

# **Using the TMS320C5402 DSK Sine Program and evmdsk54x.dll**

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## **ABSTRACT**

The TMS320C5402 DSP starter kit (DSK) for Code Composer Studio™ contains evmdsk54x.dll, a Windows library, and a header file, evmdsk54xdll.h, which allow you to use and write windows programs that can communicate with the TMS320C5402 DSK. An example program, sine, is included with Code Composer Studio, to demonstrate how evmdsk54x.dll can be used. The example contains a both WIN32 graphical user interface (GUI) and a WIN32 console application, and also a sample target program which uses the DSK code/decode (CODEC) and a C5402 multichannel buffered serial port (McBSP) to output an audio signal to the speaker jack on the DSK.

For the host side, this application report describes how to use the sine example and provides insight in using evmdsk54x.dll. This application report assumes you are familiar with MS Visual C++ and coding on the TMS320C5402, so it does not provide information on constructing an application with MS Visual C++ or creating a program using Code Composer Studio.

For the target side, this application report describes how to use the DSK to generate a signal and output the signal to the phone jack.

Version 6.0 of MS VC++ and version 2.00 of TMS320C5000™ Code Composer Studio are used in this application report.

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# 1 Introduction

To provide our customers with the ability to download and run programs on the TMS320C5402 DSK without using Code Composer Studio, dynamic linked libraries (.dll's), and their associated header files, are included with Code Composer Studio. Note that these libraries communicate with the TMS320C5402 DSK via the parallel port, and can only be used to access on-chip memory via the host port interface (HPI).

To demonstrate how these .DLL's could be used, a sample program named "sinehost", which downloads a target program and allows you to make run-time modifications to the target program, is provided in two versions:

- WIN32 console version of the host program
- WIN32 graphical user interface version of the host program

The sample target program produces a tone whose amplitude and frequency can be modified by you in real time from the personal computer (PC).

This application report describes how to use the sine example, and provides insight in using `evmdsk54x.dll`, which can be used to create a simple example.

Along with the host programs, a target program, `sine.out`, is provided, which is downloaded and executed by either of the host programs. The target program demonstrates the use of the TMS320C5402 DSK CODEC and a McBSP by generating a digital audio signal, converting the signal to an analog signal, and outputting the signal to the speaker jack on the DSK.

This application report assumes that you are familiar with MS Visual C++ and coding on the TMS320C5402, and does not provide information on constructing an application with MS Visual C++ or creating a program using Code Composer Studio.

Version 6.0 of MS VC++ and version 2.00 of the C5000™ Code Composer Studio is used in this application report.

The path names used in this application report assume that you have installed Code Composer Studio in the default path, `C:\ti`. If this is not true, then the path names should be modified to reflect where Code Composer Studio was installed.

## 1.1 Location of Files Used by These Programs

All files used by this program can be found in `C:\ti\examples\dsk5402\host`.

The source and project files for the VC console program, `sinhost_con`, can be found in `C:\ti\examples\dsk5402\host\sine\console`. The main program is `sinhost.c`.

The source and project files for the VC++ GUI program, `sinhost_gui`, can be found in `C:\ti\examples\dsk5402\host\sine\gui`. The main program is `sinhost.cpp`.

The source and Code Composer Studio project files for the program loaded into the C5402 DSK can be found in `C:\ti\examples\dsk5402\host\dsp`.

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## 2 Executing the Sine Program

The DSK should be configured and connected to the PC using the default setup described in the *TMS320C5402 DSK Quick Start Reference Guide* (SPRU368), with the addition of a speaker or headset connected to the DSK via the speaker jack. Before executing the program, power cycle the board and run the “Reset Parallel Port” program, to place the board in a known state.

The programs to be executed can be found in:

`C:\ti\examples\dsk5402\host\bin`

This subdirectory contains everything needed to execute both versions of the program.

From a command prompt, type “sinehost\_con” to start the console version of the program. The program will print instructions indicating the commands which can be entered:

```

C:\ti\examples\dsk5402\host\bin>sinehost_con

***      Opening communication with DSK
***      Opening HPI
***      Resetting DSP
***      Taking DSP out of Reset
***      Disabling FLASH access
***      Loading COFF file <sine.out>
***      Updating prog entry point for HPI boot

usage:
Input: <action> <value>

      action: 0 = switch on
              1 = update Ampl. scaler
              2 = update Freq. scaler
              3 = switch off
              4 = exit

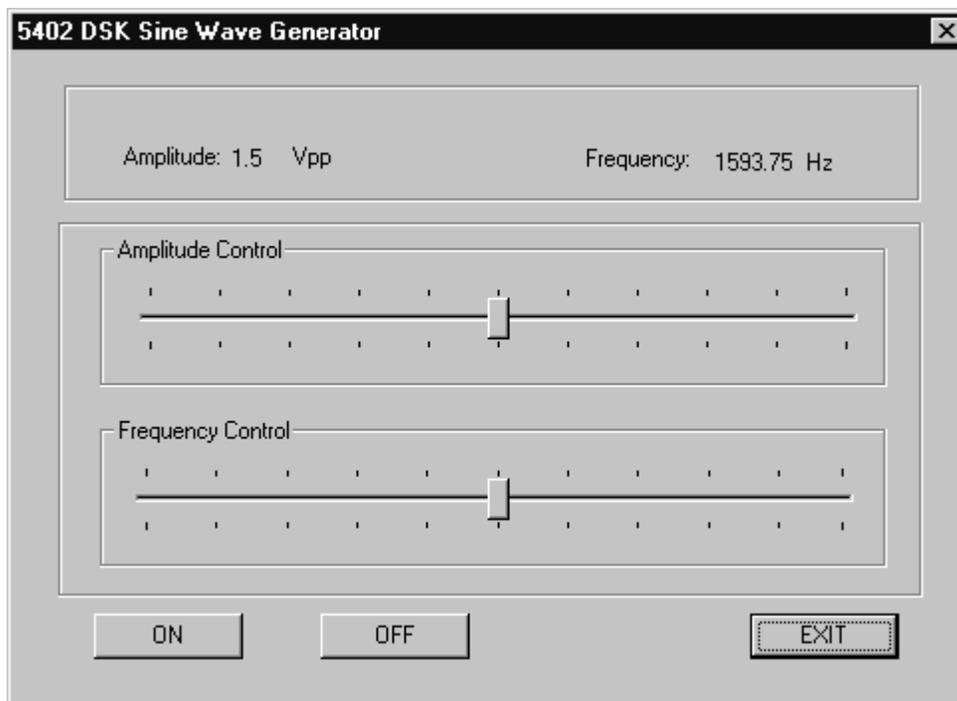
      value:  ampl. scaler = 0 to 10  -> output ampl = 0.3*value volts
              freq. scaler = 1 to 100 -> output freq = (8000*value)/256 Hz

Type in Your Input:

