

Introduction

The TMS320C54x DSKplus is a low-cost DSP starter kit with enhanced architecture. The development kit contains a stand-alone application board that you connect to your PC™ and that enables you to explore the architecture and operation of the 'C54x CPU and its peripherals. The DSKplus board executes your custom 'C54x code in real time while the Windows™-based debugger analyzes it line-by-line, displaying internal DSP register information in multiple windows, also in real time. The board's communication interface lets you create your own 'C54x DSP code and host PC code. The hardware enables the use of expansion boards for adding memory, peripherals such as codecs, interface logic, other DSPs, or microcontrollers.

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1.1 Kit Contents and Features

The DSKplus development kit contains these parts:

- ☐ The DSKplus development board
- ☐ PC parallel port cable (DB-25M to DB-25F)
- ☐ Universal power supply (Input: 100–250 V, 50–60 Hz; Output: 5-V dc, 3.3 A)
- ☐ GoDSP's Windows™-based Code Explorer™ debugger
- ☐ TMS320C54x ('C54x) algebraic assembler
- ☐ Self-test program
- ☐ Various application programs
- ☐ *TMS320C54x DSP Reference Set, Volume 1: CPU and Peripherals*
- ☐ *TMS320C54x DSP Reference Set, Volume 3: Algebraic Instruction Set*
- ☐ *TMS320C54x DSP Data Sheet*
- ☐ *TLC320AC01C Single-Supply Analog Interface Circuit Data Manual*

Several features of the DSKplus board enable MIP-intensive, low-power applications:

- ☐ One TMS320C542 ('C542) enhanced fixed-point DSP
- ☐ 40 MIPS (25-ns instruction cycle time)
- ☐ 10K words of dual-access RAM (DARAM)
- ☐ 2K words boot ROM
- ☐ One time-division-multiplexed (TDM) serial port
- ☐ One buffered serial port (BSP)
- ☐ One host port interface (HPI) for PC-to-DSP communications
- ☐ One on-chip timer
- ☐ Three power-down modes on the 'C542
- ☐ Programmable, voice-quality TLC320AC01 (DAC, ADC interface circuit)
- ☐ Socketed PAL22V10 for board customization
- ☐ Socketed oscillator
- ☐ Phase-locked-loop (PLL) clock generator
- ☐ XDS510 emulator header
- ☐ I/O expansion bus and control signals for external designs
- ☐ Standard 1/8-inch mono mini-jacks for analog I/O (microphone and multi-media speakers)

1.2 What You Need

Make sure that you have the appropriate hardware and software.

1.2.1 Hardware Requirements

In addition to kit contents, you need the following equipment to use the DSKplus board:

☐	Host	A 386, 486, or Pentium PC with a 1.44M-byte 3.5" floppy disk drive
☐	Port	DSKplus supports 4-bit parallel ports and 8-bit bidirectional parallel ports. DSKplus does not support Enhanced Printer Port and Extended Capabilities Port functionality. However, DSKplus can operate in standard mode of these ports.
☐	Memory	Minimum of 4M bytes
☐	Monitor	Color VGA

1.2.2 Software Requirements

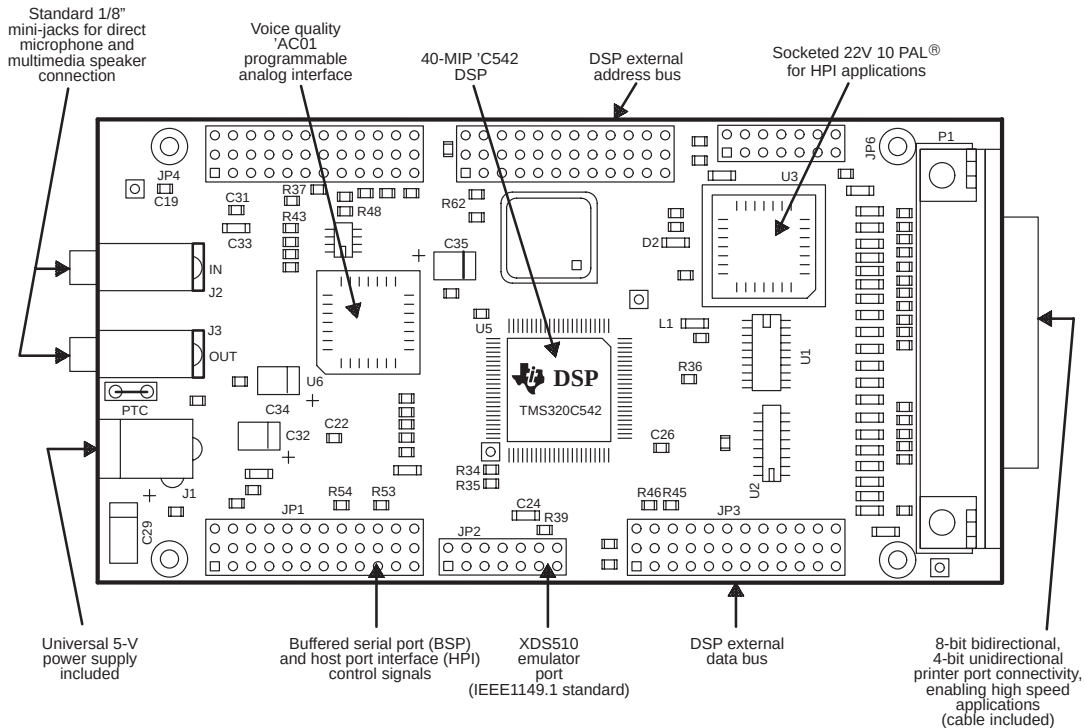
In addition to the provided software, you need the following applications to use the DSKplus board:

