



MATLAB/Simulink Digital Power Model using dsPIC33AK512MPS506 on EV42F30A with DM330029: ADC, PWM, GPIO and UART and modulated Duty Cycle

1. INTRODUCTION

This document describes the setup and the model which illustrates ADC and PWM features on the EV42F30A and DM330029 boards. [EV42F30A](#) "dsPIC33AK512MPS506 Digital Power Plug-In Module (PIM)" and [DM330029](#) "DIGITAL POWER DEVELOPMENT BOARD" using PWM and ADC, as well as UART and GPIO.

The dsPIC33AK512MPS506 Digital Power Plug-In Module (PIM) is a demonstration board that in conjunction with different power boards showcases the Microchip dsPIC33AK512MPS506 Digital Signal Controller (DSC) features. It directly plugs-in to the Digital Power Development Board (DM330029).

The PIM provides access to the dsPIC33AK512MPS506 analog inputs, the Digital-to-Analog Converter (DAC) output, the Pulse-Width Modulator (PWM) outputs and the General-Purpose Input and Output (GPIO) ports.

The Digital Power Development Board is a demonstration board that provides the user a flexible measurement platform for all compatible Microchip dsPIC33's Digital Power Plug-In Modules (PIMs).

2. SUGGESTED DEMONSTRATION REQUIREMENTS

2.1 MATLAB Model Required for the Demonstration

To clone or download this MATLAB model:

- MATLAB model can be downloaded as zip file from Microchip webpage

2.2 Software Tools Used for Testing the MATLAB/Simulink Model

- MPLAB® X IDE **v6.25**
- MPLAB® XC-DSC Compiler **v3.21**
- MATLAB R2024a
- Required MATLAB add-on packages
 - Simulink
 - Simulink Coder
 - MATLAB Coder
 - Embedded Coder
 - MPLAB Device blocks for Simulink (v3.62)

NOTE: The software tools used for testing the model during release is listed above. It is recommended to use the version listed above or later versions for building the model.

2.3 Hardware Tools Required for the Demonstration

- Digital Power Development Board ([DM330029](#))
- dsPIC33AK512MPS506 General Purpose DP-PIM ([EV42F30A](#))

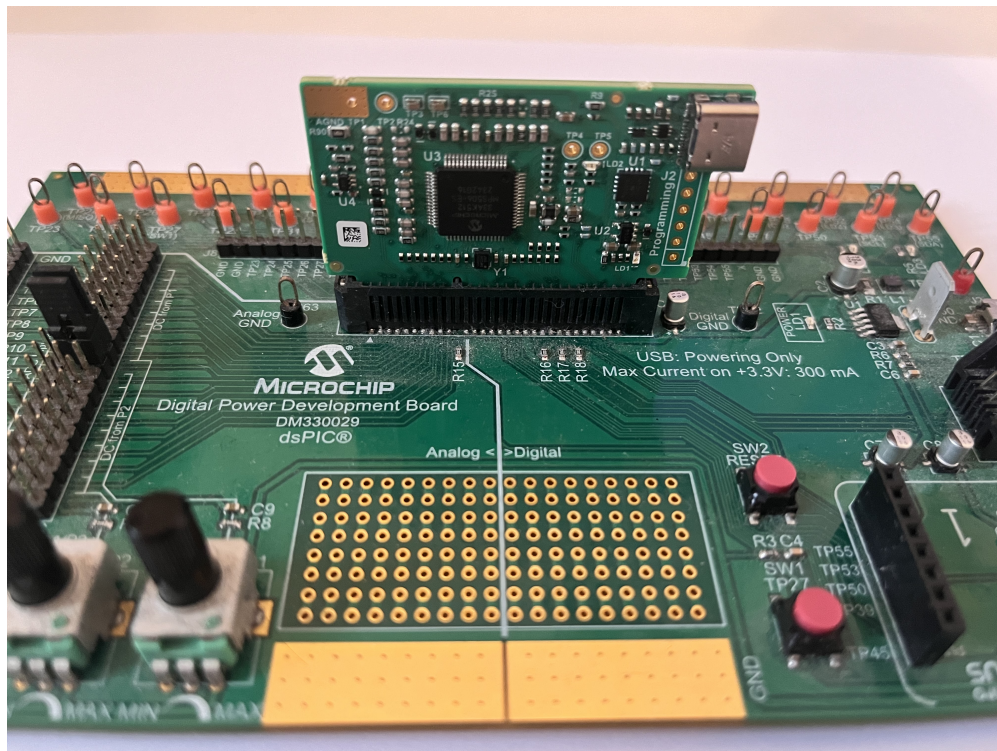
3. HARDWARE SETUP

This section describes the hardware setup required for the demonstration.

