ABSTRACT

The Delfino F28379D controlCARD (TMDSCNCD28379D) from Texas Instruments (TI) provides a great way to learn and experiment with the F2837x device family within TI’s C2000™ family of microcontrollers (MCUs). This 180-pin controlCARD is intended to provide a well-filtered robust design that is capable of working in most environments. This document provides the hardware details of the F28379D controlCARD and explains the functions, locations of jumpers, and connectors present on the board.

Figure 1-1. TMDSDOCK28379D Experimenter’s Kit

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1 Introduction

As of January 2016, all kits based on the F28377D MCU will now be replaced with the new F28379D superset device. These two MCUs are identical except for the addition of the CLB on the F28379D MCU to enable Position Manager. If the CLB is not a requirement in your application, that feature can be left untouched and the MCU will perform like the F28377D.

Each controlCARD comes with a Hardware Developer’s Kit, a full set of files necessary to evaluate and develop with a C2000 device. These files include:

- Schematics – Designed in Mentor PADS Logic
- Bill of Materials (BOM)
- Layout PCB files - Designed in Mentor layout
- Gerber files

The Hardware Developer's Kit for the controlCARD can be found in the C2000Ware at the following location:

- <install directory>\c2000\C2000Ware_x_xx_xx_xx\boards\controlCARDs\TMDSCNCD28379D\Rx_x

**WARNING**

When the controlCARD is used in a high-voltage setup, it is the user’s responsibility to confirm that the voltages and isolation requirements are identified and understood prior to energizing the board or simulation. When energized, the controlCARD or components connected to the controlCARD should not be touched. Furthermore, the capacitor A:C31 should be removed to minimize the possibility of leakage current flowing across the isolation barrier of the controlCARD.

**Note**

This kit is designed to explore the functionality of the F2837x microcontrollers. Even though the controlCARD can be treated as a good reference design, it is not intended to be a complete customer design. Full compliance to safety, EMI/EMC, and other regulations are left to the designer of the final customer’s system.
2 Errata

Current revision of controlCARD as of 2-Oct-2015: PCB rev - R1.3, ASSY rev - B.

Note

The Letter B on the controlCARD’s Serial Number sticker denotes ASSY rev – B.

2.1 Warnings/Notes/Errata

Notes for all controlCARDs:

- The F28379D controlCARD supports USB host/device connectivity. However, the micro-USB port, J8, is not isolated from the board ground. Care should be taken when this controlCARD is being used in a high-power application and this USB port is also being used. Note that external USB isolation buffers may be required for these types of applications.
- The F28379D Experimenter’s Kit ships with a USB cable and is designed to be powered via USB. However, in extreme cases the board/controlCARD may require more power than the 5V @ 500mA a computer’s USB port can provide (<0.01% of use cases). This is especially true when additional circuitry has been added to the docking station.

In such cases, it is recommended to use an external 5V power supply (2.5 mm inner diameter x 5.5 mm outer diameter) and plug it into J1. A compatible supply could be the: Phihong PSAC05R-050(P)-R-C2 + Phihong RPBAG.
- In Boot-from-SCI mode the MCU will, by default, expect GPIO84 and GPIO85 to be the IO pins responsible for sending the program to the device. These GPIOs are different from the GPIOs that connect to the isolated USB-to-serial interface via the FTDI chip, which uses GPIO28 and GPIO29. To use GPIO28 and 29 instead:
  - Change the boot mode to Get Mode and then, in your main flashed code, you can decide to call the bootloader for SCIBoot IOOption2 (in the bootROM) always, or based on whatever is desired.
  - Change the boot mode to Get Mode and configure the OTP such that SCIBoot IOOption2 is called. This is really only an option if you always want to boot from SCI or Parallel GPIO, because you will be overwriting your ability to boot from Flash.
  - With an emulator connected (TRSTn = 1), registers can be set such that SCIBoot’s IOOption2 boot mode is called.

