Emulation Tech Note 6
Getting Connected with DM4xx

Document Revision 0.02

Nov 1, 2005

1. Introduction

The TI DM4xx is a new family of TI processors based on a combination of ARM and C64+ cores aimed at the digital video market. These two cores have significantly different emulation architectures, clocking and power domain schemes all of which complicates emulation support. To address these issues TI has included a new emulation block named Ice-Pick. At this time the DM4xx devices are based on revision C of the Ice-Pick module, which is a significant improvement over the A and B versions. This technical note provides basic details on what to expect from DM4xx devices with respect to emulation.

2. DM4xx Emulation Basics

The default emulation configuration of DM4xx is Ice-Pick visible in the scan chain on power up and all other devices are switched out of the scan chain. This configuration is selected when the emulation pins EMU0 and EMU1 are both high at power up. In this configuration running a scan test with SdConfig should show an IR length of 6 and 1 device in the scan chain. The other notable detail of this configuration is that RTCK from the DM4xx can be both ARM adaptive and dynamic. When Ice-Pick is the only device in the scan chain then RTCK tracks TCK i.e. standard TI emulation clocking. However when ARM9 is in the scan chain RTCK is adaptive i.e. standard ARM style clocking. During a debug session the ARM9 and C64+ devices are dynamically switched in and out of the scan chain, as they become the device of debug focus. Looking at RTCK on a scope will show RTCK dynamically changing frequency during a debug session. In general the highest possible TCK/RTCK frequency occurs with C64+ in the scan chain. When ARM9 is in the scan chain RTCK is based on ARM9 functional clock divided by 4 to 6.

The DM4xx devices also support an alternate emulation configuration; this configuration is selected with EMU0 and EMU1 both low at power up. In this configuration, Ice-Pick, ARM92x and ARM-ETB modules are enabled in the scan chain. Running a scan test with SdConfig should show an IR length of 14 and 3 devices in the scan chain. The IR length of IcePick is 6; the ARM92x and ARM-ETB have IR lengths of 4. This configuration provides a static view of the DM4xx scan chain and is primarily aimed at emulation vendors that do not fully support Ice-Pick. In this configuration the TCK/RTCK is purely ARM adaptive style, with RTCK being derived from ARM9 functional clock divided by 4 to 6. This configuration resembles most TI OMAP devices.

The following table is summary of the DM4xx emulation configuration:

EMU1-EMU0	Default IR	Default Scan Path	RTCK
11	6	IcePick	Dynamic/Adaptive
00	14	IcePick+ARM9+ETB	Adaptive

One additional feature of Ice-Pick is support for either internal or external ARM adaptive clocking. Previous TI OMAP device support for internal adaptive clocking was problematic especially when the ARM PLLs were being dynamically switched. To achieve reliable emulation generally required a slowing of the TCK or use of an external adaptive clocking adapter. On DM4xx the internal adaptive clocking support has been greatly improved in comparison to OMAP. The selection of internal or external adaptive clocking can be configured via sdopts.cfg or the SD IcePick configuration utility. Additional details will follow in the emulator configuration sections.

Each device managed by Ice-Pick is assigned a ***port number*** which is a hardwired selection path for a given DM4xx device. The emulation software to enable/disable a given device uses this port number during a debug session. The user needs to specify the ***port numbers*** for CCStudio configuration. The current set of DM4xx device ports are summarized in the table below:

Device	Port Number for CC Setup
ARM9	0x10 (16)
ETB	0x11 (17)
C64+	0x12 (18)

In general the ETB is not configured in CCStudio so most DM4xx setups only include ARM9 and the C64+.

