

APPLICATION NOTE

TI Code Composer Studio – RTDX feature

SUNDANCE MULTIPROCESSOR TECHNOLOGY LTD.

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Summary:

This application note illustrates the use of the Real Time Data Exchange between the HOST and the DSP TIM. This document shows how RTDX is used on DSP design.

The Real Time Data Exchange is a standard component of the TI DSP. This feature is available with the software Code Composer Studio from Texas Instruments.

The protocol used to communicate between the HOST and the DSP device is the JTAG chain.

Hardware targeted:

TMS320C6000 mounted on Sundance processor-TIM

Software required:

TI Code Composer Studio version 2.20 or later

Software examples provided by Texas instruments

Introduction:

RTDX permits developers to transmit and receive data between a HOST and a target DSP without stopping their applications and to view live or saved data via an easy-to-use Object Linking and Embedding (OLE) Application Program Interface (API).

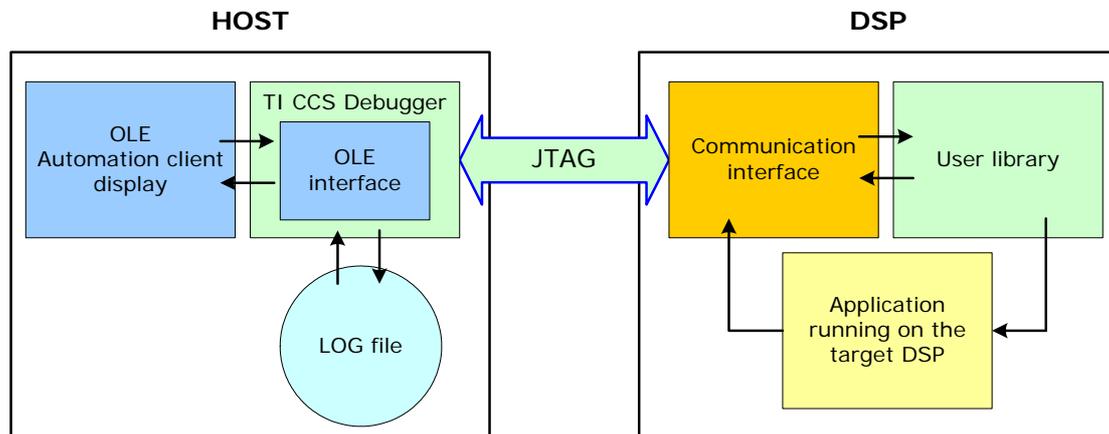


Figure 1: RTDX data flow

RTDX gives designers the industry's first DSP system that provides real-time, continuous visibility into the way target applications operates in the real world. RTDX allows system developers to transfer data between the host computer and DSP devices without stopping their target application.

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TI supplies a very small software library that runs on the target DSP. The designer's application makes C or assembly code calls to pass data to or from TI's data exchange libraries. These libraries then utilize the eXtended Development System (XDS) scan-based emulators to move the data to or from the host platform. Most important, these actions take place while the application is running on the DSP as the XDS emulator moves the data.

Initially, RTDX will transmit data at up to 8 kilobytes per second, making it well-suited for a variety of control, servo and audio applications running at full speed. For example, wireless telecommunications manufacturers can capture the outputs of their vocoder algorithms to check the implementations of speech applications. Embedded control systems will also benefit. Hard disk drive designers can test their applications without crashing the drive with improper signals to the servo motor, and engine control designers will be able to analyze changing factors like heat and environmental conditions while the control application is running. For all of these applications, users can select visualization tools that display information in a way that is most meaningful to them.

Future TI DSPs will feature RTDX bandwidth increases of ten times or more, providing greater system visibility to an even greater number of applications.

DSP to Host transfer:

The TI debugger controls the flow of data between the Host and the DSP (refer to Figure 1). Data flows from the DSP application through the User Library Interface and the Communications Interface to the TI debugger running on the host. The DSP application calls routines in the User Library Interface that buffer the data and pass it to the Communications Interface. This in turn sends the data to the debugger by way of a JTAG interface. The debugger records the data in a log file on the host.

