

HT11301D DSP Development Experiment System

I. Product Features

DSP development experiment system is tightly close to such course syllabus as *Digital Signal Processing*, *DSP Chip Principle and Development Application*, *EDA Technology* and the content is abundant, which could fully meet the teaching requirements on communication electronics, automation majors' DSP, EDA courses among colleges and universities.



- (1) Integrating DSP experiment with EDA experiment in one, the function is strong and the content is abundant. The experiment development system is based on the design philosophy of module-type, bus-type and open-type, which not only could help users familiarly use DSP's external materials, but also may finish EDA experiment by use of 30000 gates FPGA on the mainboard without increase of expansion board. It is real experiment development system integrating DSP with EDA in one.
- (2) Users could freely choose DSP CPU board at their needs and finish experiments of DSP2000 type and DSP 5000 type. And the DSP CPU board is an independent module and could be used as EVM board for secondary development, innovative experiment and R&D.
- (3) 54xEVM board is compatible with three types of 54x series' DSP chip as 5402, 5410 and 5416 and could complete DSP 5000's example program. Users could choose DSP chip according to DSP chip speed and memory capacity.
- (4) Interface resource is abundant, such as USB2.0 interface, Ethernet interface, PS/2 keyboard interface, VGA display interface, and etc.
- (5) The experiment development system has several innovative experiment module, speech card, Ethernet card, fingerprint acquisition card GPRS communication module, among which fingerprint acquisition module could be used to develop identity verification system. It is closer to practical system's development and reflects the comprehensive function of DSP; Ethernet based speech recording and playing experiment can play WAV format music, which can not only inspire users' interest in learning but also be used to develop popular network IP telephone, and etc.
- (6) It provides MATLAB and DSP's interface experiment, which could expand MATLAB experiment on DSP board. It reflects the development tendency in teaching, which is more suitable for basic teaching.

II. Performance Parameters

(1) DSP54xEVM board

- 1) Power interface: The module uses independent 5V power to provide power supply, and the power supply could be provided by two modes, which are provided power supply by experiment apparatus's mainboard while installed on the experiment apparatus and could be directly connected to external power supply while the board detaches experiment apparatus and is used as EVM board.
 - 2) Memory interface: E64K-16bit program SRAM and 256K-16bit 's data SRAM is configured on the EVM board, in addition, 4Mbit's FLASH ROM has been configured to be used for auto-load while the program starting.
 - 3) DSP54x EVM board provides all expandable resources so that users are easy to expand functions without re-design of DSP circuit. The internal resource bus is divided into three parts, respectively led to the end of EVM board for development.
 - 4) JTAG interface: DSP54x EVM includes two JTAG interfaces; one is JTAG interface of simulating DSP, while the other is JTAG interface of online program to XC95144. The control logic of EVM board could be changed freely according to users' needs.
 - 5) Control signal light: DSP54x EVM has three LEDs as working indicator light.
 - 6) DSP control logic is finished by XC95144, mainly for the function of address decoding and read-write sequential control. Being capable of online programming, CPLD is in favor of future debug and hardware upgrade.
- (2) Ethernet card module (5000 series matched): The module is mainly composed of Ethernet controller RTL8019, which could open Ethernet communication experiment as PC computer.
- (3) Audio module (5000 series matched): Adopt DSP's synchronization buffer serial-port to control MC14LC5480 chip of MOTOROLA Company, so as to achieve speech signal's acquisition, storage and playback, and complete relevant experiments combined with Ethernet card.
- (4) Fingerprint acquisition module (5000 series matched): The module is completed by adopting specialized fingerprint acquisition chip; DSP controls the chip that collects fingerprint into SRAM, then transmit image information into PC computer to display through USB2.0 interface, and could open experiment project of static image processing.
- (5) Digital tube module: Adopt eight-bit digital tube, it could process data display by using DSP control LED, it also could process experiment project of digital clock by directly using FPGA to control LED.
- (6) LCD module: Adopt 122×32 image LC module, could use DSP to control LCD so as to process image display, also could FPGA to directly control LCD.
- (7) UART module: Adopt asynchronous RS232 serial-port.
- (8) Switch input, output module: Adopt soft key-press, double pole double throw, dial code switch to be as logic input, logic output adopts 16-bit LED.
- (9) PS/2 keyboard input module: Be able to connect standard keyboard.
- (10) Virtual apparatus module: Use PC machine sound card to finish virtual signal source and virtual oscilloscope experiments, could finish part of experiment

projects under the condition of without oscilloscope in the lab.