Note:

In this document, hereinafter dsPIC33AK512MPS506 General Purpose PIM is referred as **PIM**.

1. Insert the **dsPIC33AK512MPS506 General Purpose PIM** into the PIM Interface Digital Power Development Board (DPDB). Make sure the PIM is placed correctly and oriented before going ahead.



2. Connect the **ICD4 programmer** to the **J9** connector of the DPDB board, which is used for programming, and running the dsPIC33A DSC in External Mode. Connect the host PC to the USB-C port on the PIM.



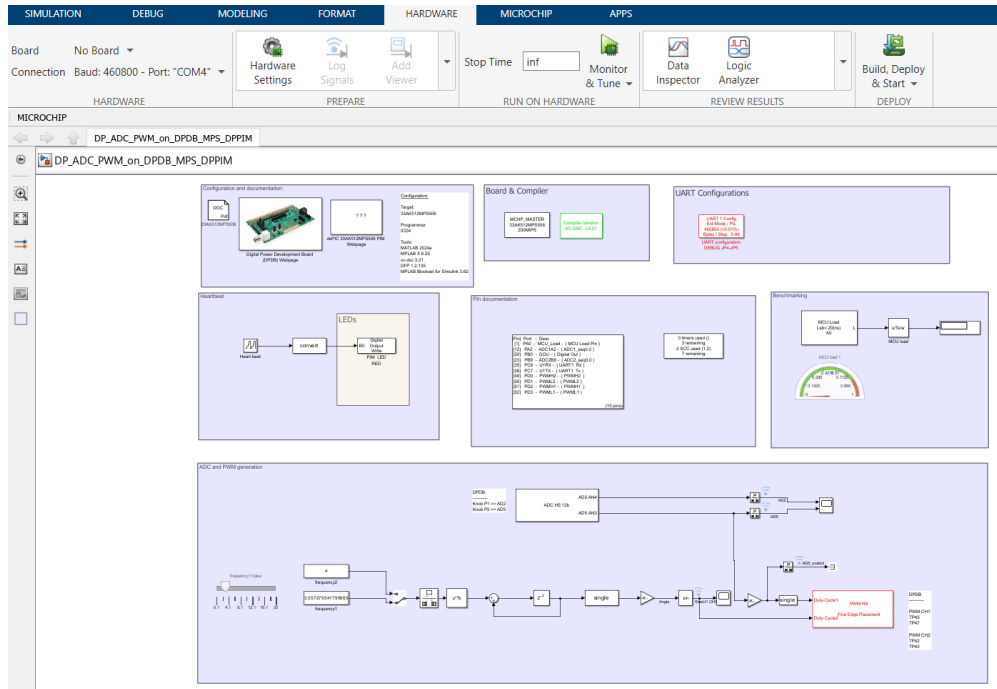
4. BASIC DEMONSTRATION

Follow the below instructions step-by-step, to set up and run the model:

1. Launch MATLAB (refer the section ["2.2 Software Tools Used for Testing the MATLAB/Simulink Model"](#)).
2. Open the folder downloaded from the repository or the download link, in which MATLAB files are saved (refer the section ["2.1 MATLAB Model Required for the Demonstration"](#)).



3. Double click on the Simulink model - **DP_ADC_PWM_on_DPDB_MPS_DPPIM.slx**. This opens the Simulink model as shown below.

