Aculab DSP65 Firmware Module

DTMF TONE DETECTION WITH SERIAL BIT STATUS

SOF1733

Version 1.3

Proprietary Information

Revision Record

Rev	Detail	Date
1.1	Initial Draft - DTMF Tone Detection DSP Software module with Serial Bit Status Communication.	14/12/2000
1.2	Re-format into new document standards	23/03/2001
1.3	Change to DSP65 port stream information	24.04.2001

Contents

1 Introduction

The DTMF Tone Detection algorithm is capable of detecting incoming DTMF Tones on a maximum of 31 timeslots (timeslot 1-31). The module will have the facility to store a stream of 16 digits maximum, in a queue (actually a FIFO) per timeslot. Handshaking takes place via timeslot 0, and the stream of DTMF digits recognised is presented at the corresponding output timeslot in the form of bytes.

2 Functionality

The DSP accepts incoming DTMF tones presented at its input stream on timeslots 1-31, thus providing up to 31 input timeslots. Communication is made available to the Host by writing bytes to timeslot 0. By toggling the Request Bit (bit 7) ORed with the timeslot number being observed (bits 0:4) and writing this byte to timeslot 0 of the DSP, the detected DTMF digits may be read from the corresponding output timeslot under observation.

2.1 The DTMF Tone Detection Software Module Structure:

Host communication:
The Host writes bytes into timeslot 0. Each byte has the general format as follows:

Bit when SET	Description
Bit 7	REQUEST
Bit 6	FLUSH BUFFER
Bit 5	not used
Bit 4	
Bit 3	timeslot
Bit 2	number under
Bit 1	observation
Bit 0	

Output timeslot response:
The Host reads bytes from the output timeslots (1-31). Each byte has the general format as follows:

Bit when SET	Description
Bit 7	not used
Bit 6	NEW_DIGIT
Bit 5	not used
Bit 4	
Bit 3	DTMF
Bit 2	digit
Bit 1	recognised
Bit 0	

The only exception being when 0xFF is read which indicates that no DTMF digit was recognised on this timeslot and the queue is empty.

2.2 The General Procedure for Setting Up a Timeslot

Timeslot 9 will be used for the purpose of this demonstration. Input timeslot 9 is presented to the "device" which is being monitored for DTMF digits and output timeslot 9 is read for detecting.

Step 1:
If the Host wishes to flush the buffer before presenting it to a stream of DTMF digits, the Host would write the byte 0x49 to timeslot 0.

Bit 6 = 1, indicating the buffer is to be flushed and
Bit 4:0 = 9, which indicate timeslot 9

Step 2:
The Host then requests a DTMF digit. The REQUEST bit is set ORed with the timeslot to be monitored. The Host would write the byte 0x89 to timeslot 0.

Bit 7 = 1, a new digit and
Bit 6 = 0, indicating no flushing required and
Bit 4:0 = 9, which indicate timeslot 9

The corresponding output timeslot (timeslot 9) should respond with 0x4X, where X is the first digit recognised in the digit queue. Bit 6 is set to indicate that this is a new digit. This bit toggles for every new digit read from the queue.

Step 3:
The Host then requests another DTMF digit by toggle the REQUEST bit ORed with the timeslot to be monitored. The Host would write the byte 0x09 to timeslot 0.

Bit 7 = 0, a new digit and
Bit 6 = 0, indicating no flushing required and
Bit 4:0 = 9, which indicate timeslot 9

The corresponding output timeslot (timeslot 9) should respond with 0x0Y, where Y is the next digit recognised in the digit queue. Note bit 6 is now clear to indicate that this is a new digit. This is done so that the Host can recognise when another digit is available especially when digits of the same value are recognised, say two '3's.

Step 4:
Steps 2 and 3 are repeated until the queue is exhausted, when no DTMF digits are recognised on the timeslot monitored. This is indicated by the byte 0xFF being read from the output timeslot.

Step 5:
Continuous polling, that is repeated writes following steps 2 and 3 until the value read is not 0xFF will ensure that the Host doesn't miss the stream of digits recognised by the Host.

Note 1 **Polling may be made every 32ms as the DTMF recognition "circuits" are based on a resolution of 32ms.**

Note 2 **Tone detection takes place on rising edge transitions. Therefore the digit queue is only written to at the onset of a tone. Thus in the case of a tone present for a long period of time, while the host flushes the DSP's buffers and sets up a request for a digit, the output buffer would still read 0xFF. The tone is still present at the input but the digit queue is not written to until the next tone transition. This is the method adopted for detection to avoid multiple 'false' detections of the same digit.**

Note 3 **Tone detection is available on both serial ports.**

2.3 Explanation of the Output timeslot Bits 4:0

The lower five bits, Bits 0:4 of each output timeslot byte represents the DTMF digit recognised for that timeslot.

Bits 4:0	Description
00001	digit 1
00010	digit 2
00011	digit 3
00100	digit 4
00101	digit 5
00110	digit 6
00111	digit 7
01000	digit 8
01001	digit 9
01110	digit *
0000	digit 0
01111	digit #
01010	digit ‘A’
01011	digit ‘B’
01100	digit ‘C’
01101	digit ‘D’

3 External interfaces

3.1 User Interface

The procedure for download utilises the program, fwdspldr.exe. It's used in the following manner:

`Fwdspldr -t65 <dsp_pos> <dsp_firmware.b65> <port_no> <pm4_filename>`

dsp_pos	= dspa or dspb
dsp_firmware	= any firmware title with the extension .b65. For DTMF detection: `ddtmfa.b65` for A-law For DTMF detection: `ddtmfu.b65` for mu-law
port_no	= 0, 1, 2…..n. As many ports as supported with DSP65s
pm4_filename	= any pm4 filename with ZAP loader

Note 4 **Refer to the DSP firmware guide for information on Card types, DSP's and their associated streams**

3.2 Program types Available

There are two types of program available:
`ddtmfa.b65` (for A-law)
`ddtmfu.b65` (for u-law)
for DTMF Tone Detection with Serial Bit Status Response

4 Configuration

Timeslot	Output
0	reserved
1	NEW DIGIT|DTMF digit
2	NEW DIGIT|DTMF digit
3	NEW DIGIT|DTMF digit
4	NEW DIGIT|DTMF digit
5	NEW DIGIT|DTMF digit
6	NEW DIGIT|DTMF digit
7	NEW DIGIT|DTMF digit
8	NEW DIGIT|DTMF digit
9	NEW DIGIT|DTMF digit
10	NEW DIGIT|DTMF digit
11	NEW DIGIT|DTMF digit
12	NEW DIGIT|DTMF digit
13	NEW DIGIT|DTMF digit
14	NEW DIGIT|DTMF digit
15	NEW DIGIT|DTMF digit
16	NEW DIGIT|DTMF digit
17	NEW DIGIT|DTMF digit
18	NEW DIGIT|DTMF digit
19	NEW DIGIT|DTMF digit
20	NEW DIGIT|DTMF digit
21	NEW DIGIT|DTMF digit
22	NEW DIGIT|DTMF digit
23	NEW DIGIT|DTMF digit
24	NEW DIGIT|DTMF digit
25	NEW DIGIT|DTMF digit
26	NEW DIGIT|DTMF digit
27	NEW DIGIT|DTMF digit
28	NEW DIGIT|DTMF digit
29	NEW DIGIT|DTMF digit
30	NEW DIGIT|DTMF digit
31	NEW DIGIT|DTMF digit