```

Note that both the action and value should be entered and separated by a space on the same line. For example, the input “2 50” would set the frequency to 1562.5 Hz.

To execute the GUI version, type “sinehost\_gui” from the command prompt. The following window will be displayed:



You can press the buttons and move the controls to obtain similar results as those given by the console version. Both programs communicate with the target using function calls to `evmdsk54x.dll`.

### 3 Description of the Host Program and `evmdsk54x` Functions It Uses

To communicate with the C5402 DSK, the host programs use functions from `evmdsk54x.dll`. The header file, `evmdsk54xdll.h`, contains the functions available to you in `evmdsk54x.dll`, and can be found in the included subdirectory for both the console and GUI versions of the host program.

The structure of the program from the viewpoint of communicating with the C5402 DSK is:

- Initialize C5402 DSK
- Load target program
- LOOP until user wants to exit
  - Process user input
  - Send appropriate message to target program
- Close communication with C5402 DSK

The host application programming interfaces (APIs) accessed via function calls used by this program are:

- |                                      |   |
|--------------------------------------|---|
| • <code>evmdsk54x_open</code>        | Open a driver connection to the C5402 DSK.          |
| • <code>evmdsk54x_hpi_open</code>    | Open communications with the C5402 DSK via the HPI. |
| • <code>evmdsk54x_reset_dsp</code>   | Hold the C5402 DSK in reset.                        |
| • <code>evmdsk54x_unreset_dsp</code> | Take the C5402 DSK out of reset.                    |

- `evmdsk54x_flash_access` Disable on board flash access to ensure flash will not be affected.
- `evmdsk54x_coff_load` Load the COFF program, *sine.out*, through the HPI.
- `evmdsk54x_hpi_write_single` Write the program start address in data memory.
- `evmdsk54x_write_single` Send information to *sine.out*, such as start, stop, and modifying parameters.
- `evmdsk54x_hpi_close` Close the HPI communication port.

A description and brief example on how to use each C5402 DSK host API function can be found in Code Composer Studio Help and is located in:

**TMS320C5402 DSK → Software → Host API(Win32 DLL)**

## 4 Description of the C5402 DSK Target Program

The project used to build *sine.out*, *sine.pjt*, is located in `C:\ti\examples\dsk5402\host\dsp`. The main function of *sine* is to receive input from the host program, process that input, and output a tone to the C5402 DSK speaker jack.

The program uses McBSP1, one of the two multichannel buffered serial ports (McBSPs), on the TMS320C5402 to receive information from the host program.

To generate and output the tone, the C5402 uses the TLC320AD50 codec on the C5402 DSK board to output the signal through the C5402 DSK speaker jack to:

- Initialize C5402.
- Initialize McBSP.
- Initialize DAC.
- LOOP until an exit command is received from the host.
  - Receive interrupt from host.
  - Process command from host.
- Disable McBSP.

## 5 Items to Consider Before Using `evmdsk54x`

The TMS320C5402 has an enhanced 8-bit host port interface (HPI-8). Remember that the HPI-8 can only access on-chip memory, so without a special boot program all programs must fit into on-chip memory.

If you desire to load a target program that uses external memory, a boot program must be loaded before you load your program. The boot program, *dsp\_xfer.out*, provided with the C5402 DSK, allows you to load a program into external memory. Copy this program, located in `C:\ti\c5400\dsk5402\utilities`, to your program directory. The program *dsp\_xfer.out*, is running while your target program is loaded, so your target program must not use the memory used by *dsp\_xfer.out*, 0x0080 to 0x0480.

When `evmdsk54x_coff_load` is called, *evmdsk54x.dll* tries to load the program, *dsp\_xfer.out*, from the current directory. If your program fits in internal memory and you do not need *dsp\_xfer.out*, you can ignore the warning which is generated.

## 6 References

1. *TMS320C5402 DSK Quick Start Reference Guide* (SPRU368).
2. *TMS320C54x DSP Reference Set: Volume 1: CPU and Peripherals* (SPRU131).
3. *TMS320C54x DSP Reference Set: Volume 5: Enhanced Peripherals* (SPRU302).
4. *Using the 5410 Multi-Channel Buffered Serial Port (McBSP) Sub-Address Scheme* (SPRA508).

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