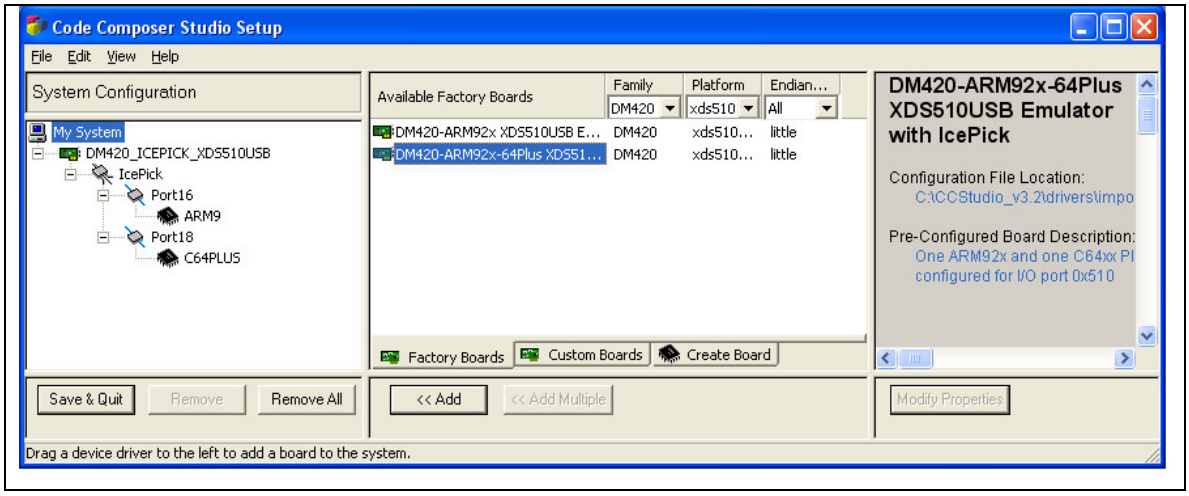
3. Getting Connected with CCS

The Spectrum Digital XDS510USB, XDS510PP+, SPI515 and SPI525 emulation drivers for CCS 3.2x and higher are Ice-Pick Rev C aware and can dynamically enable and disable scan paths. The preferred DM4xx configuration is EMU0 and EMU1 high and on-chip adaptive clocking. This configuration is also the default for TI XDS560 support. The examples given are geared towards the XDS510USB emulator but will also work on XDS510PP+, SPI515 and SPI525 with selection of the proper CCS configuration files.

Specturm Digital emulation driver releases 3.20.02 and higher are Ice-Pick Rev C aware and no longer need the external configuration utility to configure Ice-Pick.

3.1 CC Setup Configuration

In CC Setup select the filters "Family=DM420" and "Platform=xds510usb". From "Available Factory Boards" select DM420-ARM92x-64Plus XDS510USB with IcePick". This is a configuration of IcePick with two ports; ARM9 on port 0x10 (16) and C64Plus on port 0x12 (18). You should then select each device and add in the gel file of your choice. The gel files are generally part of a chip-support package and not included as part of an emulation driver install. If you are using a Spectrum Digital printer port emulator then you can use the "pp emulator" platform filter to quickly find a predefined configuration.