On the host, the TI debugger supports OLE automation. Any host application that is an OLE Automation Client (those written in Visual Basic or Visual C++, for example) can access data in an RTDX log file or send data to the target via the OLE interface.

Host to DSP transfer:

Data flows from the OLE Automation Client to the TI debugger. The debugger buffers the data on the Host. When the debugger receives a read request from the target application, the data is sent to the Communications Interface on the target via a JTAG interface. The Communications Interface passes the data to the User Library Interface, which then delivers it to the target application.

Demonstration example:

Sundance Multiprocessor Technology chose an example from TI Code Composer Studio to illustrate the functionality of the RTDX transfers.

The examples provided by TI are located in the TI installation folder on your computer. These examples are used to run on a simulator/DSK6xxx depending on the project type. Sundance Multiprocessor Technology uses the TI emulator.

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Whenever you test any example project on a different board, you need to use a proper linker command, gel file compatible with your design board. The linker command file written for the DSK may not support a custom board.

So before exploiting any examples, you must open the TI project and edit the command file. The examples provided by TI run on the DSP target, so the information relevant to the chipset do not need to be modified. But, the information particular to the Sundance modules such as the address of the external memory has to be updated with the correct settings.

Sundance Multiprocessor Technology focuses on the SMT376 mounted with a TMS320C6711 DSP. The system is composed of a SMT376 plugged into the first TIM site of the SMT310Q carrier board. The example is "m_engctl" from the TI installation folder: `..\ti\examples\dsk6711\rtdx\`

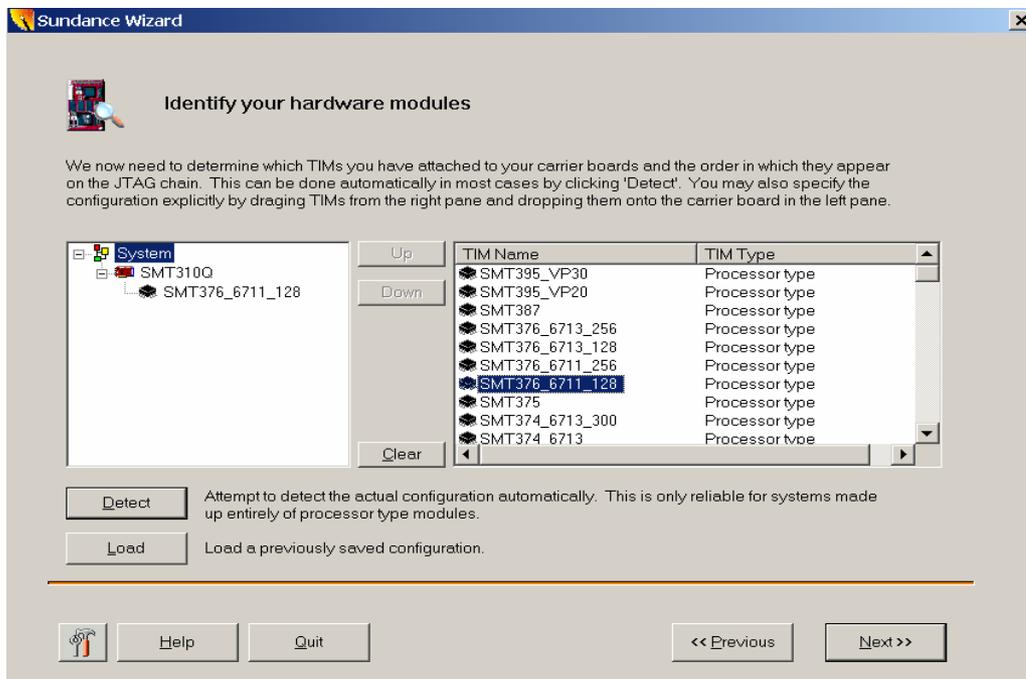
 **Similar operations can be made on the other examples provided by Texas instruments. Other type of Sundance hardware can also be used, but this requires configuring the system properly.**

Step-by-step instructions:

The next subsections will describe step-by-step how to adapt the TI example to Sundance Hardware.

