C2000Ware Systems Solution Porting Guide

C2000 System Software

TEXAS INSTRUMENTS

Outline

- Software Stack
- Projectspec and its properties
- Device Specific Updates
  - ADC, CMPSS configuration
  - Device settings and pin mapping
- Compile Check and Update

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Software Stack

- **solution.c/h files**
  - Commonly referred to as the solution file
    - Contains solution specific code, algorithms, etc.
- **solution_hal.c/h files**
  - Commonly called board files contain peripheral driver configuration for the system (i.e. ADC, SDFM, PWM, etc.)
  - Note: Most of the device related changes will be made in the board drivers
- **main.c / main.cla file**
  - Contains main function of the C project and also the CLA tasks. This file consists of the ISR framework and calls routines in other files.
- **solution-settings.h file**
  - A powerSUITE generated file which consists of all the power stage parameters required for the solution to work
  - The main, solution and board files reference the settings configured in this file.

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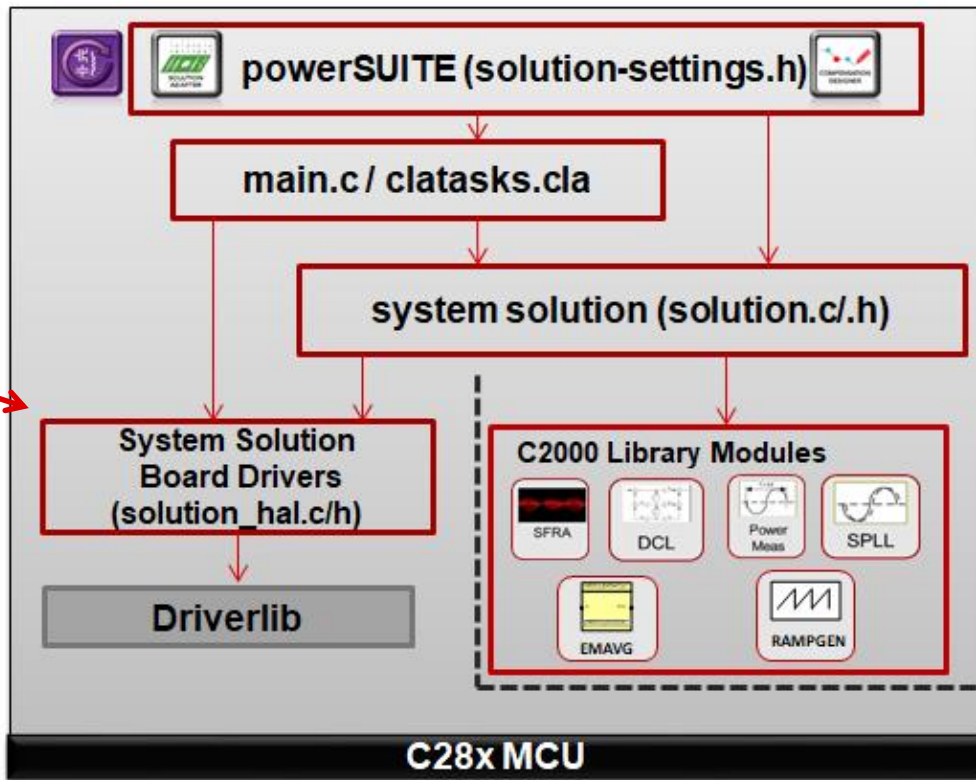
Project Properties

- Projectspec updates
  - Device part # and name, target config., linker command, and codestartbranch.asm
    - Ensure paths to various device specific files can be resolved or project will fail to import
  - Compiler build options
    - CLA,VCU Types for each device
      - E.g. VCU Type 2 (vcu2) and CLA Type 1 (cla1) for F2837x
    - CLA differences
      - E.g. Remove references to CLA background task
        » Not supported on F2837xD devices
        » Update clatask.cla file to remove background task
  - Linker build options
    - Update device specific library links
      - E.g. F28004x_CLADATROM_Symbols_Fpu32.lib
  - Find and replace all path and file references to for the selected device
    - Driverlib references
      - Update references/files driverlib.h, device.c, device.h

