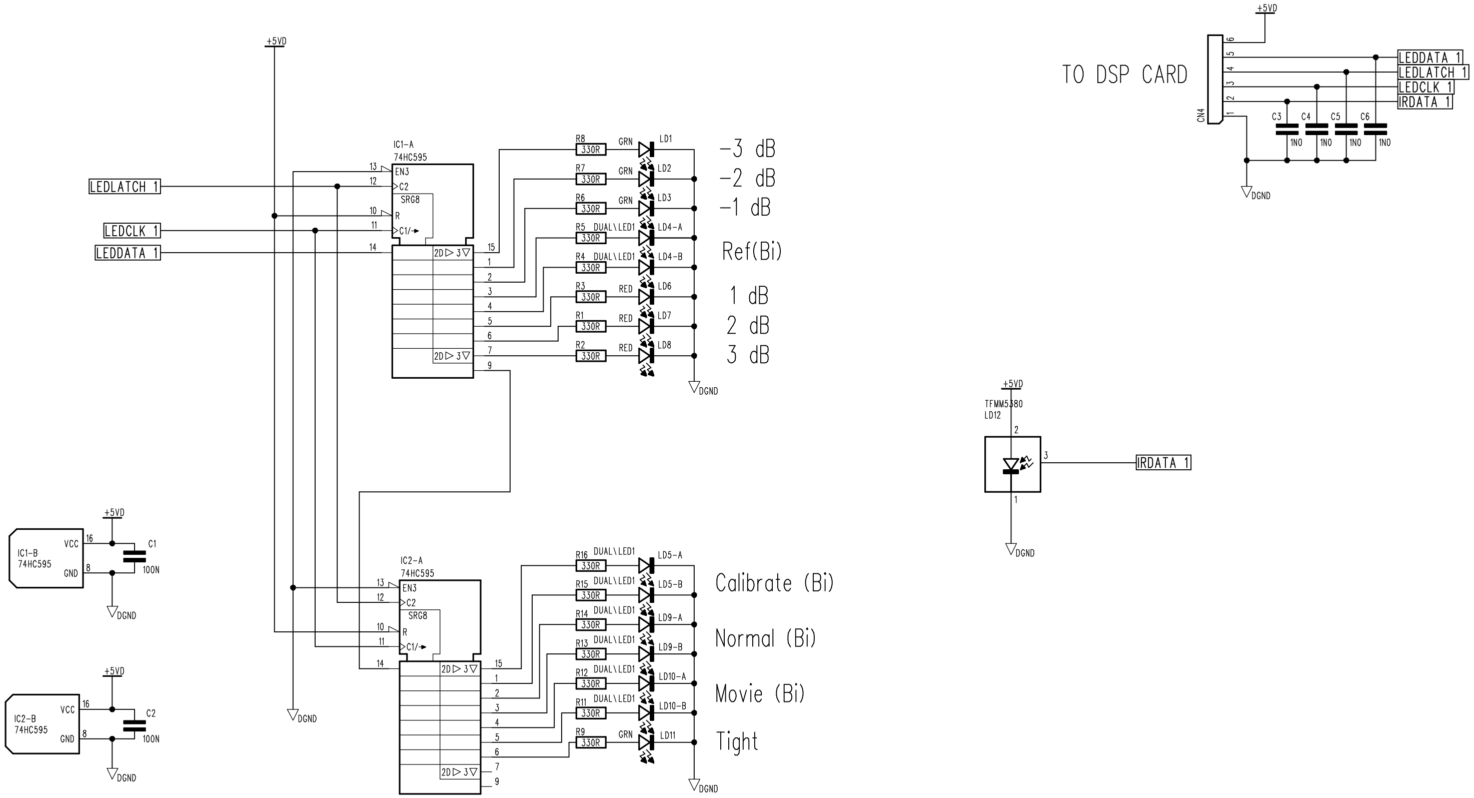

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1. PRE-PRODUCTION RELEASE 04/09/00

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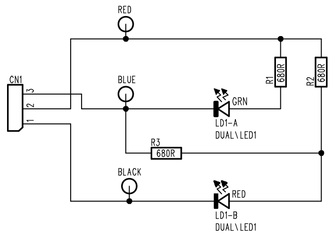

NOTE:
Fit R2 OR R3.

