



DOMAIN TECHNOLOGIES INC.

---

Users Guide version 1.2

# DT4218DB

## Audio Daughterboard

# DT4218DB Audio Daughterboard Users Guide

## October 2005

Domain Technologies, Inc.  
811 E Plano Pkwy, Suite 115  
Plano, TX 75074

Tel.: +1-972-578-1121

Fax: +1-972-578-1086

<http://www.domaintec.com>

email: support@domaintec.com

**Contents:**

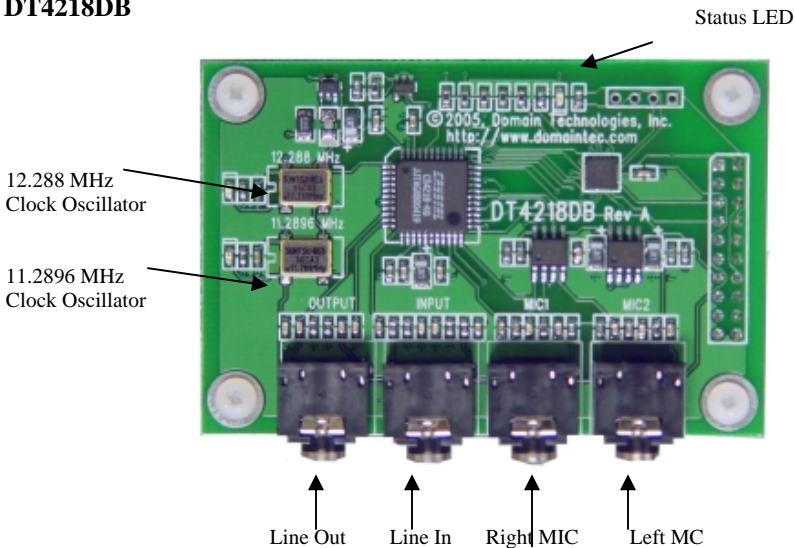
- 1. INTRODUCTION..... 5**
- 2. HARDWARE SETUP WITH DT402EB..... 6**
- 3. SAMPLE SOFTWARE ..... 6**
- 4. HARDWARE CONFIGURATION DETAILS..... 10**
- 5. CS4218 CONTROL AND STATUS WORDS DECODING..... 11**
- 6. MICROCONTROLLER COMMUNICATION PROTOCOL ..... 12**
- APPENDIX A: SCHEMATICS..... 14**
- APPENDIX B: BOARD SILKSCREEN WITH COMPONENTS LOCATION ..... 15**



## 1. Introduction

The compact DT4218DB creates a 2 channel audio test system by providing stereo audio input and output to any ZSP board with a SPORT serial connector, such as the DT402EB or the EB403LC. The board features Cirrus Logic Cs4218 16-bit stereo Delta-Sigma Codec. With two external clock sources, it supports sampling rates of 48 - 8kHz and 44.1 - 7.35 kHz. It features stereo line level output and user selectable option of stereo line level input or dual microphone. The microphone circuit supports electret microphones with bias voltage and pre-amp module.

### DT4218DB



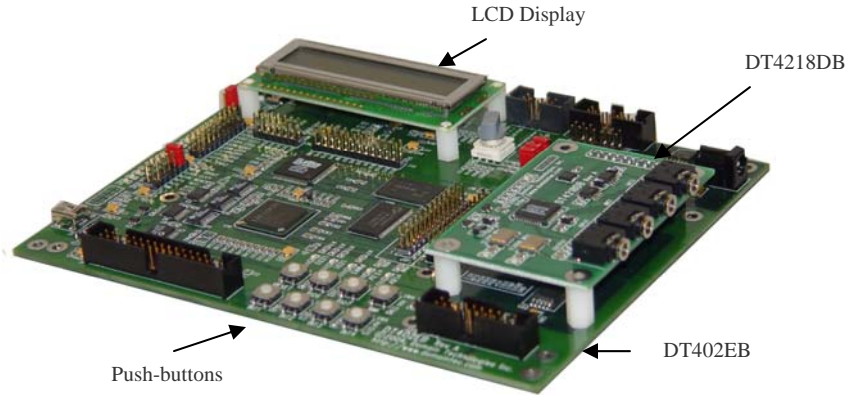
The audio data is passed through the standard Serial Port interface, with CS4218 operating in the master mode. The control signals are accessed through the on board 8051 microcontroller. The host processor accesses the microcontroller through the I2C interface. This configuration allows for full control of the CS4218 features through only two GPIO lines from the host processor.