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```
<project
        name="dab_F28004x"
        device="TMS320F280049C"
        cgtVersion="18.12.3.LTS"
        launchWizard="False"
        linkerCommandFile=""
        >
    <configuration name="RELEASE" compilerBuildOptions="--opt_level=3 --opt_for_speed=5
                    -I${PROJECT_ROOT}/device
                    -I${PROJECT_ROOT}/libraries/CLAmath
                    -I${PROJECT_ROOT}/libraries/sfra
                    -I${PROJECT_ROOT}/libraries/utilities
                    -I${PROJECT_ROOT}/device/driverlib
                    -I${PROJECT_ROOT}/libraries/DCL
                    -I${PROJECT_ROOT}/libraries/SFO
                    --define=_DEBUG --define=CLA_DEBUG=1 --define=F28x_DEVICE --define=CPU1 --define=LARGE_MODEL
                    --define=_FLASH
                    -ml -mt -v28
                    --float_support=fpu32 --cla_support=cla2 --vcu_support=vcu0 --tmu_support=tmu0 --fp_mode=relaxed
                    --cla_background_task=on
                    --diag_warning=225 --quiet --diag_suppress=10063 --diag_suppress=173 --display_error_number
                    -g -k --asm_listing"
                    linkerBuildOptions="--stack_size=0x400
                                --heap_size=0x200
                                --define RAM
                                -i${PROJECT_ROOT}/libraries/sfra
                                -i${PROJECT_ROOT}/libraries/CLAmath
                                -i${PROJECT_ROOT}/libraries/FPUfastRTS
                                -i${PROJECT_ROOT}/device/driverlib/ccs/Release
                                -i${PROJECT_ROOT}/libraries/SFO
                                -l driverlib_coff.lib
                                -l sfra_f32_tmu_coff.lib
                                -l F28004x_CLADATROM_Symbols_fpu32.lib
                                -l cla1_math_library_datarom_fpu32.lib
                                -l rts2800_fpu32_fast_supplement_coff.lib
                                -l rts2800_fpu32.lib
                                -l SFO_v8_fpu_lib_build_c28_driverlib_coff.lib" />
```

Yellow = device specific file references/settings
Red = device specific peripheral types

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```xml
<file action="copy" path="../dab/device/driverlib.h" targetDirectory="device" />
<file action="copy" path="../dab/device/device.h" targetDirectory="device" />
<file action="copy" path="../dab/device/device.c" targetDirectory="device" />
<file action="copy" path="../../../../c2000ware/device_support/f28004x/common/source/f28004x_codestartbranch.asm"
                targetDirectory="device" applicableConfigurations="RELEASE" />
<file action="copy" path="../../../../c2000ware/device_support/f28004x/common/targetConfigs/TMS320F280049C.ccxml"
                targetDirectory="targetConfigs" />
<file action="copy" path="../cmd/f28004x_flash_lnk.cmd" targetDirectory="device" />
<file action="copy" path="../../../../c2000ware/driverlib/f28004x/driverlib/" targetDirectory="device/"
                excludeFromBuild="True"/>

<file action="copy" path="../../../../c2000ware/libraries/math/CLAmath/c28/include/CLAmath.h"
                targetDirectory="libraries/CLAmath" />
<file action="copy" path="../../../../c2000ware/libraries/boot_rom/f28004x/revB/rom_symbol_libs/CLA_Data_ROM/F28004x_CLADATROM_Symbols_fpu32.lib"
                targetDirectory="libraries/CLAmath" excludeFromBuild="True" />
<file action="copy" path="../../../../c2000ware/libraries/math/CLAmath/c28/lib/clal_math_library_datarom_fpu32.lib"
                targetDirectory="libraries/CLAmath" excludeFromBuild="True" />

<file action="copy" path="../../../../c2000ware/libraries/calibration/hrpwm/f28004x/include/SFO_V8.h" targetDirectory="libraries/SFO" />
<file action="copy" path="../../../../c2000ware/libraries/calibration/hrpwm/f28004x/lib/SFO_v8_fpu_lib_build_c28_driverlib_coff.lib"
                targetDirectory="libraries/SFO" excludeFromBuild="True" />

<file action="copy" path="../../../../c2000ware/libraries/math/FPUfastRTS/c28/lib/rts2800_fpu32_fast_supplement_coff.lib"
                targetDirectory="libraries/FPUfastRTS" excludeFromBuild="True" />

<file action="copy" path="../../../../c2000ware/libraries/control/DCL/c28/source/DCL_DF22_C1.asm"
                targetDirectory="libraries/DCL/" />
<file action="copy" path="../../../../c2000ware/libraries/control/DCL/c28/source/DCL_PI_C1.asm"
                targetDirectory="libraries/DCL/" />
<file action="copy" path="../../../../c2000ware/libraries/control/DCL/c28/source/DCL_PI_C4.asm"
                targetDirectory="libraries/DCL/" />
<file action="copy" path="../../../../c2000ware/libraries/control/DCL/c28/source/DCL_PI_L1.asm"
                targetDirectory="libraries/DCL/" />
<file action="copy" path="../../../../c2000ware/libraries/control/DCL/c28/include/DCL.h" targetDirectory="libraries/DCL/" />
<file action="copy" path="../../../../c2000ware/libraries/control/DCL/c28/include/DCLCLA.h" targetDirectory="libraries/DCL/" />
<file action="copy" path="../../../../c2000ware/libraries/control/DCL/c28/include/DCLF32.h" targetDirectory="libraries/DCL/" />

<file action="copy" path="../../../../libraries/sfra/include/sfra_f32.h" targetDirectory="libraries/sfra/" />
<file action="copy" path="../../../../libraries/sfra/lib/sfra_f32_tmu_coff.lib" targetDirectory="libraries/sfra/" excludeFromBuild="True" />
<file action="copy" path="../../../../libraries/sfra/gui/source/sfra_gui_scicomms_driverlib.c" targetDirectory="libraries/sfra/" />
<file action="copy" path="../../../../libraries/sfra/gui/include/sfra_gui_scicomms_driverlib.h" targetDirectory="libraries/sfra/" />

<file action="copy" path="../../../../libraries/utilities/dlog/include/dlog_4ch.h" targetDirectory="libraries/utilities/" />
<file action="copy" path="../../../../libraries/utilities/emavg/include/emavg.h" targetDirectory="libraries/utilities/" />
<file action="copy" path="../../../../libraries/utilities/rampgen/include/rampgen.h" targetDirectory="libraries/utilities/" />

<file action="copy" path="../dab/dab_settings.h" targetDirectory="" />
<file action="copy" path="../dab/dab_main.c" targetDirectory="" />
<file action="copy" path="../../source/dab/source/dab.c" targetDirectory="" />
<file action="copy" path="../../drivers/source/dab_hal.c" targetDirectory="" />
<file action="copy" path="../../drivers/include/dab_hal.h" targetDirectory="" />
<file action="copy" path="../../source/dab/include/dab.h" targetDirectory="" />
<file action="copy" path="../../source/dab/debug/setupdebugenv_lab1.js"
                targetDirectory="" />
```

