

Trenz Electronic GmbH info@trenz-electronic.de www.trenz-electronic.de Spartan-3E FPGA Industrial Micromodule

User Manual

# **Features**

- High-density plug-in Xilinx Spartan-3E module
- **USB 2.0** interface with high speed (480 Mbit/s) data rate
- Large SPI flash for configuration and user storage accessible via USB or SPI connector
- Large DDR-SDRAM
- FPGA configuration is implemented via JTAG, SPI Flash or USB
- 3 on-board high-power, high-efficiency, switch-mode DC-DC converters (1 A for each voltage rail: 1.2 V, 2.5 V, 3.3 V)
- Power supply via USB or B2B (carrier board)
- Flexible expansion via high-density shockproof B2B (board-to-board) connectors
- Most I/O's on the B2B connectors are routed as LVDS pairs
- Evenly spread supply pins for good signal integrity

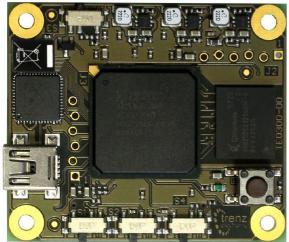


Figure 2: TE0300: top view.

- Industrial temperature grade available on request
- Low-cost, versatile and ruggedized design

# **Specifications**

- FPGA: Xilinx Spartan-3E XC3S500E XC3S1600E
- USB controller: Cypress EZ-USB FX2 USB 2.0 microcontroller CY7C68013A-56LFX
- Non volatile memory: 16 MBit 64 Mbit SPI Flash for FPGA-configuration and user data
- Volatile memory: 512 Mbit x 16 DDR SDRAM with up to 666 Mbyte/s
- Up to 110 FPGA user I/Os
- Supply voltage range: 4.0 V 5.5 V
- 1 push-button
- 1 LED
- Small size (only 40.5 mm x 47.5 mm)

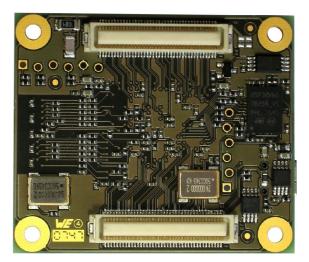


Figure 1: TE0300: bottom view.

# **Applications**

- IP (intellectual property) development
- Digital signal processing
- Image processing
- Cryptography
- Industrial control
- Low-power design
- General-purpose prototyping platform

# Description

The FPGA industrial micromodule integrates a leading edge Xilinx Spartan-3E FPGA, an USB 2.0 microcontroller, configuration Flash, DDR SDRAM and power supplies on a tiny footprint. A large number of configurable I/Os are provided via B2B mini-connectors.

The module is intended to be used as an OEM board, or to be combined with our carrier boards. It is a powerful system widely used for educational and research activities.

Boards with other configurations, larger FPGA's or equipped with industrial temperature grade parts are available on request.

Software for SPI flash programming over USB as well as reference designs for high speed data transfer over USB are included.

# **Physical Features**

# **Board Dimensions**

The module measures 40.50 mm by 47.50 mm.

# **Board-to-Board Connectors**

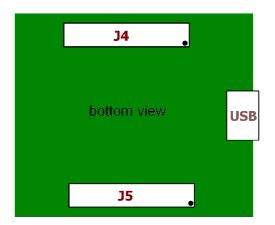


Figure 4: connector receptacles J4 and J5 (bottom view). Figure 3: module dimensions in mm (top view).

The module has two B2B (board-toboard) receptacle connectors (J4 and J5) for a total of 160 contacts (Figure 5).



Figure 5: micromodule receptacle.

The ordering numbers of the connector receptacles are given in Table 1.

supplier	header	
Digikey	H11113CT-ND H11113TR-ND H11113DKR-ND	
Hirose	DF17(3.0)-80DS-0.5V(57)	
Trenz Electronic	22684	

# Table 1: equivalent part numbers ofthe receptacle connectors J4 and J5.

The on-board receptacles mate with their corresponding headers on the carrier board (Figure 6).



P OF Header

# Figure 7: stacking height (h).

The stacking height of the TE0300 B2B connectors is 7 (seven) mm. The stacking height does not include the solder paste thickness.

# **USB** Connector

The micromodule uses a mini-USB (B type) receptacle connector.