Available controls on the DT4218DB are:

- oscillator selection
- 1 of 8 sampling frequency selection
- Power down and Reset
- Access to the CS4218 control and status register through the SPI.

## 2. Hardware setup with DT402EB

To illustrate the functionality of the DT4218DB audio daughterboard, the DT402EB development board will be used to execute the sample application Cs4218Usb.exe. User control will be provided by the Cs4218Gui program running on the PC.



Begin by inspecting the DT402EB. Note the location of the available push buttons and the LCD display. Install the DT4218DB audio daughterboard on the DT402EB. Power the DT402EB with the 5 volt power supply. As soon as power is applied, the status LEDs of the daughterboard will blink. Connect the USB cable from your PC to the DT402EB.

## 3. Sample software

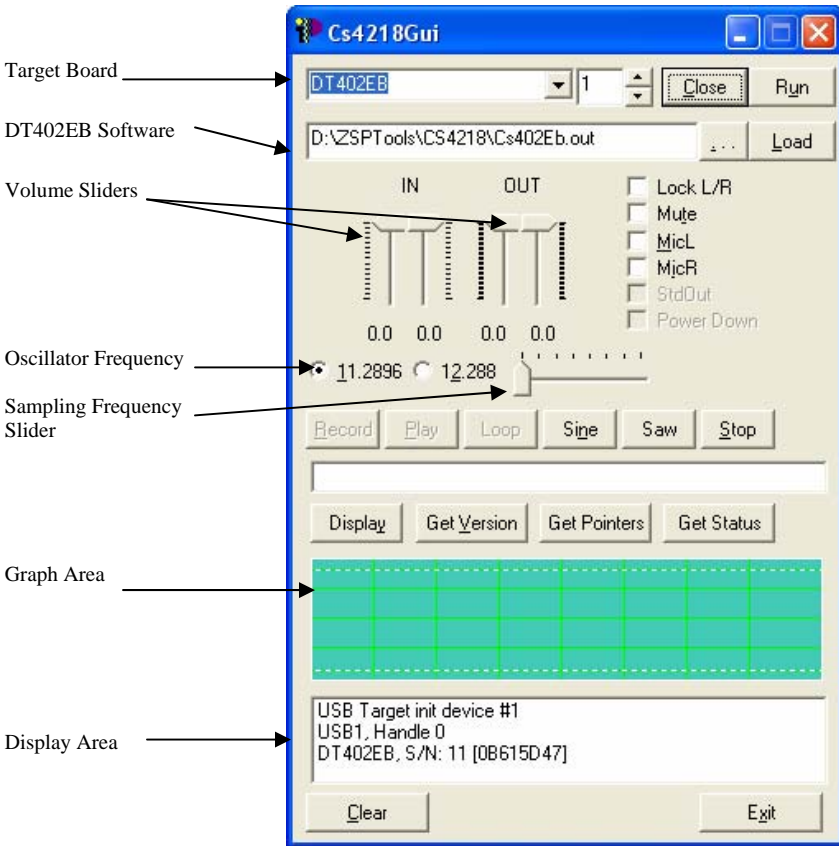
The Cs4218Gui.EXE application illustrates communication with the DT4218DB from a PC through the ZSP host port. The Cs4218Gui.EXE and the Cs4218Usb.exe application are designed for use with any ZSP development board featuring a SPORT serial connector. Domain Technologies' DT402EB is featured in this manual.

