

CPT-DFC4

DF Series Communications Peripheral Card Technical Brief

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CPT-DFC4 Manual Revision History

CARD VERSION 1.0: Initial Board for prototype purposes.

Release 1.0 – Initial Release

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DF Series Concept

1.0 DF Series Overview

The DF Series provides a modular, flexible integrated inverter controller platform through a range of interconnected cards. This structure provides an overall reduction in the footprint of the inverter, as well as providing a level of flexibility to support inverters rated from 1kW to 100kW+.

The DF Series Control Card supports Texas Instruments PTP footprint based Piccolo and Delfino Microcontrollers (MCU). Creative Power is actively supporting a subset of these MCU variations as their feature sets are closely aligned. The latest range of MCUs support TI's new integrated analog and control peripherals that are designed to consolidate additional functionality within the MCU.

The modular nature of the DF Series system is seen through the flexible DF Series Interface which connects the DF Series Control Card to a wide range of peripheral cards. These cards include an Inverter Controller and various Communications Peripheral cards. Figure 1-1 shows the general structure of the DF Series stack, with the Control Card mounted to the Inverter Motherboard and one or more Communications Peripheral Cards mounted above.

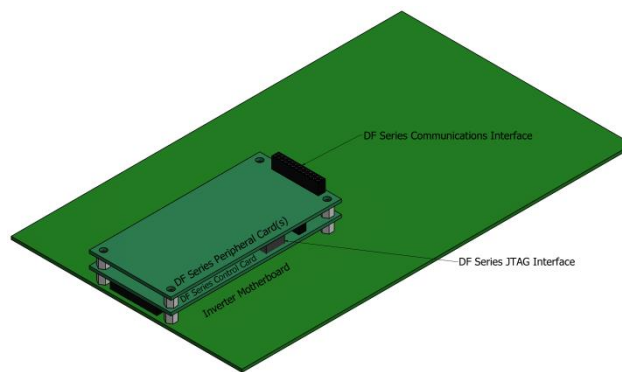


Figure 1-1: DF Series Card Stack Conceptual Overview

1.1 DF Series Card Range

The following is a list of the available cards within the DF Series. Additional cards will be added to the range as they become available.

1.1.1 DF Series Control Card:

The DF Series Control Card is available with the following part numbers:

- **CPT-DF28075 (TMS320F28075PTP MCU Processor)**
- CPT-DF28374S (TMS320F28374SPTP MCU Processor)
- CPT-DF28375S (TMS320F28375SPTP MCU Processor)
- CPT-DF28376S (TMS320F28376SPTP MCU Processor)
- **CPT-DF28377S (TMS320F28377SPTP MCU Processor)**
- CPT-DF28374D (TMS320F28374DPTP MCU Processor)
- CPT-DF28375D (TMS320F28375DPTP MCU Processor)
- CPT-DF28376D (TMS320F28376DPTP MCU Processor)
- **CPT-DF28377D (TMS320F28377DPTP MCU Processor)**

The part number corresponding to the DF Series Control Card must be specified as part of the order. The parts in bold are CPT standard load options.

The Control Card has a footprint of 96mm x 46mm (standard DF Series Footprint size)

1.1.2 DF Series Peripheral Cards

The Peripheral Cards can be mounted within the DF Stack above the Control Card, with interconnection through either the DF Communications Interface or, for the CPT-DFJ, the DF JTAG interface.

All Peripheral Cards are the standard DF Series Footprint size of 96mm x 46mm.

1.1.2.1 CPT-DFC1

CPT-DFC1 Peripheral Card provides external communications interfaces for the Control Card. It interfaces to the Control Card via the 26 way DF Communications Interface.

The CPT-DFC1 Peripheral Card supports the following functionality:

- Dual SCI to Isolated single USB Interface (two serial ports within the one USB connection)
 - USB-A: On-Card DIP Switch Selectable between SCIA and SCIC
 - USB-B: On-Card DIP Switch Selectable between SCIB and SCID
- Isolated CAN Interface
 - On-Card DIP Switch Selectable between CANA and CANB
- Isolated SPI Interface (isoSPI configuration)
 - Direction Selection: On-Card DIP Switch Selectable between Master/Slave
 - Mode Selection: On-Card DIP Switch Selectable Phase and Offset – supporting SPI Modes 0-3
- Real-Time Clock (I²C) with Supercapacitor backup

1.1.2.2 CPT-DFC4

CPT-DFC4 Peripheral Card provides external communications interfaces for the Control Card. It interfaces to the Control Card via the 26 way DF Communications Interface.