Figure 8: mini-USB (B type) recept-

Figure 6: mating header.

The ordering number of the headers is given in Table 2.

supplier	header	
Digikey	H11148DKR-ND H11148TR-ND H11148CT-ND	
Hirose	DF17(4.0)-80DP-0.5V(57)	
Trenz Electronic	22938	

# Table 2: equivalent part numbers ofthe mating connectors.

Figure 7 shows the definition of stacking height featured by the combination of the TE0300 receptacle with its corresponding header.

Power Supply

acle connector.

The module can be powered by the B2B connector or the USB connector. If both power supplies are available, the B2B connector power supply takes precedence, disabling the USB power supply automatically.

# **B2B Connector Power Supply**

The B2B connector power supply requires a single nominal 5 V DC power supply. The power is usually supplied to the module through the 5 V contacts (5Vb2b) of the B2B connectors J5 (see Appendix). The recommended minimum supply voltage is 4 V. The maximum supply voltage is 5.5 V.The recommended maximum continuous supply current is 1.5 A.

# **USB Power Supply**

The module is powered by the USB connector if the following conditions are met:

- the module is equipped with an USB connector,
- the module is connected to a USB bus,
- no power supply is provided by the B2B connectors.

In this case, other components (e.g. extension or carrier boards) may also be powered by the corresponding 5 Volt line (5V) of the B2B connector J5.

# **On-board Power Rails**

Three on-board voltage regulators provide the following power supply rails needed by the components on the micromodule:

- 1.2 V, 1 A max
- 2.5 V, 1 A max
- 3.3 V, 1 A max

The power rails are available for the FPGA and can be shared with a baseboard by the **corresponding** lines of the B2B connectors J4 and J5. Please note that the **power consumption of the FPGA is highly dependent on the design** actually loaded. So please use a tool like Xilinx Xpower to determine the expected power consumption.

Even if the provided voltages of the module are not used on the baseboard, it is recommended to bypass them to ground with 10 nF - 100 nF capacitors.

# I/O Banks Power Supply

The Spartan-3E architecture organizes I/Os into four I/O banks (see Table 3).

Bank	Supply Voltage (V)	Min (V)	Max (V)
B0	VccIO	1.2	3.3
B1	2,5	-	-
B2	3,3	-	-
B3	3,3	-	-

#### Table 3: I/O banks power supply.

Voltage for banks B1, B2 and B3 is fixed respectively to 2,5 V, 3,3 V and 3,3 V.

Voltage VccIO for bank B0 shall span from 1.2 V to 3.3 V. VccIO can be supplied either externally or internally to the micromodule.

**Warning!** Spartan-3 I/Os are not 5 V tolerant. Applying more than the recommended operating voltages at any pin, results in a damaged FPGA (see Xilinx Answer AR#19146).

## **Externally Supplied VccIO**

VccIO can be externally supplied over the B2B connector J4. If bank B0 is not used, then VccIO can be left open.

# Internally Supplied VccIO

If VccIO is **not** externally supplied, it can be internally supplied by **one** of the internal power rails of 2.5 V and 3.3 V. This is possible by short-circuiting **one** of the two pad pairs placed on the right of connector J4 at the top right corner of the bottom side of the micromodule.

Figure 9 shows how to short-circuit VccIO to internal 3.3 V power rail.

Figure 10 shows how to short-circuit VccIO to internal 2.5 V power rail.

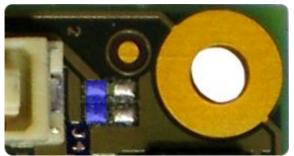


Figure 10: R103 pad pair (blue highlight) for 2.5 V internal supply.

Two suitable ways of shirt-circuiting the paid pair are by means of a zero-ohm 0603 (1608 metric) chip resistor or a solder blob.

# **FPGA User I/Os**

A total of 110 FPGA user I/Os are available on corresponding contacts of B2B connectors J4 and J5 (see Appedix).

- 37 differential digital I/O pairs: each pair is configurable as 2 singleended digital I/Os, corresponding to a maximum of 74 single-ended digital I/Os;
- 4 differential clock input pairs: each pair is configurable as differential digital I/O pair or 2 single-ended clock inputs or 2 single-ended digital I/Os (or combination thereof), corresponding to from a maximum of 8 independent clock inputs to a maximum of 8 independent digital I/Os;
- I differential clock input pair: the pair is configurable as differential digital input pair or as 2 single-ended clock inputs or 2 single-ended digital inputs (or combination thereof), corresponding to from a maximum of 2 independent clock inputs to a maximum of 2 independent digital inputs;
- 21 single-ended digital I/Os;
- 5 single-ended inputs.