The software installation CD distributed with your ZSP development board contains sample applications to illustrate the functionality of the DT4218DB audio board. The following files were installed during a typical installation:

Path	Description
ZspTools\DT4218DB\CS4218PC	Sample PC application files including sources
ZspTools\DT4218DB\CS4218ZSP	Sample ZSP application files including sources
ZspTools\DT4218DB\CS4218FW	Firmware files

## Cs4218Gui Program

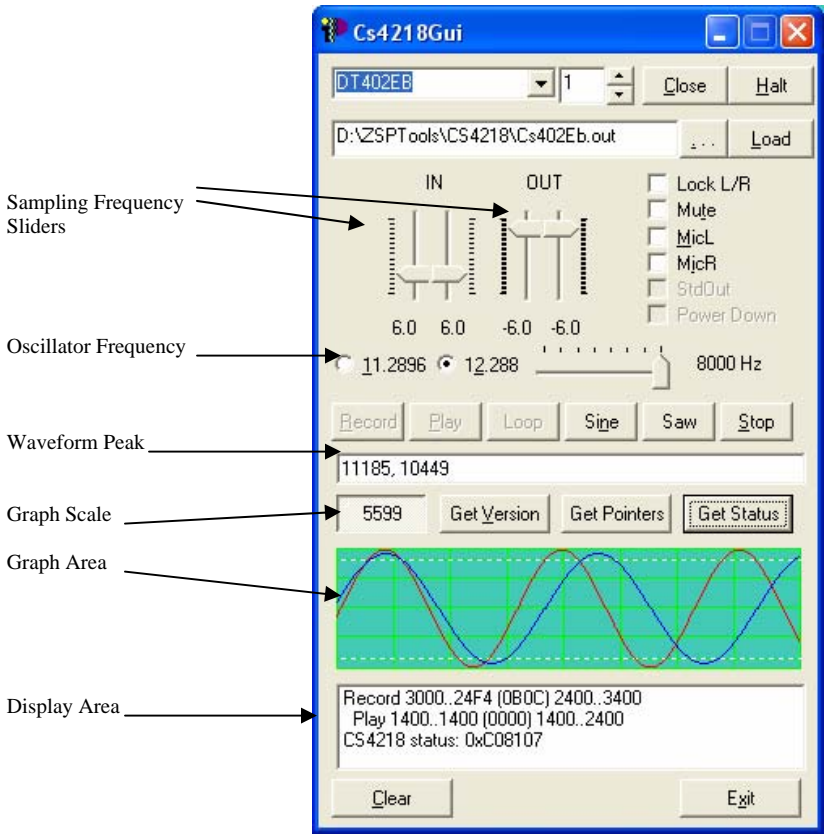
Execute the Cs4218Gui.EXE program and the following window is displayed:



Begin by defining the target ZSP board; in this example, the *DT402EB* is used. Press the *Open* button to initialize the target. Note, the *Open* button will become a *Close* button when the target device has successfully been opened. The Display area in the GUI will show a target device has been found, the target device's handle, and the device's serial number.

Next, define the location of the DT402EB software which will drive the GUI program; our software was at *D:\ZSPTools\CS4218\CS402Eb.out*. Choose the *Load* button to load the software on the DT402EB. The Display area of the GUI will be updated with the text

“File Loaded.” Continue by pressing the *Run* button; the LCD display on the DT402EB will display “Host Port Init” followed by “CS4218 test”. The *Run* button is replaced with a *Halt* button to indicate the ZSP application is executing. The sample ZSP code uses the default setting for input gain and output attenuation. These values will be shown by position of the Sampling Frequency Sliders in the GUI program. The DT4218DB has two clock oscillators: 11.2896 MHz and 12.288 MHz. The board LED and the GUI radio button will reflect the current setting.



The DT4218 audio board is shipped with the loop back cable; in this example, the cable is used to provide the output data (sine or saw) to the input connector. Through the Cs4218Gui, the *Sine* button will send the sine-waves to the output. The *Saw* button will generate two triangular waves and the *Stop* button will re-enable loop-back from ‘Input’ to ‘Output’. The incoming waveform can be monitored on the graphical display by pressing the *Display* button; the word *Display* will be replaced by the current graph scale which is the range of the half wave. The *Waveform Peak* field will contain the peak to

peak values for each displayed waveform. Changing the *Sampling Frequency* or the *Oscillator Frequency* can manipulate the graph area.