The CPT-DFC4 Peripheral Card supports the following functionality:

- Isolated RS422/RS485 Interface
 - On-Card DIP Switch Selectable between SCIB and SCID
 - On-Card DIP Switch Selectable between RS422 and RS485 Mode
- Isolated CAN Interface
 - On-Card DIP Switch Selectable between CANA and CANB
- Isolated SPI Interface (isoSPI configuration)
 - Direction Selection: On-Card DIP Switch Selectable between Master/Slave
 - Mode Selection: On-Card DIP Switch Selectable Phase and Offset – supporting SPI Modes 0-3

1.1.2.3 CPT-DFJ

- JTAG + SCI to Isolated single USB Interface
 - USB based UART Serial Port through MCU Port SCIA
 - USB JTAG Emulation interface for programming and debugging of the Control Card

1.1.3 DF Series Inverter Motherboard

The CPT-DFM1 is Creative Power's next generation high performance MCU based inverter controller motherboard. The CPT-DFM1 has been designed to provide flexibility of connection, combined with a minimum footprint for applications requiring an integrated solution to control up to a four-phase leg VSI stack.

The Inverter Motherboard is compatible with the DF Series Control Cards, and the CPT-DFM1/Control Card Platform combination contains on-card all necessary functions for a complete standalone inverter control system.

The Inverter Motherboard supports up to 8 plug/solder-in gate driver modules, enabling the system to be scaled to an applications specific topology and power rating. The card has the following features:

CPT-DFC4 DF SERIES COMMUNICATIONS PERIPHERAL CARD TECHNICAL BRIEF

- DF Series Main Interface Connectors
- 11 off Conditioned Analog Inputs (Low voltage inputs):
 - 3 differential AC voltage inputs, (Three-phase 4 wire input compatible)
 - 3 differential AC/DC voltage inputs
 - 5 current inputs (AC and DC compatible)
- Isolated Digital I/O
 - 2 isolated digital inputs (Field supply)
 - 3 MOSFET switch isolated outputs
 - 2 relay output, c/o contact
- On-Card Status Indication
 - 1 Power LED
 - 4 indication LEDs
 - Each isolated Digital I/O has an on-card status LED
- 4 off DIP switches
- 8 off CPT-Gxx compatible gate driver interface.
 - 3.3V TTL ePWM compatible outputs
 - Driven by ePWM1x to ePWM4x via the DF Series Main Interface
 - 2 sets of 4 fault feedback interrupt
 - Supports CPT's range of CPT-Gxx gate driver boards
 - Switched Gate Driver Supplies to drive isolating transformers on CPT-Gxx gate driver boards
 - Gate Driver Reset signal
- Quadrature Position Encoder input with Index and Strobe
- Push button reset
- On-card logic level supply generation
- Power supply operation from input 24VDC

The CPT-DFM1 card measures 220mm x 130mm.

1.2 DF Series Interfaces

The DF Series is modular in construction, which implies that signals require connection between the various cards. This is achieved using 2mm Dual-inline connectors between the cards within the DF Series Stack.

The Control Card consists of three Interface types:

- DF Series Main Interface (2 x 26-way + 3 x 20-way 2mm Dual-inline connectors)
- DF Series Communications Interface (26-way 2mm Dual-inline connector)
- DF Series JTAG Interface (10-way 2mm Dual-inline connector)

1.2.1 Main Interface

The DF Series Main Interface provides signal connection between the Control Card and Inverter Motherboard (CPT-DFM1). It is located on the underside of the Control Card.

The DF Series Main Interface has been broken up into 5 separate connectors. The Analog connector is located along the left hand edge of the Control Card and Motherboard. The remaining 4 connectors contain digital signals between the Control Card to the Motherboard. Their precise functionality must be specified within the user software to suit the Motherboard.

The Inverter Motherboard is configured as the base of the Main Interface Stack. The Control Card is mounted above the Inverter Motherboard.

1.2.2 Communications Interface

The DF Series Communications Interface provides signal connection between the Control Card and DFC Series Peripheral Cards. The Communications Interface is located along the right hand edge of the DF Series Footprint cards.

CPT-DFC4 DF SERIES COMMUNICATIONS PERIPHERAL CARD TECHNICAL BRIEF

The Control Card is configured as the base of the Communications Interface stack. All Peripherals cards are mounted above the Control Card.

