

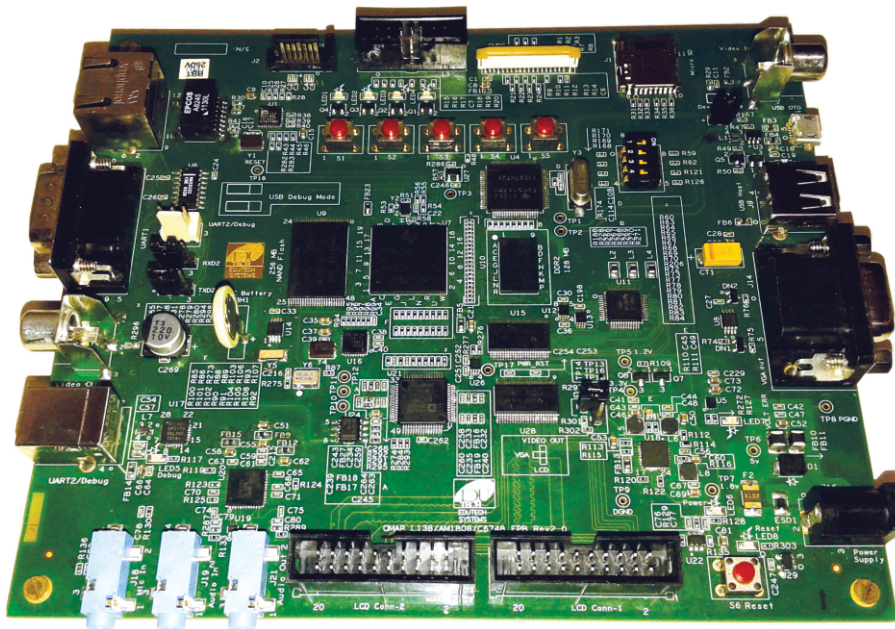
All-in-One Digital Signal Processing Lab

A complete All-in-one DSP Lab solution focusing various levels of experimentation on Signal Processing, Image, Video and Audio Processing topics designed especially for UG and PG curriculum.

Features

- All-in-one DSP Lab focusing Basic Signal Processing Experimentation, Audio, Video and Image related experimentation on a single ALL-in-One DSP Board
- Comprehensive Lab Solution for UG and PG curriculum.
- The lab package contains All-in-one DSP board/s, USB Emulator and camera interface.

All-in-One Educational Practice Board for DSP Lab



Features of All-in-One Educational Practice for DSP Lab

Processor

- TMS320C6748 - Fixed/ Floating Point Digital Signal Processor
- DSP with up to 456 MHZ performance.
- On board 14 Pin (2x7 Pin) JTAG emulation connector
- Boot mode selection switch

Memory

- On board 256 MB Flash memory
- On board 128 MB DDR2 RAM memory

Data Transfer Interfaces

- On board DB9 connector for UART-1 interface
- On board 3 pin header for UART-2 interface
- On board USB TYPE B Connector for UART-2 interface for Debug Console
- LED indication for USB connection for Debug Console
- On board Reset Switch with LED indication
- On board USB Type A Connector for USB host interface
- On board micro USB Type A Connector for USB OTG interface
- On board RJ45 connector for 10/100 Ethernet interface
- On board I2C based Temperature sensor
- On board I2C based RTC interface with battery backup
- On board SPI based micro SD card interface
- On board provision for SATA connector

Input/Output Interfaces and other Facilities

- On board Power-On LED indication
- On board 4 User LED at GPIO Pin as GPIO Test point
- On board 5 user push buttons for various applications

Special Functionality

- Boot mode selection switch
- On board Video in port available
- On board VGA out connector
- On board Provision for composite video out
- Provision for Graphics LCD interface
- On board audio jack and speaker (Mic in) interface
- On board audio codec for speaker out
- Provision for CMOS sensor connector to interface CMOS camera
- On board Temperature sensor with interrupt out facility
- On board jumper selection to switch various video out options
- On board LED to indicate power surge
- On board LED to indicate high voltage input
- On board excessive voltage protection circuit with LED indication
- Various test points for various signals
- On board jumper selection to switch UART2 between USB connector and 3 pin connector

Development Tools

USB JTAG Emulator

USB JTAG Emulator for program downloading and debugging on DSP board, compatible with latest version of CCS (V5)



Code Composer Studio

Integrated development tool (IDE) for DSP lab from Texas Instrument



Experiment List

Basic DSP Lab Experiments

- Signal generation using lookup table/Function (Square, Sine, Ramp, Sawtooth)
- Signal Modulation (AM, FM, DTMF)
- FIR Filter (Moving Average, Low Pass, Band Stop, Band Pass)
- IIR Filter (Using Cascade Second Order Filter, Cascade Second Order Transposed)
- FFT and DFT
- Fast Convolution

