

CPT-DFJ

**DF Series JTAG Interface Card
Technical Brief**

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CPT-DFJ 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.

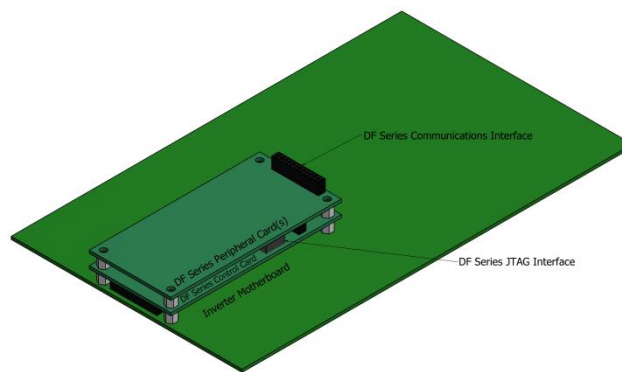


Figure 1-1: DF Series Card Stack Conceptual Overview

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)

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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:

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- 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 DIP switches
- 8 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 DF Series Peripheral Cards. The Communications Interface is located along the right hand edge of the DF Series Footprint cards.

CPT-DFJ DF SERIES JTAG INTERFACE 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-DFJ JTAG Interface Card

2.0 Overview of the CPT-DFJ

The CPT-DFJ is an isolated JTAG and Serial Communications Interface (SCI)/UART card. It provides an isolated USB interface for a Texas Instruments based microcontroller (MCU), as found on CPT's DF Series Control Cards. The JTAG Interface Card uses the same interfacing circuitry and EEPROM as found on Texas Instruments own controlCARD series.

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

On-card facilities include:

- Isolated JTAG Emulation (XDS100V2 emulator)
- Isolation Interface (ISO7220CD)
- ESD Protection on USB signals
- EEPROM with Texas Instruments JTAG Emulator Definitions
- DF Series JTAG Interface
- DF Series Footprint
- Also configurable for operation with DA Series Cards
 - 14-way IDC header for compatibility with DA Series JTAG interfaces
 - 4-way SCI header for compatibility with CPT's 4-pin serial communications
- Mini-USB PC Interface
- Code Composer Studio compatible without additional hardware