1.2.3 JTAG Interface

The DF Series Control Card has a 10 way connector that interfaces to the isolated CPT-DFJ JTAG and SCI USB card.

The isolated JTAG and SCI board is compatible with TI's default JTAG software EEPROM specification and provides a fully isolated USB JTAG Interface with a Serial Communications Interface to SCIA on the MCU.

CPT-DFC4 Communications Peripheral Card

2.0 Overview of the CPT-DFC4

The CPT-DFC1 is a communications peripheral card that forms part of the DF Series Range. It contains a DF Series Communications Interface and supports isolated RS422/RS485, CAN and SPI external interfaces.

The CPT-DFC4 card measures 96mm x 46mm and is consistent with the DF Series Interface structure.

On-card facilities include:

The CPT-DFC4 Peripheral Card has the following functionality

- Isolated RS422/RS485 Interface
 - On-Card DIP Switch Selectable between SCIB and SCID
 - On-Card DIP Switch Selectable between RS422 and RS485 Mode
 - Support for Terminating Resistors
 - ESD Signal Protection
- Isolated CAN Interface
 - Option of Mini-USB CAN connector or 0.1" Molex style
 - On-Card DIP Switch Selectable between CANA and CANB
 - ESD CAN Differential Signal Protection
- Isolated SPI Interface (isoSPI configuration)
 - Direction Selection: On-Card DIP Switch Selectable between Master/Slave
 - Mode Selection: On-Card DIP Switch Selectable Phase and Offset
- 26-way DF Series Communications Interface

Figure 2-1 shows a functional block diagram of the CPT-DFC4 card, illustrating all major sections.