Table 4 summarizes the maximum available FPGA user I/Os divided by supply voltage.

type	VccIO	3.3 V
diff. I/O pairs	≤ 18	≤ 23
diff inputs	≤ 1	none
diff. clocks	≤ 4	≤ 1
s. e. I/Os	≤ 46	≤ 58
s. e. inputs	≤ 2	≤ 4
s. e. cloks	≤ 8	≤ 3

Table 4: maximum FPGA user I/Os by supply voltage.

# **Differential Pairs**

The micromodule has a total of 42 differential signal pairs routed pairwise with a differential impedance of 100 ohm to adjacent connector pins. These lines can be used for high speed signaling up to 666 Mbit/s per differential pair (see Xilinx Application Note XAPP485).

# **User Button and LED**

# LED

The LED is lit when the U\_LED line (pin R10) is set high as detailed in the following table.

Signal	FPGA pin	FPGA ball
U_LED	IO_L15P_2 (bank 2)	R10

Tabelle 5: user led signal details.

# **Push Button**

The push button is connected to the PB input (pin V16). as detailed in the following table.

Signal	FPGA pin	FPGA ball
РВ	IP (bank 2)	V16

#### Tabelle 6: user button signal details.

The input is normally low. The input is pulled up when pressed.

# **Configuration Switches**

The micromodule hosts 4 DIP switches on the top side: S1; S2, S3 and S4.

For customers requesting a sufficient amount of units, the micromodules can be manufactured replacing the switches by fixed connections.

# **DIP Switch S1**

S1 enables / disables the communication between the Cypress EZ-USB FX2 micro-controller and the I2C CMOS Serial EEP-ROM.

Turn S1 off when programming the USB EEPROM storing the USB vendor ID and device ID. This will force the USB microcontroller to provide its default vendor ID and device ID.

S1	position	
EEPROM (on)*	EEPROM <u>en</u> abled	
Off (off)	EEPROM <u>dis</u> abled	

#### Table 7: S1 (\* default: EEPROM).

For further information, please read paragraph "Software Configuration".

# **DIP Switch S2**

S2 enables / disables the reset line. The reset line (available also on 2 contacts of the B2B connector) resets the USB micro-controller and the FPGA.

S2 has to be turned off (*Reset*) if the user wants to program the SPI Flash memory in direct mode. For programming the SPI Flash memory in indirect mode over JTAG, S2 has to be turned on (*Run*).

S2	position	
Run (on)*	system running	
Reset (off)	system reset	

#### Table 8: S2 (\*default: Run).

For further information, please read paragraph "Software Configuration".

# **DIP Switch S3**

S3 conditionally / unconditionally enables the 1.2 V and 2.5 V power rails.

When S3 is turned on, the 1.2 V and 2.5 V power rails are controlled by the USB microcontroller. At start-up, the USB microcontroller switches off the 1.2 V and 2.5 V power rails and starts up the module in low-power mode. After enumeration, the USB microcontroller firmware switches the 1.2 V and 2.5 V power rails on, if enough current is available from the USB bus.

When S3 is turned off, the 1.2 V and 2.5 V power rails are always enabled.

S3	position	
FX2 PON (on)*	rails controlled by FX2	
PON (off)	rails always enabled	

#### Table 9: S3 (\* default: FX2 PON).

**Warning!** When S3 is turned on (*FX2 PON*), make sure that no signals are applied to the input pins when power-rails are disabled by the USB microcontroller.

The 3.3 V power-rail though is out of the control of the USB-microcontroller and is supplied down-converting the 5 V power supply provided by either the USB-bus or the B2B receptacle connector. In this case, signals that are applied to the 3.3

V I/O banks do not need to be disconnected when power-rails are disabled by the USB microcontroller.

# **DIP Switch S4**

S4 enables / disables the FPGA configuration through the SPI interface. The FPGA configuration through the JTAG interface cannot be disabled.

When S4 is turned on, the FPGA tries to configure from the SPI Flash memory. The FPGA can be configured by the JTAG interface at any time.