Pre-requisites:

We assume that you have preliminary successfully installed TI Code Composer Studio and the Sundance Hardware that you want to target with the Sundance Wizard.

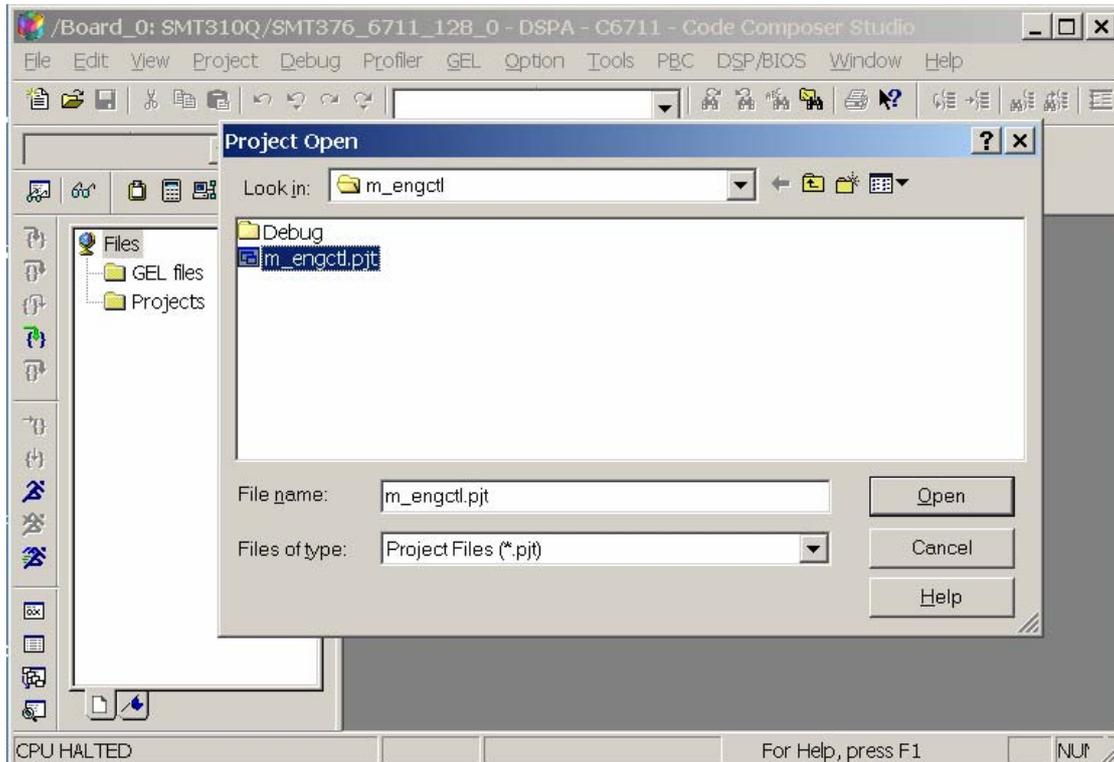


For more information about how setting up the system, please refer to [Sundance help file](#).