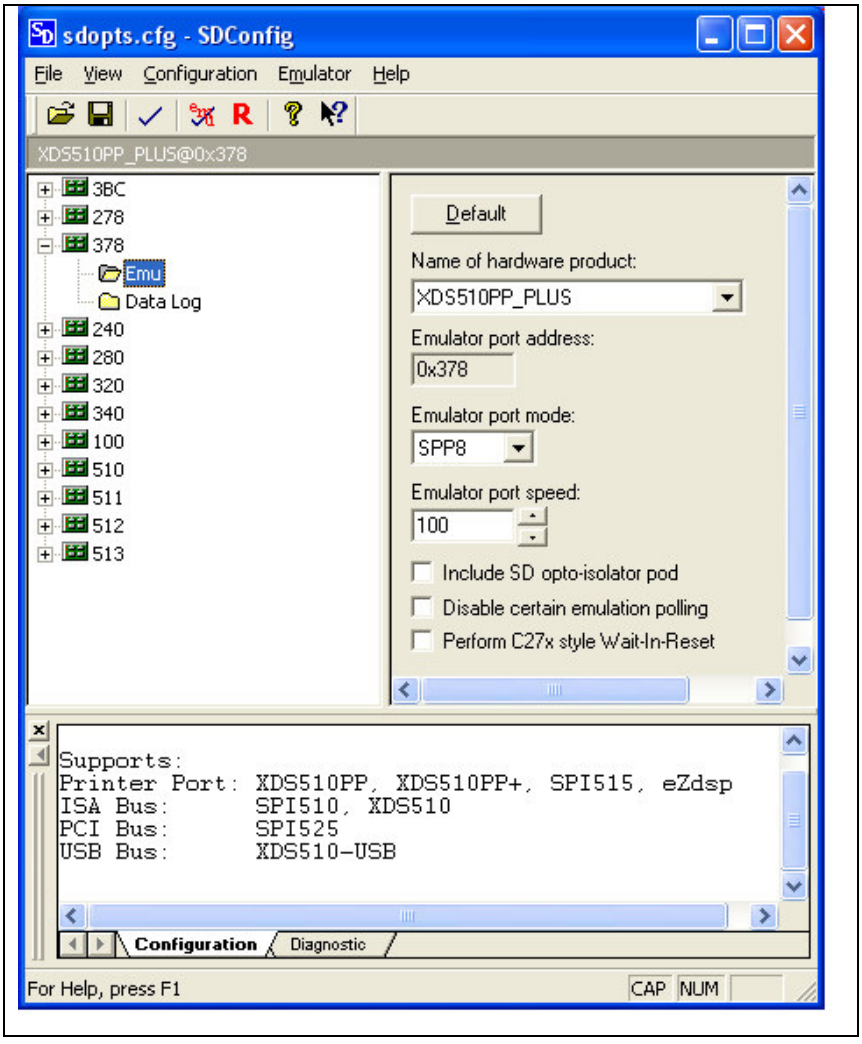
3.2 Sdopts.cfg Configuration

Verify your sdopts.cfg is configured for Ice-Pick support. From your desktop select the "***Edit sdopts.cfg v3.2***" icon. Then go to bottom of the file and verify in the XDS510USB section for your emulator port generall "[EmulatorId=510]" that following options are uncommented and set to yes:

EmuIcePickEnable=YES
EmuIcePickFtck=YES
This should be the default configuration for CCS 3.2 emulation drivers. If your sdopts.cfg file does not include these options then simply add them.

3.3 SdConfig Configuration

If you are using a Spectrum Digital printer port emulator or PCI emulator then you need to adjust your emulator port settings. Using SdConfig change your emulator port settings to select an "Emulator port speed" of 100 and uncheck the "Disable certain emulation polling" check box. This configures the emulation driver for polling mode vs fixed delay mode for optimal performance with slow RTCK. The example below shows example settings for the XDS510PP_PLUS emulator.



3.4 Ice-Pick Adaptive Clock Configuration

EmuIcePickFtck=YES enables the DM4xx on-chip adaptive clocking support for ARM9. In this configuration the TCK provided by the emulator can be free running which is the default mode for most all TI XDS510 and XDS560 class emulators. However if you are using an external adapter be sure that your adapter configuration and EmuIcePickFtck setting match. The following table summarizes settings for known adapter combinations:

Adapter Part # (on PCB)	EmuIcePickFtck	Adapter Config
SD-508511-0001 or SD-508520-0001	YES	SW1-1 = ON SW1-2 = ON BYPASS MODE
SD-508511-0001 or SD-508520-0001	NO	SW1-1 = OFF SW1-2 = OFF ADAPTIVE MODE
SD-506631-0001 and/or TI-14e-20t_cti #	YES	NA
No adapter	YES	NA

TI adapter 14e-20t_cti Rev A by default supports adaptive clocking. However TI has modified the adapter to remove this support as the XDS560 emulation drivers force Ice-Pick to on-chip adaptive (free running TCK) which creates a conflict. If you are using TI adapter 14e-20t_cti Rev A verify that adaptive clocking circuit (U1 and U2) has been removed or contact TI for details.