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

CPT-DFJ DF SERIES JTAG INTERFACE CARD TECHNICAL BRIEF

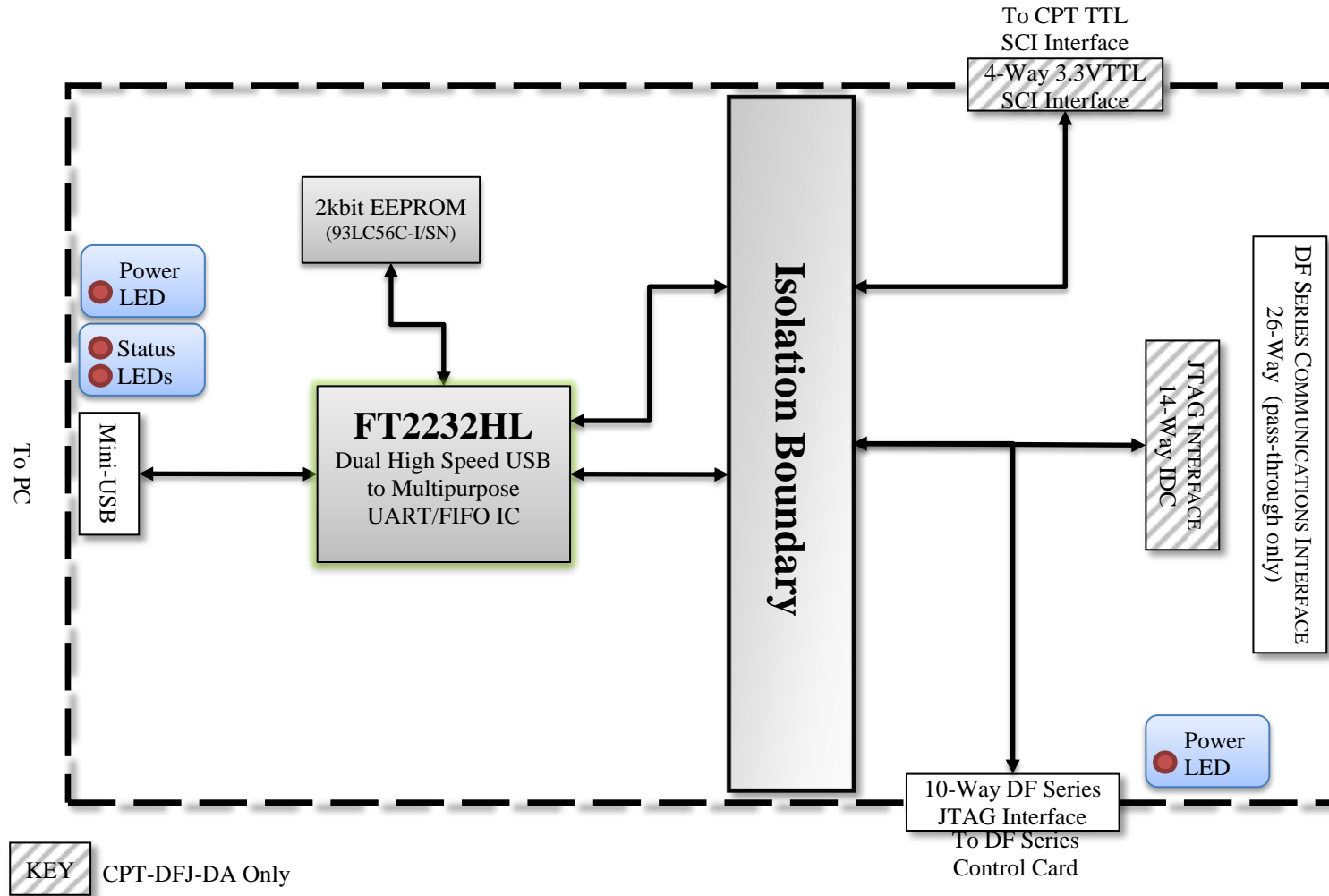


Figure 2-1: Functional Diagram of CPT-DFJ JTAG Interface Card

3.0 Specifications

3.1 Communications Interface

Definition	The JTAG Interface Card allows one 3.3V-TTL serial communications interface to be connected through the isolation to the USB. The FT2232HL IC provides conversion of the isolated 3.3V-TTL UART signals into a USB Virtual UART Port
Isolation	ISO7220CD 2500Vrms isolation per UL1577 Please consult the datasheet for these components for full isolation information

3.1.1 DF Series: Serial Communication Interface – SCIA

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: Digital I/O
Communications Port	SCIA – when used with DF Series JTAG Connector
Signals	SCITX, SCIRX
PCB Connections	GPIO29-28 – 10-way DF Series JTAG Header (X2)

3.1.2 DA Series: Serial Communication Interface – SCI

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
Signals	SCITX, SCIRX
PCB Connections	4-way MOLEX header with +3.3V and GND_MCU connections (X3)

3.2 JTAG

Definition	MCU programming interface, which enables the MCU to interface the real-time debugging environment
Compatibility	Compatible with IEEE 1149.1 standard for scan-based emulation
Isolation	ISO7220CD 2500Vrms isolation per UL1577 Please consult the datasheet for these components for full isolation information
Configuration	3.3V-TTL Level signals
PCB Connection	10-way DF Series JTAG Interface Header (X2) 14-way DA Series JTAG Header (X4)

CPT-DFJ DF SERIES JTAG INTERFACE CARD TECHNICAL BRIEF

3.3 Software

Support Software (Available Separately)	Standard library source code, sample programs Texas Instruments: Code Composer Studio V5.5 and above compatible
EEPROM Software	FT2232HL Programming Image available within Texas Instruments ControlSuite Package - Appendix B

3.4 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 JTAG Interface used for connection to the DF Series Control Card
Environmental	-40 – 85°C ambient operating temperature 5% - 95% non-condensing humidity