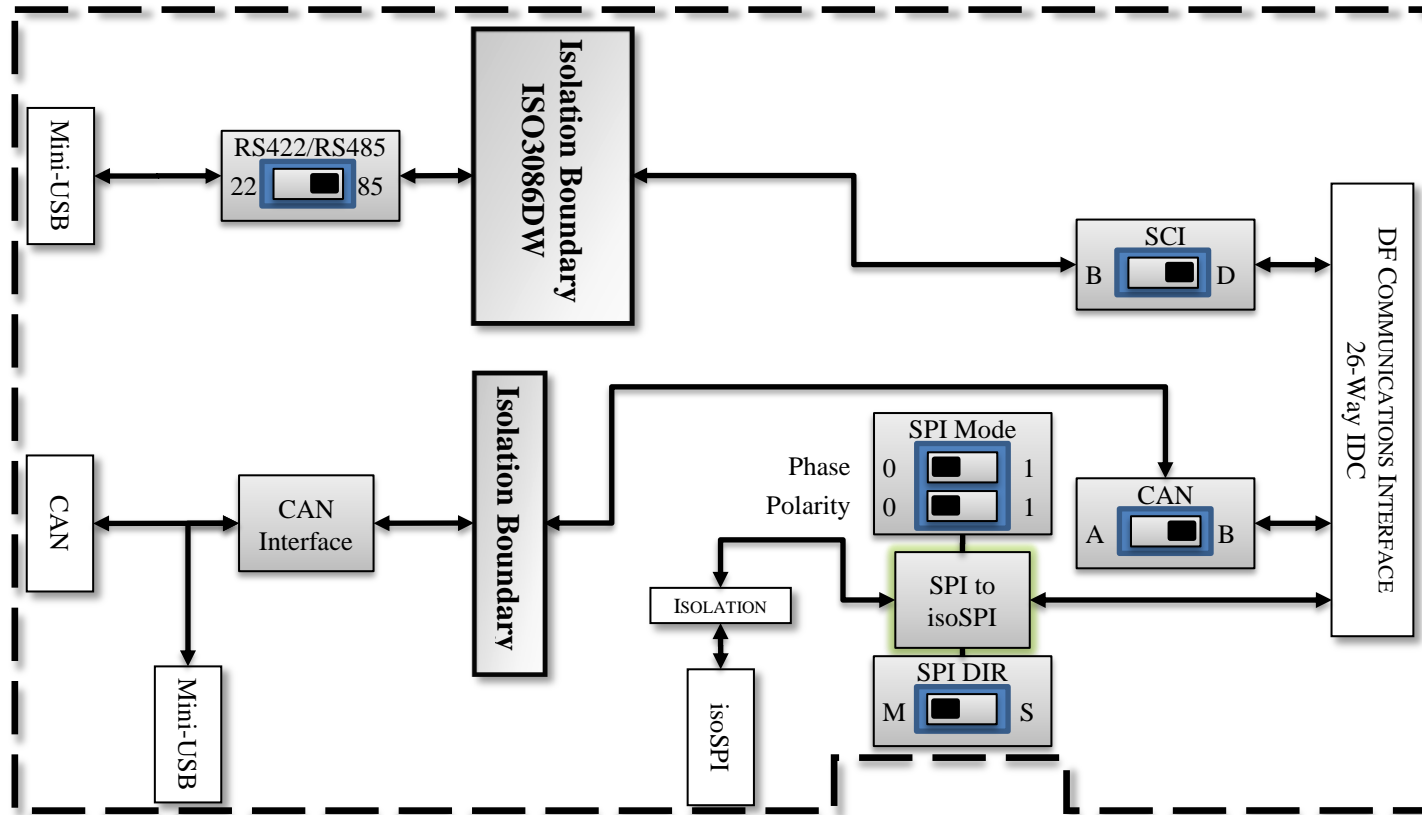


Figure 2-1: Functional Diagram of CPT-DFC4 Communications Peripheral Card

3.0 Specifications

3.1 Communications Interface

Definition	The Communications Peripheral Card contains one isolated RS422/RS485 interface, one CAN interface and an isoSPI interface.
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3.1.1 RS422/RS485 Serial Communications Interface

Definition	Two-wire asynchronous serial port (UART) that supports a 16-level, receive and transmit FIFO for reducing servicing overhead. The receiver and transmitter are double buffered with separate enable and interrupt bits. DEFAULT MODE: RS422D mode providing a full-duplex RS422 communications interface on SCID of the DF Series Communications Interface using a differential signal serial connection
Communications Port	SCIB / SCID DIP Switch S4
Communications Mode	RS422 / RS485 DIP Switch S1
Isolation	ISO3086DW 4000- V_{PEAK} Isolation, 560- V_{peak} V_{IORM} per UL1577 760390014 400 V_{RMS} Please consult the datasheet for these components for full isolation information
Bus Termination	R1 (on Y-Z) = Default is not loaded R2 (on A-B) = Default is not loaded
PCB Connections	Differential A/B, Y/Z signals and GND connection - MOLEX (X1)

3.1.2 CAN Interface

Definition	Isolated CAN Bus Interface to ISO 11898-1, 2.0A, B
Communications Port	CANA / CANB DIP Switch S5
Isolation	ISO1050 2500 V_{RMS} 760390014 400 V_{RMS} Please consult the datasheet for these components for full isolation information
Signals	CANH, CANL
Terminating Options <i>Not Loaded by Default</i>	2 off 60.4 Ω resistors (R3 , R4) – 120.8 Ω effective terminating resistor 1 off 4700pF capacitor (C3) from terminating resistor midpoint to GND_ISO
PCB Connector	Mini-USB Header (X2), MOLEX (X3)

3.1.3 isoSPI Interface

Definition	Encoded SPI Data on LTC6820 isoSPI Isolated Communication Interface
Communications Port	SPIB
Isolation	PE-68386NL 1500 V_{RMS} Please consult the datasheet for these components for full isolation information
Signals	IP, IM
Direction	Master / Slave DIP Switch S3
Modes	0, 1, 2, 3 DIP Switch S2
PCB Connector	Mini-USB Header (X5), MOLEX (X4)

CPT-DFC4 DF SERIES COMMUNICATIONS PERIPHERAL CARD TECHNICAL BRIEF

3.2 General

Physical Dimensions	L: 96mm
	W: 46mm
	H: 11mm approx.
Mounting Arrangement	4 off 3.5 mm holes located in the corners of the card 88mm x 38mm hole centres. DF Series Communications Interface used for connection to the DF Series Control Card
Environmental	-40 – 85°C ambient operating temperature 5% - 95% non-condensing humidity