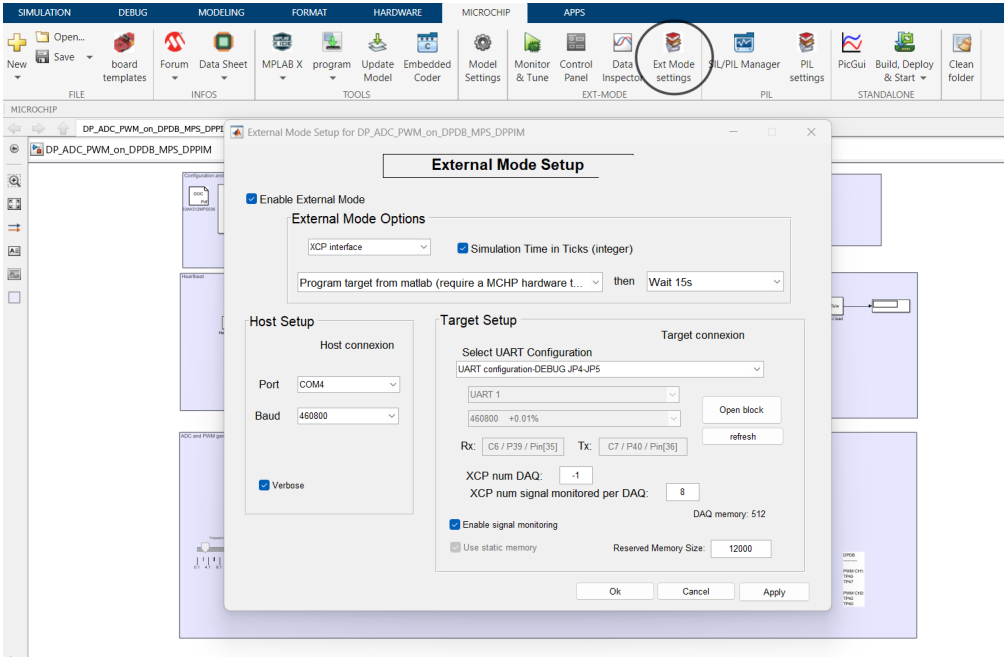


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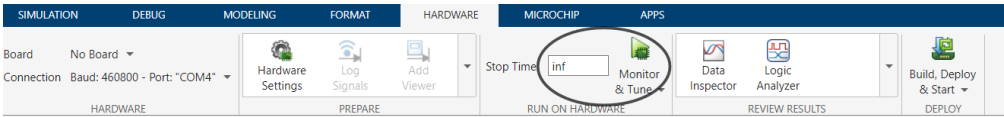
This example demonstrates the code generation to demonstrate PWM duty cycle modulation, ADC reading and parameter tuning. The simulation is not possible in this case.

4. From this Simulink model an MPLAB X project can be generated and it can be used to run separately.
5. This model uses the **External Mode** debug option for real time data visualization. To configure the external mode click on "**Ext Mode Settings**" option under the "**Microchip**" tab.

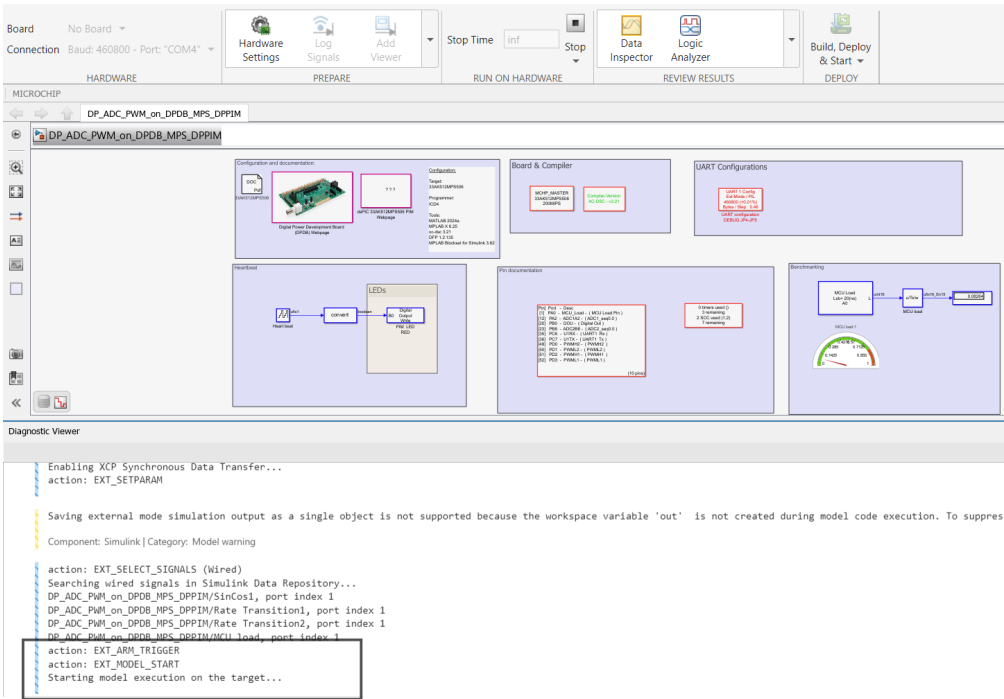
This will open **External Mode Setup** window and enable the checkboxes as shown in the figure. Also select the **COM port** connected to the development board and **Baud Rate**.