Image Processing

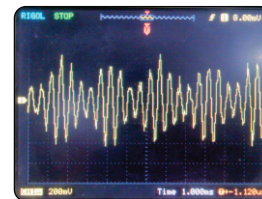
- Raster Display, loop back an image
- Sobel Filters (Edge Detection using 3x3, 5x5, 7x7 algorithms)
- Image Smoothing using convolution algorithms
- Image Sharpening using convolution algorithms
- Image Restoration using Median filtering
- Median Filter (Low Pass filters, Image Smoothing)
- Lower to threshold (Image Segmentation, Morphological Transforms)
- Negative imaging

Video Processing

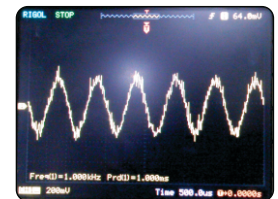
- Program for Video loopback
- Face detection algorithms
- Program to display Text on Video
- Program to display a shape on Video

Audio Processing

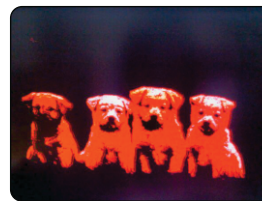
- Audio Loopback
- Filters
- Step response of AIC codec Anti aliasing filter



Amplitude Modulation



Sine Wave



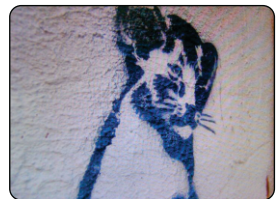
Clipping



Ramp Wave



Edge Detection



Median Filter



Image Thresholding



Image Convolution

Hands-on Training Program on DSP available.
For more details, mail us on info@techniconline.com

Tentative Example List for All in One DSP Board
SIGNAL AND AUDIO PROCESSING

1. Write a program to generate Audio loopback using pooling method.
2. Write a program to generate Audio loopback using interrupt method.
3. Write a program to generate loop back method by EDMA(Enhanced direct memory access) controller.
4. Write a program to generate delay interrupt.
5. Write a program to generate Echo effect(L138_echo_intr).
6. Write a program to generate flanging Effect .
7. Write a program to with Input Data Stored in a Buffer.
8. Write a program to generate sine wave using look up table.
9. Write a program to generate sine wave using function.
10. Write a program to generate sine wave using DIP Switches for Amplitude and Frequency Control.
11. Write a program to generate Sweep sinusoid using Table with 8000 Points.
12. Write a program to generation of DTMF Tones using a Lookup Table.
13. Write a program to generate Square wave using look up Table
14. Write a program to generate Impulse response of reconstruction Filter.
15. Write a program to generate Frequency Response of DAC Reconstruction Filter using a Pseudorandom Binary Sequence.
16. Write a program to generate Step Response of AIC3106 Codec using Pseudorandom Noise.
17. Write a program for Step Response of AIC3106 Codec Anti aliasing Filter.
18. Write a program for Demonstration of AIC3106Codec Anti aliasing Filter.
19. Write a program to generate to Identification of AIC3106 Codec bandwidth using an Adaptive Filter.
20. Write a program to Identification of AIC3106 Codec bandwidth using two CPU Boards.
21. Write a program to generate Ramp wave.
22. Write a program to generate Amplitude Modulation by polling.

DIGITAL SIGNAL PROCESSING
FINITE IMPULSE RESPONSE FILTERS

1. Write a program to generate Moving average Filter.
 2. Write a program to generate Moving Filter with Internally Generated Pseudorandom noise.
 3. Write a program to generate Identification of the moving Average filter frequency Response Using a Second CPU Board.
 4. Write a program to generate FIR filter implementation with a Pseudorandom Noise Sequence as Input.
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1. Write a program to generate FIR filter with Moving Average, Low Pass, Band Stop, and Band Pass characteristics defined in separate coefficient files.
2. Write a program to generate FIR filter implementation with internally generated a Pseudorandom Noise Sequence as Input and output stored in memory.
3. Write a program to generate Effects on Voice or music using three FIR low pass filters.
4. Write a program to generate Implementation of four different filters: Low pass, High Pass, Band Pass and Band Stop.
5. Write a program to generate Two Notch filters to a corrupted speech Recording.
6. Write a program to generate Voice Scrambling using Filtering and Modulation.
7. Write a program to FIR Filter implemented using DMA based I/O.
8. Write a program to FIR Filter implemented using DSPLIB function.
9. Write a program to FIR Filter implemented using C Calling an ASM Function.
10. Write a program to FIR Filter implemented using C Calling a Faster ASM Function.