The *Get Pointers* button updates the *Display Area* with the values of the target’s head and tail for the current record and play buffers. The *Get Status* button updates the *Display Area* with the 24-bit status word from the CODEC. The *Get Version* button updates the *Display Area* with the version of the ZSP application currently running. Use the *Clear* button at the bottom of the interface to clean the contents from the *Display* and *Graph* areas.

The *Lock L/R* checkbox locks the left and right channel for slider operations. Use the *Mute* checkbox to mute the output. To enable the left microphone input, check the *MicL* checkbox. To enable the right microphone input, check the *MicR* checkbox.

While the ZSP sample application is running, options can be controlled with the GUI or through the DT402EB pushbuttons. The board’s LCD display will reflect the pushbutton selection. INT1 and INT2 are used to control the menu selection; INT1 cycles backward while INT2 cycles forward through the menu options. INT3 and INT4 are used to select a chosen menu options’ feature. The following table displays all selectable menu options and their settable features:

	Menu	Feature
0	Frequency	7350Hz - 48000Hz
1	Left Input	0.0dB – 22.5 dB
2	Right Input	0.0dB – 22.5 dB
3	Left Output	-46.5dB – 0.0dB
4	Right Output	-46.5dB – 0.0dB
5	Left Mic	On or Off
6	Right Mic	On or Off
7	Mute	On or Off
8	Left output	Loopback; Sinewave; Saw 0x81 - Saw 0x810
9	Right output	Loopback; Sinewave; Saw 0x81 - Saw 0x810

Once testing is complete, choose the *Halt* button to stop activity on the target; the *Halt* button will become replaced by the *Run* button. Choose the *Close* button to close the connection to the target; the *Display* area will indicate the USB Target is closed and the *Close* button will be replaced by a *Load* button.

Finally, choose the *Exit* button to quit the Cs4218Gui program.

#### 4. Hardware configuration details.

The communication with the 8051 microcontroller is command driven by the host processor. The microcontroller identifies itself on the I2C bus with address 0x40:

0	1	0	0	0	0	0	R/W
---	---	---	---	---	---	---	-----

Port 0 of the 8051 microcontroller is dedicated to the SPI connections to the CS4218 (4 pins), plus interrupt lines from the CS4218 and to the SPORT connector. Currently interrupts are not supported.

Port 1 of the 8051 controls oscillator selection, sampling frequency selection, reset, power down and status LED.

Bit	Name	Function
0	FSEL0	Selects sampling frequency. Options are listed in the following table
1	FSEL1	
2	FSEL2	
3	OSC11	Active high selects oscillator 11.2896 MHz
4	OSC12	Active high selects oscillator 12.288 MHz
5	RSTn	Active low CS4218 reset
6	PDNn	Active low CS4218 power down
7	LED	Active low LED driver (0-LED is on)

Decoding for sampling frequency select pins FSEL0..FSEL2 for both available input clock frequencies.

MF6:F1 FSEL0	MF7:F2 FSEL1	MF8:F3 FSEL2	N	Fs (kHz)	
				12.288 MHz	11.2896 MHz
0	0	0	256	48.00	44.10
0	0	1	284	32.00	29.40
0	1	0	512	24.00	22.05
0	1	1	640	19.20	17.64
1	0	0	768	16.00	14.70
1	0	1	1024	12.00	11.025
1	1	0	1280	9.60	8.82
1	1	1	1536	8.00	7.35

