

CPT-Mini2810 Card

Technical Brief

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Revision History of the CPT-Mini2810 Interface Board

Card Revision 1.0:

Version 1.0 - Initial Release

Card Revision 1.1:

Version 1.1 - Major restructuring of the board to remove the test functionality.
Added CPLD
Added Hysteresis Controller functionality
- basic manual only to mention capability
Added Multiplexer for analog inputs
Added DACs (4 x external, 4 x internal)
Removed Isolated RS-232/485 interfaces

Technical Brief released only

Version 1.2 - Full Release of Technical Brief

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CPT-Mini2810 Board

1.0 Overview of the CPT-Mini2810 Board

The CPT-Mini2810 interface board is part of the third-generation processor boards based on the MINI MICRO card series. Used in conjunction with the CPT-DA2810 DSP processor card, it provides a low cost, high performance DSP based controller, intended specifically for applications where a discrete BUS based system would be too expensive, and where time/money/resource constraints make a custom design impracticable. The card is designed around a plug-in CPT-DA2810 circuit board that utilises Texas Instruments TMS320F2810 or TMS320F2811 DSP chips, which have been specifically optimised for use in digital motor/motion control applications. This DSP is capable of running with a 150MHz system clock.

The CPT-Mini2810 interface card measures 202mm x 73mm and has 10 major sections:

- CPT-DA2810 plug-in,
- MINI BUS interface,
- Analog Inputs,
- PWM Outputs,
- Digital I/O,
- DAC Outputs
- Altera MAX II CPLD
- Optional Hysteresis Controller
- Communications
- Ancillary support circuitry.

The board is designed to plug into a custom-designed motherboard (such as a CS-IIB, CS-GIIB or CS-IIC also available from Creative Power Technologies).

The plug-in card requires regulated +/-15V and 5V supplies to be provided from off-card.

On-card facilities include:

- A CPT-DA2810 socket
- 1 x TTL level serial interface with transmit control functionality (off-card RS-422/485 capable)
- 1 x TTL level serial interface
- 4 wire clocked serial port (can be configured for master/slave operation)
- 1 off 16-bit TTL digital I/O ribbon connector, supporting 2 off 8 bit I/O banks
- 16 off single ended analog inputs
- Configurable hysteresis band controller
- 8 bit MINI bus interface (INTEL iSBX compatible)
- 6 bit TTL digital input / external interrupt port
- JTAG Programmable MAX II EPM570T100C5N CPLD
- 8 PWM outputs, arranged as 3 off complementary pairs and 2 off independent outputs
- 8 selectable PWM outputs, arranged as 3 off complementary pairs and 2 off independent outputs
- 4 DAC outputs ($\pm 10V$)
- On-card voltage regulation

Figure 1-1 is a functional block diagram of the CPT-Mini2810 controller card, showing all major sections.

1.1 CPT-DA2810 Interface

The CPT-Mini2810 requires a plug-in controller card to operate. There is an 80 way IDC header located in the centre of the board for connection to a CPT-DA2810, or equivalent, processor board. All signals on the CPT-Mini2810 are correctly buffered to interface with the CPT-DA2810 board.

1.2 Digital I/O

The CPT-Mini2810 supports 16 bits of digital I/O, arranged as 1 port of 8 bits digital output and 1 port of 8 bits digital input. DSP I/O pins B0-B7 form one TTL level digital output bank and the digital input bank is shared among I/O pins on DSP ports A, B and the CPLD. Access is via a buffered 20-way IDC header connector (ribbon cable type connector). Digital Ground and +5V connections are also brought out to this connector for use by external interface circuitry. Four of the digital inputs can be selected within the CPLD to interface to different capture ports on the DSP.

The eight digital outputs can also be configured as PWM outputs on Event Manager B (EVB).

Six TTL level buffered external interrupts are also provided through a separate 16-way IDC header.

