

DSP 180 Interface User Guide

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Abstract

This document provides information about interface board that allows user to connect Texas Instruments 180 pin control card to Typhoon HIL emulator.



Typhoon HIL

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1 Overview

DSP Interface for TI 180 pin DSP cards is the way to go for those who want to accelerate the development of Power Electronics applications for Texas Instrument family of DSPs.

Typhoon HIL emulates power stage of a PE device that includes power converters, electrical machinery, filters, electrical grid, PV cells, passive elements, etc. with 1 μ s overall time resolution.

In this way users can develop and immediately test their control applications without worrying about safety measures required in the power laboratory environment.

2 Features

- HSEC 180 pin socket for TI Control Cards
- All HIL and DSP signals available through measurement terminals
- 5V power supply switch/selector (HIL or external) with LED indication
- CAN bus (3.3V, RJ45 connector)
- JTAG connector for external emulator (voltage level 3.3V)
- 24 HIL Digital Inputs (including 16 DSP's PWM signals)
- 16 HIL Digital Outputs (including DSP's 3 encoder signals)
- 24 HIL Analog Outputs (clamped to 3.3V on TI Control Card)
- Dimensions: 225mm (8.8 inch) by 80mm (3.2 inch)

3 Blok diagram

DSP 180 Interface functional block diagram is shown in Figure 3.1. Power supply section has been emitted for simplicity.

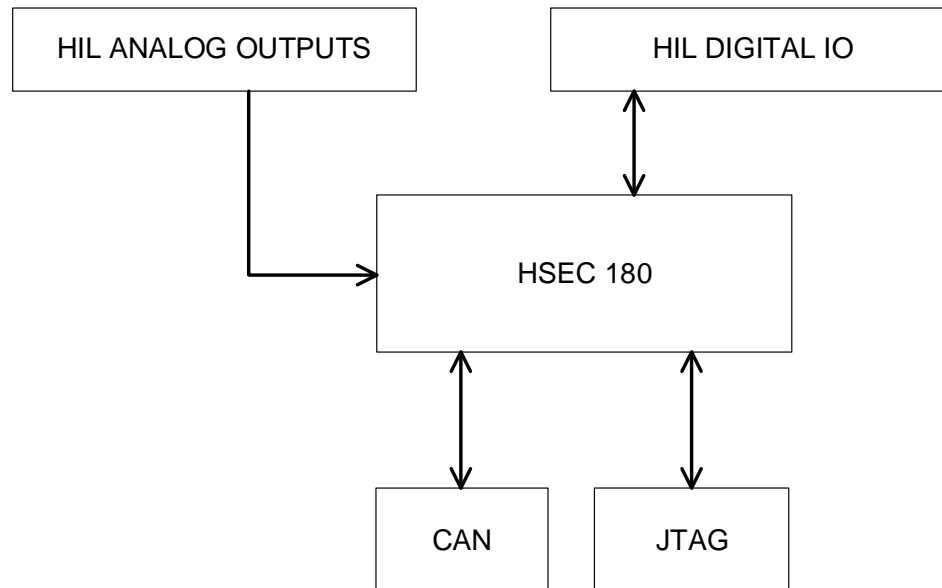


Figure 3.1 – DSP 180 Interface functional block diagram

4 Detailed description

DSP 180 Interface is shown in Figure 4.1. Numbers in white circles represents the sections of chapter 4 that describe the marked components of board.