## 5. CS4218 Control and Status words decoding.

### CS4218 control word bit encoding

Bit(s)	Symbol	Description	Settings
7..0	Unused		
11..8	RG3 . RG0	Right Input Gain 1.5 dB increments	0000 = No gain (0 dB) 1111 = 22.5 dB gain
15..12	LG3- LG0	Left Input Gain 1.5 dB increments.	0000 = No gain (0 dB) 1111 = 22.5 dB gain
16	ISR	Input Mux, Right Select	0 = RIN1 1 = RIN2
17	ISL	Input Mux, Left Select	0 = LIN1 1 = LIN2
18	MUTE	Mute DAC outputs	0 = Outputs ON 1 = Outputs Muted
23..19	RA4 . RA0	Right Output Attenuation 1.5 dB increments.	00000 = no atten. (0 dB) 11111 = 46.5 dB atten
28.24	LA4 . LA0	Left Output Attenuation 1.5 dB increments.	00000 = no atten. (0 dB) 11111 = 46.5 dB atten
29	DO1	Digital Output 1	0 = output LOW 1 = output HIGH
30	MASK	Mask for the interrupt generated when status changed	
31	Unused		

### CS4218 status word encoding

Bit(s)	Symbol	Description	Settings
1..0	Unused		
2	ADV	ADC valid data	0 = Invalid ADC data 1 = Valid ADC data
3	DI1	Digital Input 1	0 = Input LOW 1 = Input HIGH
4	RCL	ADC Right Clipping	0 = Normal 1 = Clipping
5	LCL	ADC Left Clipping	0 = Normal 1 = Clipping
7..6	ER1..ER0	Error bits	
11..8	Unused		
15..12	VER3..VER0	CS4218 Version Number	0000 = Rev A 1000 = Rev B and late
17..16	ER1..ER0	Error bits	

18	Unused		
19	DI1	Digital Input 1	0 = Input LOW 1 = Input HIGH
20	RCL	ADC Right Clipping	0 = Normal 1 = Clipping
21	LCL	ADC Left Clipping	0 = Normal 1 = Clipping
22	ADV	ADC valid data	0 = Invalid ADC data 1 = Valid ADC data
31..23	Unused		

## 6. Microcontroller Communication protocol.

Host processor communicates with the DT4218DB microcontroller by sending byte commands through the I2C interface. Some command are followed by the parameters, for some command microcontroller returns response of 1 or 3 bytes. Details for commands are in the table below.

Cmd	Name	Params	Returns	Description
0	GET_VER	-	1 byte	Get code version
1	GET_CTRL	-	3 bytes	Read control word
2	WRITE_CTRL	3 bytes	-	Write control word
3	READ_STATUS	-	3 bytes	Read status word
4	SCAN_CTRL	-	-	Scan status word
5	LED_ENA	-	-	Enable auto LED toggle
6	LED_DISA	-	-	Disable auto LED toggle
7	READ_PORT0	-	1 byte	Read Port0
8	WRITE_PORT0	1 byte	-	Write Port0
9	READ_PORT1	-	1 byte	Read Port1
10	WRITE_PORT1	1 byte	-	Write Port1

**Get Version** – retrieve a byte with current version of the microcontroller firmware.

**Read Control Word** – get current CS4218 settings, it is usually issued during initialization. Normally host processor stores image of the control word in the local memory.

**Write Control Word** – send 3 byte value to be written into the CS4218, it control various operating options and gain/attenuation. LSB is not sent since it is not used.

**Read Status** – get 3 bytes of the CS4218 status. MSB is not sent, since it is not used. The status word has to be read from the CS4218 with the Scan Control command, which uploads current control value while retrieving the status word.

**Scan Control** – perform data shift operation to/from the CS4218

**LED Enable** – enable auto toggle of the status LED. For normal operation it can be disabled, so the host processor can control it.