1.3 Analog Inputs

The 16 off analog inputs accept a $\pm 10V$ input through a 26-way IDC header connector (normal ribbon cable type connector). Due to the need for explicit external calibration of the TMS320F2810 ADC module only 12 analog inputs can be accessed at any given time. The 26-way header has been retained to provide full compatibility with the existing CS-MiniDSP peripheral range. Selection of the active analog channels is achieved on-card by changeover analog switches. Eight of the analog inputs are selectable through analog switches to feed into four DSP analog channels.

The TMS320F2810 has a 12-bit A/D converter with two built-in Sample and Hold circuits. This enables two input channels, one on each ADC unit, to be sampled and converted almost “simultaneously” in a pipelined process. The DSP A/D converter accepts input voltages in the range of 0-3V. Conditioning circuits are provided on the CPT-Mini2810 to translate the incoming $\pm 10V$ to 0-3V. Glitch filtering and diode clamps are located on the CPT-DA2810 as they are best placed next to the DSP pins to minimise noise injection and to protect the DSP inputs.

In addition, two banks of 4 analog inputs (4 voltage or 4 current) can be fed to the hysteresis controller circuitry (not loaded by default) located on-card. Analog switches are used to select the source for each signal.

1.4 Gate Drive Interface

The CPT-Mini2810 interface board supports 16 PWM outputs, 8 off available on a 16-way gate drive interface sourced from Event Manager A (EVA), and 8 off shared with the digital I/O connector sourced from Event Manager B (EVB).

The EVA 16-way gate drive connector has buffered TTL level PWM outputs for connection to an external gate driver board. The port supports 8 PWM outputs, which can be sourced from either the 80-way CPT-DA2810 interface or via the on-card hysteresis controller.

Event Manager A PWM outputs are made up of 3 complementary pairs (6 outputs) with programmable deadbands and 2 independent outputs generated by simple compare units. The simple compare units can be paired within the CPLD to create complementary signals and to introduce a programmable deadband.

The hysteresis controller generates PWM gate signals from the on-card circuitry via the CPLD outputs. The default version of the CPT-Mini2810 does not have the hysteresis controller functionality loaded.

Fault monitoring for EVA is supported using the PDPINTA* external interrupt, which causes the PWM outputs to enter a high impedance state in the event of a fault. This is a hardware-triggered function within the DSP and is available on the 16-way interrupts connector.

Event Manager B (EVB), which is available via the CPT-DA2810 80 way interface, can also be configured in PWM mode. It is available for off-card use through the digital I/O interface connector. Fault monitoring for EVB is supported using the PDPINTB* external interrupt, which is available on the interrupts 16-way connector.

1.5 Analog Outputs

There are 4 off external analog outputs on the CPT-Mini2810 that are produced from a quad 12-bit *nanoDAC*®. Each DAC output is conditioned to produce a bipolar output ($\pm 10V$). All DAC outputs are fed to a single 10-way IDC header. The DACs are accessed via the SPI.

Four off additional analog outputs can be loaded and used, in conjunction with the external DACs, when the hysteresis controller functionality is active. This DAC and associated circuitry are not loaded on the default CPT-Mini2810 board.

1.6 Communications

The CPT-Mini2810 interface board has one off asynchronous serial port and a 4-wire serial peripheral interface (SPI). The asynchronous serial port can be configured to operate through the CS-MiniDSP plug-in TTL compatible interface or, alternatively, to a dedicated connector capable of supporting an off-card RS-232/422/485 interface.

The SPI is available on the CS-MiniDSP plug-in footprint. The SPI is also used in master mode for on-card peripheral communication.

None of the communications ports are isolated on-card.

1.7 Hysteresis Controller

The CPT-Mini2810 has the provision for a four channel variable bandwidth closed loop hysteresis controller. Each hysteresis channel has a summing amplifier that creates an error signal from the difference between a target reference command and a feedback input. Each error signal feeds into a variable band hysteresis comparator that switches its output up and down as the error crosses lower and upper hysteresis boundaries. The comparator outputs feed into a CPLD, which allows additional logic such as crossover delays and lock out functions to be integrated with the comparator outputs before sending them on as gate command signals to the EVA PWM outputs to control a power electronic switching stage.

