DTMF Generation

A Virtual Peripheral DTMF Dialer

Introduction

Many telecom applications, such as auto dialer's, telephone keypads and security systems, require DTMF transmission for dialing and data transmission. Using two PWM virtual peripherals and eight sine lookup tables, an entire 16 key keypad of DTMF patterns can be generated with a Scenix SX microcontroller.

A telephone keypad is broken up into four rows and four columns for a total of 16 keys. Each row and column is represented by a frequency; therefore, each key is uniquely represented by the sum of a row and column as in table 1.

		High Band Frequencies			
		1209	1336	1477	1633
Low Band Frequencies	697	1 $11	2 $12	3 $14	A $18
	770	4 $21	5 $22	6 $24	B $28
	852	7 $41	8 $42	9 $44	C $48
	941	* $81	0 $82	# $84	D $88

Table 1 – DTMF Keyboard matrix

DTMF_GEN Source Code

This application combines two modified PWM virtual peripherals and a 16-bit timer with sine lookup tables to generate the desired frequencies. When passed a number string, the dialnum routine enables the PWM outputs and using the 16-bit timer, sends each DTMF tone for a duration of approximately 320 milliseconds with an inter-digit delay of approximately 100 milliseconds.

This virtual peripheral relies on external RC filters to generate complete DTMF tones. A low pass filter is required on each PWM output to create the analog DTMF tone signal as shown in the circuit in figure 1.

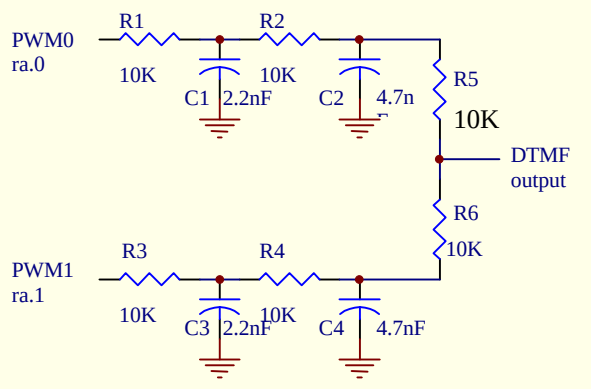

Figure 1 – PWM Output Filters

Additionally, before this circuit can be connected to any telephone system an appropriate DAA circuit is also required. As seen in the source code, bit three of port A is used to enable the DAA output.