**LED Disable** – disable auto toggle, so the host processor can control it by setting the bit 7 of the Port 1.

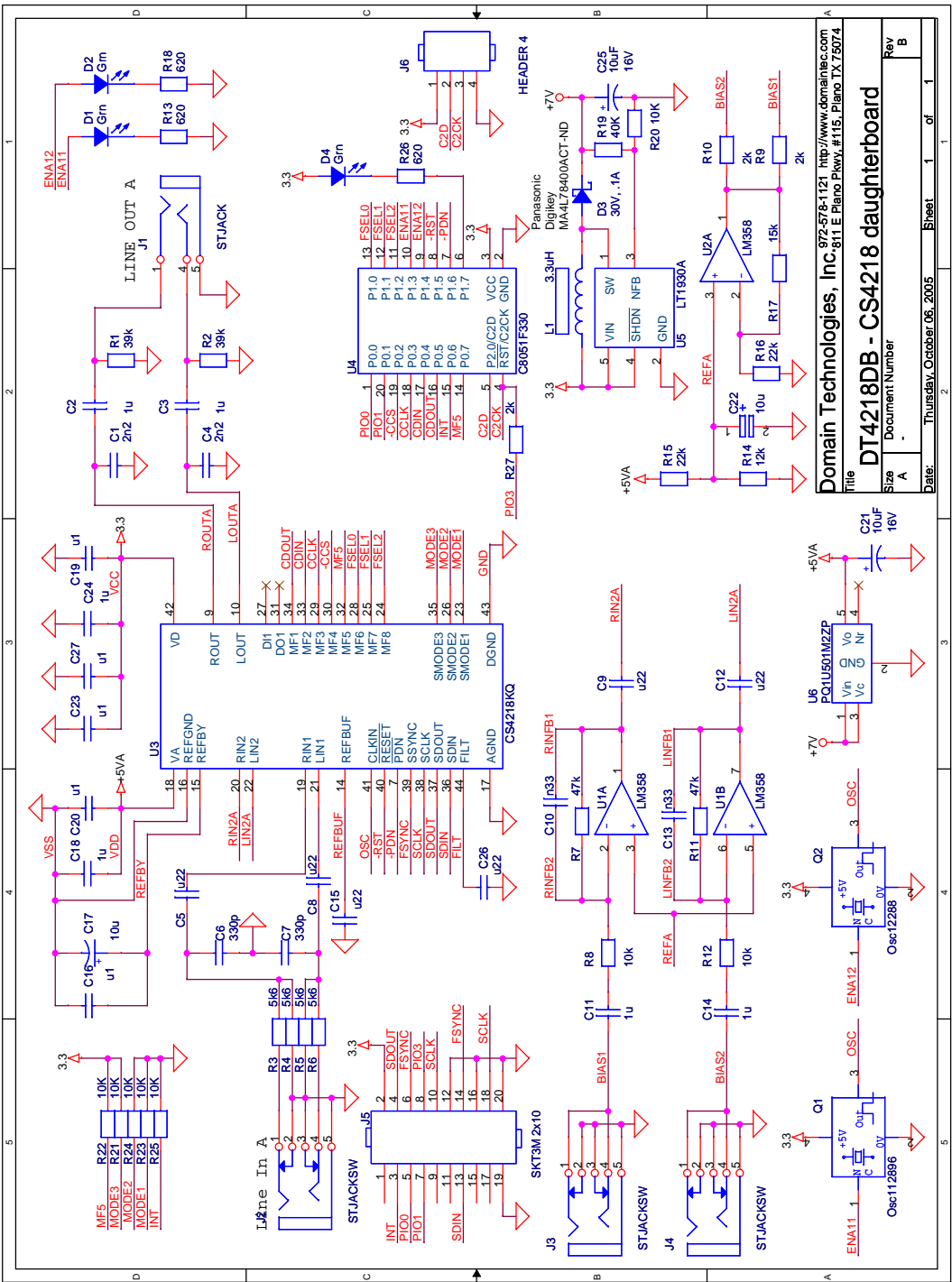
**Read Port0** – not needed for normal operation

**Write Port0** – not needed for normal operation

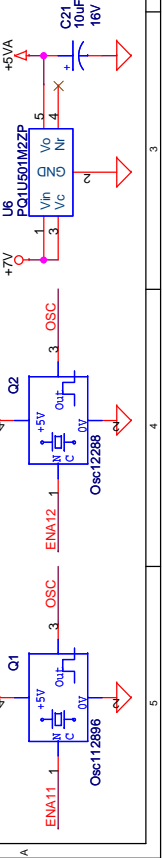
**Read Port1** – get current control signal settings