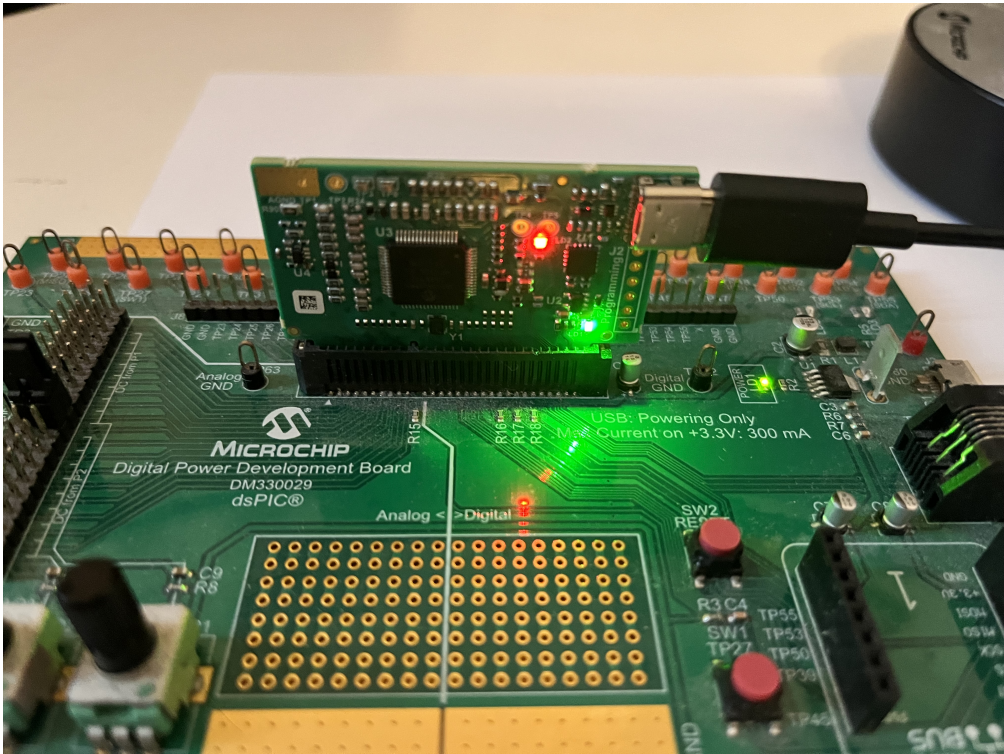
6. To generate the code and run the example on the hardware, click on **"Monitor & Tune"** option under the **Hardware** tab and ensure that **"Stop Time"** is set to **"inf"**.