☐	Windows	Windows 3.1 or Windows 95
☐	ASCII editor	

1.3 Functional Overview

The diagram of the DSKplus development board is shown in Figure 1–1. It identifies the analog interface circuit TLC320AC01 ('AC01), IEEE.1149.1 emulation port (XDS510), host port interface (HPI), CPU, and peripherals.

Figure 1–1. DSKplus Board Diagram



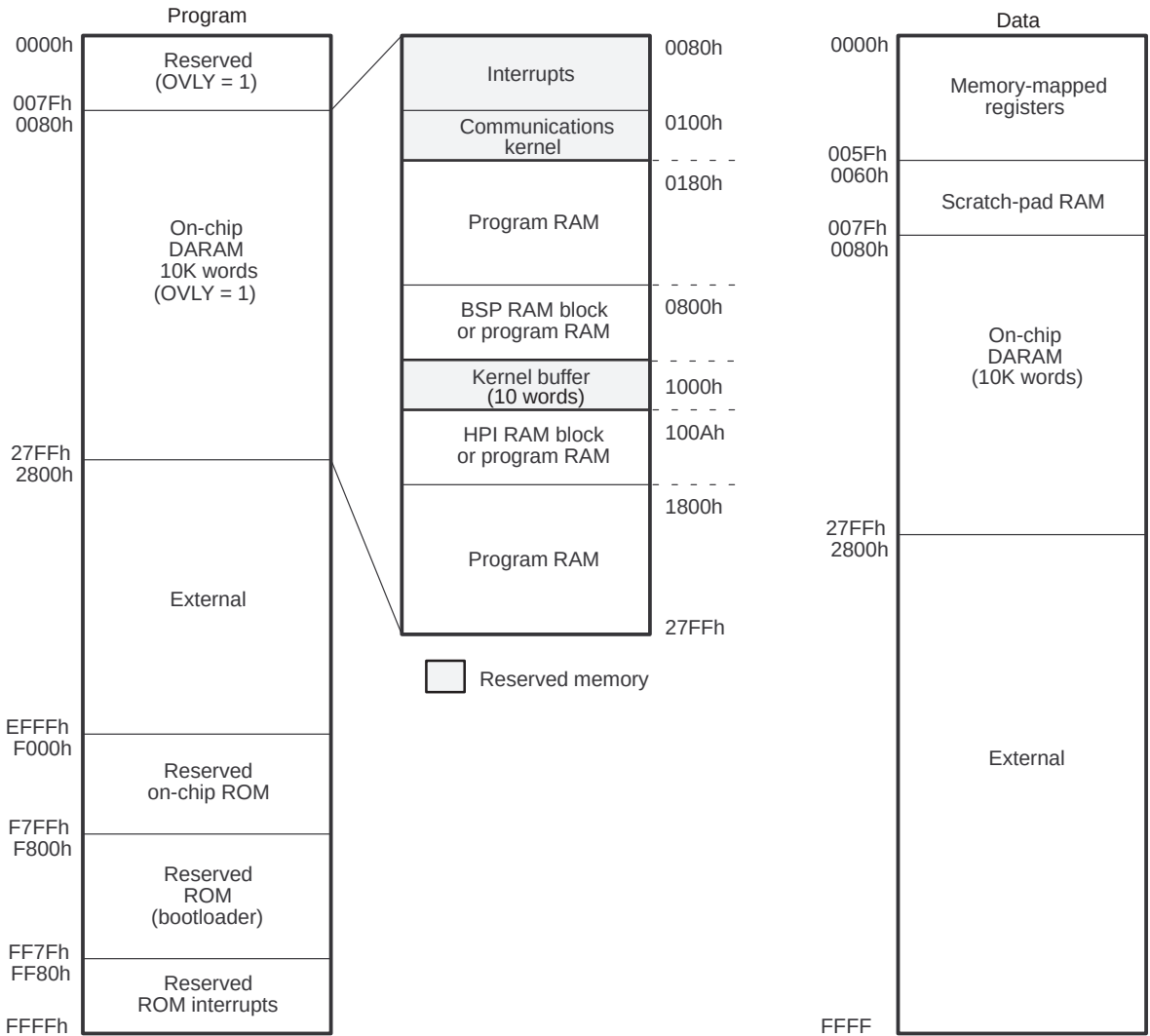
The host port interface logic is an on-board PAL[®] device that operates as the main interface between the host PC's parallel port and the 'C542 host port interface (HPI). As a result, the interface logic gives the host PC direct control of the 'C542's HPI and DSP reset signal, and it can configure the board to operate with different PC parallel ports (that is, 4-bit and 8-bit printer ports).

