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APPLICATION NOTE

AN960

Equalization of DTMF Signals Using the MC34014

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INTRODUCTION

This application note will describe how to obtain equalization (line length compensation) of the DTMF dialing tones using the MC34014 speech network. While the MC34014 does not have an internal dialer, it has the interface for a dialer so as to provide the means for putting the DTMF tones onto the Tip & Ring lines. The Equalization amplifier, whose gain varies with loop current, was meant primarily to equalize the speech signals. However, by adding one resistor, it can be used to equalize the DTMF signals as well.

CIRCUIT DESCRIPTION

Referring to Figure 1, the gain of the equalization amplifier varies with loop current as it is a function of the voltage at the LR pin (Pin 13). The gain varies from a minimum of −12 dB at low loop currents (long line), to −2.5 dB at high loop currents (short line). The output at EQ (Pin 6) is in phase with the signals going out onto Tip & Ring, but is out of phase with the DTMF input signals from the dialer at R7 (see Figure 2). Because of the out-of-phase relationship, the signal at EQ can be used to partially cancel the signals at the Tone Input (Pin 16). The addition of resistor R10 provides the path for this function, with the result that the DTMF gain increases as loop current decreases.

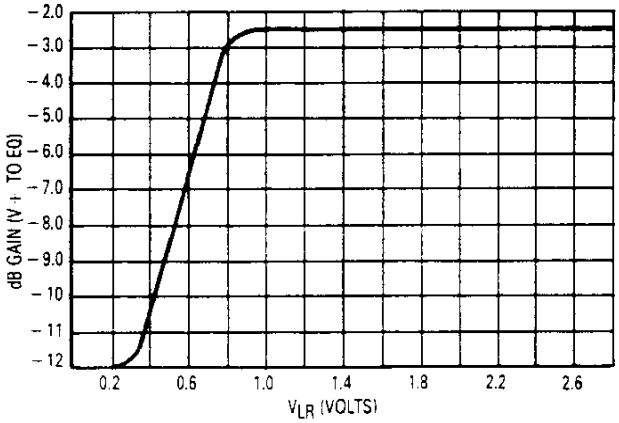

Figure 1. Equalization Amplifier Gain

Because the addition of R10 cancels some of the signal going into Pin 16, resistor R7 must be decreased in order to restore the overall gain from the dialer to Tip & Ring.

The DTMF gain values indicated in Figures 3 and 4 is the gain from the tone dialer (input at R7) to the Tip & Ring lines terminated with a 600 ohm resistor. Figure 3 indicates the gain CHANGE (as the loop current is varied from 60 to 20 mA) versus different values of R10. The gain change is a function of R10, and independent of R7. Figure 4 indicates the DTMF gain versus R7 for different values of R10 at a loop current of 20 mA.

Because the typical telephone line is not purely resistive, there will be a phase shift of other than 180° from the DTMF dialer to Tip & Ring in most applications. For this reason, the values of R10 and R7 will have to be adjusted slightly from those in the graphs to compensate for the phase shift.

The MC34014 data sheet mentions that a dc bias current of 20–50 μA is required into Pin 16 in order to bias the DTMF amplifier. The addition of R10 will provide the bias current from the EQ output for most applications, in which case it may be desirable to ac couple the dialer to R7 with a 0.5 μF capacitor. Excessive bias current will result in clipping of the signals at Tip & Ring. If just the addition of R10 results in excessive bias current, then the EQ output should be ac coupled to R10 with a 0.5 μF capacitor, and the bias current supplied either from the dialer or from an additional resistor as shown in Figure 5.

For further information on the MC34014, refer to its' data sheet.

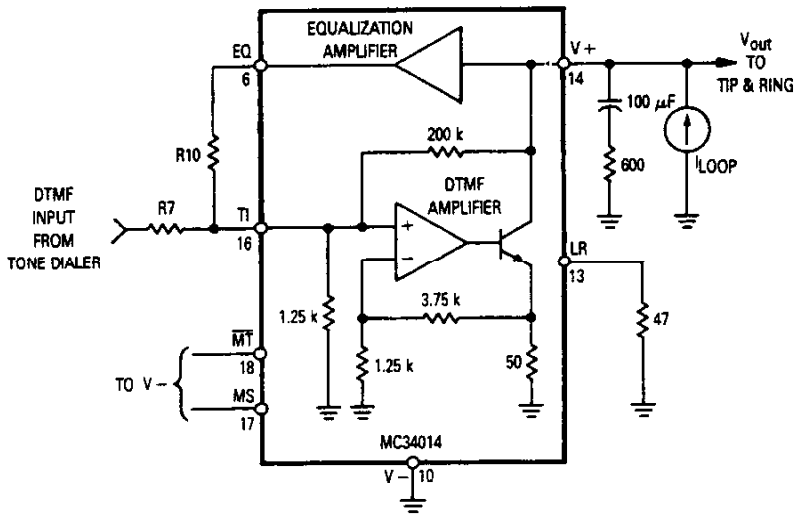

Figure 2. DTMF Driver

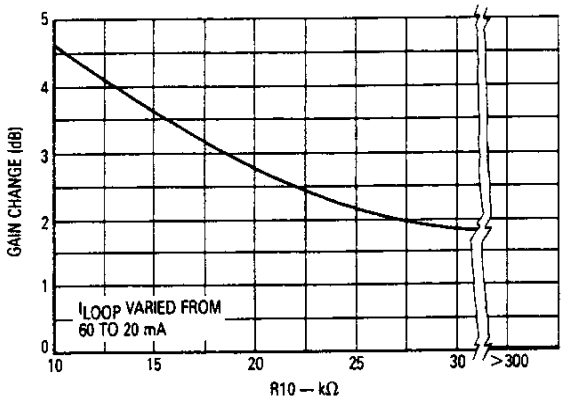

Figure 3. Gain Change

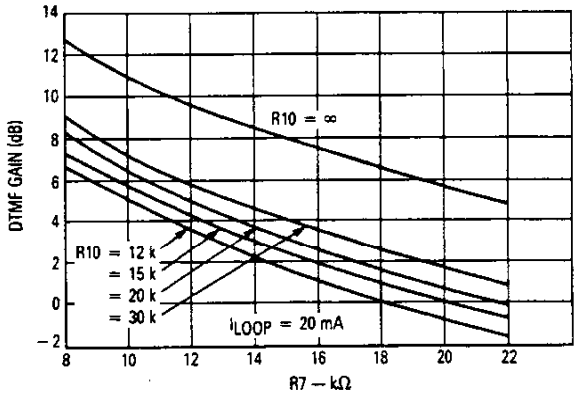

Figure 4. DTMF Gain

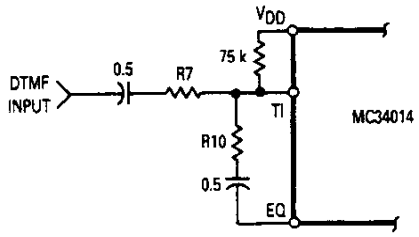

Figure 5. Alternate Biasing

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