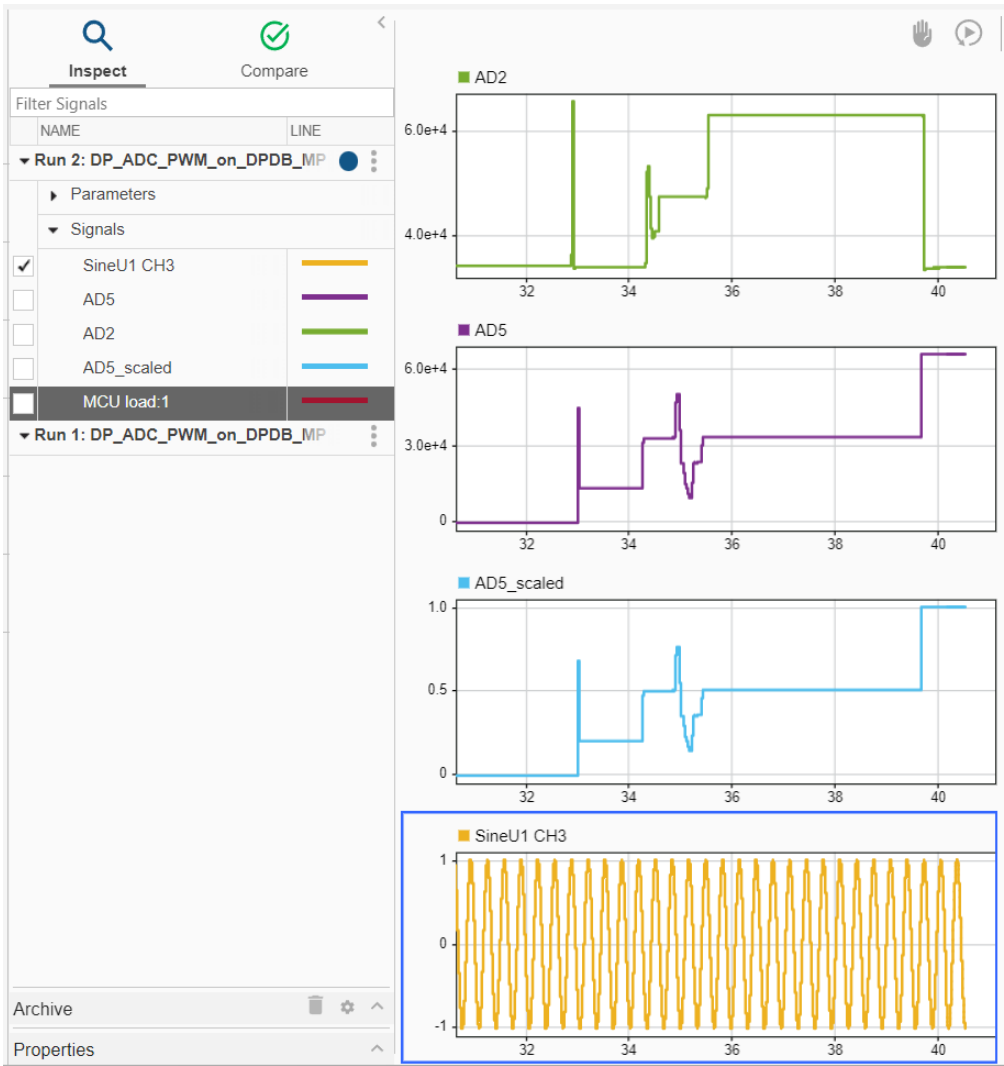
7. After compiling the code and programming the device, External Mode will be activated on the dsPIC DSC.



