

A Constant Power "Pan" Control Circuit for Microphone Audio Mixing

The SSM-2134 permits the design of a constant power, transient-free "PAN" control circuit suitable for installation in the highest performance audio mixing consoles. The design incorporates unique and vital features. The PAN IN/OUT switch does not introduce transient type noise or interruptions in the audio when activated or deactivated, and when panning, an accurate constant power output is maintained between the sum of the two channels. The design allows "punching-in" and "punching-out" of the PAN circuit while mixing down or on-the-air, without transient clicks or holes in the mix.

The design utilizes conventional parts, e.g., a single SPST switch and a linear 10k Ω potentiometer. U₁ (SSM-2134) is used as a unity gain, inverting buffer with an input impedance of 37.4k Ω . The input source could be a VCA element or audio direct from the fader control. The values shown will allow a VCA, for example, the SSM-2013, to be used with only minor additions. The overall application circuit is noninverting from input to output.

The 15k Ω series input resistors R_S , plus the inverting input 15k Ω R_i in parallel with 5k Ω (1/2 of 10k Ω , with the PAN control

in the center) forms an attenuator that has a 14dB loss. Rotating the PAN control in either direction decreases the attenuation to -11 dB for one channel and maximum attenuation for the other.

$$\frac{1}{R_L} = \frac{1}{R_1} + \frac{1}{5k\Omega}, \quad R_L = 3.75k\Omega$$

Attenuation is calculated as:

$$dB_{\text{Loss}} = 20 \log \frac{R_L}{R_L + R_S} = 20 \log \frac{3.75k\Omega}{3.75k\Omega + 15k\Omega} = -14dB$$

Amplifier (U_2 & U_3) gain is:

$$\text{dB}_{\text{GAIN}} = 20 \log \frac{R_F}{R_i} = 20 \log \frac{75\text{k}\Omega}{15\text{k}\Omega} = +14\text{dB}$$

The frequency response is typically 10Hz to 50kHz, within 0.5dB. Total harmonic distortion plus noise will measure less than 0.007% from 20Hz to 20kHz, and SMPTE intermodulation distortion less than 0.01%. The amplifier clipping level is +24dBu with $\pm 18V_{CC}$ power supply rails. Headroom is nominally 30dB, and 27dB at full PAN for the operating channel.

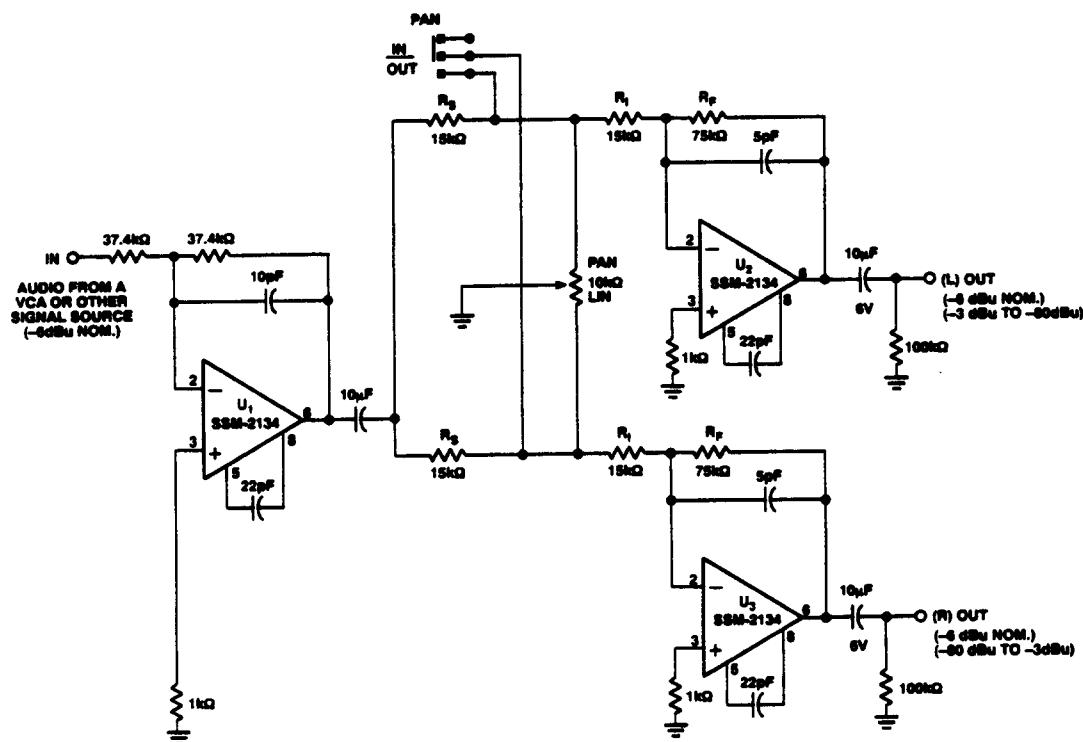


FIGURE 1: Constant Power Type Control Circuit with Transient Free IN/OUT Switching

TABLE 1: Circuit Performance Specifications

PAN Range, L \leftarrow C \rightarrow R (L Out)	+3dB \leftarrow 0dB \rightarrow -80dB
PAN Range, R \leftarrow C \rightarrow L (R Out)	+3dB \leftarrow 0dB \rightarrow -80dB
Max Input Level	+24dBu
Input Impedance, Balanced	37.4k Ω
Max Output Level (> 600 Ω \pm 18V _{DC} PS)	+24dBu
Headroom	30dB
Output Voltage Slew Rate	<6V/ μ s
Frequency Response (\pm 0.05dB)	20 Hz to 20kHz
Frequency Response (\pm 0.5dB)	10 Hz to 50kHz
THD + Noise (20Hz to 20kHz, +8dBu)	0.005%
THD + Noise (20Hz to 20kHz, +24dBu)	0.03%
IMD (SMPTE 60Hz & 4kHz, 4:1, +24dBu)	0.02%
S/N Ratio	130dB