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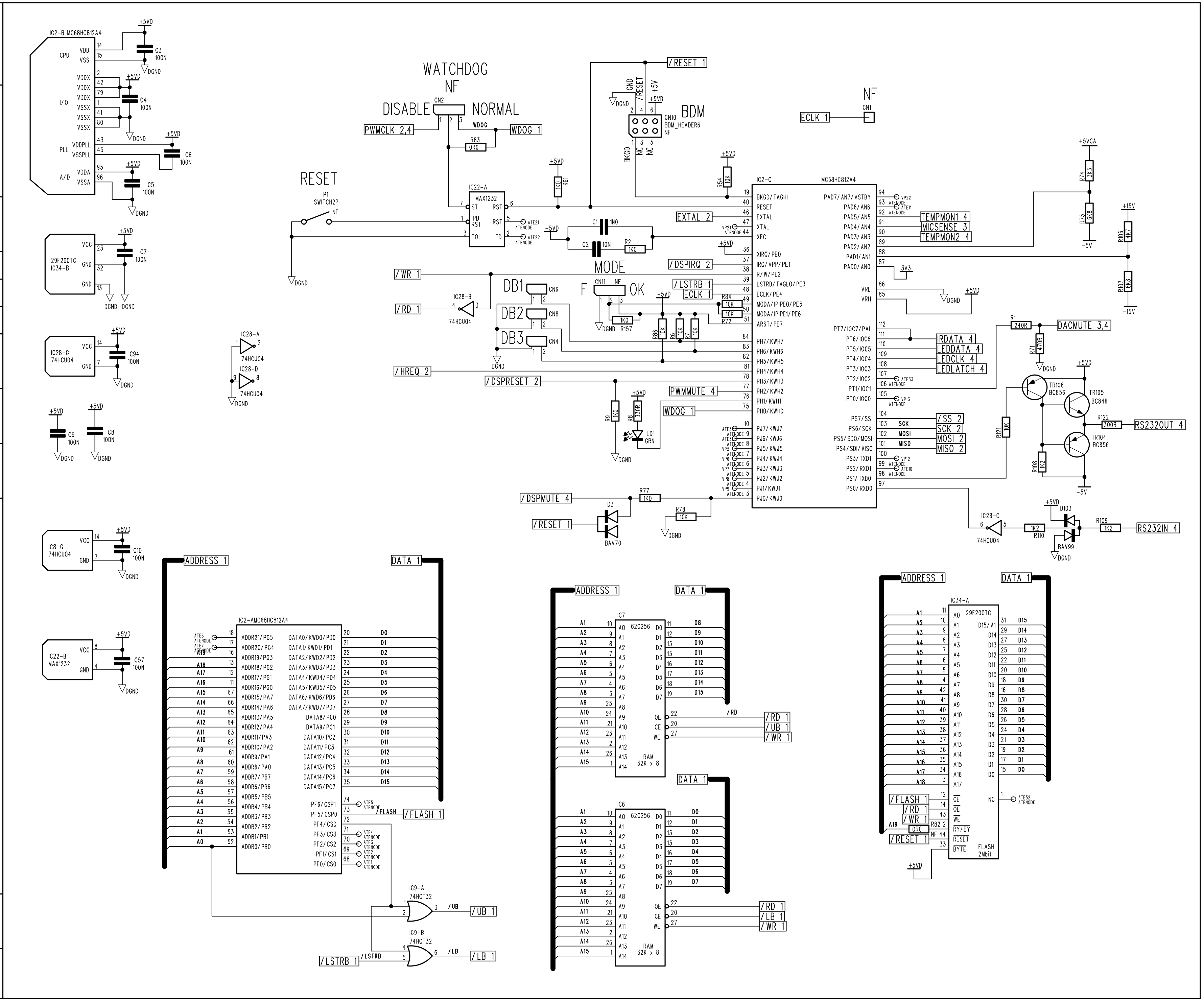
1. PROTOTYPE RELEASE 20/09/00
2. PRE PRODUCTION RELEASE 23/01/01