  For more information, see the device-specific TRM.
- R83 on the controlCARD is populated to allow a customer to evaluate the controlCARD without a baseboard if desired. Because R83 is populated, the controlCARD putd more capacitance on the USB 5V supply than the USB specification allows. R83 should be removed in order to meet the specification.

2.2 Warnings About Specific controlCARD Revisions

Warnings about R1.0a revision F28377D controlCARDs:

- Among many other changes made, the pinout of the R1.1 F28377D controlCARD is different from the pinout of the pre-release R1.0a controlCARDs. When porting code, see the kit documentation and schematics in the C2000Ware install on your computer in the /boards/controlCARDs subdirectory.

Warnings about R1.1 and earlier F28377D controlCARDs:

- The F28377D MCU is not 5 V tolerant. Because of this, some additional protection is needed between the USB port J8 and the MCU. In particular, resistor R72 should change from 0R0 to 100K and resistor R74 should change from 0R0 to 10K. This effectively limits the voltage/current received by the MCU pin. This issue was fixed in R1.1a and later revision controlCARDs.
- If used, the crystal X1 should be acceptable in most applications. However, it can fail under some worst case conditions. To assure proper operation, see the TMS320F2837xD Real-Time Dual-Core MCUs Silicon Errata. This issue was fixed in R1.1a and later revision controlCARDs.
- Several name changes were made to pins on the device and are now reflected in R1.1a controlCARD documentation. No functionality was affected.
Warnings about R1.1a and earlier F28377D controlCARDs:

- The circuitry used to drive the C2000 MCU’s voltage references is not ideal. Instead, it is recommended that users use the voltage reference driving circuitry found in the R1.3 controlCARD.

Warnings about R1.3 of F28379D controlCARD:

- R51-R54 were mistakenly populated with 100 MΩ resistors instead of 100 mΩ resistors. With 100 MΩ resistors used, the voltage references for the analog-to-digital converters (ADCs) may not be held adequately constant and the accuracy/precision of ADC results may be affected during sampling/conversion. It is recommended that customers replace R51-R54 with 100 mΩ, 0603, 5% tolerance (or better) resistors. For evaluation of the controlCARD in a lab environment, it is also acceptable to short R51-R54 using 0 Ω resistors or solder bridges, however, populating with 100 mΩ is preferred. For more information, see the following E2E post: https://e2e.ti.com/support/microcontrollers/c2000/f/171/t/576301.
3 Getting Familiar With the controlCARD

3.1 F28379D controlCARD Features

- Delfino F28379D Microcontroller – High performance C2000 microcontroller is located on the controlCARD.
- 180-pin HSEC8 Edge Card Interface – Allows for compatibility with all of C2000’s 180-pin controlCARD-based application kits and controlCARDs. Compatibility with 100-pin controlCARDs can be accomplished using the TMDSADAP180TO100 adapter card (sold separately).
- Built-in Isolated JTAG Emulation – An xds100v2 emulator provides a convenient interface to Code Composer Studio™ without additional hardware. Flipping a switch allows an external JTAG emulator to be used.
- Connectivity – The controlCARD contains connectors that allow the user to experiment with USB, a microSD card, and isolated UART/SCI with the F28379D MCU. A hi-density connector is also provided to experiment with external memory.
- Key Signal Breakout – Most GPIO, ADC and other key signals routed to hard gold connector fingers.
- Robust Power Supply Filtering – Single 5 V input supply powers an on-CARD 3.3 V LDO. All MCU inputs are then decoupled using LC filters near the device.
- ADC Clamping – ADC inputs are clamped by protection diodes.
- Anti-Aliasing Filters – Noise filters (small RC filters) can be easily added on several ADC input pins.

3.2 Assumed Operating Conditions

This kit is assumed to run at standard room conditions. The EVM should run at approximately standard ambient temperature and pressure (SATP) with moderate-to-low humidity.