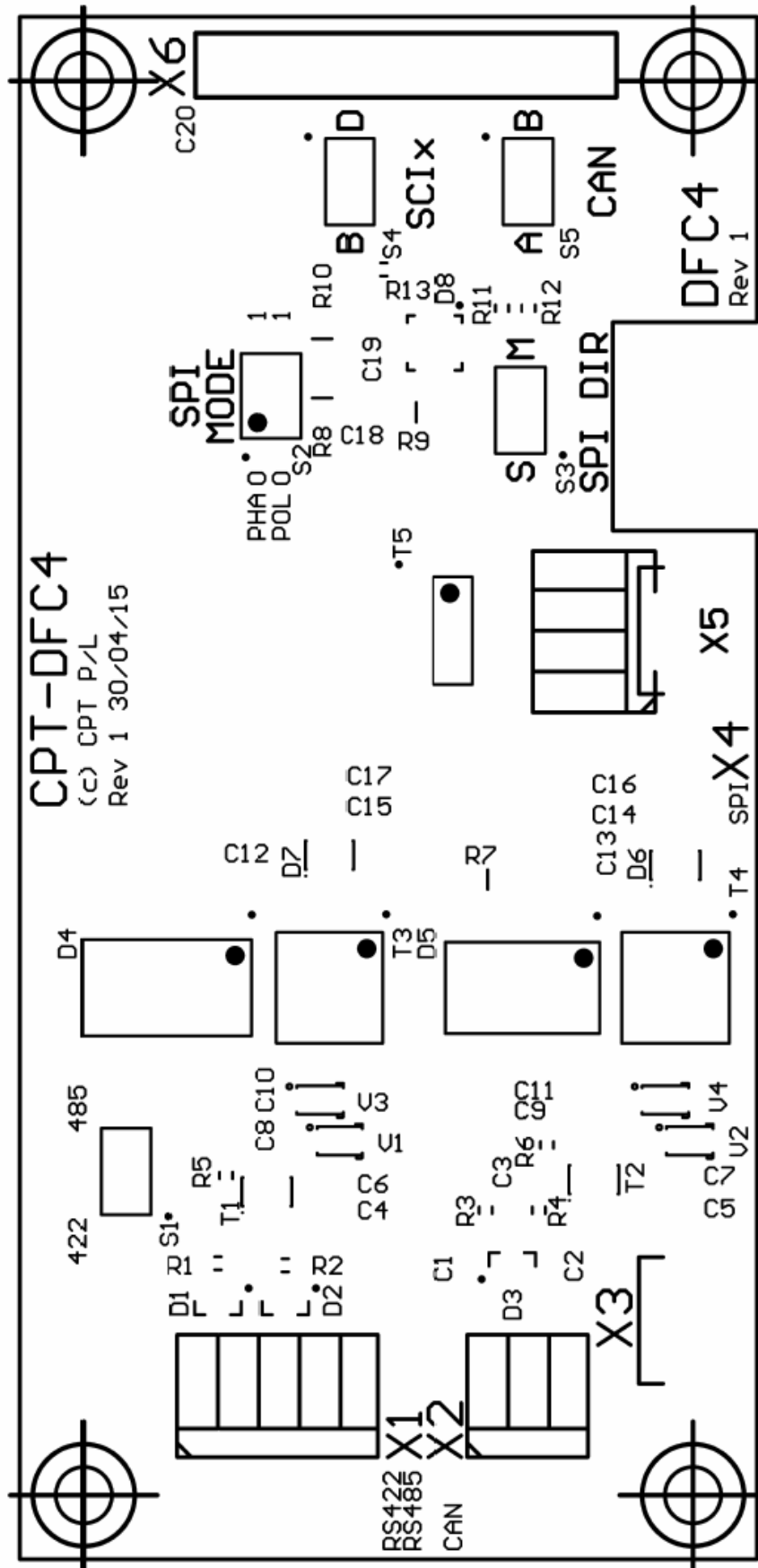
3.3 Order Codes

CPT-DFC4	isoSPI not Loaded
CPT-DFC4-SPI	isoSPI Loaded

Appendices

Appendix A Component Layout

Top Layer



Appendix B Texas Instruments Documentation

TMS320F28075PTP Piccolo Microcontroller

Texas Instruments Website: <http://www.ti.com/product/TMS320F28075/technicaldocuments>

Datasheet Document Number: SPRS902
Technical Manual Document Number: SPRUHM9

TMS320F2837xSPTP

Texas Instruments Website: <http://www.ti.com/product/TMS320F28377S/technicaldocuments>

Datasheet Document Number: SPRS881
Technical Manual Document Number: SPRUHX5

TMS320F2837xDPTP

Texas Instruments Website: <http://www.ti.com/product/TMS320F28377D/technicaldocuments>

Datasheet Document Number: SPRS880C
Technical Manual Document Number: SPRUHM8C

ControlSuite

Texas Instruments Website: <http://www.ti.com/tool/controlsuite>