INFINITE IMPULSE RESPONSE FILTERS

1. Write a program to implementation of an IIR filter Using cascade second order filter.
2. Write a program to implementation of an IIR filter Using cascade second order Transposed.
3. Write a program for Estimating the Frequency Response of an IIR filter using Pseudorandom Noise as Input.
4. Write a program for Estimating the Frequency Response of an IIR filter using Sequence of Impulses as Input.
5. Write a program for Fourth order Elliptic Low pass IIR Filter Designed Using fdatool.
6. Write a program for Band Pass Filter Design using fdatool.
7. Write a program to implementation of an IIR filter Using DSPLIB Function DSPF_sp_biquad().
8. Write a program to Fixed Point Implementation of an IIR Filter.
9. Write a program to implementation of a Fourth Order IIR Filter Using AIC3106 Digital Effects Filter.
10. Write a program for Generation of a Sine Wave Using a Difference Equation.
11. Write a program to generation of DTMF Signal using Difference Equations.
12. Write a program for generation of a Swept Sinusoidal Using a Difference Equation.
13. Write a program for Sine generation using a Difference Equation with C Calling an ASM Function.

FAST FOURIER TRANSFORM

1. Write a program for DFT of Sequence of Real Numbers with Outputs in the CCS Graphical Display Window and in MATLAB.
 2. Write a program for Estimating Execution Times for DFT and FFT Functions.
 3. Write a program to demonstrate the EDMA3 Memory Move.
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1. Write a program for DFT of a signal in Real Time using a DFT Function with Pre calculated Twiddle Factors.
2. Write a program for FFT of a Real Time Input Signal using an FFT Function in C.
3. Write a program for FFT of a Real Time Input Signal using TI's C-Callable Optimized Radix-2 FFT Function.
4. Write a program for FFT of a Real Time Input Signal using TI's C-Callable Optimized DSPLIB FFT Function.
5. Write a program for demonstration of Fast Convolution.
6. Write a program for Real Time Fast Convolution.
7. Write a program for demonstration of Graphic Equalizer.

ADAPTIVE FILTER

1. Write a Program for demonstration of Adaptive Filter using C code.
2. Write a Program of Adaptive Filter for sinusoidal Noise Cancellation.
3. Write a Program of Adaptive Filter for sinusoidal Noise Cancellation using External Inputs.
4. Write a Program for Adaptive Filter for System Identification of a Fixed FIR Filter as an Unknown System.
5. Write a Program for Adaptive Filter for System Identification of a Fixed FIR Filter as an Unknown System with Weights of an Adaptive Filter Identification as a FIR Band Pass.
6. Write a Program for Adaptive Filter for System Identification of a Fixed IIR Filter as an Unknown System.
7. Write a Program for Adaptive FIR Filter for System Identification of System External to the board.
8. Write a Program Adaptive FIR Filter for System Identification of System External to the board Using DSPLIB Function.

IMAGE PROCESSING

1. Write a program for Edge detection of the image using Sobel algorithm.
 2. Write a program for Image Smoothing and Image Sharping using convolution functions.
 3. Write a program for Image Restoration using Median filtering.
 4. Write a program for Image Thresholding using Image clipping.
 5. Write a program for Image Thresholding using different function.
 6. Image Conversion Color space conversion from YCbCr to RGB.
 7. Image Matching using Image Correlation Function.
 8. Image Pixels Expansion.
 9. Boundary and perimeter computation of the image.
 10. Basic dilation and erosion operations performs on binary images
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1. To Generate Image Histogram.
2. Image Compression and Decompression using forward and Inverse DCT Functions.
3. Image Compression and Decompression using High Performance Motion Estimation Functions.
4. Image Compression and Decompression in Open CV using Quantization Functions.
5. Image processing using Open CV by Wavelet Processing Functions.

VIDEO PROCESSING

1. Write a program for Video Loopback.
2. Write a program for Face Detection.
3. Write a program for Text display on live Video.
4. Write a program for Shape Display on Live Video.

BSL EXAMPLES

1. Write a program to generate Raster Display on VGA.
2. Write a program to Connect the USB host keyboard with kit and Display on VGA.
3. Write a program to connect the USB host Mouse with kit and Display on VGA.
4. Write a program to Connect the UART.
5. Write a program to Playing game by USB host Keyboard and Display on VGA.
6. Write a program for Audio Loop back (MCASP).
7. Write a program for LED2 blinking.
8. Write a program for USB mass storage detecting (USB host MSC).
9. Write a program for USB mass storage detecting (USB dev MSC) on VGA.
10. Write a program to display on hyper terminal.
11. Write a program to demonstrate the Grlib_Demo using USB mouse.
12. Write a program to demonstrate the Ethernet Loopback.
13. Write a program to demonstrate the Ethernet Library input.
14. Write a program to DSP Exception.
15. Write a program to Data Transmit and receive on UART.
16. Write a program to demonstrate the EDMA.



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