3.3 Using the controlCARD

In order for the controlCARD to work, the controlCARD’s MCU must be powered. This is most often done by inputting 5 V through the HSEC connector via an accompanying baseboard. For example, if using a TMDSHSEDCO Docking Station baseboard, 5VDC should be input into the docking station’s J1 or J17. Then, S1 needs to be toggled to the appropriate position.

Optionally, the MCU could also be powered via the micro-USB connector on the controlCARD.

Based on the way the controlCARD will be used, additional hardware settings are necessary, see Table 3-1.

### Table 3-1. Getting Started Reference

<table>
<thead>
<tr>
<th>A:SW1 (controlCARD)</th>
<th>Debug Using CCS and the On-Card xds100v2 Emulator</th>
<th>Debug Using CCS and an External Emulator via the Baseboard</th>
<th>Standalone (Boot from FLASH or other boot mode)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position 1: ON (up)</td>
<td>Position 1: ON (up)</td>
<td>Position 1: ON (up)</td>
<td>Position 1: ON (up)</td>
</tr>
<tr>
<td>A:J1 (controlCARD)</td>
<td>Connect a mini USB cable between A:J1 and your computer. In CCS, use this target configuration: TMS320F28379D device with an xds100v2 emulator.</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>SW1 (controlCARD)</td>
<td>Position 1: OFF (up)</td>
<td>Position 1: OFF (up)</td>
<td>Set SW1 as desired</td>
</tr>
<tr>
<td>Position 2: ON (down)</td>
<td>Position 2: ON (down)</td>
<td>Position 2: ON (down) Putting the C2000 device into Wait Mode can reduce the risk of connectivity issues.</td>
<td></td>
</tr>
</tbody>
</table>
Table 3-1. Getting Started Reference (continued)

<table>
<thead>
<tr>
<th>Debug Using CCS and the On-Card xds100v2 Emulator</th>
<th>Debug Using CCS and an External Emulator via the Baseboard</th>
<th>Standalone (Boot from FLASH or other boot mode)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseboard’s JTAG connector (J2 on the TMDSHSECDOCK docking station baseboard)</td>
<td>Connect an external emulator.</td>
<td>---</td>
</tr>
</tbody>
</table>

Code Composer Studio is an Integrated Development Environment (IDE) used to debug and develop software for the C2000 series of MCUs. CCS can be downloaded from the following link: https://www.ti.com/tool/ccstudio.

For users new to C2000's F2837x series of devices and CCS, TI's C2000 Academy provides several easy-to-follow training modules and hands-on lab exercises to help users get started quickly.

The following PDF documents are provided to describe where each of the F28379D MCU's pins will appear on the controlCARD connector/docking station:

- TMDSCNCD28379D_180cCARD_pinout_R1_3 – tells where each MCU pin will go on the HSEC controlCARD connector or the 120/180-pin controlCARD docking station.
- TMDSCNCD28379D_100DIMmap_R1_3 – tells where each MCU pin will go to on the DIM100 controlCARD connector or the DIM100 docking station. This assumes that the TMDSADAP180TO100 adapter card is used.

These PDF documents can be found in C2000Ware at the following location:

- `<install_directory>c2000\C2000Ware_x_xx_xx_xx\boards\controlCARDs\TMDSCNCD28379D\Rx_x`

### 3.4 Experimentation Software

Code Composer Studio (CCS) Integrated Development Environment (IDE) is recommended for developing and debugging software for the C2000 series of MCUs. CCS is free to download and use with the controlCARD.

C2000Ware contains a full suite of example software designed to work with the F28379D controlCARD. This software package includes many example projects that allow the user to experiment with the ADC, PWM, and other C2000 peripherals.

Support files for both register-level and driver-level programming are included with C2000Ware:

- Register header files are located at: `	i\c2000\C2000Ware_XXXX\device_support\f2837xd\examples`
- Driverlib programming examples are located at: `	i\c2000\C2000Ware_XXXX\driverlib\f2837xd\examples`

For users new to C2000's F2837x series of devices and CCS, TI's C2000 Academy provides several easy-to-follow training modules and hands-on lab exercises to help users get started quickly.
4 Special Notes on Connectivity

4.1 xds100v2 Emulator and SCI/UART Connectivity

The F28379D controlCARD provides emulation and USB-to-UART adapter functionality on the controlCARD. This allows for a convenient method to debug and demo the F28379D MCU.