When S4 is turned off, the FPGA waits to be configured by the JTAG interface.

For further information about direct (pure SPI) / indirect (SPI over JTAG) in-system programming of SPI flash memories, please see Xilinx Application Notes XAP-P951 "Configuring Xilinx FPGAs with SPI Serial Flash" and XAPP974 "Indirect Programming of SPI Serial Flash PROMs with Spartan-3A FPGAs".

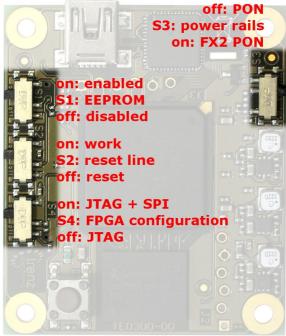
<b>S</b> 4	position	
SPI (on)*	FPGA configuration: JTAG + SPI	
JTAG (off)	FPGA configuration: JTAG	

#### Table 10: S4 (\* default: SPI).

**Warning!** When downloading via parallel JTAG programmer to FPGA, it can happen that programming fails with Error: "'1': Programming terminated. DONE did not go high." Try setting DIP switch S4 to JTAG-only. A bug in certain Xilinx iMPACT versions can cause this.

# **DIP Switches Overview**

Figure 11 summarizes functions and location of the four DIP switches.



# Figure 11: DIP switches overview. **JTAG and SPI**

The offset holes for J2 and J3 allow a removable press fit of standard 0.100 inch header pins to connect the fly wires without any soldering necessary.

# **JTAG Header**

JTAG signals are available on the dedicated header J2 through a JTAG programmer with flying leads as described in Table 11.

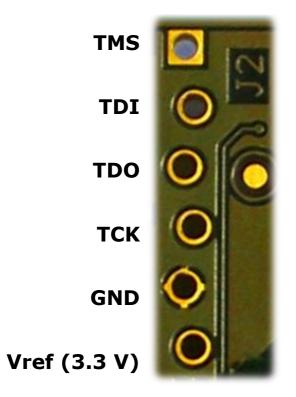


Table 11: JTAG header (J2).

# **SPI Header**

SPI signals are routed to / from bank 2 of the FPGA as detailed in Table 12 and made available on the dedicated header J3 accessible through an SPI programmer with flying leads as described in Table 13.

Signal	FPGA pin	FPGA ball
SPI /S	IO_L01P_2	U3
SPI D	IO_L03N_2	T4
SPI Q	IO_L16N_2	N10
SPI /C	IO_L26N_2	U16

Table 12: SPI signal details (bank 2).

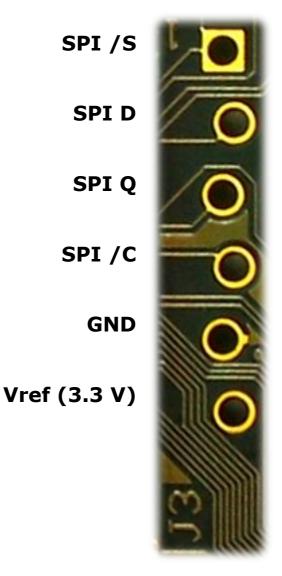


Table 13: SPI header (J3).

# **Clock Networks**

# 24 MHz Clock Oscillator

The module has a 24 MHz SMD clock oscillator providing a clock source for both the USB microcontroller and the FPGA as detailed in Table 14.

Signal	FPGA pin	FPGA ball
24MHZ1	IO_L12P_2 (bank 2)	N9

## **Main Clock Oscillator**

The module has a main SMD clock oscillator providing a clock source for the FPGA as detailed in Table 15.

Signal	FPGA pin	FPGA ball
100MHZ 125MHZ	GCLK0 (bank 2)	U10

#### Table 15: main clock signal details.

Standard frequencies are 100 MHz and 125 MHz (please visit Trenz Electronic website for current ordering information). The lower the main clock frequency, the lower the module power consumption. Moreover, as the main clock is preferably used as DDR SDRAM clock, a lower clock frequency makes easier for the development tools to meet the timing requirements (particularly for DDR SDRAM). For customized boards, this clock can be changed according to user requirements.

# Interface Clock (IFCLK)

The IFCLK line synchronizes the communication between the USB microcontroller and bank3 of the FPGA as detailed in Table 16.