The target reference commands and hysteresis bandwidths are generated on card using eight 12 bit DACs, controlled by the CPT-DA2810 DSP controller. All four hysteresis channels are independent and essentially identical, except that analog changeover switches are provided on-card to enable the channel 1 error to be sent to all four hysteresis comparators to implement a single channel of multiple-hysteresis-band multilevel converter control. The analog switches also enable the channel 3 error to be sent to two hysteresis comparators to implement 2 pairs of channels of multiple hysteresis-band converter control.

The software and hardware functionality for this feature is not available with the default CPT-Mini2810 controller. Provision for the components exists on the CPT-Mini2810 artwork as supplied.

Please contact Creative Power Technologies to upgrade to the Hysteresis Controller version of the board.

1.8 Power Supply

The CPT-Mini2810 operates from +5V digital and +15V/-15V analog supplies via the MiniDSP plug-in compatible sockets.

2.0 Specifications

2.1 Plug-In Controller DSP Section

| | |
|-------------------------|---|
| External Processor Card | CPT-DA2810 – with a Texas Instruments TMS320F2810 or 2811 DSP |
| On-card Memory | No on-card Memory – see the CPT-DA2810 Technical Manual for details |
| Clock | 150MHz clock signal via X7 to the CPLD (this link is soldered by default) |
| Reset | 120ms hardware reset generated on the CPT-DA2810 from power up and supply failure. Triggered via X10.1 or by CPT-DA2810 on-card Link (S1) |
| Interrupts | Support for Gate Driver Faults, and 3 off external off-card interrupts |

2.2 Mini Bus Interface

| | |
|----------------------------|--|
| Mini Bus Description | 8 data bits, 3 address bits, 3 I/O select lines, control signals (similar to Intel iSBX microbus) |
| Mini Bus I/O Address Space | 24 I/O ports on Mini Bus, accessible as 3 banks of 8 addressable ports Generated within the CPLD from the SPI on the DA2810 interface |
| Connector – Plug-In | 36 way IDC socket, X14 |

2.3 Analog Inputs

| | |
|---------------------------|--|
| Number of A/D Inputs | 16 |
| Number of A/D Channels | 12 off conditioned ADC signals to the CPT-DA2810 analog interface (X2) |
| Definition | Analog Switches select 4 of 8 analog channels. Individual switch selection between A and B channels 12 off single-ended input connections providing conditioned analog inputs |
| Input Voltage Range | ±10V Maximum |
| Output Voltage Range | 0-3V Maximum |
| Dynamic Response | Cut-off frequency >150kHz |
| Connector Input – Plug-In | 26-way IDC Socket, X2 , requiring ±15V analog supply, 16 off analog input signals, and AGND |
| Connector Output | Part of the CPT-DA2810 interface, X8 |

2.4 Analog Outputs

| | |
|--------------------------|---|
| Definition | 4 off 12-Bit Buffered DACs with output signal conditioning |
| Number of Channels | 4 |
| DAC Resolution | 12 bits (1 x LSB = 4.88mV) |
| Voltage Range | $-\frac{2048}{2048} \times 10V = -10V$ to $\frac{2047}{2048} \times 10V = 9.995V$ |
| Gain & Offset Adjustment | Software Calibration Required |
| DAC Settling Time | 3 – 4.5µs |
| DAC Interface | Accessed via SPI interface with DAC1* (GPIOD6) chip select |
| Slew Rate | 1.8V/µs |
| PCB Connection | 10 pin shrouded IDC header, with output signals, and interleaved AGND (X1) |