Note that the FTDI chip, its support circuitry, and associated isolation components are placed in Macro A, the left section of the controlCARD. Each of these components contains an additional A within the component reference designator (that is, A:R2 for resistor 2 in Macro A), see Figure 4-1.

Each F28379D controlCARD’s xds100v2 is programmed with a fixed serial number. If a debug session needs to involve two or more F28379D controlCARDs, each controlCARD needs to have a unique serial number and some need to be reprogrammed, see: https://software-dl.ti.com/ccs/esd/documents/xdsdebugprobes/emu_xds100.html (under Additional Information).

The configuration of the switches on A:SW1 determine whether the on-board emulator is active, whether an external emulator can be used, or whether the device will boot from FLASH/peripherals, see Table 5-1.

![Figure 4-1. xds100v2 Emulation Circuitry and Isolation Circuitry is Denoted by A](image)

4.2 External Connector – J9

External connector, J9, can be used to connect the controlCARD to another board. The ability to connect up to EMIF2, SPI-C, I2C-A, and 2 GPIO are provided – although any peripheral mux option provided on these GPIOs is technically possible.

Note that the GPIOs (122-125) that attach to the SPI portions of this connector, also go to the microSD connector. At any specific time, only one should be used to avoid contention.

Note that the GPIOs (53-68) that attach to the EMIF data lines of this connector and GPIOs (91 and 92) that attach to the I2C portions of this connector also go to the baseboard via the HSEC connector. These GPIOs should either be used to connect to the baseboard OR utilized on this header to avoid contention.

Figure 4-2 shows the connector that mates with J9 is the Hirose DF40HC(4.0)-60DS-0.4V(51).
Figure 4-2. Hirose DF40HC(4.0)-60DS-0.4V(51)
4.3 Evaluation of the Analog-to-Digital Converters (ADCs)

When using the F28379D on-chip ADCs, there are some useful guidelines to help realize the performance numbers listed in the *TMS320F2837xD Real-Time Dual-Core Microcontrollers* data sheet. This is especially true for the AC parameters such as: SNR, THD, and SINAD. Furthermore, it can also be shown that there is a direct correlation between the SNR of the ADC results and the spread of ADC codes seen for a DC input. These tips will improve the range and standard deviation of a DC input as well. Finally, while topics addressed will be with respect to the controlCARD, they are also applicable to other implementations using the F28379D MCU.

**On-board resistors and capacitors:** By default (Figure 4-3), all inline resistors to the ADC pins are a simple 0-Ω shunt and all capacitors to the ground plane are not populated. While this circuit can be used to supply the ADC inputs with a voltage, likely both the resistor (R) and capacitor (C) will need to be populated based on the voltage source's characteristics. Referring to the ADC Input Model, the ADC input has its own RC network made up of the internal sample and hold capacitor, switch resistance, and parasitic capacitance. By changing the inline resistance and parallel capacitor, the input circuit can be optimized to assist with settling time and/or filtering the input signal. Finally, it is recommended in general to use Negative-Positive 0 PPM/°C (NP0/C0G) capacitors as these have better stability over temperature and across input frequencies than other types of capacitors.

**Voltage source and drive circuitry:** While the on-chip ADCs are configurable 12-bit/16-bit architectures (4096/65536 distinct output codes when converting an analog signal to the digital domain), the translation will only be as precise as the input provided to the ADC. The typical rule of thumb when defining the source resolution to realize the full specification of an ADC is to have a 1-bit better source than the converter. In this case, that would mean that ideally the analog input should be accurate to 13 bits for a 12-bit mode and 17 bits for a 16-bit mode.