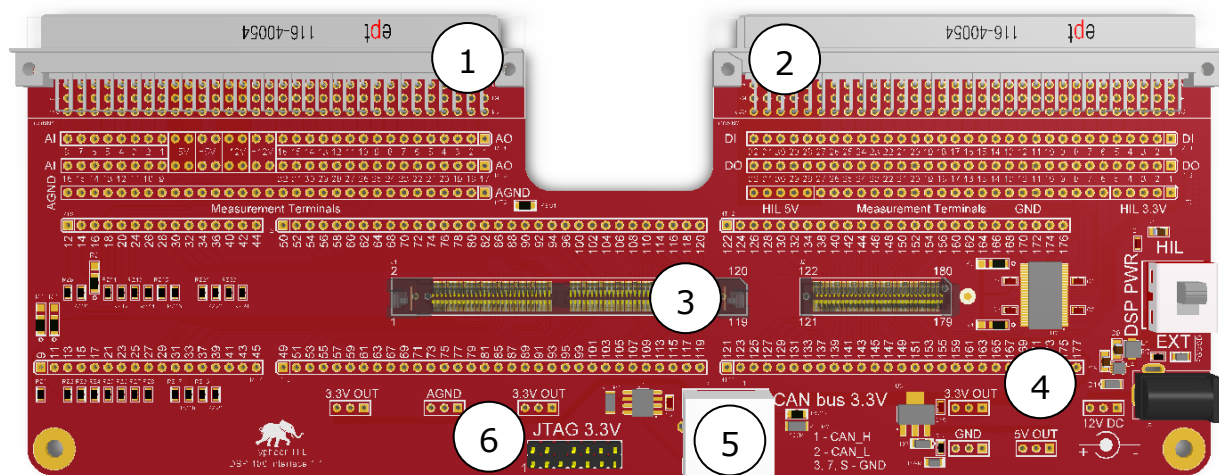


Figure 4.1 – DSP 180 Interface layout

4.1 Analog signal connector

This is a 96 pin DIN 41612/IEC receptacle connector that is directly pluggable into analog connector of the Typhoon HIL emulators. Table 1 shows how 24 analog signals from Typhoon HIL emulator are connected to HSEC 180 socket (DSP's analog stage).

HIL Analog Outputs have a series 120 Ω RZ1-RZ24 resistors that, together with TI Control Card ADC protection diodes (U6-U11), forms a 0-3.3V clamping circuit thus protecting the DSP ADC stage from signal overvoltage and undervoltage.

Table 1: Analog signals routing

| Typhoon HIL Analog Stage | DSP Analog Stage |
|-------------------------------------|-----------------------------|
| AO1/AI1* | ADC-A0/DAC-A |
| AO2/AI2* | ADC-A1/DAC-B |
| AO3 | ADC-A2 |
| AO4 | ADC-A3 |
| AO5 | ADC-A4 |
| AO6 | ADC-A5 |
| AO7 | ADC-14 |
| AO8 | ADC-15 |
| AO9 | ADC-B0 |
| AO10/AI3* | ADC-B1/DAC-C |
| AO11 | ADC-B2 |
| AO12 | ADC-B3 |
| AO13 | ADC-B4 |
| AO14 | ADC-B5 |
| AO15 | ADC-D0 |
| AO16 | ADC-D1 |
| AO17 | ADC-C2 |
| AO18 | ADC-C3 |
| AO19 | ADC-C4 |
| AO20 | ADC-C5 |
| AO21 | ADC-D2 |
| AO22 | ADC-D3 |
| AO23 | ADC-D4 |
| AO24 | ADC-D5 |

* Depending on the position of R1, R2 or R3 jumpers, HIL AO or HIL AI is connected to the DSP analog pin. Defaults are HIL AO connected to DSP ADC.

4.2 Digital signal connector

This is a 96 pin DIN 41612/IEC receptacle connector that is directly pluggable into digital connector of the Typhoon HIL emulators. Table 2 shows how 40 digital signals (16 outputs and 24 inputs) from Typhoon HIL emulator are routed to the DIM100 (DSP).

16 HIL digital outputs are level shifted from HIL's 5V to DSP's 3.3V over a SN74LVCH16T245 level shifter. Level shifter outputs can be enabled/disabled by jumpers R4 (lower 8 outputs) and R5 (upper 8 outputs). All outputs enabled by default.

Table 2: Digital signals routing

| Typhoon HIL Digital Output | DSP Digital Input | Typhoon HIL Digital Input | DSP Digital Output |
|----------------------------|-------------------|---------------------------|--------------------|
| DO1 | GPIO-54/QEP-2A | DI1 | GPIO-00/PWM-1A |
| DO2 | GPIO-55/QEP-2B | DI2 | GPIO-02/PWM-2A |
| DO3 | GPIO-56/QEP-2S | DI3 | GPIO-04/PWM-3A |
| DO4 | GPIO-57/QEP-2I | DI4 | GPIO-06/PWM-4A |
| DO5 | GPIO-50 | DI5 | GPIO-08/PWM-5A |
| DO6 | GPIO-51 | DI6 | GPIO-10/PWM-6A |
| DO7 | GPIO-52 | DI7 | GPIO-01/PWM-1B |
| DO8 | GPIO-53 | DI8 | GPIO-03/PWM-2B |
| DO9 | GPIO-35 | DI9 | GPIO-05/PWM-3B |
| DO10 | GPIO-36 | DI10 | GPIO-07/PWM-4B |
| DO11 | GPIO-37 | DI11 | GPIO-09/PWM-5B |
| DO12 | GPIO-38 | DI12 | GPIO-11/PWM-6B |
| DO13 | GPIO-60 | DI13 | GPIO-14/PWM-8A |
| DO14 | GPIO-61 | DI14 | GPIO-12/PWM-7A |
| DO15 | GPIO-62 | DI15 | GPIO-15/PWM-8B |
| DO16 | GPIO-63 | DI16 | GPIO-13/PWM-7B |
| | | DI17 | GPIO-34 |
| | | DI18 | GPIO-39 |
| | | DI19 | GPIO-40 |
| | | DI20 | GPIO-41 |
| | | DI21 | GPIO-44 |
| | | DI22 | GPIO-45 |
| | | DI23 | GPIO-48 |
| | | DI24 | GPIO-49 |