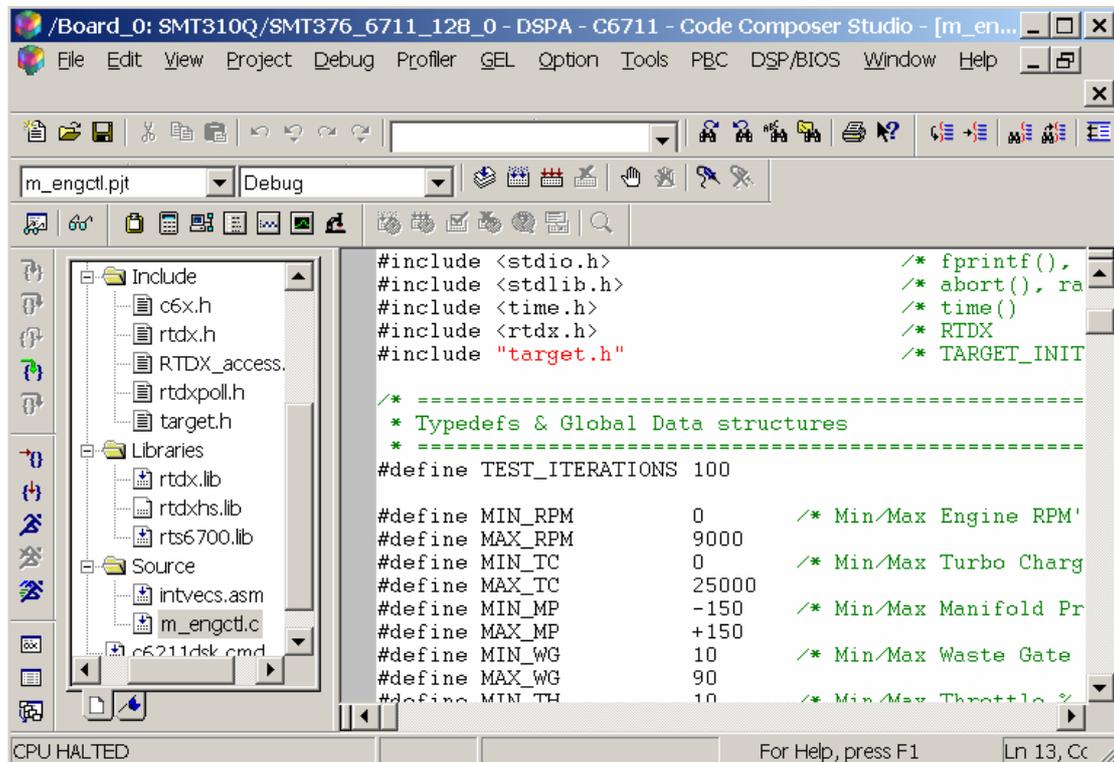
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Opening the TI project:

The project is already built for the user by Texas Instruments.



You just have to open the project directly for the folder:
..\\ti\\examples\\dsk6711\\rtdx\\m_engctl\\m_engctl.pjt

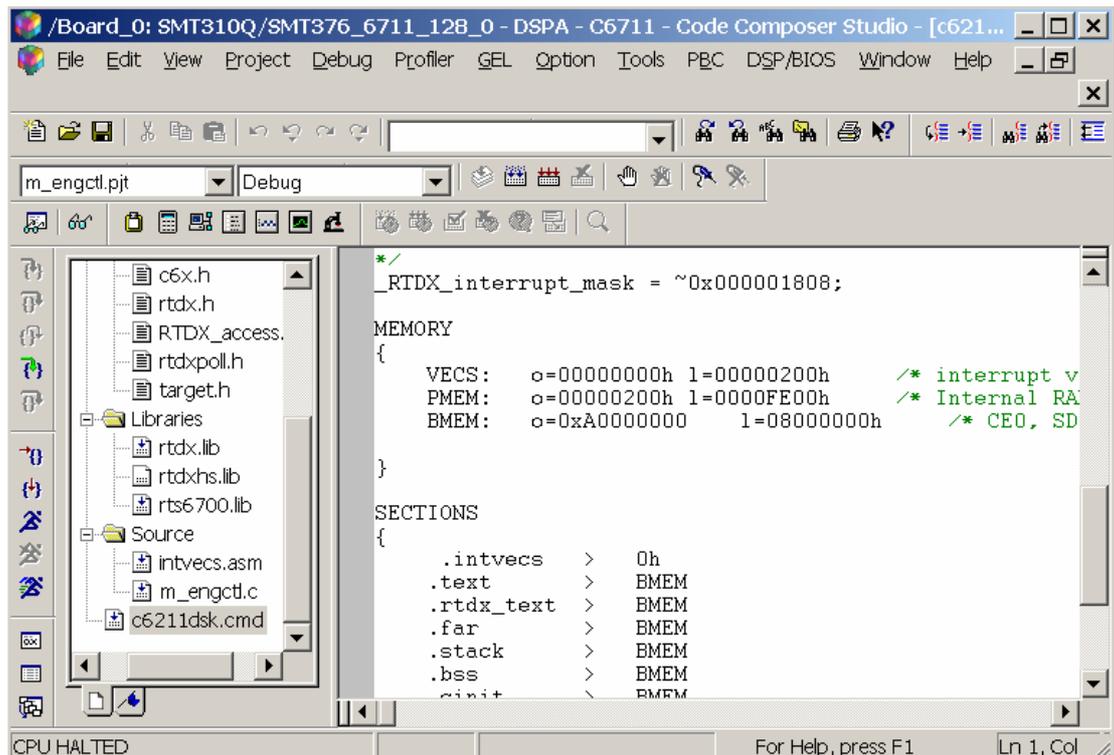


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Modifying the TI command file to support Sundance Boards:

In the left menu, you can see the TI command file. If you edit it, you can see the memory map of the DSP. You normally have to change the sections about the external memory (such as the SDRAM). In the TI command file, the external memory is named BMEM. You need to modify the start and end addresses according to the user guide of the processor-TIM you use.

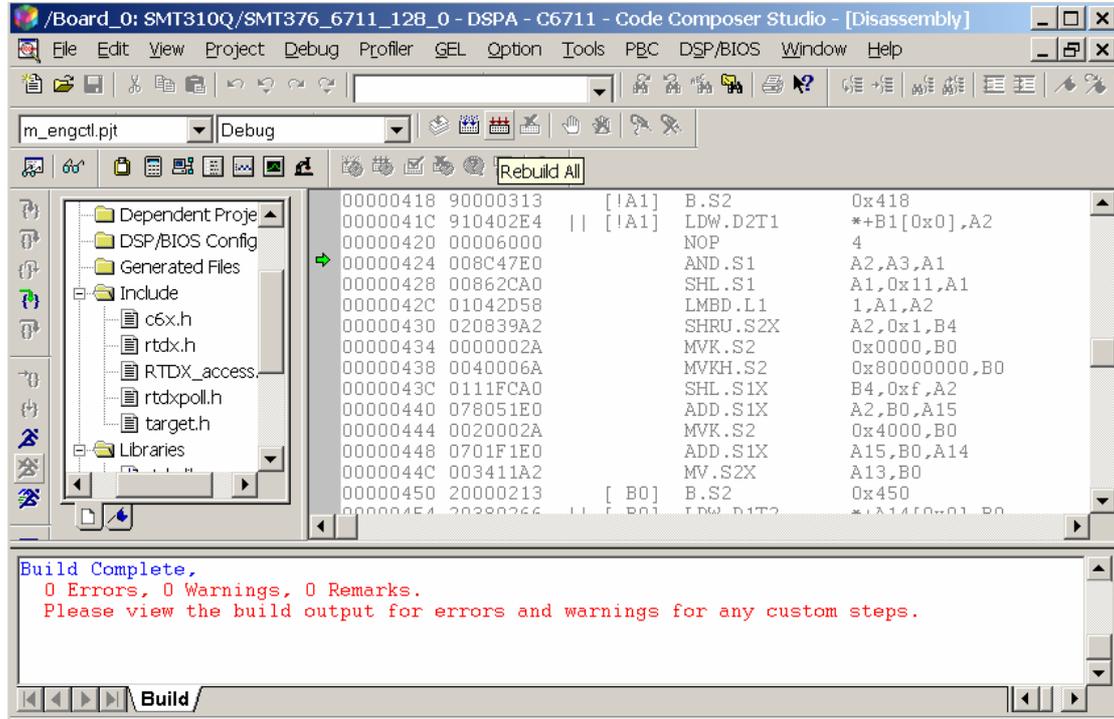
For example, the SDRAM is mapped at the address 0xA0000000 up to 0xA7F00000 in the SMT376_6711_128. So, we can reserve the address, which starts at 0xA0000000, and specify the length to 0x08000000.



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Building the project:

The project can be built now. You just have to recompile the whole project by executing the icon REBUILD ALL from the menu.



The result of compilation should not display any error like it is shown in the previous picture.

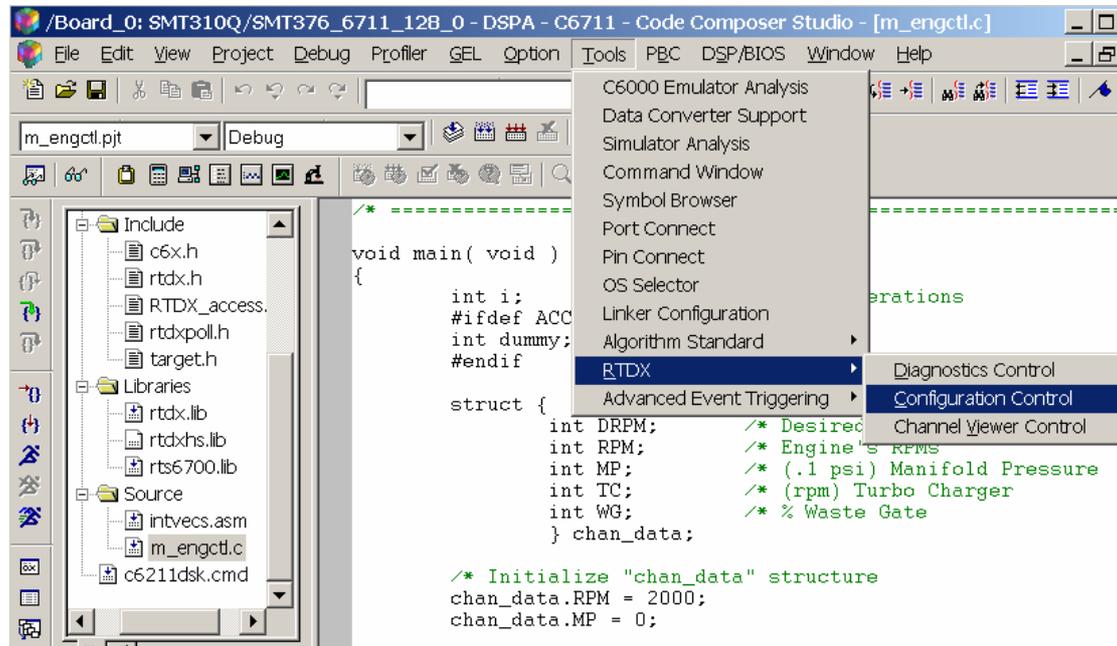
The executable file .out is created in the debug folder of your project. This file is the code compiled for the target. The instructions contained in it run on the DSP only.

If any errors are displayed, you should correct them before going further in this application note.

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Configuring the RTDX device:

To use the RTDX feature of the DSP, you should first enable it by selecting the CONFIGURATION CONTROL tools box.

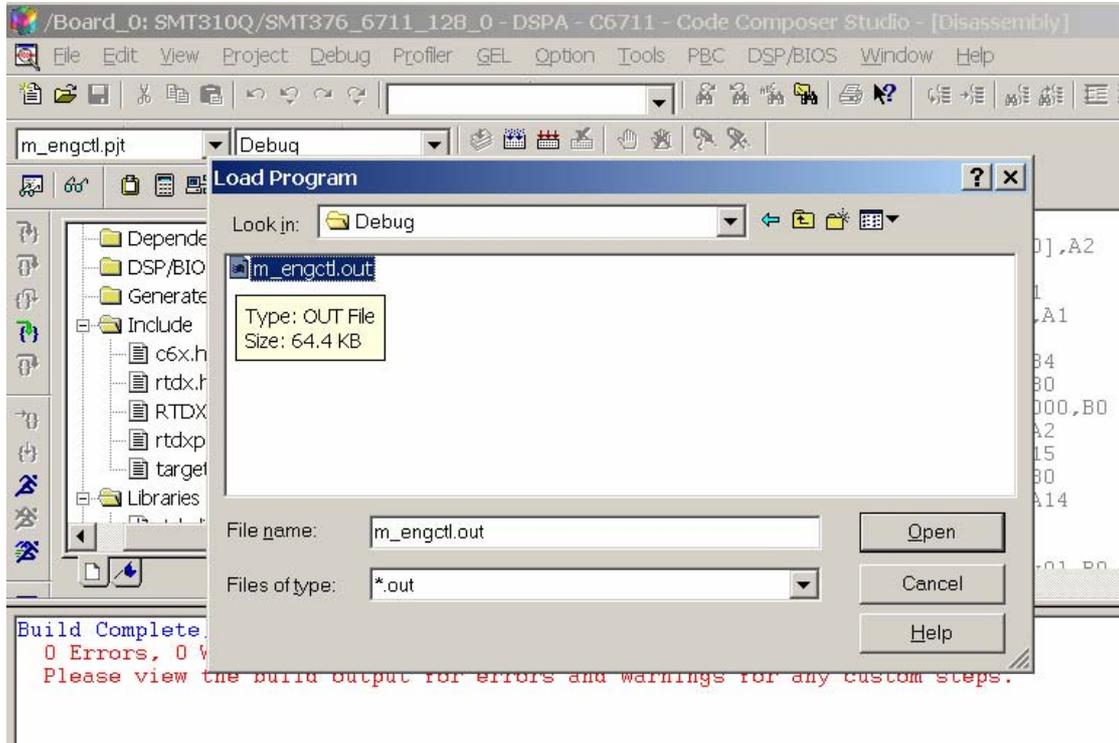


The RTDX a utility window appears and you have to tick the RTDX box to enable it.

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Downloading the DSP application:

Now, you are ready to download in the DSP the application created. You have to select LOAD PROGRAM from the FILE menu.



Once you open the “**m_engctl.out**” file, the download window shows you the progress of the loading in the target DSP.

Running the application:

You run the DSP application by accessing the icon RUN from the left utility bar or from the menu DEBUG.

The DSP application runs continuously. Now, the DSP executes the instructions and wait the Host application to exchange data with it. The data exchanges use the RTDX device between the DSP and the Host.

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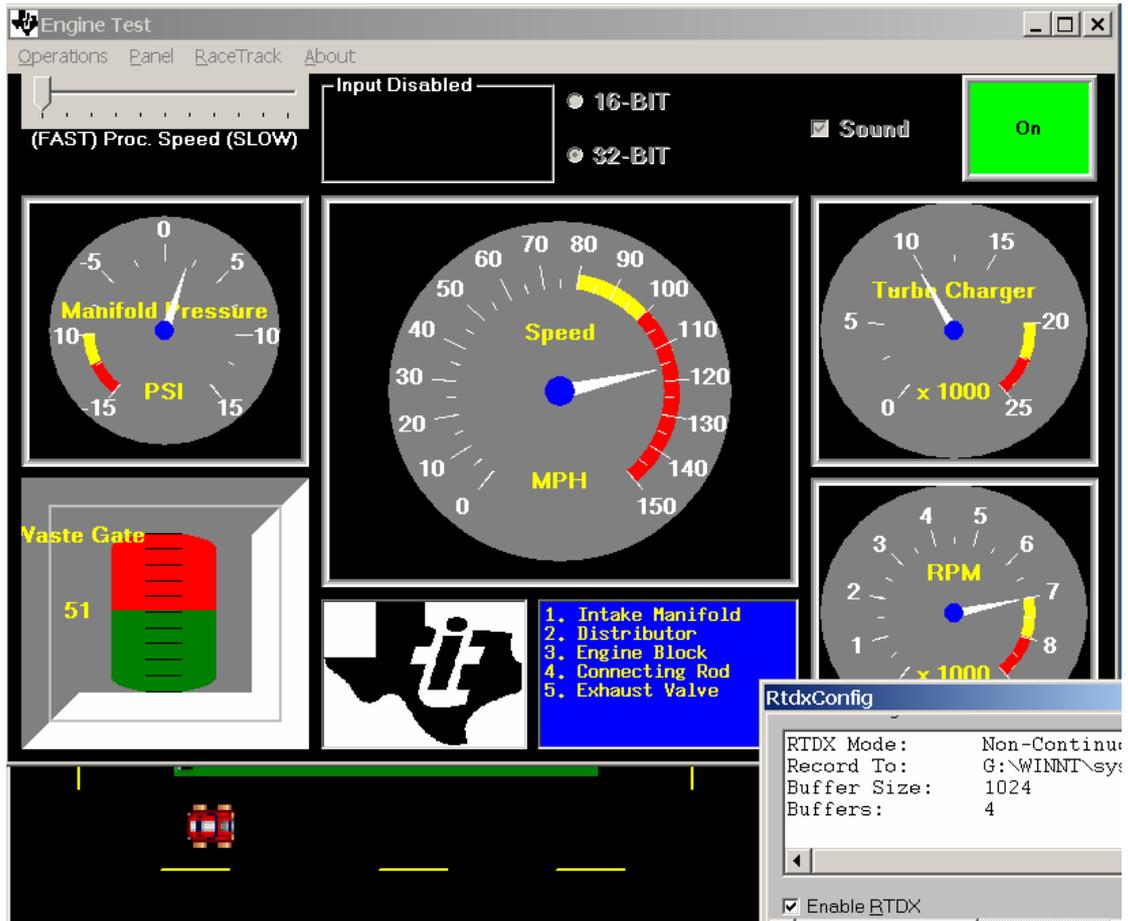
Running the Host application:

The Host application "Engine Test" is ready to use. It is located in the folder Host applications (..\ti\examples\hostapps\rtdx\engineprog\engineprog.exe)

It is provided by Texas Instruments as well.

When you execute the file "engineprog.exe", the GUI is displayed.

You have to select the parameter 32-bit data word (because you use a device from the C6000 family DSP). Then, you can run the GUI pressing the button ON. You should see a little car on the RaceTrack running on the second OLE windows. All the parameters and speed counters evolves in real time as the car.



Observing the results:

By watching at all the animations, you can see the features of the RTDX device to communicate from the DSP to the Host and vice-versa.

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Conclusion:

The communication protocol, between the target DSP and the Host, uses the RTDX device.

The application exchange data through the JTAG. It also shows that Sundance Hardware supports the RTDX features embedded in the TI DSP.

This application shows that TI CCS can also be used to design Real Time applications. It can be used to test the JTAG connection between the Host and the target DSP. It can be the similar test for the JTAG chain that Sundance provide to test the Host Comport in the SMT6300.

This type of HOST-DSP applications can give ideas for the future. Sundance Multiprocessor Technology could develop Host and DSP communication protocol using the Sundance communication resources such as Global Bus, Comports, Sundance Digital bus 16- or 32-bit, Rocket-IO Serial Link.

[Link to similar application for TI Code Composer Studio:](#)

- Writing an RTDX host application using MATLAB:

<http://focus.ti.com/lit/an/spra386/spra386.pdf>

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