Typically, voltage supplies or regulators are not designed to be precise, but rather accommodate a wide range of current loads within a certain tolerance, and for this reason, are not ideal to show the performance of a higher bit ADC, like the one on the F28379D. This does not take into account that many times the supply in question is providing the main voltage to power the MCU itself, which also introduces noise and other artifacts into the signal.
In addition to the quality of the input signal, there is also the aspect of the load presented to the ADC when it samples the input. Ideally, an input to an ADC would have zero impedance so as not to impact the internal R/C network when the sampling event takes place. In many applications, however, the voltages that are sampled by the ADC are derived from a series of resistor networks that are often large in value to decrease the active current consumption of the system. A solution to isolate the source impedance from the ADC sampling network is to place an operational amplifier in the signal path. Not only does this isolate the impedance of the signal from the ADC, it also shields the source itself from any effects the sampling network may have on the system.

**Recommended source for evaluation:** The Precision Signal Injector (PSI) EVM from TI was used to validate the ADC performance on the F28379D ControlCARD. This EVM supports both single ended as well as differential ended outputs using a 16-bit digital-to-analog converter (DAC) as the signal source then passed through a high precision op-amp with post amplifier filtering. The EVM is powered and controlled through a standard USB connection from a host PC and includes a GUI to control its output. The outputs are routed through single or dual SMA type connectors. It is highly recommended to place additional female SMA connectors (**Figure 4-4**) on the controlCARD docking station to receive the signal via SMA cable for best noise immunity. For the local RC network, 30-Ω resistors and 300 pF capacitors were used. Using this setup, the ADC parameters were observed to be consistent with the published numbers in the *TMS320F2837xD Real-Time Dual-Core Microcontrollers* data sheet.

![Figure 4-4. Female SMA Connector](image-url)
5 Hardware References

Table 5-1 shows the various connections available on the board. Figure 5-1 illustrates the location of many of these components on the board.

**WARNING**

When the controlCARD is used in a high-voltage setup, it is the user’s responsibility to confirm that the voltages and isolation requirements are identified and understood prior to energizing the board or simulation. When energized, the controlCARD or components connected to the controlCARD should not be touched. Furthermore, the capacitor A:C31 should be removed to minimize the possibility of leakage current flowing across the isolation barrier of the controlCARD.

Figure 5-1. Key components on the controlCARD
### Table 5-1. Hardware References

#### Connectors

<table>
<thead>
<tr>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A:J1</td>
<td>Emulation/UART connector - USB mini A connector used to provide xds100v2 emulation and USB-to-UART(SCI) communication through FTDI logic. A:SW1 determines which connections are enabled to the MCU.</td>
</tr>
<tr>
<td>U5</td>
<td>SD Micro card slot – connects to MCU via SPI</td>
</tr>
<tr>
<td>J8</td>
<td>USB connector – USB micro AB connector supports USB 2.0 host/device</td>
</tr>
<tr>
<td>J9</td>
<td>Enables a secondary board to have access to the F28379D’s EMIF2 and several other digital signals.</td>
</tr>
</tbody>
</table>

#### Jumpers

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Description</th>
</tr>
</thead>
</table>
| J2-J7  | USB PHY connection enable/disable jumpers:  
  - **All jumpers up** – The MCU will be connected to the USB PHY on the controlCARD via GPIOs 42, 43, 46, 47, 120, and 121  
  - **All jumpers down** – The MCU will not connect to the USB PHY and all signals will instead go through the 180-pin controlCARD connector. |

#### LEDs

<table>
<thead>
<tr>
<th>LED</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD1</td>
<td>Turns on when the controlCARD is powered ON (green)</td>
</tr>
<tr>
<td>LD2</td>
<td>Controlled by GPIO-31 with negative logic (red)</td>
</tr>
<tr>
<td>LD3</td>
<td>Controlled by GPIO-34 with negative logic (red)</td>
</tr>
<tr>
<td>A:D2</td>
<td>Turns on when ISO JTAG logic is powered on (green)</td>
</tr>
<tr>
<td>A:D3</td>
<td>JTAG/UART RX toggle indicator (blue)</td>
</tr>
<tr>
<td>A:D4</td>
<td>JTAG/UART TX toggle indicator (blue)</td>
</tr>
</tbody>
</table>