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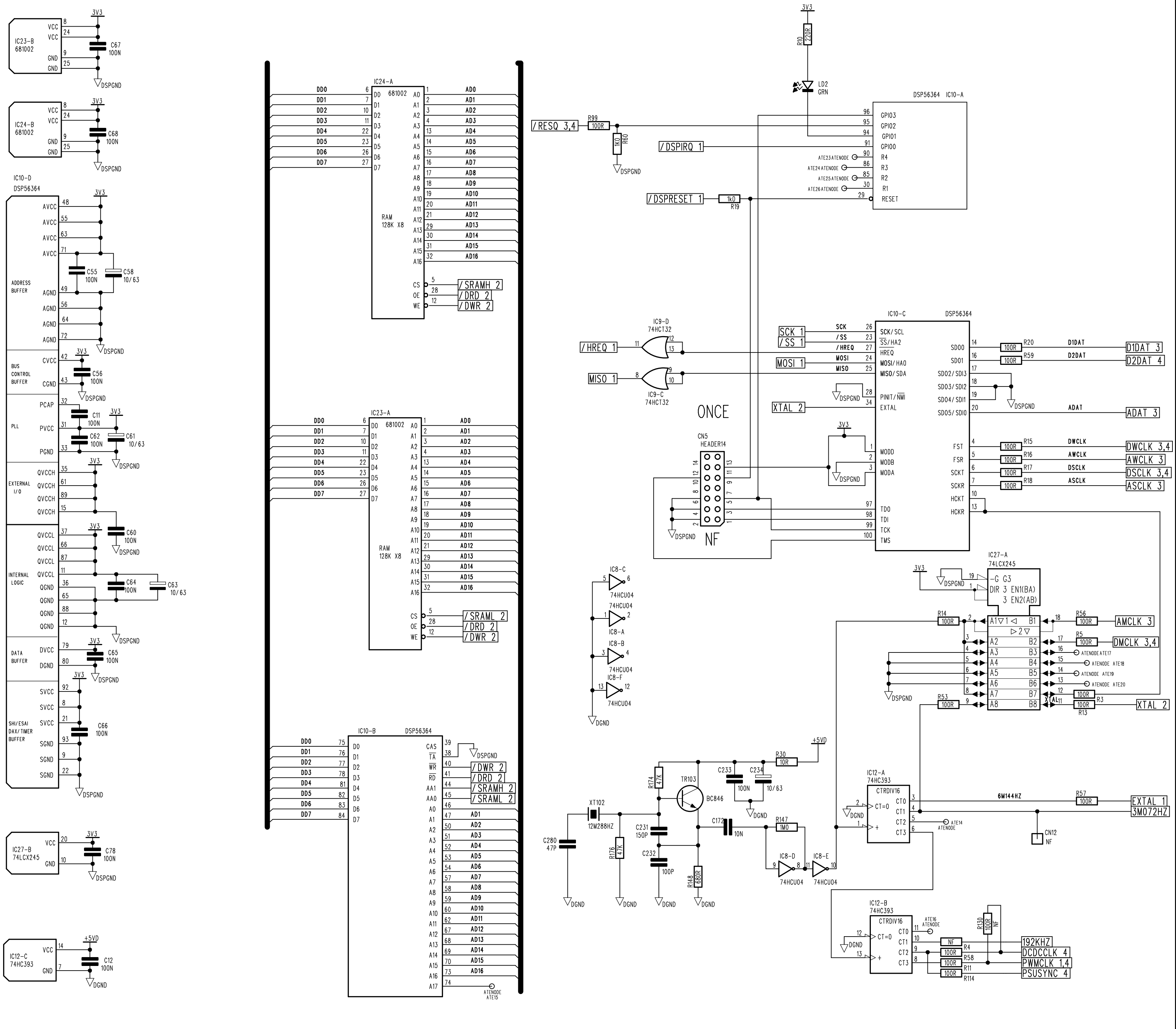