4.3 HSEC 180 control card connector

HSEC 180 connector is a standardized connector for Texas Instruments 180 pin control cards. DSP 180 Interface supports TI's 180 pin Delfino F28377 and F28379 Control Cards. Texas Instruments 180 pin Control Card is shown in Figure 4.2.

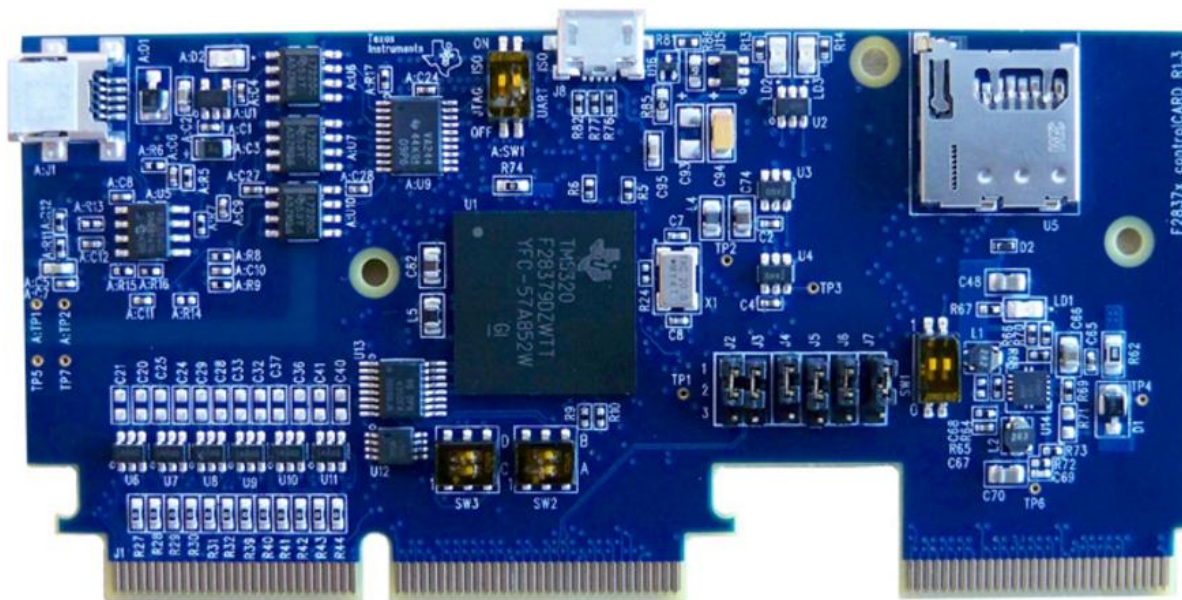


Figure 4.2 - TI 180 pin Control Card

4.4 Power supply

DSP 180 Interface is powered by a 5V rail, supplied directly from HIL's 5V or onboard 5V buck regulator (powered externally from a 12V DC adapter). DSP PWR switch is used to select the power source. External power supply option makes it possible to use the DSP 180 Interface as a standalone DSP breakout board.

External PSU stage is powered from a 12V DC adapter and outputs the 5V rail needed for powering the TI Control Card. \overline{PGOOD} LED will turn ON when the output voltage of the external PSU stage is significantly lower than 5V (for example 4.7V) or when its output current is significantly larger than 1A (for example 1.5A).

PWR LED is connected to the 5V rail of TI Control Card power supply. Onboard 3.3V regulator is also sourced from 5V rail of TI Control Card power supply and is used for powering JTAG, CAN and HIL DO level shifter.