Yellow = device specific file references
Red = device specific path references

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- Place device specific driverlib files in the f28004x/dab/<device>_device folder
- C2000Ware_DigitalPower_SDK_2_00_01_00\c2000ware\device_support\f2837xd\common\include
  - device.h and driverlib.h
- C2000Ware_DigitalPower_SDK_2_00_01_00\c2000ware\device_support\f2837xd\common\source
  - device.c

C2000Ware_DigitalPower_SDK_2_00_01_00 > solutions > tida_010054 > f28004x > dab   ∨ ↺

☐ Name	Date modified
📁 device	10/31/2019 3:16 PM
📁 f2837x_device	2/26/2020 10:38 PM
📝 dab_main	10/25/2019 10:44 AM
📝 dab_settings	10/25/2019 10:44 AM

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Device Specific Updates

- ADC configuration
  - setupADC()
    » Update this function following similar steps detailed in the initADC() and initADCSOC() functions in the ADC examples
- CMPSS configuration
  - setupBoardProtection(), setupCMPSS() or setupSynchronousRectificationAction()
    » Update this function following similar steps detailed in the initCMPSS() functions in the ADC examples
    » Remove any driverlib function calls that are not supported on the selected device
- Note: Reference configuration procedures available in the respective C2000Ware driverlib examples and other device specific system solutions