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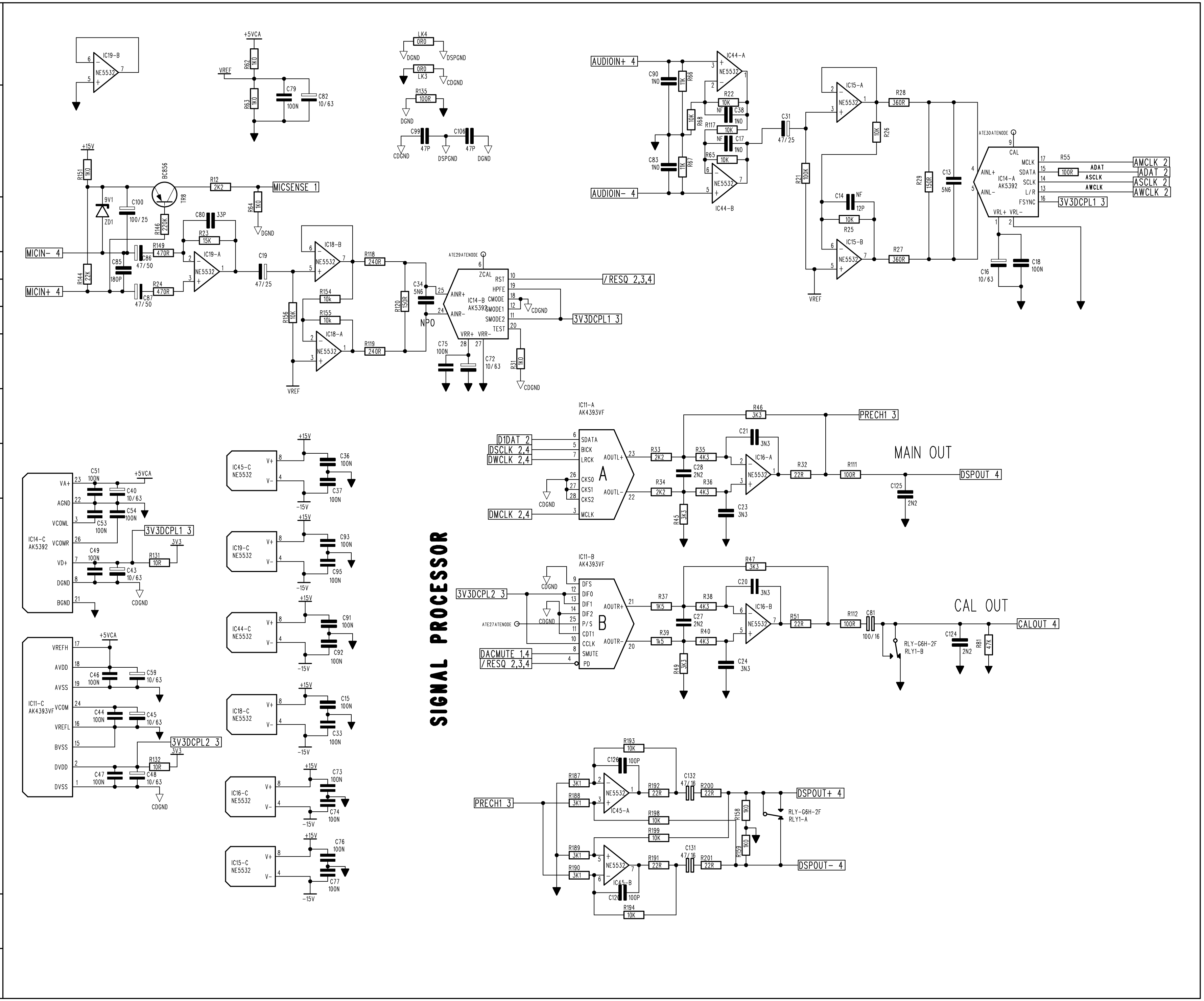