When DSP PWR switch is in HIL position, the 5V rail of TI Control Card is supplied directly from HIL's 5V rail.

4.5 CAN bus

DSP's CAN-A module (GPIO-30/CANRX-A and GPIO-31/CANTX-A) is connected to onboard CAN transceiver, SN65HVD232D from Texas Instruments, which forms 3.3V CAN bus as shown in Figure 4.3. CAN bus is accessible over RJ45 connector and is terminated with two 120 Ω resistors. If external 3.3V CAN bus is connected to DSP 180 Interface CAN bus then care must be taken to remove the redundant terminating resistors on both buses. On DSP 180 Interface CAN bus this is done by removing RSC2 (0 Ω) resistor.

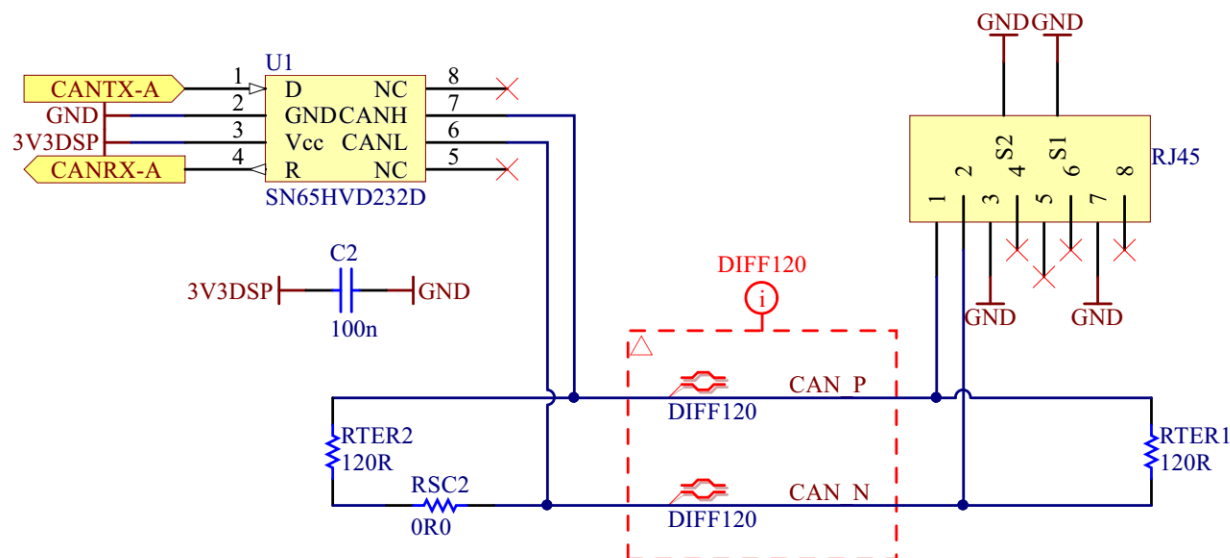


Figure 4.3 - CAN bus schematic

4.6 JTAG

14 pin JTAG header pinout is shown in Figure 4.4.

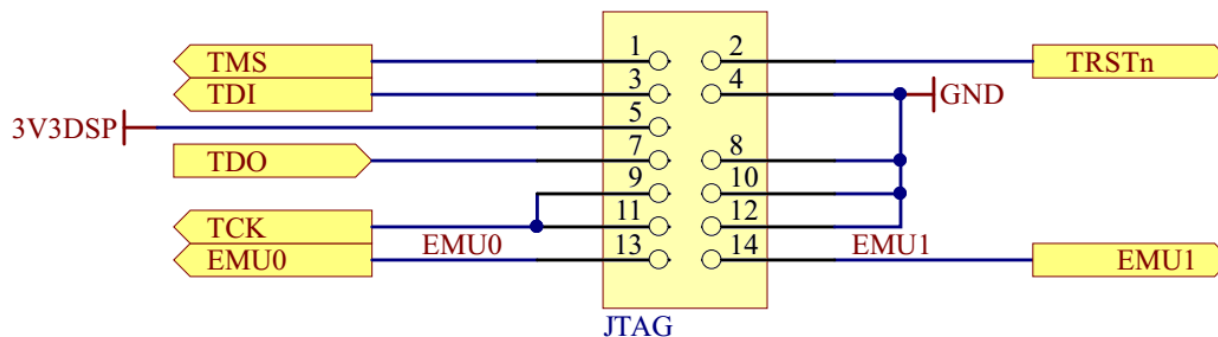


Figure 4.4 - 14 pin JTAG header signals

5 Product Images.

3D model and picture of DSP Interface are shown in Figure 5.1 and Figure 5.2.