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F2837x dab_hal.c

```c
void DAB_HAL_setupADC(void)
{
    ADC_setPrescaler(ADCA_BASE, ADC_CLK_DIV_4_0);
    ADC_setPrescaler(ADCB_BASE, ADC_CLK_DIV_4_0);
    ADC_setPrescaler(ADCC_BASE, ADC_CLK_DIV_4_0);

    //
    // Set resolution and signal mode and load corresponding trims.
    //
    ADC_setMode(ADCA_BASE, ADC_RESOLUTION_12BIT, ADC_MODE_SINGLE_ENDED);
    ADC_setMode(ADCB_BASE, ADC_RESOLUTION_12BIT, ADC_MODE_SINGLE_ENDED);
    ADC_setMode(ADCC_BASE, ADC_RESOLUTION_12BIT, ADC_MODE_SINGLE_ENDED);

    //
    // Set pulse positions to late
    //
    ADC_setInterruptPulseMode(ADCA_BASE, ADC_PULSE_END_OF_CONV);
    ADC_setInterruptPulseMode(ADCB_BASE, ADC_PULSE_END_OF_CONV);
    ADC_setInterruptPulseMode(ADCC_BASE, ADC_PULSE_END_OF_CONV);

    ADC_enableConverter(ADCA_BASE);
    ADC_enableConverter(ADCB_BASE);
    ADC_enableConverter(ADCC_BASE);

    DEVICE_DELAY_US(1000);
```

F28004x dab_hal.c

```c
void DAB_HAL_setupADC(void)
{

    ADC_setVREF(ADCA_BASE, ADC_REFERENCE_INTERNAL, ADC_REFERENCE_3_3V);
    ADC_setVREF(ADCB_BASE, ADC_REFERENCE_INTERNAL, ADC_REFERENCE_3_3V);
    ADC_setVREF(ADCC_BASE, ADC_REFERENCE_INTERNAL, ADC_REFERENCE_3_3V);

    ADC_setPrescaler(ADCA_BASE, ADC_CLK_DIV_2_0);
    ADC_setPrescaler(ADCB_BASE, ADC_CLK_DIV_2_0);
    ADC_setPrescaler(ADCC_BASE, ADC_CLK_DIV_2_0);

    ADC_enableConverter(ADCA_BASE);
    ADC_enableConverter(ADCB_BASE);
    ADC_enableConverter(ADCC_BASE);

    DEVICE_DELAY_US(1000);
```

F2837x ADC example

```c
//
// initADC - Function to configure and power up ADCA.
//
void initADC(void)
{
    //
    // Set ADCCLK divider to /4
    //
    ADC_setPrescaler(ADCA_BASE, ADC_CLK_DIV_4_0);

    //
    // Set resolution and signal mode and load corresponding trims.
    //
    ADC_setMode(ADCA_BASE, ADC_RESOLUTION_12BIT, ADC_MODE_SINGLE_ENDED);

    //
    // Set pulse positions to late
    //
    ADC_setInterruptPulseMode(ADCA_BASE, ADC_PULSE_END_OF_CONV);

    //
    // Power up the ADC and then delay for 1 ms
    //
    ADC_enableConverter(ADCA_BASE);
    DEVICE_DELAY_US(1000);
}
```

Obtained from:
C2000Ware_DigitalPower_SDK_2_00_01_00\c2000ware\
driverlib\f2837xd\examples\cpu1\adc

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Device Specific Updates

- Device settings
  - Update the device clock defines
    - Note: the F2837x, F2838x has a 200 MHz clock, while F28004x have a 100 MHz clock
      - CPU_SYS_CLOCK_FREQ, ECAPSYSCLOCK_FREQ set to 200 for 200 MHz device
  - Check pin mapping for system defines
    - Some pins are not available or don't have same functionality
      - Reference the datasheet for more information on pin selection and features

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Compile Check and Update

- Build the project and work to resolve the remaining errors that persist
- Once no errors are present, proceed to verify functionality on board
  - Note: Ensure the system clocks are setup appropriately before proceeding

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References

- C2000Ware DigitalPower SDK
  - F2837x based system solutions
    - TIDM-1000
  - F28004x based system solutions
    - TIDM-02002, TIDM-1007, TIDM-1000
  - F2838x based system solutions
    - TIDM-1000
  - C2000Ware
    - See ADC, CMPSS, SDFM, etc. specific examples for driver configurations
- F2838x, F2837x and F28004x TRMs, datasheets
- C2000 Real-Time Control Peripherals
  - SPRU566
- C2000 workshops

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