DTMF Generation Using The SX Communications Controller

SCENIX

Application Note 7
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Introduction

Many telephony applications, such as auto-dialers, telephone keypads and security systems, require DTMF generation for dialing and data transmission. The SX communications controller can be used to implement two artificial sine wave and PWM Virtual Peripheral modules required to perform DTMF generation.

A telephone keypad is broken up into four rows and four columns for a total of 16 keys. Each of these rows and columns is assigned to a specific frequency. To generate a specific digit, the system needs to generate the frequencies corresponding to the row and column in which the digit resides.

.**Table 1. DTMF Keyboard Matrix**

		High Band Frequencies (Hz)			
		1209	**1336**	**1477**	**1633**
Low Band Frequency (Hz)	**697**	1	2	3	A
	770	4	5	6	B
	852	7	8	9	C
	941	*	0	#	D

The SX DTMF generation Virtual Pheripheral is extremely efficient. The core software is only 89 words in length. The entire demo program is less than 500 words long, including string tables, UART Virtual Pheripheral, delay routines, and other routines required to demonstrate the DTMF generation software.

The DTMF generation Virtual Pheripheral uses two artificial sine-generation routines; one for the low frequency and one for the high frequency. It multiplies the high frequency amplitude by 1.25 (twist) and adds it to the low frequency amplitude, and outputs this value onto the PWM pin (D/A conversion.) The mainline routine handles the digit to frequency decoding, and the dial and pause times. Detailed information about artificial sin generation, UART, and PWM is available at http://www.scenix.com.

Software Flowcharts

Two artificial sine-generator Virtual Pheripheral modules are used in the DTMF generation software. Figure 1 shows the flowchart for the program. The sine genertors run in the interrupt service routine, transparent to the mainline routine..
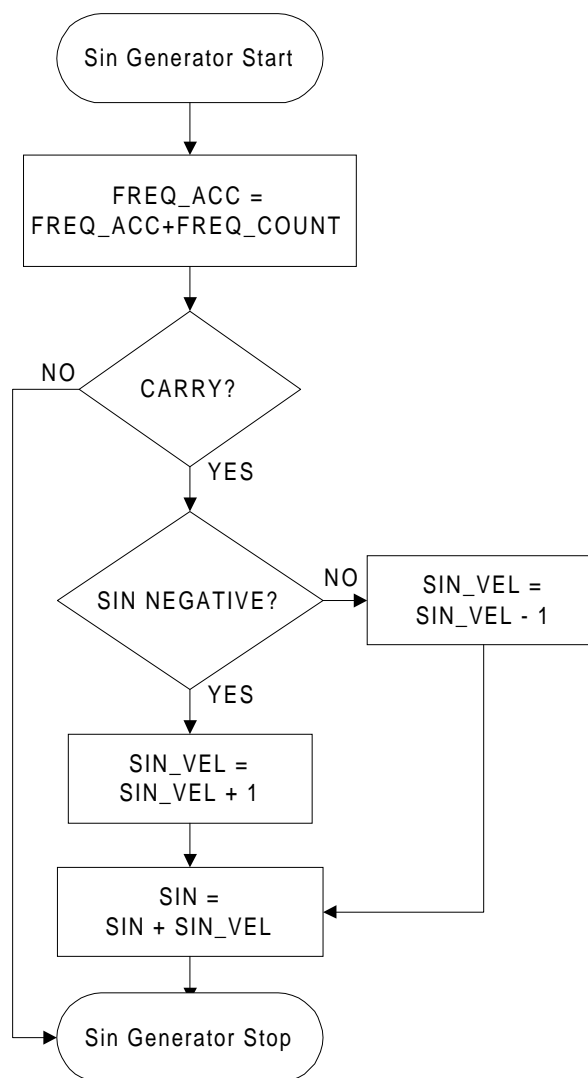

Figure 1.