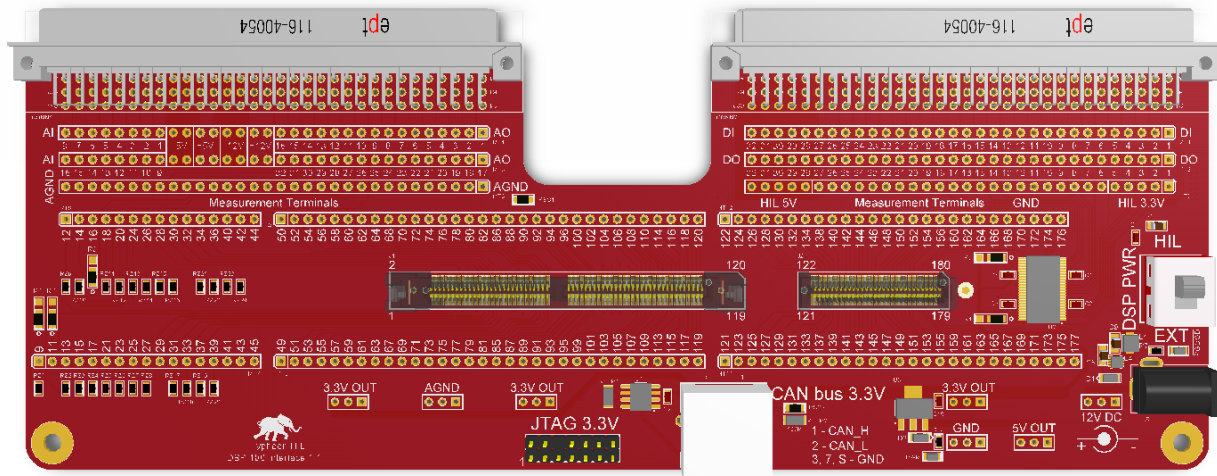


Figure 5.1 -3D model of DSP 180 Interface

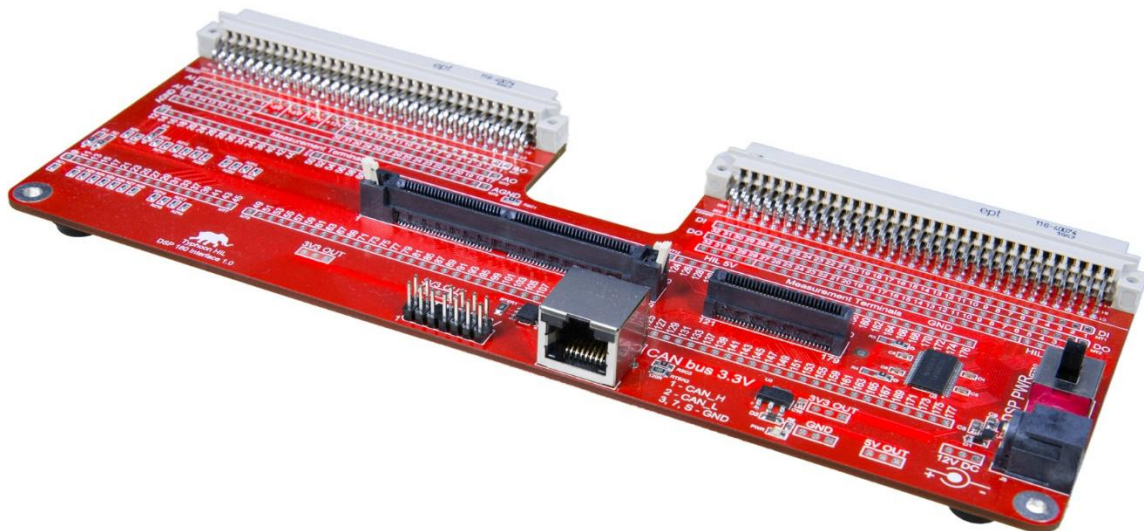


Figure 5.2 - DSP 180 Interface

6 Revision history

| Date | Version | Revision |
|------------|---------|------------------|
| 03-11-2016 | 1.0 | Initial release. |
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