When you power the board and start the debugger, the debugger software initializes the host interface logic and configures the board to the correct parallel port mode, either 4-bit or 8-bit. At this time, the communication link between the DSKplus board and host PC is ready for operation.

For the DSKplus and the host to communicate properly, the DSP must follow a common communication protocol defined by the host. Therefore, the host PC downloads the protocol to the DSP communication software, which resides in DSP memory at addresses 80h–17Fh. The protocol also uses a mutual com-

munication buffer in DSP memory at 1000h–1009h. The communication buffer is the memory used for communicating between the host and DSP. All memory locations from 80h –17Fh and 1000h –1009h are reserved and must never be written over. See the DSKplus memory map in Figure 1–2 for information on reserved memory.

Figure 1–2. DSKplus Memory Map



The 'AC01 analog interface circuit provides a single channel of voice-quality data acquisition. The 'AC01 has the following features:

- ☐ Single-chip solution A/D and D/A conversions with 14 bits of dynamic range
- ☐ Built-in, programmable antialiasing filter
- ☐ Software-programmable sampling rates
- ☐ Software-programmable reset, gain, and loopback
- ☐ Software-programmable power-down mode
- ☐ 2-channel analog input summing
- ☐ Software-selectable auxiliary input
- ☐ Configurable as master/slave to allow cascading

The 'AC01 interfaces directly to the 'C542 TDM serial port. The 'AC01 generates the required shift clock (SCLK) and frame sync (FS) pulses used to send data to/from the 'AC01. These pulses are a function of software-programmable registers and the 'AC01 master clock. The master clock is generated by the on-board oscillator. See Chapter 4, *Software Considerations*, for instructions on how to program the 'AC01 or see the *TLC320AC01C Single-Supply Analog Interface Circuit Data Manual*.

The DSKplus board provides six headers, including an XDS510 emulator header, to aid in the design of daughter boards. The XDS510 emulator header allows the board to act as an XDS emulator target board with robust, nonintrusive debugging capabilities. The XDS is the advanced emulator from TI available through your local sales office.

The on-board 10-MHz oscillator provides a clock to the 'C542, the 'AC01, and the PAL[®] device. The 'C542 PLL option is set to 4, creating a 40-MHz internal clock oscillator. The 'AC01 runs at 10 MHz. The 'AC01 data manual includes information for operation at 10.368 MHz; the data from the 'AC01 tables and graphs must be interpolated to 10 MHz.

The GoDSP Code Explorer provides a Windows-based debugging interface and a manageable development environment. The debugger interface can display and modify all of the internal registers of the DSP. Some common functions of the debugger are single-stepping code, setting breakpoints in code, setting up watch windows, and managing file I/O. Additional debugger features and information can be found in Chapter 3, *DSKplus Debugger and Application Loader Software*. These tools allow you to fully develop and debug DSP code in a real-time environment.

The DSKplus software includes a Windows-based real-time debugger, DSKplus application loader, and an absolute algebraic assembler. The DSKplus algebraic assembler enables you to program in assembly language without having extensive knowledge of the mnemonic instruction set. Take, for example, a case in which you want to multiply two numbers, $x \times y$, and place the result in accumulator B. With a mnemonic-based assembler, you must know the function of each mnemonic instruction:

```
STM    #y, AR2          ; Address of first multiplicand
STM    #X, AR3          ; Address of second multiplicand
::
MPY    *AR3, *AR2, B    ;
```

With an algebraic assembler, you use simpler mathematical notation:

```
AR2 = #y
AR3 = #X
::
B = *AR2 * *AR3
```

For more information regarding the algebraic instruction set, see *TMS320C54x DSP Reference Set, Volume 3: Algebraic Instruction Set*.

The DSKplus algebraic assembler converts the source file with a .asm extension to an object-based COFF file with a .obj extension. As a result, code addressing is fully resolved at assembly time using in-line assembler directives, so there is no need for a linker stage. The code is ready to be loaded into the DSP.