- (11)Signal adjustment module: Process overlay and amplification to signal
- (12)Filter module: Analog filtering for signals.
- (13)USB 2.0 module: Achieve USB 2.0 transmission experiment by 68013 of CYPRESS company.
- (14)Data bus interface module: Complete data communication of DSP and FPGA
- (15)DC motor module (2000 series matched): Complete DC motor's direction measurement, speed measurement and speed regulation experiments.
- (16)AC motor module (2000 series matched): Complete AC motor's speed control.
- (17)Xilinx CPLD module: Complete EVM board's logic control.
- (18)Xilinx load configuration module: In system load Xilinx programmable logic components
- (19)Altera FPGA module: Complete EDA experiment and DSP's interface experiment
- (20)Altera load configuration module: In system load Altera programmable logic components
- (21)EPC2 configuration module: FPGA power-down protection
- (22)SPI interface: Complete SPI interface's DA conversion experiment and EEPROM storage area access experiment
- (23)SCI interface: Complete SCI asynchronous serial communication experiment
- (24)CAN interface: Complete CAN interface experiment
- (25)VGA interface: Complete display interface experiment
- (26)DSP emulator module: The module could be as DSP module to provide simulation, and also be as an independent emulator detaching experiment apparatus to use, support DSP chip of TI all series.
- (27)Signal source module: Provide two-channel signal source, respectively generates sine wave, triangular wave and square wave.
- (28)2407EVM board: Complete relevant experiments of 2000 series DSP by using the module
- (29)Experiment apparatus host specification: 35cm×27cm×11cm

III. Experiment Contents

5000 Series DSP Experiment

- (1) System hardware units and operating instruction
- (2) Application of CCS software and emulator

Assembly Language Program Design Experiment

- (3) Program control and transfer
- (4) Stack application method
- (5) AS and multiply operation
- (6) Repetitive operation
- (7) Data block transfer
- (8) Dual operand multiply
- (9) Long word operation
- (10) Fractional operation
- (11) Division operation

(12) Floating-point operation

Instances of Application Program Development

(13) D/A conversion experiment

(14) Taylor series expansion design sine signal generator

(15) A/D conversion, sampling theorem experiment

(16) DSP implementation approach to IIR filter

(17) DSP implementation approach to FIR filter

(18) DSP implementation approach to FFT

(19) Convolution arithmetic experiment (C version)

(20) Correlation arithmetic experiment (C version)

(21) DSP implementation approach to IIR filter (C version)

(22) DSP implementation approach to FIR filter (C version)

(23) DSP implementation approach to FFT (C version)

(24) DSP implementation approach to discrete cosine conversion

(25) LMS arithmetic experiment of adaptive filter

(26) Speech encoding/decoding (G711 encoder/ decoder)

On-chip Peripheral Equipment and Application

(27) Timer: timer generation square wave experiment

(28) I/O operation: Digital tube display experiment

(29) Interrupt system: Key-press interrupt experiment

(30) Image LCD experiment

Expandability Experiments

(31) Software wireless radio experiment

(32) QPSK modulation and demodulation experiment

(33) FSK modulation and demodulation experiment

(34) Finger acquisition experiment based on USB2.0 transmission (equipped fingerprint acquisition card)

(35) Speech recording and playing experiment based on Ethernet transmission (equipped Ethernet card and speech card)

(36) FLASH online burn experiment

(37) GPRS short message transceiver experiment (need to equip GPRS module, users self-equip G network mobile phone's SIM card of application address)

(38) GPRS phone dialing and answering experiment (need to equip GPRS module, users self-equip G network mobile phone's SIM card of application address)

Modern DSP technology Experiment

(39) DSP system design experiment based on technology of SOPC and EDA

DSP and MATLAB Interface

(40) CCSLink basic experiment

(41) Correlation arithmetic experiment

(42) FFT implementation

(43) DCT

(44) DSP implementation approach to IIR filter

(45) DSP implementation approach to FIR filter

(46) Implementation approach to LMS adaptive filter

2000 Series Experiments (Equip 2407EVM Board)

- (47) CCS C2000 2.0 installation and configuration
- (48) I/O basic operation experiment
- (49) Timer experiment
- (50) General timer comparison output waveform experiment
- (51) PWM waveform output experiment
- (52) ADC sampling experiment
- (53) DA conversion experiment of SPI interface
- (54) SPI interface access to external EEPROM memory
- (55) Asynchronous serial communication experiment of SCI interface
- (56) CAN experiment
- (57) Flash burn experiment
- (58) Quadrature impulse encoding experiment
- (59) Experiment of DC motor speed measurement and PID speed regulation (equip DC motor)
- (60) Experiment of AC motor speed measurement and PID speed regulation (equip AC motor)

EDA Experiments

- (61) Decoder design experiment
- (62) Priority encoder design experiment
- (63) Frequency division design experiment
- (64) Digit adder design experiment
- (65) Variable mode counter experiment
- (66) Stream light experiment
- (67) RAM design experiment
- (68) ROM design experiment
- (69) FIFO design experiment
- (70) Digital clock design experiment
- (71) High-speed A/D, D/A interface circuit design experiment
- (72) Direct digital frequency synthesizer experiment
- (73) FSK modulation experiment
- (74) QPSK modulation experiment
- (75) RS232 interface design experiment
- (76) PS2 keyboard interface logic design experiment
- (77) VGA display controller design experiment
- (78) LCD controller experiment