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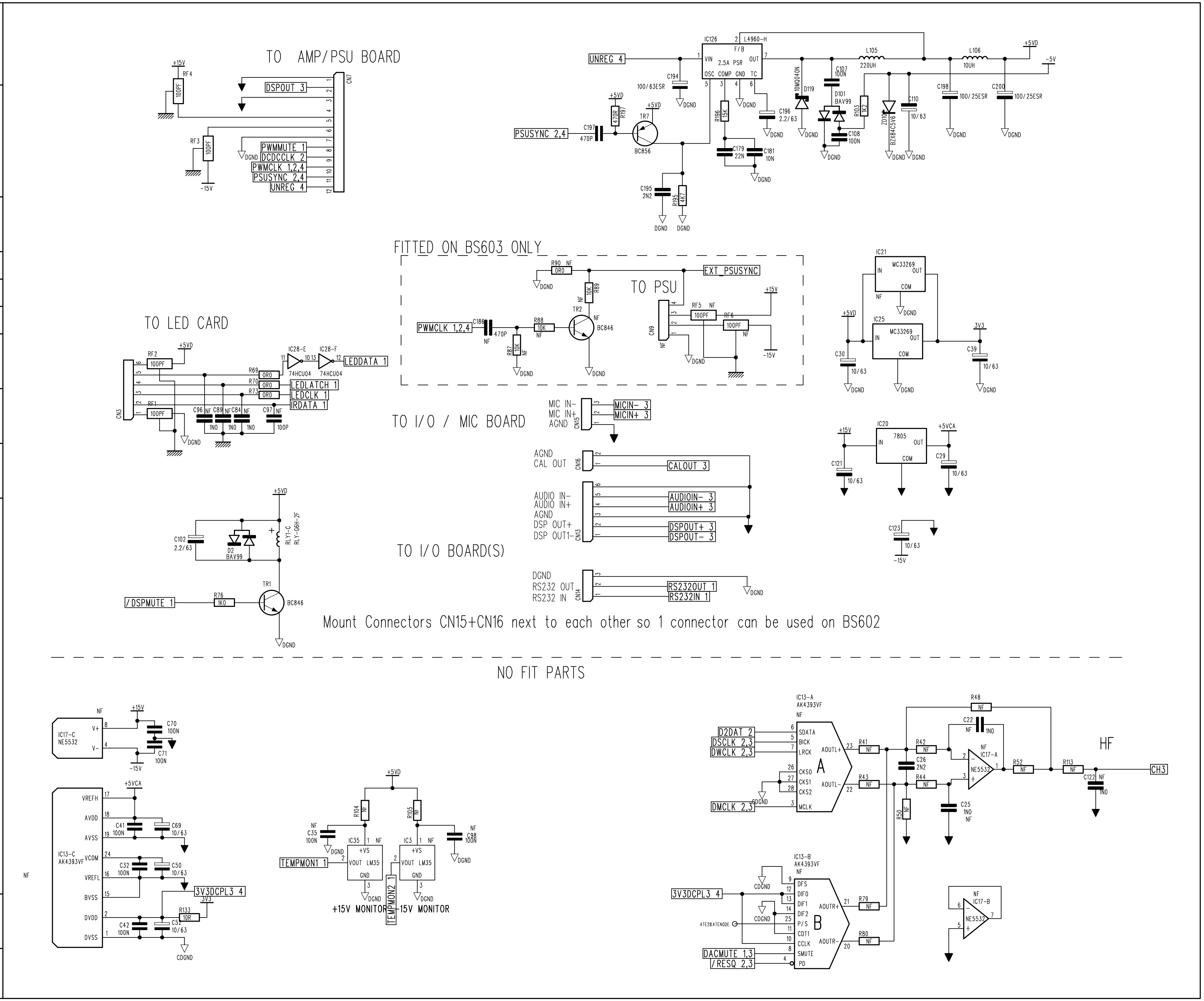

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TITLE: BS600 PWM AMPLIFIER

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FILENAME: S-C267AS-02.SCH

DRAWN: CN

DATE: 04/09/00

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FINISH:

ISSUE COMMENTS:

1. PRE-PRODUCTION RELEASE 04/09/00
2. PRODUCTION RELEASE 13/11/00

PART NUMBER: