C2833x/C2823x C/C++ Header Files and Peripheral Examples Quick Start

1 Device Support:

This software package supports 2833x and 2823x devices. This includes the following: TMS320F28335, TMS320F28334, TMS320F28332, TMS320F28235, TMS320F28234, and TMS320F28232.

Throughout this document, TMS320F28335, TMS320F28334, TMS320F28332, TMS320F28235, TMS320F28234, and TMS320F28232 are abbreviated as F28335, F28334 F28332, F28235, F28234, and F28232 respectively.

2 Introduction:

The C2833x/C2823x C/C++ peripheral header files and example projects facilitate writing in C/C++ Code for the Texas Instruments TMS320x2833x DSPs. The code can be used as a learning tool or as the basis for a development platform depending on the current needs of the user.

- Learning Tool:

  This download includes several example Code Composer Studio™[†] projects for a '2833x/'2823x development platform. One such platform is the eZdsp™[††] F28335 USB from Spectrum Digital Inc. (www.spectrumdigital.com).

  These examples demonstrate the steps required to initialize the device and utilize the on-chip peripherals. The provided examples can be copied and modified giving the user a platform to quickly experiment with different peripheral configurations.

  These projects can also be migrated to other devices by simply changing the memory allocation in the linker command file.

- Development Platform:

  The peripheral header files can easily be incorporated into a new or existing project to provide a platform for accessing the on-chip peripherals using C or C++ code. In addition, the user can pick and choose functions from the provided code samples as needed and discard the rest.

To get started this document provides the following information:

- Overview of the bit-field structure approach used in the C2833x/C2823x C/C++ peripheral header files.
- Overview of the included peripheral example projects.
- Steps for integrating the peripheral header files into a new or existing project.
- Troubleshooting tips and frequently asked questions.

[†] Code Composer Studio is a trademark of Texas Instruments (www.ti.com).
[††] eZdsp is a trademark of Spectrum Digital Inc (www.spectrumdigital.com).
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- Migration tips for users moving from the DSP281x and DSP280x header files to the DSP2833x/2823x header files.

Finally, this document does not provide a tutorial on writing C code, using Code Composer Studio, or the C28x Compiler and Assembler. It is assumed that the reader already has a 28335 hardware platform setup and connected to a host with Code Composer Studio installed. The user should have a basic understanding of how to use Code Composer Studio to download code through JTAG and perform basic debug operations.

2.1 Revision History

Version 1.10

- ❑ This version includes minor corrections to the header and common files, and adds support for F2823x non-floating point unit examples. These examples use the same common and header files as the F2833x examples. A detailed revision history can be found in Section 9.

Version 1.03

- ❑ This version includes minor additions to the header and common files, including an upgraded revision to the SFO library V5. A detailed revision history can be found in Section 9.

Version 1.02

- ❑ This version includes minor additions to the gel files and updates to the source/example files. A detailed revision history can be found in Section 9.

Version 1.01

- ❑ This version fixes some typos and minor errors in the DSP2833x header files and examples. A detailed revision history can be found in Section 9.

Version 1

- ❑ This version is the first release of the DSP2833x header files and examples.

2.2 Where Files are Located (Directory Structure)

As installed, the *C2833x/C2823x C/C++ Header Files and Peripheral Examples* is partitioned into a well-defined directory structure. By default, the source code is installed into the c:\tidcs\c28\DSP2833x\<version> directory.

Table 1 describes the contents of the main directories used by DSP2833x/2823x header files and peripheral examples:

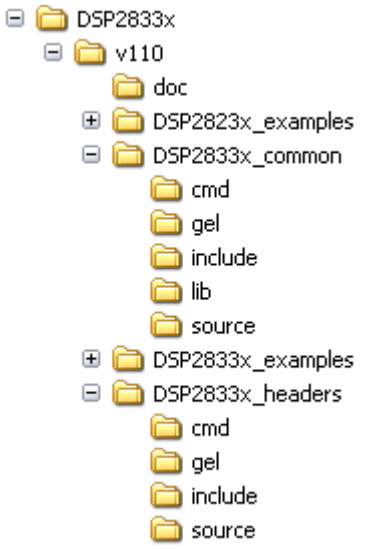


Table 1. DSP2833x Main Directory Structure

Directory	Description
<base>	Base install directory. By default this is c:\tidcs\c28\DSP2833x\v100. For the rest of this document <base> will be omitted from the directory names.
<base>\doc	Documentation including the revision history from the previous release.
<base>\DSP2833x_headers	Files required to incorporate the peripheral header files into a project . The header files use the bit-field structure approach described in Section 3. Integrating the header files into a new or existing project is described in Section 5.
<base>\DSP2833x_examples	Example Code Composer Studio projects compiled with floating point unit *enabled*. These example projects illustrate how to configure many of the on-chip peripherals. An overview of the examples is given in Section 4.
<base>DSP2833x_common	Common source files shared across example projects to illustrate how to perform tasks using header file approach. Use of these files is optional, but may be useful in new projects. A list of these files is in Section 8.
<base>\DSP2823x_examples	Example Code Composer Studio projects compiled with floating point unit *disabled*. These example projects illustrate how to configure many of the on-chip peripherals. An overview of the examples is given in Section 4.

Under the *DSP2833x_headers* and *DSP2833x_common* directories the source files are further broken down into sub-directories each indicating the type of file. Table 2 lists the sub-directories and describes the types of files found within each:

Table 2. DSP2833x Sub-Directory Structure

Sub-Directory	Description
DSP2833x_headers\cmd	Linker command files that allocate the bit-field structures described in Section 3.
DSP2833x_headers\source	Source files required to incorporate the header files into a new or existing project.
DSP2833x_headers\include	Header files for each of the on-chip peripherals.
DSP2833x_common\cmd	Example memory command files that allocate memory on the devices.
DSP2833x_common\include	Common .h files that are used by the peripheral examples.
DSP2833x_common\source	Common .c files that are used by the peripheral examples.
DSP2833x_common\lib	Common library (.lib) files that are used by the peripheral examples.
DSP2833x_common\gel	Code Composer Studio GEL files for each device. These are optional.

3 Understanding The Peripheral Bit-Field Structure Approach

The following application note includes useful information regarding the bit-field peripheral structure approach used by the header files and examples.

This method is compared to traditional #define macros and topics of code efficiency and special case registers are also addressed. The information in this application note is important to understand the impact using bit fields can have on your application code.

Programming TMS320x28xx and 28xxx Peripherals in C/C++ **(**SPRAA85)

4 Peripheral Example Projects

This section describes how to get started with and configure the peripheral examples included in the C2833x/C2823x Header Files and Peripheral Examples software package.

NOTE:

Because the '2833x devices are floating-point devices, the '2833x peripheral examples are configured for floating-point by default. Therefore, Code Composer Studio V3.3+ with C2000 CodeGenTools V5.x, which includes fpu32 floating-point support, is required to build and run these examples. To run these examples on Code Composer 3.1 and earlier, they must be re-configured for fixed-point (For more information, see Section 4.6).

Because the '2823x devices are fixed-point devices, the '2823x peripheral examples are configured for non-floating-point by default. These examples run as-is on Code Composer 3.3 and earlier.

4.1 Getting Started

To get started, follow these steps to load the 32-bit CPU-Timer example. Other examples are set-up in a similar manner.

1. **Have a hardware platform, such as the eZdsp F28335 USB, connected to a host with Code Composer Studio installed.**

   NOTE: As supplied, the '2833x and '2823x example projects are built for the '28335/'28235 device. If you are using another 2833x or 2823x device, the memory definition in the linker command file (.cmd) will need to be changed and the project rebuilt.

2. **Load the example's GEL file (.gel) or Project file (.pjt).**

   Each example includes a Code Composer Studio GEL file to help automate loading of the project, compiling of the code and populating of the watch window. Alternatively, the project file itself (.pjt) can be loaded instead of using the included GEL file.

   To load the '2833x CPU-Timer example's GEL file follow these steps:

   a. In Code Composer Studio: *File->Load GEL*

   b. Browse to the CPU Timer example directory: *DSP2833x_examples\cpu_timer* (or *DSP2823x_examples\cpu_timer*)

   c. Select *Example_2833xCpuTimer.gel* (or *Example_2823xCpuTimer.gel*) and click on *open*.

   d. From the Code Composer GEL pull-down menu select

      DSP2833x CpuTimerExample-> Load_and_Build_Project (for '2833x devices)

      DSP2823x CpuTimerExample-> Load_and_Build_Project (for '2823x devices)

This will load the project and build compile the project.

3. Edit DSP28_Device.h

Edit the DSP2833x_Device.h file and make sure the appropriate device is selected. By default the 28335 is selected. For ‘2823x devices, the ‘2833x counterpart is selected. For instance, if using F28235, DSP28_28335 is selected as the TARGET.

```
//---------------------------------------------------------------------------
* DSP2833x_headers\include\DSP2833x_Device.h
//---------------------------------------------------------------------------*/

#define   TARGET   1
//---------------------------------------------------------------------------
// User To Select Target Device:

#define   DSP28_28335  TARGET
#define   DSP28_28334  0
#define   DSP28_28332  0
```

4. Edit DSP2833x_Examples.h

Edit DSP2833x_Examples.h and specify the clock rate, the PLL control register value (PLLCR and DIVSEL). These values will be used by the examples to initialize the PLLCR register and DIVSEL bits.

The default values will result in a 150Mhz SYSCLKOUT frequency.

```
/*************************************************************
* DSP2833x_common\include\DSP2833x_Examples.h
*************************************************************/
/*-----------------------------------------------------------------------
      Specify the PLL control register (PLLCR) and divide select (DIVSEL) value.
-----------------------------------------------------------------------*/
//#define DSP28_DIVSEL   0   // Enable /4 for SYSCLKOUT(default at reset)
//#define DSP28_DIVSEL   1 // Disable /4 for SYSCKOUT
#define DSP28_DIVSEL     2 // Enable /2 for SYSCLKOUT
//#define DSP28_DIVSEL     3 // Enable /1 for SYSCLKOUT

#define DSP28_PLLCR   10
//#define DSP28_PLLCR    9
//#define DSP28_PLLCR    8
//#define DSP28_PLLCR    7
//#define DSP28_PLLCR    6
//#define DSP28_PLLCR    5
//#define DSP28_PLLCR    4
//#define DSP28_PLLCR    3
//#define DSP28_PLLCR    2
//#define DSP28_PLLCR    1
//#define DSP28_PLLCR    0  // (Default at reset) PLL is bypassed in this mode
//-----------------------------------------------------------------------
```

In DSP2833x_Examples.h, also specify the SYSCLKOUT rate. This value is used to scale a delay loop used by the examples. The default value is for a 150 Mhz SYSCLKOUT. If you have a 100 MHz device you will need to adjust these settings accordingly.

```
/*************************************************************
* DSP2833x_common\include\DSP2833x_Examples.h
*************************************************************/
……
#define CPU_RATE    6.667L   // for a 150MHz CPU clock speed (SYSCLKOUT)
//#define CPU_RATE    7.143L   // for a 140MHz CPU clock speed (SYSCLKOUT)
//#define CPU_RATE    8.333L   // for a 120MHz CPU clock speed (SYSCLKOUT)
……
```

In DSP2833x_Examples.h also specify the maximum SYSCLKOUT frequency (150MHz or 100MHz) by setting it to 1 and the other to 0. This value is used by those examples with timing dependent code (i.e. baud rates or other timing parameters) to determine whether 150MHz code or 100MHz code should be run.

The default value is for 150Mhz SYSCLKOUT. If you have a 100MHz device you will need to adjust these settings accordingly. If you intend to run examples which use these definitions at a different frequency, then the timing parameters in those examples must be directly modified accordingly regardless of the setting here.

```
/*************************************************************
* DSP2833x_common\include\DSP2833x_Examples.h
*************************************************************/
……
#define CPU_FRQ_100MHZ   0     // 100 MHz CPU Freq - 1 for 100 MHz devices
#define CPU_FRQ_150MHZ   1     // 150 Mhz CPU Freq - default, 1 for 150 MHz devices

//---------------------------------------------------------------------------
```

5. Review the comments at the top of the main source file: Example_2833xCpuTimer.c.

A brief description of the example and any assumptions that are made and any external hardware requirements are listed in the comments at the top of the main source file of each example. In some cases you may be required to make external connections for the example to work properly.

6. Perform any hardware setup required by the example.

Perform any hardware setup indicated by the comments in the main source. The CPU-Timer example only requires that the hardware be setup for “Boot to SARAM” mode. Other examples may require additional hardware configuration such as connecting pins together or pulling a pin high or low.

Table 3 shows a listing of the boot mode pin settings for your reference. Refer to the documentation for your hardware platform for information on configuring the boot mode pins. For more information on the ‘2833x/’2823x boot modes refer to the device specific *Boot ROM Reference Guide*.

Table 3. 2833x/2823x Boot Mode Settings

GPIO87 XA15 PU	GPIO86 XA14 PU	GPIO85 XA13 PU	GPIO84 XA12 PU	Mode
1	1	1	1	Boot to flash 0x33FFF6
1	1	1	0	Call SCI-A boot loader
1	1	0	1	Call SPI-A boot loader
1	1	0	0	Call I2C boot loader
1	0	1	1	Call eCAN-A boot loader
1	0	1	0	Call McBSP-A boot loader
1	0	0	1	Boot to XINTF x16 0x100000
1	0	0	0	Boot to XINTF x32 0x100000
0	1	1	1	Boot to OTP 0x380400
0	1	1	0	Call parallel GPIO boot loader
0	1	0	1	Call parallel XINTF boot loader
0	1	0	0	Boot to M0 SARAM 0x000000
0	0	1	1	Branch to check boot mode
0	0	1	0	Boot to flash, bypass ADC cal
0	0	0	1	Boot to SARAM, bypass ADC cal
0	0	0	0	Boot to SCI-A, bypass ADC cal

7. Load the code

Once any hardware configuration has been completed, from the Code Composer GEL pull-down menu select

DSP2833x CpuTimerExample-> Load_Code (for '2833x devices)

This will load the .out file into the 28x device, populate the watch window with variables of interest, reset the part and execute code to the start of the main function. The GEL file is setup to reload the code every time the device is reset so if this behavior is not desired, the GEL file can be removed at this time. To remove the GEL file, right click on its name and select *remove*.

8. Run the example, add variables to the watch window or examine the memory contents.

9. Experiment, modify, re-build the example.

If you wish to modify the examples it is suggested that you make a copy of the entire header file packet to modify or at least create a backup of the original files first. New examples provided by TI will assume that the base files are as supplied.

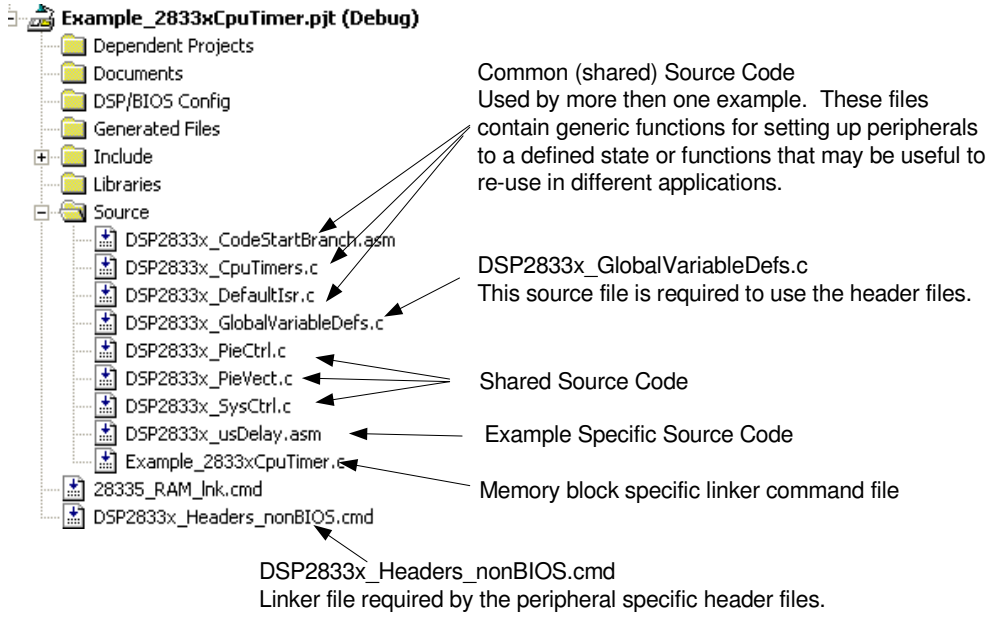
Sections 4.2 and 4.3 describe the structure and flow of the examples in more detail.

10. When done, remove the example's GEL file and project from Code Composer Studio.

To remove the GEL file, right click on its name and select *remove*. The examples use the header files in the *DSP2833x_headers* directory and shared source in the *DSP2833x_common* directory. Only example files specific to a particular example are located within in the example directory.

Note: Most of the example code included uses the .bit field structures to access registers. This is done to help the user learn how to use the peripheral and device. Using the bit fields has the advantage of yielding code that is easier to read and modify. This method will result in a slight code overhead when compared to using the .all method. In addition, the example projects have the compiler optimizer turned off. The user can change the compiler settings to turn on the optimizer if desired.

4.2 Example Program Structure



Each of the example programs has a very similar structure. This structure includes unique source code, shared source code, header files and linker command files.

NOTE:

The ‘2823x example programs use the same source and include files as the ‘2833x example programs. The only difference between the ‘2823x examples and the ‘2833x examples is that ‘2823x programs are compiled for fixed-point, and ‘2833x programs are compiled for floating-point.

```
/*************************************************************************
* DSP2833x_examples\cpu_timer\Example_2833xCpuTimer.c
*************************************************************************/

#include "DSP2833x_Device.h"     // DSP2833x Headerfile Include File
#include "DSP2833x_Examples.h"   // DSP2833x Examples Include File
```

- **DSP2833x_Device.h**

  This header file is required to use the header files. This file includes all of the required peripheral specific header files and includes device specific macros and typedef statements. This file is found in the *<base>\DSP2833x_headers\include* directory.

- **DSP2833x_Examples.h**

  This header file defines parameters that are used by the example code. This file is not required to use just the DSP2833x peripheral header files but is required by some of the

common source files. This file is found in the *<base>\DSP2833x_common\include* directory.

4.2.1 Source Code

Each of the example projects consists of source code that is unique to the example as well as source code that is common or shared across examples.

- **DSP2833x_GlobalVariableDefs.c**

  Any project that uses the DSP2833x peripheral header files must include this source file. In this file are the declarations for the peripheral register structure variables and data section assignments. This file is found in the *<base>\DSP2833x_headers\source* directory.

- **Example specific source code:**

  Files that are specific to a particular example have the prefix Example_2833x (or Example_2823x) in their filename. For example Example_2833xCpuTimer.c is specific to the CPU Timer example and not used for any other example. Example specific files are located in the *<base>\DSP2833x_examples\<example>* directory for '2833x devices and in the *<base>\DSP2823x_examples\<example>* directory for '2823x devices.

- **Common source code:**

  The remaining source files are shared across the examples. These files contain common functions for peripherals or useful utility functions that may be re-used. Shared source files are located in the DSP2833x_shared\source directory. Users may choose to incorporate none, some, or the entire shared source into their own new or existing projects.

4.2.2 Linker Command Files

Each example uses two linker command files. These files specify the memory where the linker will place code and data sections. One linker file is used for assigning compiler generated sections to the memory blocks on the device while the other is used to assign the data sections of the peripheral register structures used by the DSP2833x peripheral header files.

- **Memory block linker allocation:**

The linker files shown in Table 4 are used to assign sections to memory blocks on the device. These linker files are located in the *<base>\DSP2833x_common\cmd* directory. Each example will use one of the following files depending on the memory used by the example.

Table 4. Included Memory Linker Command Files

Memory Linker Command File Examples	Location	Description
28335_RAM_lnk.cmd	DSP2833x_common\cmd	28335/28235 memory linker command file. Includes all of the internal SARAM blocks on a 28335/28235 device. "RAM" linker files do not include flash or OTP blocks.
28334_RAM_lnk.cmd	DSP2833x_common\cmd	28335/28235 SARAM memory linker command file.
28332_RAM_lnk.cmd	DSP2833x_common\cmd	28334/28234 SARAM memory linker command file.
F28335.cmd	DSP2833x_common\cmd	F28335/F28235 memory linker command file. Includes all Flash, OTP and CSM password protected memory locations.
F28334.cmd	DSP2833x_common\cmd	F28334/F28234 memory linker command file.
F28332.cmd	DSP2833x_common\cmd	F28332/F28232 memory linker command file.

- **Header file structure data section allocation:**

  Any project that uses the header file peripheral structures must include a linker command file that assigns the peripheral register structure data sections to the proper memory location. These files are described in Table 5.

Table 5. DSP2833x Peripheral Header Linker Command File

Header File Linker Command File	Location	Description
DSP2833x_Headers_BIOS.cmd	DSP2833x_headers\cmd	Linker .cmd file to assign the header file variables in a BIOS project. This file must be included in any BIOS project that uses the header files. Refer to section 5.2.
DSP2833x_Headers_nonBIOS.cmd	DSP2833x_headers\cmd	Linker .cmd file to assign the header file variables in a non-BIOS project. This file must be included in any non-BIOS project that uses the header files. Refer to section 5.2.

4.3 Example Program Flow

All of the example programs follow a similar recommended flow for setting up a 2833x/2823x device. Figure 1 outlines this basic flow:

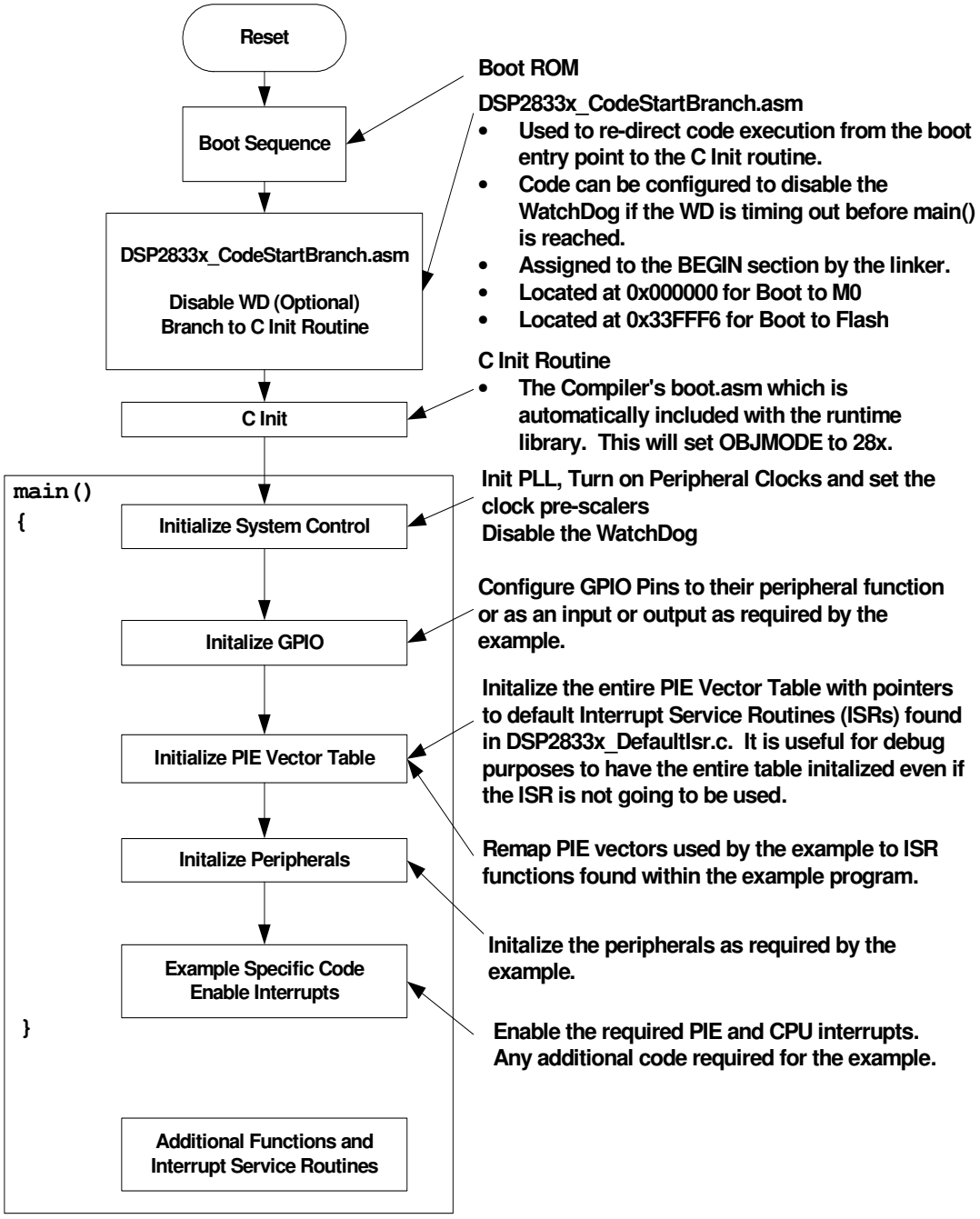


Figure 1. Flow for Example Programs

4.4 Included Examples:

Table 6. Included Examples

Example	Description
adc_dma	ADC example with ADC interfaced to DMA. ChannelA0-A3 are converted 10 times.
adc_seq_ovd_tests	ADC test using the sequencer override feature.
adc_seqmode_test	ADC Seq Mode Test. Channel A0 is converted forever and logged in a buffer
adc_soc	ADC example to convert two channels: ADCINA3 and ADCINA2. Interrupts are enabled and PWM1 is configured to generate a periodic ADC SOC on SEQ1.
cpu_timer	Configures CPU Timer0 and increments a count each time the ISR is serviced.
dma_ram_to_ram	Example of RAM to RAM data block transfer using the DMA.
dma_xintf_to_ram	Example of XINTF to RAM data block transfer using the DMA.
ecan_a_to_b_xmit	Transmit from eCANa to eCANb
ecan_back2back	eCAN self-test mode example. Transmits eCAN data back-to-back at high speed without stopping.
ecap_apwm	This example sets up the alternate eCAP pins in the APWM mode
ecap_capture_pwm	Captures the edges of a ePWM signal.
epwm_deadband	Example deadband generation via ePWM3
epwm_timer_interrupts	Starts ePWM1-ePWM6 timers. Every period an interrupt is taken for each ePWM.
epwm_trip_zone	Uses the trip zone signals to set the ePWM signals to a particular state.
epwm_up_aq	Generate a PWM waveform using an up count time base ePWM1-ePWM3 are used.
epwm_updown_aq	Generate a PWM waveform using an up/down time base. ePWM- ePWM3 are used.
eqep_freqcal	Frequency cal using eQEP1
eqep_pos_speed	Pos/speed calculation using eQEP1
external_interrupt	Configures GPIO0 as XINT1 and GPIO1 as XINT2. The interrupts are fired by toggling GPIO30 and GPIO31 which are connected to XINT1 (GPIO0) and XINT2 (GPIO1) externally by the user.
flash	ePWM timer interrupt project moved from SARAM to Flash. Includes steps that were used to convert the project from SARAM to Flash. Some interrupt service routines are copied from FLASH to SARAM for faster execution.
fpu	Two projects illustrating the difference between code compiled with floating-point hardware (FPU) and fixed-point hardware (using software to simulate floating-point). *Note: This example is not included in the DSP2823x_examples directory because DSP2823x devices do not have an FPU.*
gpio_setup	Three examples of different pinout configurations.
gpio_toggle	Toggles all of the I/O pins using different methods – DATA, SET/CLEAR and TOGGLE registers. The pins can be observed using an oscilloscope.
hrpwm	Sets up ePWM1-ePWM4 and controls the edge of output A using the HRPWM extension. Both rising edge and falling edge are controlled.
hrpwm_sfo	Use TI's MEP Scale Factor Optimizer (SFO) library to change the HRPWM. This version of the SFO library supports HRPWM on ePWM channels 1-4 only.
hrpwm_sfo_v5	Use TI's MEP Scale Factor Optimizer (SFO) library version 5 to change the HRPWM. This version of the SFO library supports HRPWM on up to 16 ePWM channels (if available)
hrpwm_slider	This is the same as the hrpwm example except the control of CMPAHR is now controlled by the user via a slider bar. The included .gel file sets up the slider.
i2c_eeprom	Communicate with the EEPROM on the eZdsp F28335 USB platform via I2C

Included Examples Continued…

lpm_haltwake	Puts device into low power halt mode. GPIO0 is configured to wake the device from halt when an external high-low-high pulse is applied to it.
lpm_idlewake	Puts device into low power idle mode. GPIO0 is configured as XINT1 pin. When an XINT1 interrupt occurs due to a falling edge on GPIO0, the device is woken from idle.
lpm_standbywake	Puts device into low power standby mode. GPIO0 is configured to wake the device from halt when an external high-low-high pulse is applied to it.
mcbsp_loopback	McBSP-A example that uses the peripheral's loop-back testmode to send data.
mcbsp_loopback_dma	McBSP-A example that uses the peripheral's loop-back testmode with the DMA to send and receive data.
mcbsp_loopback_interrupts	McBSP-A example that uses the peripheral's loop-back testmode to send data. Interrupts are used in this example.
mcbsp_spi_loopback	McBSP-A example that configures the peripheral for SPI mode and uses the loop-back testmode to send data.
sci_autobaud	Externally connect SCI-A to SCI-B and send data between the two peripherals. Baud lock is performed using the autobaud feature of the SCI. This test is repeated for different baud rates.
sci_echoback	SCI-A example that can be used to echoback to a terminal program such as hyperterminal. A transceiver and a connection to a PC is required.
scia_loopback	SCI-A example that uses the peripheral's loop-back test mode to send data.
scia_loopback_interrupts	SCI-A example that uses the peripheral's loop-back test mode to send data. Both interrupts and FIFOs are used in this example.
spi_loopback	SPI-A example that uses the peripherals loop-back test mode to send data.
spi_loopback_interrupts	SPI-A example that uses the peripherals loop-back test mode to send data. Both interrupts and FIFOs are used in this example.
sw_prioritized_interrupts	The standard hardware prioritization of interrupts can be used for most applications. This example shows a method for software to re-prioritize interrupts if required.
timed_led_blink	This example blinks GPIO32 (LED on the eZdsp) at a rate of 1 Hz using CPU Timer 0.
watchdog	Illustrates feeding the dog and re-directing the watchdog to an interrupt.
xintf_run_from	This example shows how to run from XINTF zone 7 and configure the XINTF memory interface on the F28335 eZdsp.

4.5 Executing the Examples From Flash

Most of the DSP2833x/2823x examples execute from SARAM in "boot to SARAM" mode. One example, *DSP2833x_examples\Flash* (or *DSP2823x_examples\Flash*), executes from flash memory in "boot to flash" mode. This example is the PWM timer interrupt example with the following changes made to execute out of flash:

1. **Change the linker command file to link the code to flash.**

   Remove 28335_RAM_lnk.cmd from the project and add one of the flash based linker files (ex: F28335.cmd, F28334.cmd, or F28332.cmd). These files are located in the *<base>DSP2833x_common\cmd\ directory*.

2. **Add the *DSP2833x_common\source\DSP2833x_CSMPasswords.asm* to the project.**

   This file contains the passwords that will be programmed into the Code Security Module (CSM) password locations. Leaving the passwords set to 0xFFFF during development is recommended as the device can easily be unlocked. For more information on the CSM refer to the appropriate *System Control and Interrupts Reference Guide*.

3. **Modify the source code to copy all functions that must be executed out of SARAM from their load address in flash to their run address in SARAM.**

   In particular, the flash wait state initialization routine must be executed out of SARAM. In the DSP2833x/2823x examples, functions that are to be executed from SARAM have been assigned to the ramfuncs section by compiler CODE_SECTION #pragma statements as shown in the example below.

```
/*********************************************************************
* DSP2833x_common\source\DSP2833x_SysCtrl.c
*********************************************************************/

#pragma CODE_SECTION(InitFlash, "ramfuncs");
```

   The ramfuncs section is then assigned to a load address in flash and a run address in SARAM by the memory linker command file as shown below:

```
/*********************************************************************
* DSP2833x_common\include\F28335.cmd
*********************************************************************/
SECTIONS
{
   ramfuncs    : LOAD = FLASHD,
                 RUN = RAML0,
                 LOAD_START(_RamfuncsLoadStart),
                 LOAD_END(_RamfuncsLoadEnd),
                 RUN_START(_RamfuncsRunStart),
                 PAGE = 0
}
```

The linker will assign symbols as specified above to specific addresses as follows:

Address	Symbol
Load start address	RamfuncsLoadStart
Load end address	RamfuncsLoadEnd
Run start address	RamfuncsRunStart

These symbols can then be used to copy the functions from the Flash to SARAM using the included example MemCopy routine or the C library standard memcopy() function.

To perform this copy from flash to SARAM using the included example MemCopy function:

a. Add the file *DSP2833x_common\source\DSP2833x_MemCopy.c* to the project.

b. Add the following function prototype to the example source code. This is done for you in the *DSP2833x_Examples.h* file.

```
/*************************************************************
* DSP2833x_common\include\DSP2833x_Examples.h
*************************************************************/

MemCopy(&RamfuncsLoadStart, &RamfuncsLoadEnd, &RamfuncsRunStart);
```

c. Add the following variable declaration to your source code to tell the compiler that these variables exist. The linker command file will assign the address of each of these variables as specified in the linker command file as shown in step 3. For the DSP2833x/2823x example code this has is already done in *DSP2833x_Examples.h*.

```
/*************************************************************
* DSP2833x_common\include\DSP2833x_GlobalPrototypes.h
*************************************************************/

extern Uint16 RamfuncsLoadStart;
extern Uint16 RamfuncsLoadEnd;
extern Uint16 RamfuncsRunStart;
```

d. Modify the code to call the example MemCopy function for each section that needs to be copied from flash to SARAM.

```
/*************************************************************
* DSP2833x_examples\Flash source file
*************************************************************/

MemCopy(&RamfuncsLoadStart, &RamfuncsLoadEnd, &RamfuncsRunStart);
```

4. Modify the code to call the flash initialization routine:

This function will initialize the wait states for the flash and enable the Flash Pipeline mode.

```
/*********************************************************************
* DSP2833x peripheral example .c file
*********************************************************************/

InitFlash();
```

5. Set the required jumpers for "boot to Flash" mode.

The required jumper settings for each boot mode are shown in Table 7.

Table 7. 2833x/2823x Boot Mode Settings

GPIO87 XA15 PU	GPIO86 XA14 PU	GPIO85 XA13 PU	GPIO84 XA12 PU	Mode
1	1	1	1	**Boot to flash 0x33FFF6**
1	1	1	0	Call SCI-A boot loader
1	1	0	1	Call SPI-A boot loader
1	1	0	0	Call I2C boot loader
1	0	1	1	Call eCAN-A boot loader
1	0	1	0	Call McBSP-A boot loader
1	0	0	1	Boot to XINTF x16 0x100000
1	0	0	0	Boot to XINTF x32 0x100000
0	1	1	1	Boot to OTP 0x380400
0	1	1	0	Call parallel GPIO boot loader
0	1	0	1	Call parallel XINTF boot loader
0	1	0	0	Boot to M0 SARAM 0x000000
0	0	1	1	Branch to check boot mode
0	0	1	0	Boot to flash, bypass ADC cal
0	0	0	1	Boot to SARAM, bypass ADC cal
0	0	0	0	Boot to SCI-A, bypass ADC cal

Refer to the documentation for your hardware platform for information on configuring the boot mode selection pins.

For more information on the '2833x/'2823x boot modes refer to the appropriate *Boot ROM Reference Guide*.

6. Program the device with the built code.

This can be done using SDFlash available from Spectrum Digital's website (www.spectrumdigital.com). In addition the C2000 on-chip Flash programmer plug-in for Code Composer Studio.

These tools will be updated to support new devices as they become available. Please check for updates.

7. **To debug, load the project in CCS, select *File->Load Symbols->Load Symbols Only*.**

   It is useful to load only symbol information when working in a debugging environment where the debugger cannot or need not load the object code, such as when the code is in ROM or flash. This operation loads the symbol information from the specified file.

4.6 Converting Floating-Point Compiled Examples to Fixed-Point and Vice Versa

This section applies to '2833x devices only.

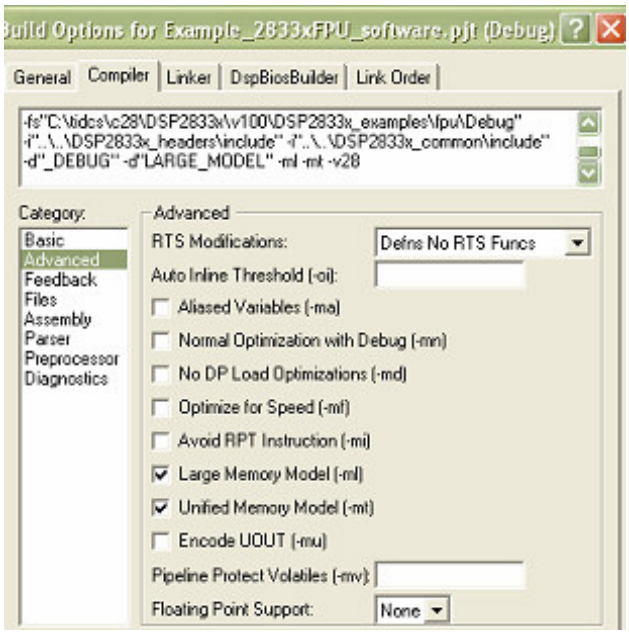
Because the '2833x is a floating-point device, all of the DSP2833x examples (unless otherwise denoted in the example description) are configured for floating-point. In some cases, it may be desirable to compile the code for fixed-point instead of floating-point. For instance, because Code Composer Studio V3.1 and prior versions of CCS only support fixed-point compiled projects, if the example project needs to be compiled and run on one of these CCS versions, it must be converted to fixed-point first.

To convert the examples so they compile for fixed-point, certain steps must be taken. The following steps are demonstrated on the example in *DSP2833x_examples\fpu*. The directory includes two projects with identical C-code— one compiled using fixed-point instructions and the other compiled using floating-point instructions.

1. **Configure the compiler build options for fixed-point instead of floating-point.**

   a. Go to Project->Build Options.

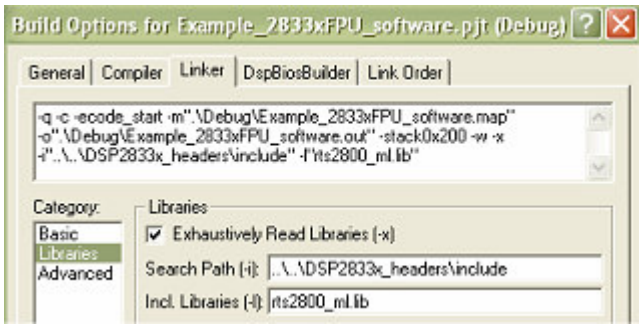
   b. In the Compiler tab window, click on the "Advanced" category and select "None" from the "Floating point support: " pull-down menu OR remove: `--float_support=fpu32` from the textbox at the top of the window.



2. **Use the fixed-point version of the rts2800.lib library instead of the floating-point version.**

   a. Click on the "Linker" tab at the top of the window.

   b. Click on the "Libraries" category and in the "Incl. Libraries" textbox, replace the floating-point version of the rts2800 library (`rts2800_fpu32.lib`) with the fixed-point large memory version: `rts2800_ml.lib` .



3. **Replace any floating-point compiled libraries included in the project with their fixed-point equivalents.**

   If your project is compiled for floating-point (fpu32 option), then any libraries included by your project must also be compiled for floating-point. Likewise, if your project is compiled for fixed-point, the included libraries must also be compiled for fixed-point.

   a. In the Project View window, click on the plus sign next to the "Libraries" folder to view the libraries.

   b. Right click on the floating-point compiled library and select "Remove from Project".

   c. Then right-click on the "Libraries" folder and select "Add Files to Project…"

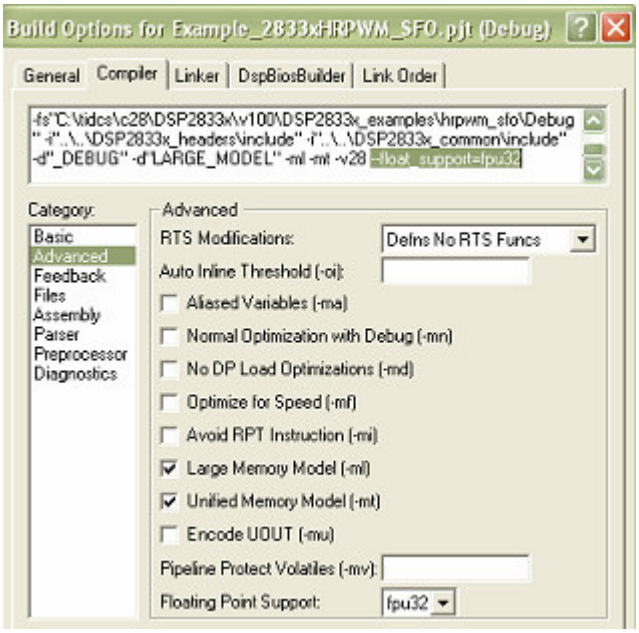
   d. In the *DSP2833x_common\lib* directory or in the directory where the fixed-point compiled version of your library is located, select the fixed-point version of the library to add it to your project.

After these 3 steps are performed, the floating-point example project has been converted to fixed-point and can be re-compiled and built for fixed-point. To convert a fixed-point example back into floating-point, the following steps must be taken:

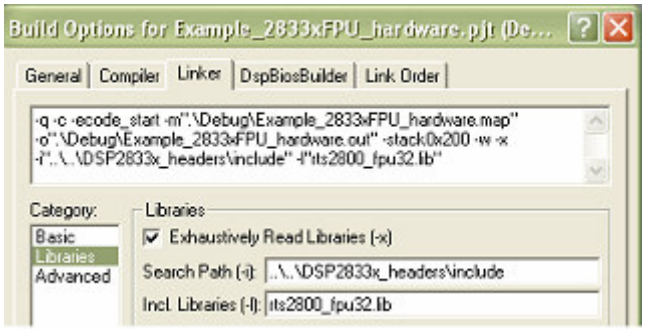
1. **Configure the compiler build options for floating-point instead of fixed-point.**

   a. Go to Project->Build Options.

   b. In the Compiler tab window, click on the "Advanced" category and select "fpu32" from the "Floating point support: " pull-down menu OR add: `-v28 --float_support=fpu32` to the textbox at the top of the window (The –v28 option may already be in the textbox).



2. **Use the floating-point version of the rts2800.lib library instead of the fixed-point version.**



   a. Click on the “Linker” tab at the top of the window.

   b. Click on the “Libraries” category and in the “Incl. Libraries” textbox, replace the fixed-point version of the rts2800 library (`rts2800_ml.lib or rts2800.lib`) with the floating-point version: `rts2800_fpu32.lib` .

3. **Replace any fixed-point compiled libraries included in the project with their floating-point equivalents.**

   a. In the Project View window, click on the plus sign next to the “Libraries” folder to view the libraries.

   b. Right click on the floating-point compiled version of the library and select “Remove from Project”.

   c. Then right-click on the “Libraries” folder and select “Add Files to Project…”

   d. In the *DSP2833x_common\lib* directory or in the directory where the floating-point compiled version of your library is located, select the fixed-point version of the library to add it to your project.

After these 3 steps are performed, the fixed-point example project has been converted to floating-point and can be re-compiled and built for floating-point.

5 Steps for Incorporating the Header Files and Sample Code

Follow these steps to incorporate the peripheral header files and sample code into your own projects. If you already have a project that uses the DSP280x or DSP281x header files then also refer to Section 7 for migration tips.

5.1 Before you begin

Before you include the header files and any sample code into your own project, it is recommended that you perform the following:

1. **Load and step through an example project.**

   Load and step through an example project to get familiar with the header files and sample code. This is described in Section 4.

2. **Create a copy of the source files you want to use.**

   DSP2833x_headers: code required to incorporate the header files into your project
   DSP2833x_common: shared source code much of which is used in the example projects.
   DSP2823x_examples: '2823x fixed-point compiled example projects that use the header files and shared code.
   DSP2833x_examples: '2833x floating-point compiled example projects that use the header files and shared code.

5.2 Including the DSP2833x Peripheral Header Files

Including the DSP2833x header files in your project will allow you to use the bit-field structure approach in your code to access the peripherals on the DSP. To incorporate the header files in a new or existing project, perform the following steps:

1. **#include "DSP2833x_Device.h" in your source files.**

   This include file will in-turn include all of the peripheral specific header files and required definitions to use the bit-field structure approach to access the peripherals.

```
/*************************************************************
* User's source file
*************************************************************/

#include "DSP2833x_Device.h"
```

2. **Edit DSP2833x_Device.h and select the target you are building for:**

   In the below example, the file is configured to build for the '28335/'28235 device.

```
/*-----------------------------------------------------------------
* DSP2833x_headers\include\DSP2833x_Device.h
-----------------------------------------------------------------*/
#define   TARGET        1
#define   DSP28_28335   TARGET    // Selects '28335/'28235
#define   DSP28_28334   0         // Selects '28334/'28234
#define   DSP28_28332   0         // Selects '28332/'28232… etc
```

   By default, the '28335/'28235 device is selected.

3. **Add the source file *DSP2833x_GlobalVariableDefs.c* to the project.**

   This file is found in the *DSP2833x_headers\source* directory and includes:

   – Declarations for the variables that are used to access the peripheral registers.

   – Data section #pragma assignments that are used by the linker to place the variables in the proper locations in memory.

4. **Add the appropriate DSP2833x header linker command file to the project.**

   As described in Section 3, when using the DSP2833x header file approach, the data sections of the peripheral register structures are assigned to the memory locations of the peripheral registers by the linker.

   To perform this memory allocation in your project, one of the following linker command files located in *DSP2833x_headers\cmd* must be included in your project:

   – For non-DSP/BIOS[†] projects: *DSP2833x_Headers_nonBIOS.cmd*

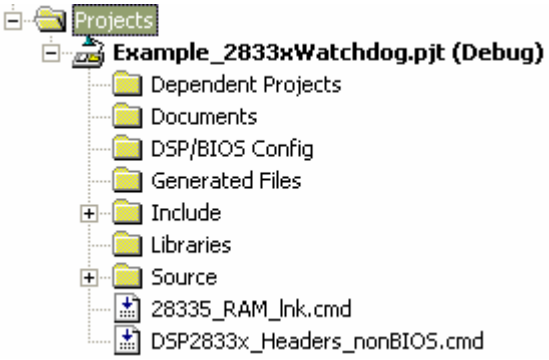
   – For DSP/BIOS projects: *DSP2833x_Headers_BIOS.cmd*

   The method for adding the header linker file to the project depends on the version of Code Composer Studio being used.

   Code Composer Studio V2.2 and later:

   As of CCS 2.2, more then one linker command file can be included in a project.

   Add the appropriate header linker command file (BIOS or nonBIOS) directly to the project.



   Code Composer Studio prior to V2.2

   Prior to CCS 2.2, each project contained only one main linker command file. This file can, however, call additional .cmd files as needed. To include the required memory allocations for the DSP2833x header files, perform the following two steps:

[†] DSP/BIOS is a trademark of Texas Instruments

1) Update the project's main linker command (.cmd) file to call one of the supplied DSP2833x peripheral structure linker command files using the -l option.

```
/*************************************************************************
* User's linker .cmd file
*************************************************************************/

/* Use this include file only for non-BIOS applications */
-l DSP2833x_Headers_nonBIOS.cmd
/* Use this include file only for BIOS applications */
/* -l DSP2833x_Headers_BIOS.cmd */
```

2) Add the directory path to the DSP2833x peripheral linker .cmd file to your project.

a. Open the menu: *Project->Build Options*

b. Select the *Linker tab* and then Select *Basic.*

c. In the *Library Search Path*, add the directory path to the location of the *DSP2833x_headers\cmd* directory on your system.

5. Add the directory path to the DSP2833x header files to your project.

To specify the directory where the header files are located:

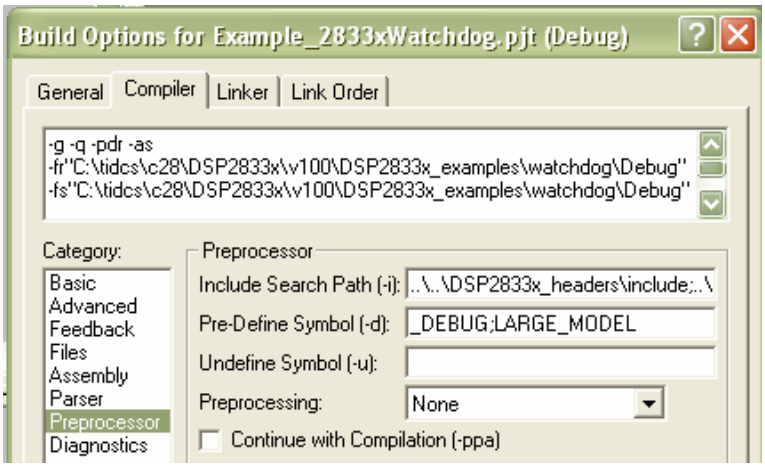
a. Open the menu:

Project->Build Options

b. Select the *Compiler tab*

c. Select *pre-processor*.

d. In the *Include Search Path*, add the directory path to the location of *DSP2833x_headers\include* on your system.



6. Additional suggested build options:

The following are additional compiler and linker options. The options can all be set via the *Project->Build Options* menu.

– ***Compiler Tab:***

❑ **-ml** **Select *Advanced* and check –ml**

Build for large memory model. This setting allows data sections to reside anywhere within the 4M-memory reach of the 28x devices.

❑ **-pdr** **Select *Diagnostics* and check –pdr**

Issue non-serious warnings. The compiler uses a warning to indicate code that is valid but questionable. In many cases, these warnings issued by enabling -pdr can alert you to code that may cause problems later on.

- ***Linker Tab:***

  - **-w Select *Advanced* and check –w**

    Warn about output sections. This option will alert you if any unassigned memory sections exist in your code. By default the linker will attempt to place any unassigned code or data section to an available memory location without alerting the user. This can cause problems, however, when the section is placed in an unexpected location.

  - **-e Select *Basic* and enter Code Entry Point –e**

    Defines a global symbol that specifies the primary entry point for the output module. For the DSP2833x/DSP2823x examples, this is the symbol “code_start”. This symbol is defined in the DSP2833x_common\source\DSP2833x_CodeStartBranch.asm file. When you load the code in Code Composer Studio, the debugger will set the PC to the address of this symbol. If you do not define a entry point using the –e option, then the linker will use _c_int00 by default.

5.3 Including Common Example Code

Including the common source code in your project will allow you to leverage code that is already written for the device. To incorporate the shared source code into a new or existing project, perform the following steps:

1. **#include "DSP2833x_Examples.h" in your source files.**

   This include file will include common definitions and declarations used by the example code.

```
/*************************************************************************
* User's source file
*************************************************************************/

#include "DSP2833x_Examples.h"
```

2. **Add the directory path to the example include files to your project.**

   To specify the directory where the header files are located:

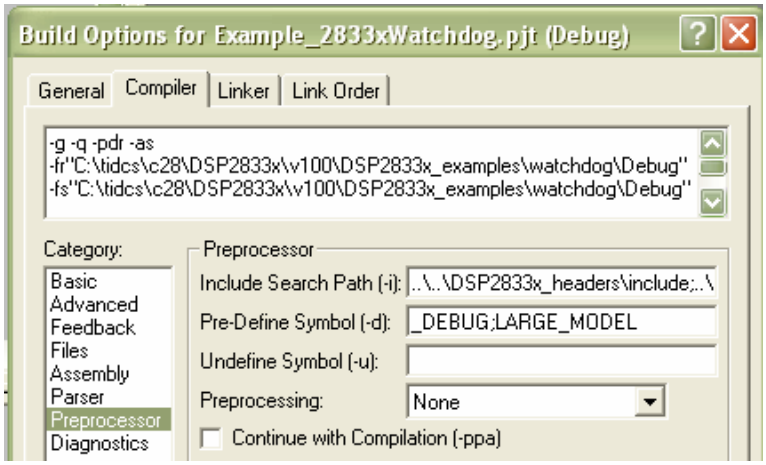
   a. Open the menu:

      Project->Build Options

   b. Select the *Compiler tab*

   c. Select *pre-processor*.

   d. In the *Include Search Path*, add the directory path to the location of DSP2833x_common/include on your system.
      Use a semicolon between directories.



   For example the directory path for the included projects is:
   ..\..\DSP2833x_headers\include;..\..\DSP2833x_common\include

3. **Add a linker command file to your project.**

   The following memory linker .cmd files are provided as examples in the *DSP2833x_common\cmd* directory. For getting started the basic *28335_eZdsp_RAM_lnk.cmd* file is suggested and used by most of the examples.

Table 8. Included Main Linker Command Files

Memory Linker Command File Examples	Location	Description
28335_RAM_lnk.cmd	DSP2833x_common\cmd	28335/28235 memory linker command file. Includes all of the internal SARAM blocks on a 28335/28235 device. “RAM” linker files do not include flash or OTP blocks.
28334_RAM_lnk.cmd	DSP2833x_common\cmd	28334/28234 SARAM memory linker command file.
28332_RAM_lnk.cmd	DSP2833x_common\cmd	28332/28232 SARAM memory linker command file.
F28335.cmd	DSP2833x_common\cmd	F28335/F28235 memory linker command file. Includes all Flash, OTP and CSM password protected memory locations.
F28334.cmd	DSP2833x_common\cmd	F28334/F28234 memory linker command file.
F28332.cmd	DSP2833x_common\cmd	F28332/F28232 memory linker command file.

4. Set the CPU Frequency

In the *DSP2833x_common\include\DSP2833x_Examples.h* file specify the proper CPU frequency. Some examples are included in the file.

```
/*-----------------------------------------------------------------
* DSP2833x_common\include\DSP2833x_Examples.h
-----------------------------------------------------------------*/
……
#define CPU_RATE    6.667L   // for a 150MHz CPU clock speed (SYSCLKOUT)
//#define CPU_RATE    7.143L   // for a 140MHz CPU clock speed (SYSCLKOUT)
//#define CPU_RATE    8.333L   // for a 120MHz CPU clock speed (SYSCLKOUT)
……
```

5. Add desired common source files to the project.

The common source files are found in the *DSP2833x_common\source* directory.

6. Include .c files for the PIE.

Since all catalog ‘2833x/’2823x applications make use of the PIE interrupt block, you will want to include the PIE support .c files to help with initializing the PIE. The shell ISR functions can be used directly or you can re-map your own function into the PIE vector table provided. A list of these files can be found in section 8.2.1.

6 Troubleshooting Tips & Frequently Asked Questions

- **In the examples, what do "EALLOW;" and "EDIS;" do?**

  EALLOW; is a macro defined in DSP2833x_Device.h for the assembly instruction EALLOW and likewise EDIS is a macro for the EDIS instruction. That is EALLOW; is the same as embedding the assembly instruction asm(" EALLOW");

  Several control registers on the 28x devices are protected from spurious CPU writes by the EALLOW protection mechanism. The EALLOW bit in status register 1 indicates if the protection is enabled or disabled. While protected, all CPU writes to the register are ignored and only CPU reads, JTAG reads and JTAG writes are allowed. If this bit has been set by execution of the EALLOW instruction, then the CPU is allowed to freely write to the protected registers. After modifying the registers, they can once again be protected by executing the EDIS assembly instruction to clear the EALLOW bit.

  For a complete list of protected registers, refer to *TMS320x2833x System Control and Interrupts Reference Guide* (SPRU712).

- **Peripheral registers read back 0x0000 and/or cannot be written to.**

  There are a few things to check:

  - Peripheral registers cannot be modified or unless the clock to the specific peripheral is enabled. The function InitPeripheralClocks() in the DSP2833x_common\source directory shows an example of enabling the peripheral clocks.
  - Some peripherals are not present on all 2833x family derivatives. Refer to the device datasheet for information on which peripherals are available.
  - The EALLOW bit protects some registers from spurious writes by the CPU. If your program seems unable to write to a register, then check to see if it is EALLOW protected. If it is, then enable access using the EALLOW assembly instruction. *TMS320x2833x System Control and Interrupts Reference Guide* (SPRUFB0) for a complete list of EALLOW protected registers.

- **Memory block L0, L1 read back all 0x0000.**

  In this case most likely the code security module is locked and thus the protected memory locations are reading back all 0x0000. Refer to the for information on the code security module.

- **Code cannot write to L0 or L1 memory blocks.**

  In this case most likely the code security module is locked and thus the protected memory locations are reading back all 0x0000. Code that is executing from outside of the protected cannot read or write to protected memory while the CSM is locked. Refer to the *TMS320x2833x Control and Interrupts Reference Guide* (SPRUFB0) for information on the code security module

- **A peripheral register reads back ok, but cannot be written to.**

  The EALLOW bit protects some registers from spurious writes by the CPU. If your program seems unable to write to a register, then check to see if it is EALLOW protected. If it is, then enable access using the EALLOW assembly instruction. *TMS320x2833x System Control and Interrupts Reference Guide* (SPRUFB0) for a complete list of EALLOW protected registers.

- **I re-built one of the projects to run from Flash and now it doesn't work. What could be wrong?**

  Make sure all initialized sections have been moved to flash such as .econst and .switch.

  If you are using SDFlash, make sure that all initialized sections, including .econst, are allocated to page 0 in the linker command file (.cmd). SDFlash will only program sections in the .out file that are allocated to page 0.

- **Why do the examples populate the PIE vector table and then re-assign some of the function pointers to other ISRs?**

  The examples share a common default ISR file. This file is used to populate the PIE vector table with pointers to default interrupt service routines. Any ISR used within the example is then remapped to a function within the same source file. This is done for the following reasons:

  – The entire PIE vector table is enabled, even if the ISR is not used within the example. This can be very useful for debug purposes.

  – The default ISR file is left un-modified for use with other examples or your own project as you see fit.

  – It illustrates how the PIE table can be updated at a later time.

- **When I build the examples, the linker outputs the following: warning: entry point other than _c_int00 specified. What does this mean?**

  This warning is given when a symbol other then _c_int00 is defined as the code entry point of the project. For these examples, the symbol code_start is the first code that is executed after exiting the boot ROM code and thus is defined as the entry point via the –e linker option. This symbol is defined in the DSP2833x_CodeStartBranch.asm file. The entry point symbol is used by the debugger and by the hex utility. When you load the code, CCS will set the PC to the entry point symbol. By default, this is the _c_int00 symbol which marks the start of the C initialization routine. For the DSP2833x examples, the code_start symbol is used instead. Refer to the source code for more information.

- **When I build many of the examples, the compiler outputs the following: remark: controlling expression is constant. What does this mean?**

  Some of the examples run forever until the user stops execution by using a while(1) {} loop The remark refers to the while loop using a constant and thus the loop will never be exited.

- **When I build some of the examples, the compiler outputs the following: warning: statement is unreachable. What does this mean?**

Some of the examples run forever until the user stops execution by using a while(1) {} loop. If there is code after this while(1) loop then it will never be reached.

- **I changed the build configuration of one of the projects from "Debug" to "Release" and now the project will not build. What could be wrong?**

  When you switch to a new build configuration (*Project->Configurations*) the compiler and linker options changed for the project. The user must enter other options such as include search path and the library search path. Open the build options menu *(Project->Build Options)* and enter the following information:

  – Compiler Tab, Preprocessor: Include search path

  – Linker Tab, Basic: Library search path

  – Linker Tab, Basic: Include libraries (ie rts2800_ml.lib)

  Refer to section 0 for more details.

- **In the flash example I loaded the symbols and ran to main. I then set a breakpoint but the breakpoint is never hit. What could be wrong?**

  In the Flash example, the InitFlash function and several of the ISR functions are copied out of flash into SARAM. When you set a breakpoint in one of these functions, Code Composer will insert an ESTOP0 instruction into the SARAM location. When the ESTOP0 instruction is hit, program execution is halted. CCS will then remove the ESTOP0 and replace it with the original opcode. In the case of the flash program, when one of these functions is copied from Flash into SARAM, the ESTOP0 instruction is overwritten code. This is why the breakpoint is never hit. To avoid this, set the breakpoint after the SARAM functions have been copied to SARAM.

- **The eCAN control registers require 32-bit write accesses.**

  The compiler will instead make a 16-bit write accesses if it can in order to improve codesize and/or performance. This can result in unpredictable results.

  One method to avoid this is to create a duplicate copy of the eCAN control registers in RAM. Use this copy as a shadow register. First copy the contents of the eCAN register you want to modify into the shadow register. Make the changes to the shadow register and then write the data back as a 32-bit value. This method is shown in the DSP2833x_examples\ ecan_back2back example project.

6.1 Effects of read-modify-write instructions.

When writing any code, whether it be C or assembly, keep in mind the effects of read-modify-write instructions.

The '28x DSP will write to registers or memory locations 16 or 32-bits at a time. Any instruction that seems to write to a single bit is actually reading the register, modifying the single bit, and then writing back the results. This is referred to as a read-modify-write instruction. For most registers this operation does not pose a problem. A notable exception is:

6.1.1 Registers with multiple flag bits in which writing a 1 clears that flag.

For example, consider the PIEACK register. Bits within this register are cleared when writing a 1 to that bit. If more then one bit is set, performing a read-modify-write on the register may clear more bits then intended.

The below solution is incorrect. It will write a 1 to any bit set and thus clear all of them:

```
/*************************************************************
* User's source file
*************************************************************/

     PieCtrl.PIEACK.bit.Ack1 = 1;     // INCORRECT! May clear more bits.
```

The correct solution is to write a mask value to the register in which only the intended bit will have a 1 written to it:

```
/*************************************************************
* User's source file
*************************************************************/

     #define PIEACK_GROUP1  0x0001
            ……
      PieCtrl.PIEACK.all = PIEACK_GROUP1;    // CORRECT!
```

6.1.2 Registers with Volatile Bits.

Some registers have volatile bits that can be set by external hardware.

Consider the PIEIFRx registers. An atomic read-modify-write instruction will read the 16-bit register, modify the value and then write it back. During the modify portion of the operation a bit in the PIEIFRx register could change due to an external hardware event and thus the value may get corrupted during the write.

The rule for registers of this nature is to never modify them during runtime. Let the CPU take the interrupt and clear the IFR flag.

7 Migration Tips for moving from the TMS320x280x or TMS320x281x header files to the TMS320x2833x/TMS320x2823x header files

This section includes suggestions for moving a project from the 280x or 281x header files to the 2833x header files.

1. **Create a copy of your project to work with or back-up your current project.**
2. **Open the project (.pjt) file in a text editor**

   Replace DSP280x or DSP281x with DSP2833x/DSP2823x so that the appropriate source files are used. Check the path names to make sure they point to the appropriate header file and source code directories.

3. **Load the project into Code Composer Studio**

   Use the Edit-> find in files dialog to find instances of DSP280x_Device.h and DSP280x_Example.h for 280x header files, or DSP281x_Device.h and DSP281x_Example.h for 281x header files. Replace these with DSP2833x_Device.h and DSP2833x_Example.h respectively.

4. **Make sure you are using the correct linker command files (.cmd) appropriate for your device and for the DSP2833x header files.**

   You will have one file for the memory definitions and one file for the header file structure definitions. Using a 280x or 281x memory file can cause issues since the H0 memory block has been split, renamed, and/or moved on the 2833x/2823x devices.

5. **Build the project.**

   The compiler will highlight areas that have changed. If migrating from the TMS320x280x header files, code should be mostly compatible after all instances of DSP280x are replaced with DSP2833x in all relevant files, and the above steps are taken. Additionally, several bits have been removed and/or replaced. See Table 9.

Table 9. Summary of Register and Bit-Name Changes from DSP280x V1.41 to DSP2833x V1.01

Peripheral	Register	Bit Name		Comment
		Old	New	
SysCtrlRegs				
	XCLK			Register removed because XCLKOUT is controlled by XINTF now.
	PLLSTS	CLKINDIV(bit 1)	DIVSEL (bits 8,7)	DIVSEL allows more values by which CLKIN can be divided.

If migrating from the TMS320x281x header files, most of these changes will fall into one of the following categories:

- Bit-name or register name corrections to align with the peripheral user guides. See Table 10 for a listing of these changes.
- Code that was written for the 281x event manager (EV) will need to be re-written for the 2833x/2823x ePWM, eCAP and eQEP peripherals.
- Code for the 281x McBSP will need to be modified for the 2833x/2823x version of the peripheral (FIFO replaced with DMA).

Code for the 281x XINTF will need to be modified for the 2833x/2823x version of the peripheral in the following ways:

- The .cmd linker file will need to be updated because zone memory locations have changed and the 2833x/2823x only has Zones 0, 6, and 7.
- Because both the boot ROM and the XINTF zones are always memory-mapped on the 2833x, there is no longer any need for the MPNMC bit in the XINTCNF2 registers. Therefore, the MPNMC bit on the 281x is now reserved on the 2833x/2823x. See Table 10.
- On the 281x, the clock to the XINTF was always enabled. On the 2833x/2823x, code must be added which will enable/disable the clock to the XINTF module in the PCLKCR3 system control register.
- Because the XINTF pins on the 2833x/2823x are now MUX'd with GPIO pins at reset, code migrating from the 281x to the 2833x/2823x will need to modify the XINTF initialization to enable the GPIO pins for XINTF mode.
- There is now an XRESET register on the 2833x/2823x which was not available on the 281x.

Table 10. Summary of Register and Bit-Name Changes from DSP281x V1.00 to DSP2833x V1.01

Peripheral	Register	Bit Name		Comment
		Old	New	
AdcRegs				
	ADCTRL2	EVB_SOC_ SEQ2	EPWM_SOCB_ SEQ2	SOC is now performed by ePWM
		EVA_SOC_ SEQ1	EPWM_SOCA_ SEQ1	SOC is now performed by ePWM
		EVB_SOC_ SEQ	EPWM_SOCB_ SEQ	SOC is now performed by ePWM
DevEmuRegs				
	DEVICEID		PARTID REVID	Split into two registers, PARTID and REVID
EcanaRegs				
	CANMDL	BYTE1	BYTE3	Order of bytes was incorrect
		BYTE3	BYTE1	
		BYTE4	BYTE0	
	CANMDH	BYTE5	BYTE7	Order of bytes was incorrect
		BYTE7	BYTE5	
		BYTE8	BYTE4	
GpioMuxRegs				
				The GPIO peripheral has been redesigned from the 281x. All of the registers have moved from 16-bit to 32-bits. The GpioMuxRegs are now the GpioCtrlRegs and the bit definitions have all changed. Please refer to *TMS320x2833x Control and Interrupts Reference Guide* for more information on the GPIO peripheral.
PieCtrlRegs				
	PIECTRL	PIECRTL	PIECTRL	Typo
SciaRegs, ScibRegs				
	SCIFFTX	TXFFILIL	TXFFIL	Typo
		TXINTCLR	TXFFINTCLR	Alignment with user's guide.
	SCIFFRX	RXFIFST	RXFFST	Typo – Also corrected in user's guide
McbspaRegs				
	MFFTX			The McBSP FIFO on the 281x has been removed and replaced by the DMA. Therefore these FIFO registers do not exist on the 2833x. Please refer to the *TMS320x2833x McBSP Reference Guide* for more information on the McBSP peripheral.
	MFFRX			
	MFFCT			
XintfRegs				
	XINTCNF2	MPNMC	Rsvd2	The MPNMC bit does not exist on the 2833x
	XTIMING1			There is no Zone 1 on the 2833x
	XTIMING2			There is no Zone 2 on the 2833x

8 Packet Contents:

This section lists all of the files included in the release.

8.1 Header File Support – DSP2833x_headers

The DSP2833x header files are located in the *<base>\DSP2833x_headers* directory.

8.1.1 DSP2833x Header Files – Main Files

The following files must be added to any project that uses the DSP2833x header files. Refer to section 5.2 for information on incorporating the header files into a new or existing project.

Table 11. DSP2833x Header Files – Main Files

File	Location	Description
DSP2833x_Device.h	DSP2833x_headers\include	Main include file. Include this one file in any of your .c source files. This file in-turn includes all of the peripheral specific .h files listed below. In addition the file includes typedef statements and commonly used mask values. Refer to section 5.2.
DSP2833x_GlobalVariableDefs.c	DSP2833x_headers\source	Defines the variables that are used to access the peripheral structures and data section #pragma assignment statements. This file must be included in any project that uses the header files. Refer to section 5.2.
DSP2833x_Headers_BIOS.cmd	DSP2833x_headers\cmd	Linker .cmd file to assign the header file variables in a BIOS project. This file must be included in any BIOS project that uses the header files. Refer to section 5.2.
DSP2833x_Headers_nonBIOS.cmd	DSP2833x_headers\cmd	Linker .cmd file to assign the header file variables in a non-BIOS project. This file must be included in any non-BIOS project that uses the header files. Refer to section 5.2.

8.1.2 DSP2833x Header Files – Peripheral Bit-Field and Register Structure Definition Files

The following files define the bit-fields and register structures for each of the peripherals on the 2833x devices. These files are automatically included in the project by including *DSP2833x_Device.h.* Refer to section 4.2 for more information on incorporating the header files into a new or existing project.

Table 12. DSP2833x Header File Bit-Field & Register Structure Definition Files

File	Location	Description
DSP2833x_Adc.h	DSP2833x_headers\include	ADC register structure and bit-field definitions.
DSP2833x_CpuTimers.h	DSP2833x_headers\include	CPU-Timer register structure and bit-field definitions.
DSP2833x_DevEmu.h	DSP2833x_headers\include	Emulation register definitions
DSP2833x_DMA.h	DSP2833x_headers\include	DMA register structures and bit-field definitions.
DSP2833x_ECan.h	DSP2833x_headers\include	eCAN register structures and bit-field definitions.
DSP2833x_ECap.h	DSP2833x_headers\include	eCAP register structures and bit-field definitions.
DSP2833x_EPwm.h	DSP2833x_headers\include	ePWM register structures and bit-field definitions.
DSP2833x_EQep.h	DSP2833x_headers\include	eQEP register structures and bit-field definitions.
DSP2833x_Gpio.h	DSP2833x_headers\include	General Purpose I/O (GPIO) register structures and bit-field definitions.
DSP2833x_I2c.h	DSP2833x_headers\include	I2C register structure and bit-field definitions.
DSP2833x_Mcbsp.h	DSP2833x_headers\include	McBSP register structure and bit-field definitions.
DSP2833x_PieCtrl.h	DSP2833x_headers\include	PIE control register structure and bit-field definitions.
DSP2833x_PieVect.h	DSP2833x_headers\include	Structure definition for the entire PIE vector table.
DSP2833x_Sci.h	DSP2833x_headers\include	SCI register structure and bit-field definitions.
DSP2833x_Spi.h	DSP2833x_headers\include	SPI register structure and bit-field definitions.
DSP2833x_SysCtrl.h	DSP2833x_headers\include	System register definitions. Includes Watchdog, PLL, CSM, Flash/OTP, Clock registers.
DSP2833x_Xintf.h	DSP2833x_headers\include	XINTF register structure and bit-field definitions.
DSP2833x_XIntrupt.h	DSP2833x_headers\include	External interrupt register structure and bit-field definitions.

8.1.3 Code Composer .gel Files

The following Code Composer Studio .gel files are included for use with the DSP2833x Header File peripheral register structures.

Table 13. DSP2833x Included GEL Files

File	Location	Description
DSP2833x_Peripheral.gel	DSP2833x_headers\gel	Provides GEL pull-down menus to load the DSP2833x data structures into the watch window. You may want to have CCS load this file automatically by adding a GEL_LoadGel("<base>DSP2833x_headers\/gel\DSP2833x_peripheral.gel") function to the standard F28335.gel that was included with CCS.

8.1.4 Variable Names and Data Sections

This section is a summary of the variable names and data sections allocated by the DSP2833x_headers\source\DSP2833x_GlobalVariableDefs.c file. Note that all peripherals may not be available on a particular 2833x device. Refer to the device datasheet for the peripheral mix available on each 2833x family derivative.

Table 14. DSP2833x Variable Names and Data Sections

Peripheral	Starting Address	Structure Variable Name
ADC	0x007100	AdcRegs
ADC Mirrored Result Registers	0x000B00	AdcMirror
ADC Calibration Value Locations	0x380083	AdcCalVal
Code Security Module	0x000AE0	CsmRegs
Code Security Module Password Locations	0x33FFF8-0x33FFFF	CsmPwl
CPU Timer 0	0x000C00	CpuTimer0Regs
Device and Emulation Registers	0x000880	DevEmuRegs
DMA Registers	0x001000	DmaRegs
eCAN-A	0x006000	ECanaRegs
eCAN-A Mail Boxes	0x006100	ECanaMboxes
eCAN-A Local Acceptance Masks	0x006040	ECanaLAMRegs
eCAN-A Message Object Time Stamps	0x006080	ECanaMOTSRegs
eCAN-A Message Object Time-Out	0x0060C0	ECanaMOTORegs
eCAN-B	0x006200	ECanbRegs
eCAN-B Mail Boxes	0x006300	ECanbMboxes
eCAN-B Local Acceptance Masks	0x006240	ECanbLAMRegs
eCAN-B Message Object Time Stamps	0x006280	ECanbMOTSRegs
eCAN-B Message Object Time-Out	0x0062C0	ECanbMOTORegs
ePWM1	0x006800	EPwm1Regs
ePWM2	0x006840	EPwm2Regs
ePWM3	0x006880	EPwm3Regs

Peripheral	Starting Address	Structure Variable Name
ePWM4	0x0068C0	EPwm4Regs
ePWM5	0x006900	EPwm5Regs
ePWM6	0x006940	EPwm6Regs
eCAP1	0x006A00	ECap1Regs
eCAP2	0x006A20	ECap2Regs
eCAP3	0x006A40	ECap3Regs
eCAP4	0x006A60	ECap4Regs
eCAP5	0x006A80	ECap5Regs
eCAP6	0x006AA0	ECap6Regs
eQEP1	0x006B00	EQep1Regs
eQEP2	0x006B40	EQep2Regs
External Interrupt Registers	0x007070,	XIntruptRegs
Flash & OTP Configuration Registers	0x000A80	FlashRegs
General Purpose I/O Data Registers	0x006fC0	GpioDataRegs
General Purpose Control Registers	0x006F80	GpioCtrlRegs
General Purpose Interrupt Registers	0x006fE0	GpioIntRegs
I2C	0x007900	I2caRegs
McBSP-A	0x005000	McbspaRegs
McBSP-B	0x005040	McbspbRegs
PIE Control	0x000CE0	PieCtrlRegs
SCI-A	0x007050	SciaRegs
SCI-B	0x007750	ScibRegs
SCI-C	0x007770	ScicRegs
SPI-A	0x007040	SpiaRegs
XINTF	0x000B20	XintfRegs

8.2 Common Example Code – DSP2833x_common

8.2.1 Peripheral Interrupt Expansion (PIE) Block Support

In addition to the register definitions defined in DSP2833x_PieCtrl.h, this packet provides the basic ISR structure for the PIE block. These files are:

Table 15. Basic PIE Block Specific Support Files

File	Location	Description
DSP2833x_DefaultIsr.c	DSP2833x_common\source	Shell interrupt service routines (ISRs) for the entire PIE vector table. You can choose to populate one of functions or re-map your own ISR to the PIE vector table. **Note: This file is not used for DSP/BIOS projects.**
DSP2833x_DefaultIsr.h	DSP2833x_common\include	Function prototype statements for the ISRs in DSP2833x_DefaultIsr.c. **Note: This file is not used for DSP/BIOS projects.**
DSP2833x_PieVect.c	DSP2833x_common\source	Creates an instance of the PIE vector table structure initialized with pointers to the ISR functions in DSP2833x_DefaultIsr.c. This instance can be copied to the PIE vector table in order to initialize it with the default ISR locations.

In addition, the following files are included for software prioritization of interrupts. These files are used in place of those above when additional software prioritization of the interrupts is required. Refer to the example and documentation in *DSP2833x_examples\sw_prioritized_interrupts* for more information.

Table 16. Software Prioritized Interrupt PIE Block Specific Support Files

File	Location	Description
DSP2833x_SWPrioritizedDefaultIsr.c	DSP2833x_common\source	Default shell interrupt service routines (ISRs). These are shell ISRs for all of the PIE interrupts. You can choose to populate one of functions or re-map your own interrupt service routine to the PIE vector table. **Note: This file is not used for DSP/BIOS projects.**
DSP2833x_SWPrioritizedIsrLevels.h	DSP2833x_common\include	Function prototype statements for the ISRs in DSP2833x_DefaultIsr.c. **Note: This file is not used for DSP/BIOS projects.**
DSP2833x_SWPrioritizedPieVect.c	DSP2833x_common\source	Creates an instance of the PIE vector table structure initialized with pointers to the default ISR functions that are included in DSP2833x_DefaultIsr.c. This instance can be copied to the PIE vector table in order to initialize it with the default ISR locations.

8.2.2 Peripheral Specific Files

Several peripheral specific initialization routines and support functions are included in the peripheral .c source files in the *DSP2833x_common\src* directory. These files include:

Table 17. Included Peripheral Specific Files

File	Description
DSP2833x_GlobalPrototypes.h	Function prototypes for the peripheral specific functions included in these files.
DSP2833x_Adc.c	ADC specific functions and macros.
DSP2833x_CpuTimers.c	CPU-Timer specific functions and macros.
DSP2833x_DMA.c	DMA specific functions and macros.
DSP2833x_Dma_defines.h	#define macros that are used for the DMA examples.
DSP2833x_ECan.c	Enhanced CAN specific functions and macros.
DSP2833x_ECap.c	eCAP module specific functions and macros.
DSP2833x_EPwm.c	ePWM module specific functions and macros.
DSP2833x_EPwm_defines.h	#define macros that are used for the ePWM examples
DSP2833x_EQep.c	eQEP module specific functions and macros.
DSP2833x_Gpio.c	General-purpose IO (GPIO) specific functions and macros.
DSP2833x_I2C.c	I2C specific functions and macros.
DSP2833x_I2c_defines.h	#define macros that are used for the I2C examples
DSP2833x_Mcbsp.c	McBSP specific functions and macros.
DSP2833x_PieCtrl.c	PIE control specific functions and macros.
DSP2833x_Sci.c	SCI specific functions and macros.
DSP2833x_Spi.c	SPI specific functions and macros.
DSP2833x_SysCtrl.c	System control (watchdog, clock, PLL etc) specific functions and macros.
DSP2833x_Xintf.c	XINTF specific functions and macros.

Note: The specific routines are under development and may not all be available as of this release. They will be added and distributed as more examples are developed.

8.2.3 Utility Function Source Files

Table 18. Included Utility Function Source Files

File	Description
DSP2833x_ADC_cal.asm	Includes the ADC_cal function, which is pre-programmed into reserved TI OTP. This function, which copies device-specific calibration data into the ADCREFSEL and ADCOFFTRIM registers, is normally called in the boot ROM. When debugging though, if the boot ROM is bypassed, it is necessary to call this function after enabling the clocks to the ADC in order to use the ADC module.
DSP2833x_CodeStartBranch.asm	Branch to the start of code execution. This is used to re-direct code execution when booting to Flash, OTP or M0 SARAM memory. An option to disable the watchdog before the C init routine is included.
DSP2833x_DBGIER.asm	Assembly function to manipulate the DEBIER register from C.
DSP2833x_DisInt.asm	Disable interrupt and restore interrupt functions. These functions allow you to disable INTM and DBGM and then later restore their state.
DSP2833x_usDelay.asm	Assembly function to insert a delay time in microseconds. This function is cycle dependant and must be executed from zero wait-stated RAM to be accurate. Refer to *DSP2833x_examples\adc* for an example of its use.
DSP2833x_CSMPasswords.asm	Include in a project to program the code security module passwords and reserved locations.

8.2.4 Example Linker .cmd files

Example memory linker command files are located in the *DSP2833x_common\cmd* directory. For getting started the basic 28335_eZdsp_RAM_lnk.cmd file is suggested and used by many of the included examples.

The SARAM blocks L0, L1, L2, and L3 are mirrored on these devices. For simplicity these memory maps only include one instance of these memory blocks.

Table 19. Included Main Linker Command Files

Memory Linker Command File Examples	Location	Description
28335_RAM_lnk.cmd	DSP2833x_common\cmd	28335/28235 memory linker command file. Includes all of the internal SARAM blocks on a 28335/28235 device. “RAM” linker files do not include flash or OTP
28334_RAM_lnk.cmd	DSP2833x_common\cmd	28334/28234 SARAM memory linker command file.
28332_RAM_lnk.cmd	DSP2833x_common\cmd	28332/28232 SARAM memory linker command file.
F28335.cmd	DSP2833x_common\cmd	F28335/F28235 memory linker command file. Includes all Flash, OTP and CSM password protected memory locations.
F28334.cmd	DSP2833x_common\cmd	F28334/F28234 memory linker command file.
F28332.cmd	DSP2833x_common\cmd	F28332/ F28232 memory linker command file.

8.2.5 Example Library .lib Files

Example library files are located in the *DSP2833x_common\lib* directory. For this release the IQMath library is included for use in the example projects. Please refer to the *C28x IQMath Library - A Virtual Floating Point Engine (*SPRC087) for more information on IQMath and the most recent IQMath library. The SFO libraries are also included for use in the example projects. Please refer to *TMS320x28xx, 28xxx HRPWM Reference Guide* (SPRU924) for more information on SFO library usage and the HRPWM module.

Table 20. Included Library Files

Main Liner Command File Examples	Description
IQmath.lib	Please refer to the *C28x IQMath Library - A Virtual Floating Point Engine (*SPRC087) for more information on IQMath. This is a fixed-point compiled library.
IQmathLib.h	IQMath header file.
SFO_TI_Build.lib	Please refer to the *TMS320x28xx, 28xxx HRPWM Reference Guide* (SPRU924) for more information on the SFO library
SFO_TI_Build_fpu.lib	The floating-point equivalent of SFO_TI_Build.lib. See Section 4.6 for information about including fixed and floating point libraries.
SFO.h	SFO header file
SFO_TI_Build_V5.lib/ SFO_TI_Build_V5B.lib	Please refer to the *TMS320x28xx,28xxx HRPWM Reference Guide* (SPRU924) for more information on the SFO V5 library. Updated versions will be marked with alphabetical characters after “V5” (i.e. SFO_TI_Build_V5B.lib)
SFO_TI_Build_V5_fpu.lib/ SFO_TI_Build_V5B_fpu.lib	The floating-point equivalent of SFO_TI_Build_V5.lib. See Section 4.6 for information about including fixed and floating point libraries. Updated versions will be marked with alphabetical characters after “V5” (i.e. SFO_TI_Build_V5B.lib)
SFO_V5.h	SFO V5 header file

9 Detailed Revision History:

Changes from V1.03 to V1.10

Changes to Header Files:

a) **DSP2833x_Peripheral.gel–** Collapsed eCAN register submenus into one submenu each for eCAN-A and eCAN-B to reduce GEL submenu size (reaching Code Composer Studio limit)

b) **DSP2833x_Device.h-** added types for int64 and Uint64.

c) **DSP2833x_Headers_BIOS.cmd** and **DSP2833x_Headers_nonBIOS.cmd –** Fixed comments – “DMA Rev. 0” changed to “DMA”.

Changes to Common Files:

d) **DSP2833x_SWPrioritizedDefaultIsr.c** and **DSP2833x_DefaultIsr.c –** Removed references to EMPTY_ISR(). The function is not used in any other file in header file directory structure.

e) **f28335.gel, f28334.gel,** and **f28332.gel –** Collapsed several GEL submenus, removed code which adds FPU registers to watch window upon connect, modified important messages to appear only once upon file preload, and configured gel to display an error message only when ADC not properly calibrated.

Changes to Example Files:

f) **DSP2823x_examples -** Added DSP2823x_examples folder with all of the same examples as DSP2833x_examples (minus fpu) compiled with fixed-point code instead of floating-point code because DSP2823x devices do not have an FPU.

g) **Example2833x_SWPrioritizedDefaultIsr.c –** Removed reference to EMPTY_ISR(). The function is not used in any other file in header file directory structure.

Changes from V1.02 to V1.03

Changes to Header Files:

a) **DSP2833x_Headers_Bios.cmd –** Added sections for ECAP5/ECAP6 and removed SECTIONS definition for PIE_VECT.

b) **DSP2833x_Gpio.h –** Added missing QUALPRD1 field to GPBCTRL_BITS.

Changes to Common Files:

c) **DSP2833x_SWPrioritizedDefaultIsr.c –** Fixed some PIEIER number typos.

d) **SFO_TI_Build_V5B.lib** and **SFO_TI_Build_V5Bfpu.lib –** Because the SFO_MepEn() function in the original version of the SFO library was restricted to MEP control on falling edge only with HRLOAD on CTR=ZRO, a new version of the V5 library, V5B, was added, which includes a SFO_MepEn() function that supports *all* available HRPWM configurations – falling and rising edge as well as HRLOAD on CTR=ZRO and CTR=PRD.

Changes to Example Files:

e) **Example_2833xECanBack2Back.c–** Removed initialization code and replaced with InitECana() function from DSP2833x_ECan.c file.

f) **Example_2833xHRPWM.c –** Modified configuration such that duty cycle really starts at 50% (was off by 1 count) and fixed some minor typos.

Changes from V1.01 to V1.02

Changes to Header Files:

a) **DSP2833x_Spi.h –** Removed extern references to SPI-B to SPI-D (legacy from DSP280x)

Changes to Common Files:

b) **DSP2833x_Mcbsp.c –** Removed GPAQSEL bit field updates to output-only MDXA and MDXB GPIO pin configurations. Also set #define CLKGDV_VAL to default value of 1.

c) **F28335.gel, F28334.gel, and F28332.gel** – Added ADC_Cal() function called in OnRestart(), OnReset(), and OnFileLoaded(), and XINTF_enable() function called in OnPreFileLoaded().

Changes to Example Files:

d) **Xintf Examples** – In init_zone7() function, added EALLOW and EDIS because XINTF registers are now EALLOW-protected.

Changes from V1.00 to V1.01

Changes to Header Files:

a) **DSP2833x_Peripheral.gel** – Corrected location of External Interrupt registers.

b) **DSP2833x_SysCtrl.h** – Previously, Flash and OTP waitstates (PAGEWAIT, RANDWAIT, and OTPWAIT) were configured for 100 MHz SYSCLKOUT. Hooks for 150 MHz SYSCLKOUT have been added to configure them for 150 MHz SYSCLKOUT as well.

c) **DSP2833x_Mcbsp.h** – Removed MFFST register. It no longer applies to 2833x McBSP.

Changes to Common Files:

d) **DSP2833x_DefaultIsr.h** – Was previously incorrectly named DSP2833x_DefaultISR.h. Naming has been fixed.

a) **DSP2833x_Mcbsp.c** – Removed references to MFFST register.

Changes to Example Files:

b) **Example_2833xCpuTimer.c** – Added hooks to switch between 150MHz SYSCLKOUT and 100MHz SYSCLKOUT when generating a 1 second timer interrupt.

c) **Example_2833xMcBSP_DLB_DMA.c, Example_2833xMcBSP_DLB_int.c** – Removed references to MFFST register.

d) **Example_2833xFlash.c** – Changed toggling GPIO pin from GPIO34 to GPIO32 (GPIO32 corresponds to LED on 2833x eZdsp)

e) **Example_2833xLEDBlink.c** – Created new example in timed_led_blink/ example directory which toggles GPIO32 to turn the eZdsp on and off at a 1 Hz rate.

V1.00

- This version is the first customer release of the DSP2833x header files and examples.