#### Resistors and Capacitors

<table>
<thead>
<tr>
<th>Resistor</th>
<th>Description</th>
</tr>
</thead>
</table>
| R59, R60 | Alternate Reference Configuration Resistors  
  These resistors allow the user to choose whether the alternate reference for the ADCs will be given by:  
  - If R59 is unpopulated & R60 is populated  
    A precision 3.0V reference (REF5030)  
  - If R59 is populated & R60 is unpopulated  
    The reference will be given by pin 45 of the HSEC controlCARD connector. This will presumably allow the baseboard to provide the desired voltage reference. |

<table>
<thead>
<tr>
<th>Capacitor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R27-R50 and C18-C41</td>
<td>Optional RC input filter for all ADC inputs</td>
</tr>
</tbody>
</table>

#### Switches (default position in BOLD)

<table>
<thead>
<tr>
<th>Switch</th>
<th>Description</th>
</tr>
</thead>
</table>
| SW1    | Boot Mode Switch:  
  Controls the Boot Options of the F28379D device. For more information, (0 is down, 1 is up), see the device-specific data sheet.  
Mode # Switch Position 1 (GPIO-72) Switch Position 2 (GPIO-84) Boot from 00 0 0 Parallel I/O 01 0 1 Boot from SCI 02 1 0 Wait Boot Mode 03 1 1 Get Mode (Flash by default)  
<table>
<thead>
<tr>
<th>Mode</th>
<th>Switch Position 1 (GPIO-72)</th>
<th>Switch Position 2 (GPIO-84)</th>
<th>Boot from</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>0</td>
<td>0</td>
<td>Parallel I/O</td>
</tr>
<tr>
<td>01</td>
<td>0</td>
<td>1</td>
<td>Boot from SCI</td>
</tr>
<tr>
<td>02</td>
<td>1</td>
<td>0</td>
<td>Wait Boot Mode</td>
</tr>
<tr>
<td>03</td>
<td>1</td>
<td>1</td>
<td>Get Mode (Flash by default)</td>
</tr>
</tbody>
</table>
### Table 5-1. Hardware References (continued)

