

C2000Ware Systems Solution Porting Guide

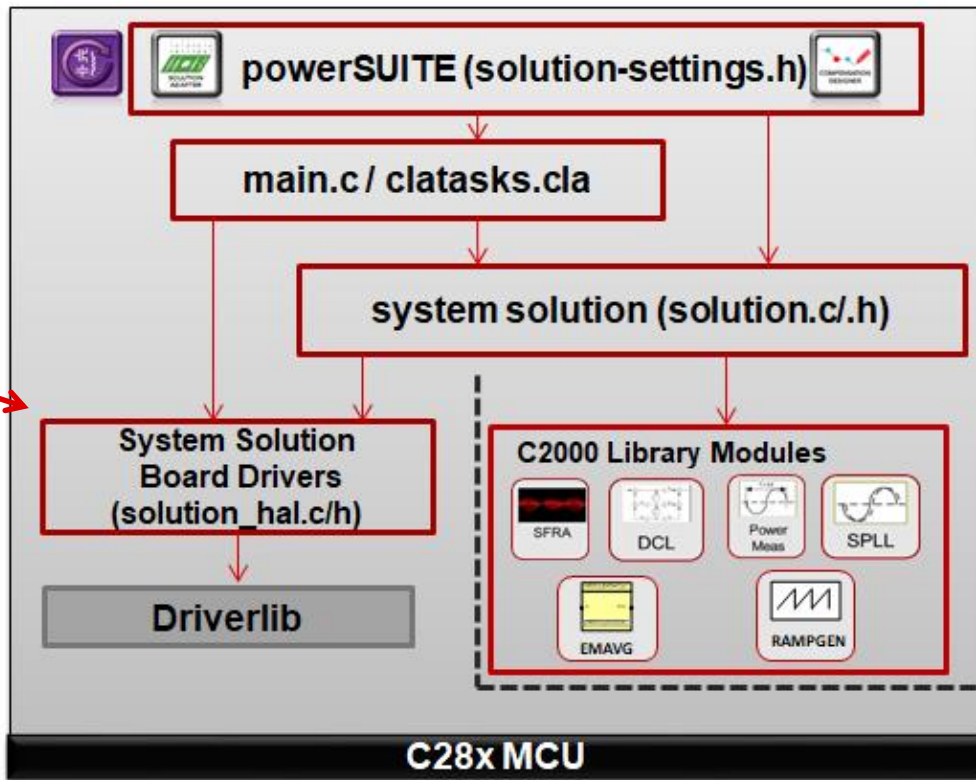
C2000 System Software

Outline

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

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.



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

<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 clal_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



Diagram illustrating file references in a project configuration (likely a Makefile or similar build system) and a corresponding directory structure.

Left Panel: Project Configuration (Makefile/Build System)

The configuration lists various files and their target directories. Key entries include:

- `<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" applicabilityConfigurations="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/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/rtx2800_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_tm_u_coff.lib" targetDirectory="libraries/sfra/" excludeFromBuild="True" />`
- `<file action="copy" path=../libraries/sfra/gui/source/sfra_gui_scicomm_driverlib.c" targetDirectory="libraries/sfra/" />`
- `<file action="copy" path=../libraries/sfra/gui/include/sfra_gui_scicomm_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="" />`

Right Panel: Directory Structure (dab_F28004x [Active - RELEASE])

- Binaries
- Includes
- device
 - device.c
 - device.h
 - driverlib.h
 - f28004x_codestartbranch.asm
 - f28004x_flash_lnk.cmd
 - driverlib
- libraries
 - CLAmath
 - DCL
 - FPufastRTS
 - SFO
 - sfra
 - utilities
- RELEASE
- targetConfigs
 - TMS320F280049C.ccxml [Active/Default]
- dab_hal.c
- dab_hal.h
- dab_main.c
- dab_settings.h
- dab.c
- dab.h
- setupdebugenv_lab1.js

Legend:

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

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TEXAS INSTRUMENTS

- 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

<input type="checkbox"/> 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

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

F2837x dab_hal.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);
```

F2837x ADC example

```
//
// 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);
}
```

F28004x dab_hal.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);
```

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

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

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](#)