TMS320 DSP
DESIGNER'S NOTEBOOK

Creating a Delay Buffer on a TMS320C2x EVM

APPLICATION BRIEF: SPRA214

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February 1993

TEXAS INSTRUMENTS

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Creating a Delay Buffer on a TMS320C2x EVM

Abstract

This document discusses how to implement an audio delay buffer using the TMS320C2x Evaluation Module (EVM). A block diagram of the circuit and a memory map showing how the delay is implemented are included. There is a code listing of the code used for this function.

Design Problem

How can I implement an audio delay buffer with the TMS320C2x EVM?

Solution

The key to this technique is that the buffer length is equal to the sample delay time you want to use and that the input/output rates are equal. There is only one pointer required and it is used for output and input both (in that order). The delayed value is first output and then a new input value is read into memory. Finally, the pointer is incremented to the next memory location. Due to the fact that there is only one pointer overhead to check if pointer(s) is at the end of the buffer is reduced. Use a counter to determine when the pointer is at the end of the buffer. This approach can be implemented using a BANZ instruction.

Figure 1. Hardware

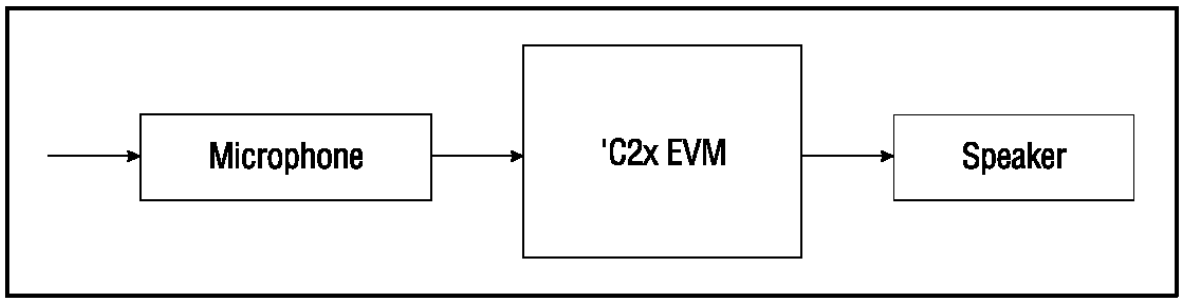
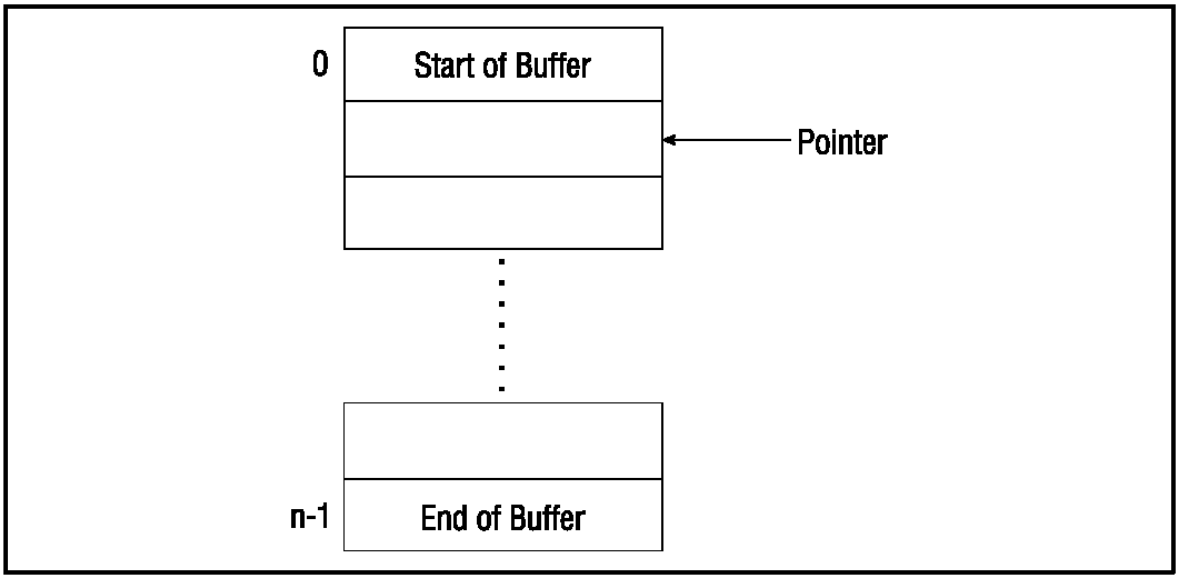


Figure 2. Memory - delay buffer



Software

This shows only the portion required for the delay buffer implementation. The entire program is on the BBS as 2XEVMBUF.EXE, which is a self-extracting zip file.

Example 1. Software Example

```
;———————— CONSTANTS

BUFFER_START     .set 08000h         ;Define delay buffer constants
BUFFER_LENGTH    .set 04000h

;———————— MEMORY DEFINITION
;Reserve ext RAM for delay buffer

DELAY            .usect “ext_mem”, 16384

;———————— ZERO DELAY BUFFER

    larp         AR1
    lrlk         AR0, BUFFER_LENGTH-1 ;AR0 = Memory block length-1
    lrlk         AR1, BUFFER_START    ;AR1 = Delay Buffer pointer
    ZAC
ZER01
    sacl         *+, AR0          ;Initialize Delay Buffer to zero
    banz         ZERO1, AR1       ;Done??

;———————— INITIALIZE DELAY BUFFER ————————————————-

    lrlk         AR0, BUFFER_LENGTH-1 ;AR0 = end of buffer counter
```

```
    lrlk        AR1, BUFFER_START    ;AR1 = output/input pointer
    larp        AR1

;————————————————————————————————————————————————————————-;
INTERRUPT SERVICE ROUTINES
;————————————————————————————————————————————————————————-

RINT                            ;Serial Port Receive Interrupt
    LDPK        0
    lac         *               ;Read delayed input from memory
    sacl        DXR             ;Echo to AIC output
    lac         DRR             ;Read latest AIC input
    sacl        *+, AR0         ;Store to delay buffer
    banz        OUT, AR1        ;Check to see if at end of buffer
                                ;If yes reinitialize AR0 and AR1
    lrlk        AR0, BUFFER_LENGTH-1
    lrlk        AR1, BUFFER_START
OUT
    eint                        ;Re-enable GLOBAL interrupt
    ret                         ;Return to MAIN
    .end
```