Figure 2 shows the flowchart for the interrupt service routine used in the DTMF generation demo software. Although this flowchart shows that the UARTs are not running while DTMF generation is enabled, there is still sufficient processing power available left to run the UARTs simultaneously.
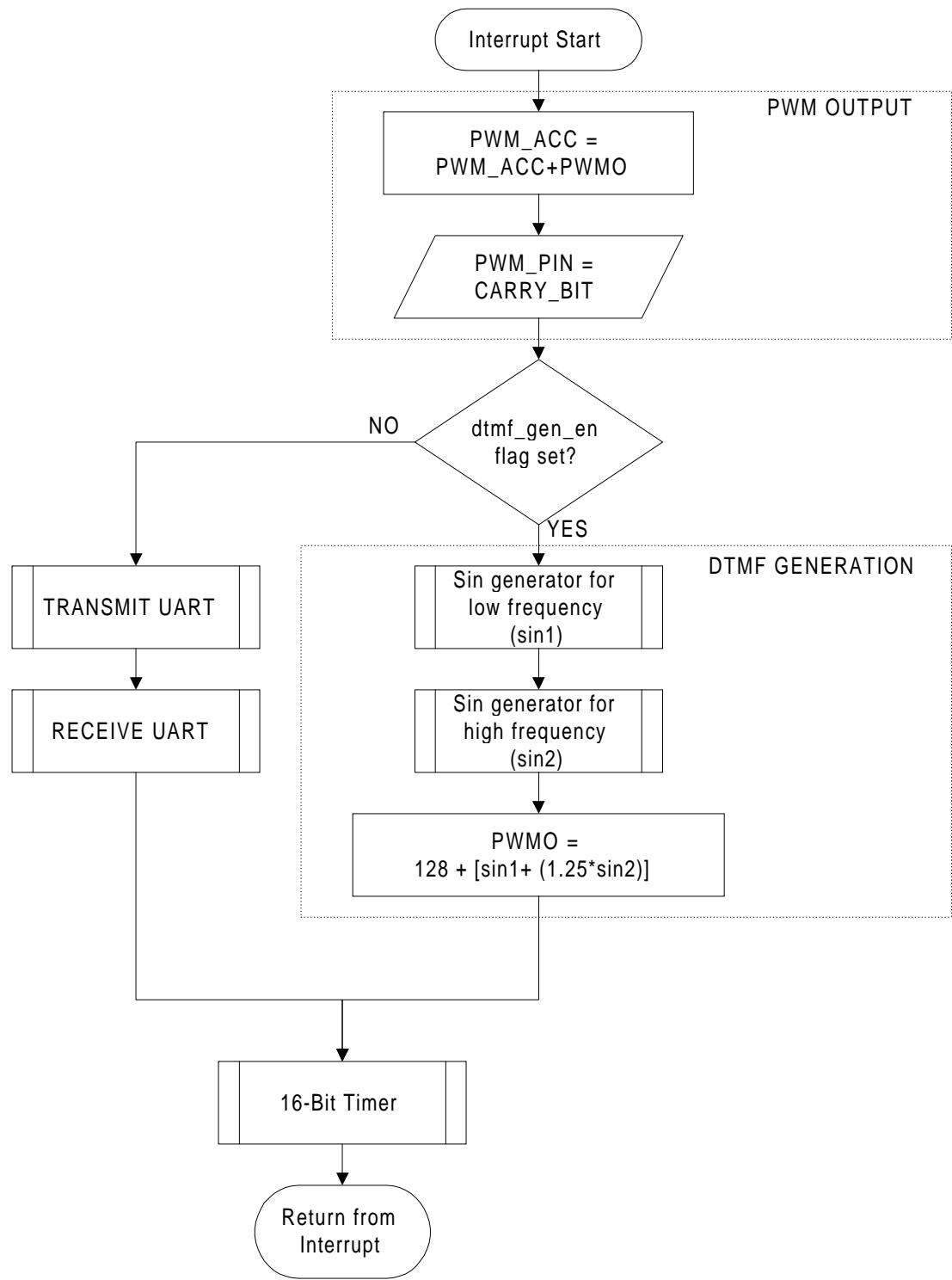

Figure 2.

Operating The Demo

Depending on the maximum frequency desired, the appropriate R and C values must be chosen to achieve required PWM resolution. Ideally, the maximum sine frequency output must be calculated first, then the low-pass cutoff must be chosen at this frequency. For DTMF generation, the maximum output frequency is 1633 Hz.

To calculate the component values for a cutoff frequency of 1633 Hz, first the value of R must be chosen.

R=600 ohms

Now, calculate C:

C = 1/(2 * pi * Cutoff Frequency * R)

Therefore:

C = 1/(2 * 3.14 * 1633Hz * 600 ohms)

And

C = 0.162uF

An RS-232 interface is required to run the DTMF demonstration software as-is, although the program should be modular enough to change in order to bypass the RS-232 interface. For the RS-232 level conversion, a MAX232 IC will do the job. Following are the steps to operate the demo:

1. Set the terminal program for 19200 bps, No Parity, 8 Data Bits, 1 Stop Bit.

2. Apply the power to the board.

3. Push the reset button on the board

4. Type "D"

5. Type characters such as '1', '2', '3' or '*' or '#' on the keyboard and the SX will dial each of these characters for a 100ms duration.
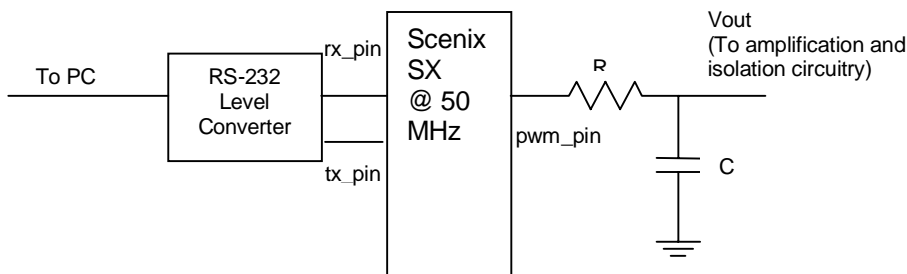
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For the latest contact and support information on SX devices, please visit the Scenix Semiconductor website at www.scenix.com. The site contains technical literature, local sales contacts, tech support and many other features.

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