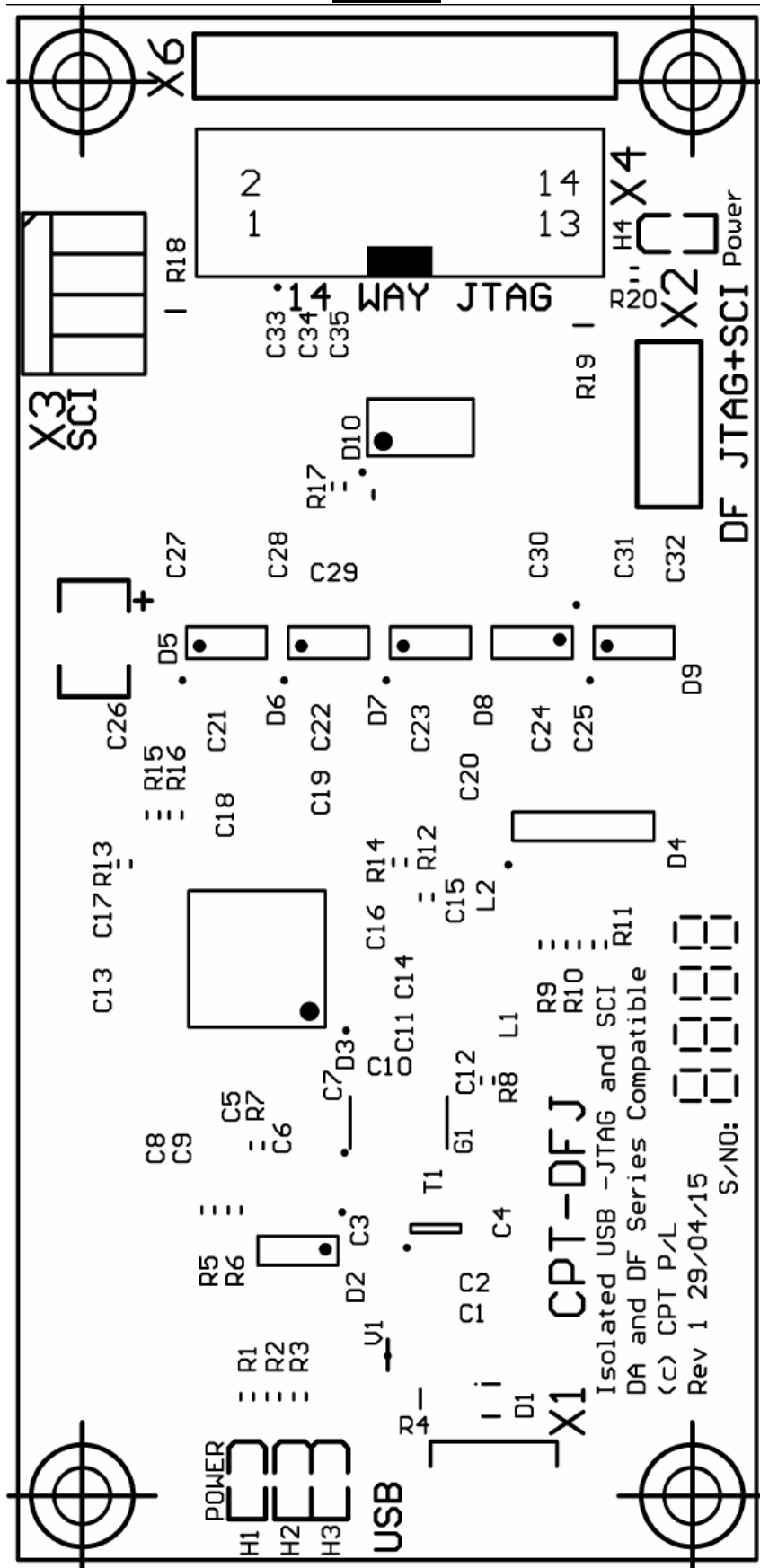
3.5 Order Codes

CPT-DFJ	DF Series JTAG Interface Only (X2 and X6 loaded)
CPT-DFJ-DA	DA Series JTAG Interface + SCI MOLEX Connector Only (X3 and X4 Loaded instead of X2 and X6)

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>

Location: ControlSUITE\development_kits\~Utilities

Document: How to Program On Board XDS100 USB Jtag.doc

EEPROM Programming File: XDS100_wUART.ept