2.5 PWM Gate Drive Interface

| | |
|---------------------------------------|---|
| Definition | A 16-way IDC connector, X3 , providing 8 PWM outputs |
| PWM Outputs | 8 PWM outputs consist of – a) EVA Mode (sourced from the CPT-DA2810 interface) 3 complementary pairs (6 outputs) with programmable deadband (0-102µs) 2 independent outputs generated by simple compare units <i>or</i> 1 complementary pair with programmable (CPLD generated) deadband b) Hysteresis Controller Mode (sourced from the CPLD and hysteresis hardware on-card) 4 complementary pairs (8 outputs) with programmable (CPLD generated) deadband |
| Gate Fault Interrupt | PDPINTA* on interrupt header, which when unmasked and active low, causes the timer compare outputs immediately to go to a high impedance state Pull-down resistors on the PWM outputs act to disable the PWM drive signals |
| Digital high output voltage threshold | 3.30V |
| Digital low output voltage threshold | 1.10V |
| Connector – Plug-In | 16-way IDC socket, X3 . GND also available on connector |

2.6 Digital I/O

| | |
|---|---|
| Definition | 1 bank of 8 bit TTL digital input 1 bank of 8 bit TTL digital outputs (can be configured as PWM outputs) 1 bank of 6 bit TTL external interrupts. All four bits can be used as digital inputs |
| Digital high input voltage threshold | 3.30V |
| Digital low input voltage threshold | 1.10V |
| Digital outputs rated at | ±35mA per bit, ABSOLUTE MAXIMUM |
| Typical digital high output voltage @ 10mA source | 4.34V |
| Typical digital low output voltage @ 10mA sink | 0.33V |
| Connector – Plug-In | 20-way IDC socket, X6 . +5V (DVCC) and GND also available on connector |
| Note: Output voltage specified for +5V DVCC | |

2.7 Interrupts Interface

| | |
|--------------------------------------|---|
| Definition | 1 bank of 6 bit TTL external interrupts. These signals can also be configured as digital inputs |
| DSP Interrupts Available | PDPINTA* PDPINTB* XINT1A (interfaces to XINT1 via the CPLD) XINT2 CAP3 CAP6 |
| External Reset | Off-card Reset signal (RESET_INPUT*) (normally high – active low to cause reset). Connected in parallel with reset switch, S1 |
| Digital high input voltage threshold | 3.30V |
| Digital low input voltage threshold | 1.10V |
| Connector – Plug-In | 16-way IDC socket, X10 . GND also available on the connector |

2.8 Communications Interface

| | |
|---------------|---|
| Definition | The CPT-Mini2810 interface board has a TTL level serial port, a transmit control capable TTL serial port and a 4 wire clocked serial port. |
| Configuration | Serial Port SCIB is CPLD configurable to either a TTL level serial port (via the MiniDSP plug-in interface X12) or a TTL level serial port with a transmit control signal (X13) The 4 wire clocked serial port operates independently |
| Isolation | No |

2.8.1 TTL Level Serial Interface

| | |
|---------------------|---|
| Definition | A 16-way IDC connector, X12 , providing two-pin serial communications at a TTL level |
| Compatibility | Transmit is provided on X12 pin 5 and Receive is provided on X12 pin 3 |
| Connector – Plug-In | 16-way IDC socket, X12 . GND also available on connector |

2.8.2 TTL Level Serial Interface with Transmit Control

| | |
|---------------------|---|
| Definition | A 5-way molex connector, X11 , providing two-pin serial communications at a TTL level with a separate transmit control. Capable of operation as an off-card RS-485 interface |
| Compatibility | The interface is compatible with the CPT-COM isolated battery powered RS-232 circuit board (pins 1-4) and the CPT-COM4 isolated RS-232/422/485 board |
| Configuration | Transmit Control Signal driven from TX_CTRL* (GPIOA15) |
| Connector – Plug-In | 5-way molex header, X11 . 3.3V and GND also available on connector |

2.8.3 Clocked Serial Port Interface

| | |
|---------------------|--|
| Definition | A 10-way IDC connector, X9 , providing 4 wire clocked serial communications port. +5V (DVCC) and GND made available on connector for external use |
| Compatibility | Buffered 4 wire I/O clocked serial communications protocol. Capable of operating in master or slave mode via M_S* (GPIOA14) signal. |
| Configuration | Off-card interface can be disabled through OC_SPI_EN (GPIOA13) |
| Connector – Plug-In | 10-way IDC socket, X9 . DVCC and GND also available on connector |