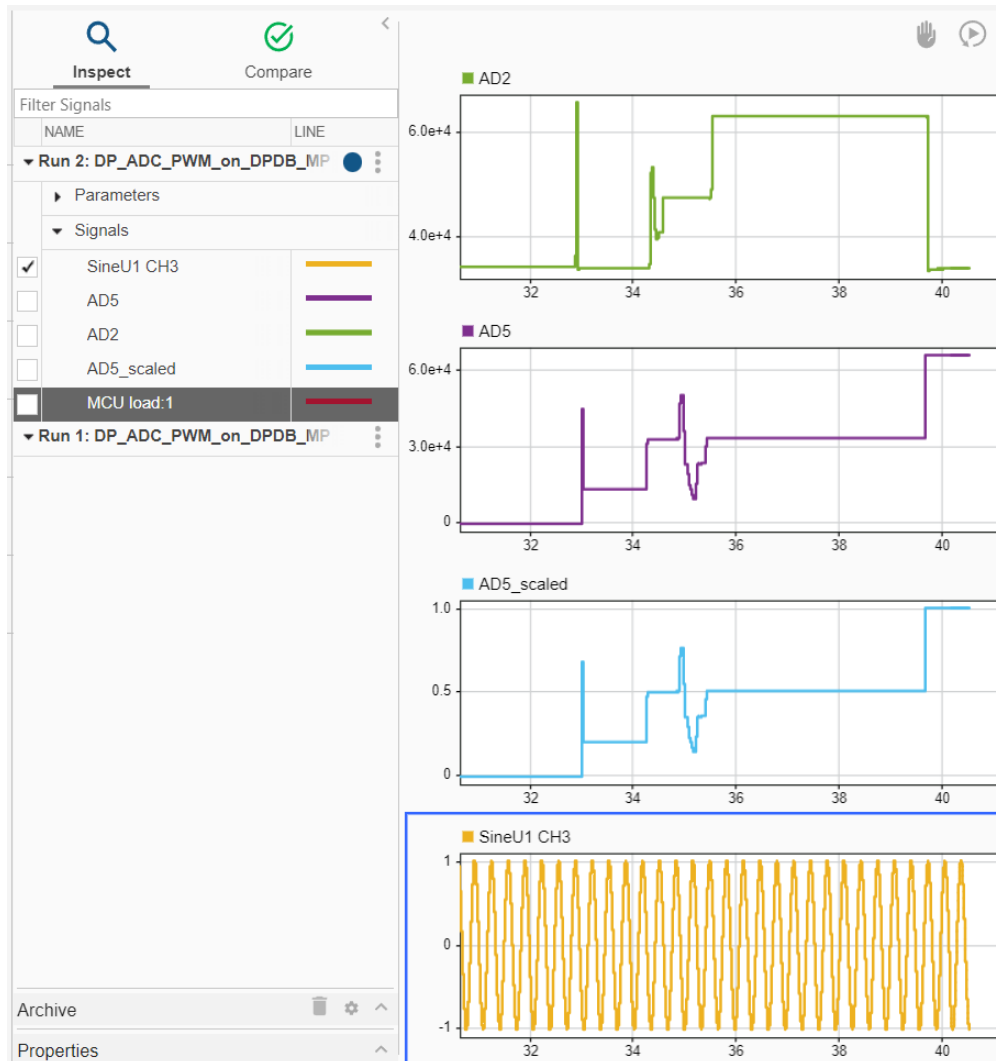
8. The **General Purpose LED** will be blinking.



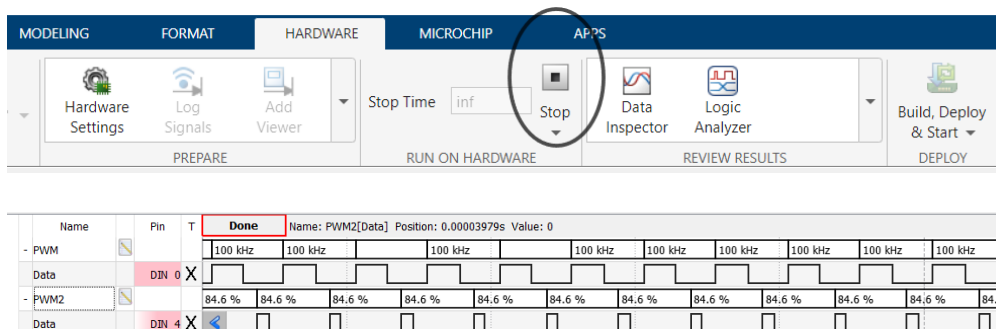
9. Move the position of the P1 and P2 knobs, to change the voltage input to the ADC channels from zero to full scale. Two ADC and two PWM channels are used, configured to produce PWM signal at 100kHz.



10. To visualise the raw ADC values, open the Scope or inspect the data in the Data Inspector. One ADC channel value stream is passed directly as scaled duty cycle to the first PWM channel. The other ADC channel is passed to a sine wave function. The output of the sine wave is passed as duty cycle to the second PWM channel. The complementary PWM channels can be observed on DPDB test points (TP45, TP47) and (TP40, TP42). A slider can be used in external mode to further modulate the sine wave frequency.



11. Click on the **Stop** button to stop the model and external mode.



REFERENCES:

For more information, refer to the following documents or links.

1. dsPIC33AK512MPS506 Digital Power Plug-In Module (PIM) [EV42F30A](#)

2. DIGITAL POWER DEVELOPMENT BOARD ([DM330029](#))
3. MPLAB® X IDE User's Guide ([DS50002027](#)) or [MPLAB® X IDE help](#)
4. [MPLAB® X IDE installation](#)
5. [MPLAB® XC-DSC Compiler installation](#)
6. [MPLAB Device Blocks for Simulink :dsPIC, PIC32 and SAM mcu](#)
7. [External Mode Demo](#)