<table>
<thead>
<tr>
<th>SW2</th>
<th>ADC VREFHI Control Switch for ADC modules A &amp; B:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Switch 1 (lower switch) – VREFHI Control Switch for ADC module A:</td>
</tr>
<tr>
<td></td>
<td>• In the left position – ADC-A is configured to use VDDA (3.3 V) as the ADC’s voltage reference. The full-scale range of this ADC will be 0-3.3 V, but the ADC will have reduced accuracy/precision.</td>
</tr>
<tr>
<td></td>
<td>• In the right position – ADC-A is configured to either use a precise 3.0 V voltage reference or an external voltage may be used as a reference. R59 and R60 determine which setting is used (see description for R59/ R60, above)</td>
</tr>
<tr>
<td></td>
<td>Switch 2 (upper switch) – VREFHI Control Switch for ADC module B:</td>
</tr>
<tr>
<td></td>
<td>• In the left position – ADC-B is configured to use VDDA (3.3 V) as the ADC’s voltage reference. The full-scale range of this ADC will be 0-3.3 V, but the ADC will have reduced accuracy/precision.</td>
</tr>
<tr>
<td></td>
<td>• In the right position – ADC-B is configured to either use a precise 3.0 V voltage reference or an external voltage may be used as a reference. R59 and R60 determine which setting is used (see description for R59/ R60, above)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SW3</th>
<th>ADC VREFHI Control Switch for ADC modules C &amp; D:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Switch 1 (lower switch) – VREFHI Control Switch for ADC module C:</td>
</tr>
<tr>
<td></td>
<td>• In the left position – ADC-C is configured to use VDDA (3.3 V) as the ADC’s voltage reference. The full-scale range of this ADC will be 0-3.3V, but the ADC will have reduced accuracy/precision.</td>
</tr>
<tr>
<td></td>
<td>• In the right position – ADC-C is configured to either use a precise 3.0 V voltage reference or an external voltage may be used as a reference. R59 and R60 determine which setting is used (see description for R59/ R60, above)</td>
</tr>
<tr>
<td></td>
<td>Switch 2 (upper switch) – VREFHI Control Switch for ADC module D:</td>
</tr>
<tr>
<td></td>
<td>• In the left position – ADC-D is configured to use VDDA (3.3 V) as the ADC’s voltage reference. The full-scale range of this ADC will be 0-3.3V, but the ADC will have reduced accuracy/precision.</td>
</tr>
<tr>
<td></td>
<td>• In the right position – ADC-D is configured to either use a precise 3.0 V voltage reference or an external voltage may be used as a reference. R59 and R60 determine which setting is used (see description for R59/ R60, above).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A:SW1</th>
<th>Isolated emulation and UART communication enable switches:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Switch Position 1 – JTAG Enable:</td>
</tr>
<tr>
<td></td>
<td>• ON – All signals between the xds100v2 emulation logic and the MCU will be connected. This setting is valid when the MCU is being debugged or programmed via the on-card xds100v2 emulator.</td>
</tr>
<tr>
<td></td>
<td>• OFF – The xds100v2 emulation logic will NOT be connected to the MCU. This setting is valid when the device will boot from FLASH, boot from a peripheral directly, or when an external JTAG emulator will be used.</td>
</tr>
<tr>
<td></td>
<td>Switch Position 2 – ISO UART communication enable:</td>
</tr>
<tr>
<td></td>
<td>• ON – The C2000 MCU’s GPIO-28 (and pin 76 of the 180-pin controlCARD connector) will be coupled to the FTDI’s USB-to-Serial adapter. This allows UART communication to a computer via the FTDI chip. However, in this position, GPIO-28 will be forced high by the FTDI chip. Functionality of pin 76 of the connector will be limited.</td>
</tr>
<tr>
<td></td>
<td>• OFF – The C2000 MCU will NOT be connected to the FTDI USB-to-Serial adapter. Pin 76 of the 180-pin controlCARD connector will be directly connected to GPIO-28.</td>
</tr>
</tbody>
</table>
6 References

- Texas Instruments: TMS320F2837xD Real-Time Dual-Core MCUs Silicon Errata
- Texas Instruments: TMS320F2837xD Real-Time Dual-Core Microcontrollers data sheet

7 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision A (January 2019) to Revision B (June 2022) Page

- **Global**: Updated the titles of the TMS320F2837xD data sheet and errata.................................1
- **Section 1 (Introduction)**: Added WARNING about using controlCARD in a high-voltage setup. Updated section..................................................................................................................................................3
- **Section 3.3 (Using the controlCARD)**: Added WARNING about using controlCARD in a high-voltage setup. Updated section..................................................................................................................................................6
- **Section 3.4 (Experimentation Software)**: Updated section........................................................................................................................................................................................................................................7
- **Section 4.3 (Evaluation of the Analog-to-Digital Converters (ADCs))**: Updated section........................................................................................................................................................................................................................................10
- **Section 5 (Hardware References)**: Added WARNING about using controlCARD in a high-voltage setup......12
- **Section 6 (References)**: Updated titles of the TMS320F2837xD data sheet and errata........................................15
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3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

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3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.
Concernant les EVMs avec antennes détachables

Conformément à la réglementation d’Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d’un type et d’un gain maximal (ou inférieur) approuvé par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l’intention des autres utilisateurs, il faut choisir le type d’antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l’intensité nécessaire à l’établissement d’une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d’antenne énumérés dans le manuel d’usage et ayant un gain admissible maximal et l’impédance requise pour chaque type d’antenne. Les types d’antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l’exploitation de l’émetteur.

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2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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