2.9 Software

| | |
|------------------|---|
| Support Software | Standard library source code, sample programs Texas Instruments: Code Composer Studio V3.1 and above |
|------------------|---|

2.10 Power Supplies

| | |
|-----------------|---|
| Definition | The board's power supplies must be sourced from the plug-in sockets on the MiniDSP footprint |
| Input Voltage | Regulated +5VDC / GND - Digital Input Regulated +15V/-15V/AGND – Analog Inputs |
| Power Connector | Digital +5V Supply via Connectors X6, X9 and X14 . Analog +15V/-15V Supply via Connector X2 |

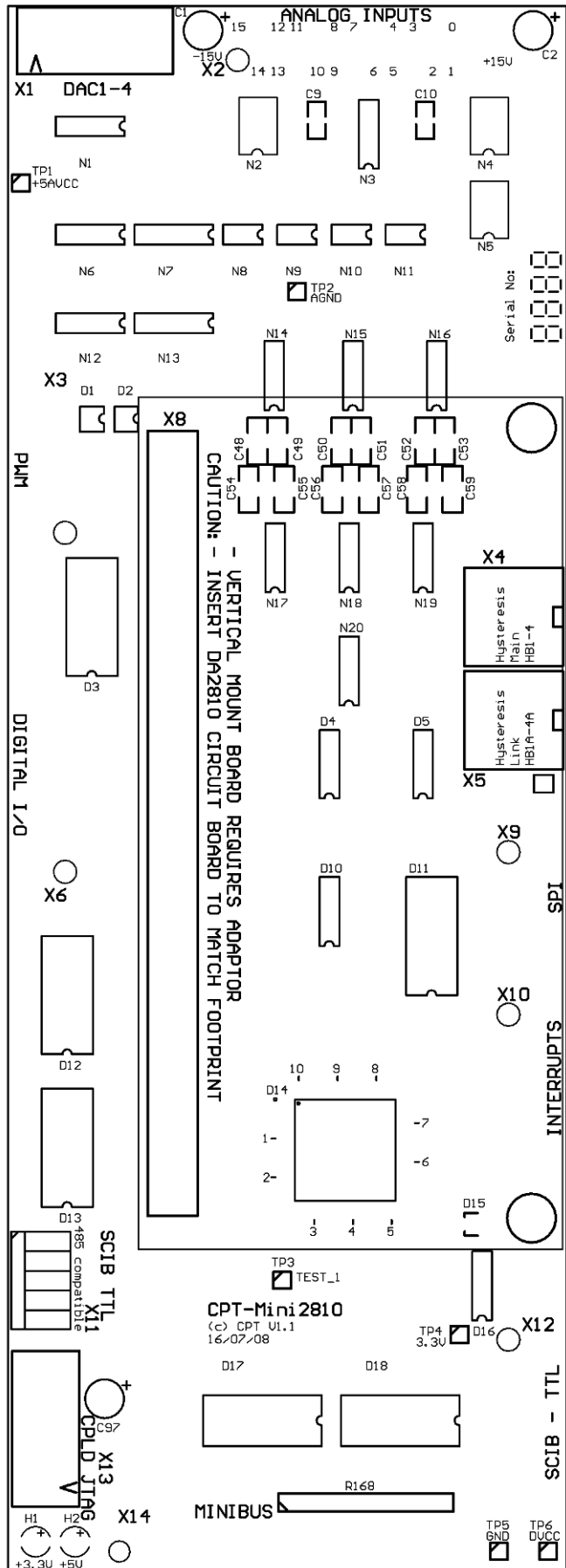
2.11 General

| | |
|---------------------|--|
| Physical Dimensions | L: 202mm |
| | W: 73mm |
| | H: 30mm approx. |
| Environmental | 0 – 50°C Ambient operating temperature 5% - 95% non condensing humidity |

Appendix

Appendix A Component Layout

Top Layer



Bottom Layer