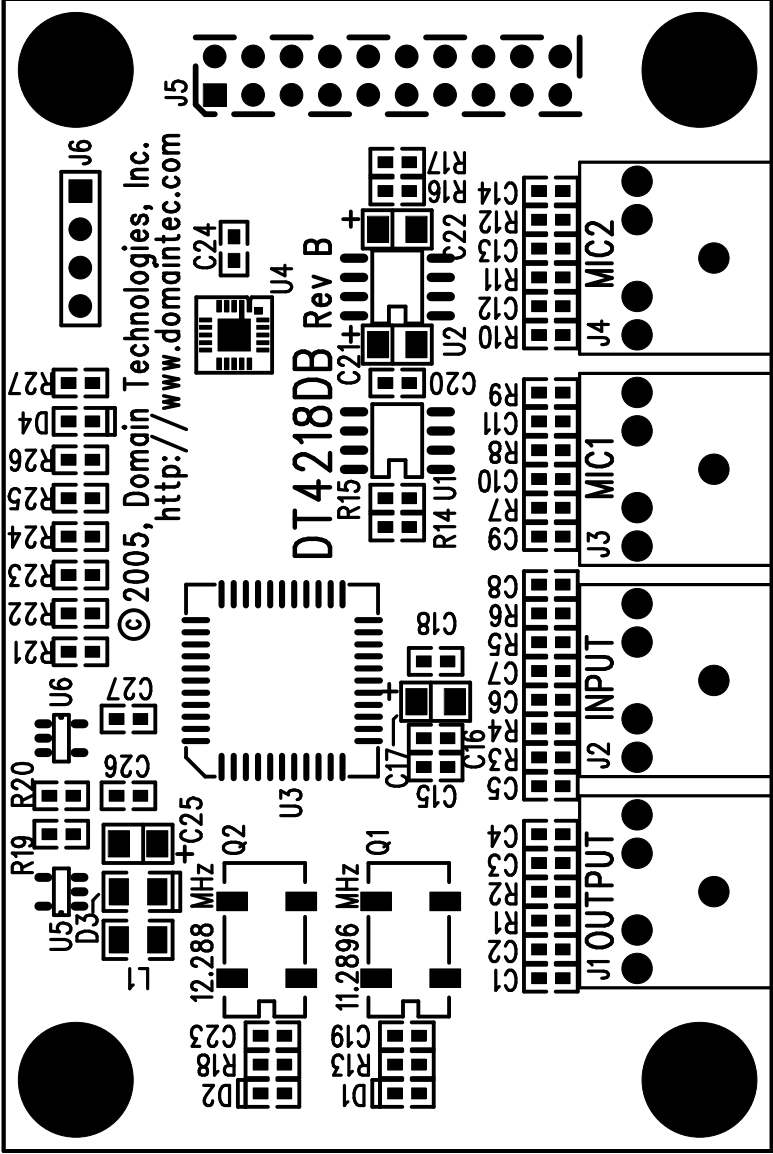
**Write Port1** – set control signal settings, to set active oscillator, sampling frequency, reset, power down, and LED according to the following table:

Bit(s)	Name	Function
2..0	FSEL2..FSEL0	Selects sampling frequency.
3	OSC11	Active high selects oscillator 11.2896 MHz
4	OSC12	Active high selects oscillator 12.288 MHz
5	RSTn	Active low CS4218 reset
6	PDNn	Active low CS4218 power down
7	LED	Active low LED driver (0-LED is on)



Domain Technologies, Inc. 972-578-1121 <http://www.domaintec.com>  
 DT4218DB - CS4218 daughterboard  
 Title: \_\_\_\_\_  
 Size: \_\_\_\_\_  
 A: \_\_\_\_\_  
 Document Number: \_\_\_\_\_  
 Date: Thursday, October 06, 2005 Sheet: 1 of 1





© 2005, Domain Technologies, Inc.  
<http://www.domaintec.com>

### DT4218DB Rev B

Domain Technologies, Inc.

<http://www.domaintec.com>