Signal	FPGA pin	FPGA ball
IFCLK	LHCLK5 (bank 3)	K4

Table 16: interface clock signal details (bank 3).

# Digital Clock Manager (DCM)

The DCMs of the FPGA can be used to synthesize arbitrary clock frequencies from any on-board clock network, differ-

ential clock input pair or single-ended clock input. For further reference, please read Xilinx data sheet DS485 "Digital Clock Manager (DCM) Module" (dcm\_module.pdf) and Xilinx application note XAPP462 "Using Digital Clock Managers (DCMs) in Spartan-3 FPGAs" (xapp462.pdf).

# **On-board Memories**

The TE0300 has three on-board memories:

- DDR SDRAM
- SPI Flash
- serial EEPROM

#### **DDR SDRAM**

TE0300 modules have a 512Mb DDR SDRAM component for operation (code and data) accessible through the FPGA.

Commercial-grade modules mount the following component:

Micron Technology MT46V32M16BN-6

Industrial-grade modules mount the following component:

Micron Technology MT46V32M16BN-6 IT

You can get the exact part number of the component mounted on your module from the Micron FBGA decoder:

http://www.micron.com/support/part\_inf o/fbga/decoder

When developing DDR SDRAM designs with Xilinx tools (e.g. MIG, MPMC, ...), you should select the following product type:

#### MT46V32M16-6.

Should it be not available, you can use one of the following product types:

- MT46V32M16-5
- MT46V32M16XX-5B
- MT46V32M16BN-5B

- MT46V32M16FN-5B
- MT46V32M16P-5B
- MT46V32M16TG-5B

TE0300 modules with the following part numbers

- TE0300-00
- TE0300-00-4I5C
- TE0300-00B
- TE0300-01
- TE0300-01B
- TE0300-01BLP

are assembled with

Qimonda HYB25DC512160CF-6

512Mb DDR SDRAM components. When developing DDR SDRAM designs with Xilinx tools, you should select the following product type:

HYB25D512160BF-6.

## **SPI Flash**

TE0300 modules have a

STMicroelectronics M25P32

32-Mbit, low voltage, serial Flash memory with 75 MHz SPI bus interface for configuration and operating storage accessible through USB or SPI.

# Serial EEPROM

TE0300 modules have a

Micron Technology 24LC128

128K I2C CMOS Serial EEPROM for EZ-USB FX2 firmware, vendor ID and device ID storage accessible through the EZ-USB FX2 microcontroller.

# **Module Configuration**

This section describes how to configure the TE0300 module and access some of its resources.

The JTAG interface allows a fast, frequent but volatile configuration of the TE0300 module. However, only through the JTAG interface it is possible to develop and debug with Xilinx tools (e.g. Xilinx Chip-Scope, Xilinx Microprocessor Debugger.

The SPI interface allows a fast, frequent and non-volatile configuration of the TE0300 module.

Configuration of the TE0300 module through a USB host is recommended for occasional, non-volatile on-site operations such as firmware upgrade.

# **System Requirements**

TE0300 modules can be configured through a host computer with the follow-ing system requirements:

- Operating system: Microsoft Windows 2000, Microsoft Windows XP, Microsoft Vista;
- Xilinx ISE 10.1 or later for indirect SPI in-system programming (see Xilinx Answer AR #25377);
- Xilinx EDK for some reference designs;
- Interface: USB host;
- JTAG/SPI USB cable with flying leads.

### EZ-USB FX2 Microcontroller Firmware

If the EEPROM has never been programmed before (virgin board), S1 can be switched to **EEPROM**. The USB microcontroller will detect an empty EEPROM and will provide its default vendor ID and device ID to the USB host.

DIP switch	on (left)	off (right)
S1	EEPROM	-
S2	Run	-
S3	Х	Х
S4	х	х

If the EEPROM has been programmed before (EEPROM not empty), S1 must be switched to **Off**. The USB microcontroller will detect a missing EEPROM and will provide its default vendor ID and device ID to the USB host.

DIP switch	on (left)	off (right)
S1	-	Off
S2	Run	-
S3	Х	Х
S4	Х	Х

### *Generic USB Microcontroller Driver installation*

If the USB microcontroller (Cypress EZ-ESB FX2) driver is not installed on the host computer, then the easiest way to do it is the following:

- disconnect the micromobule or leave the micromodule unconnected;
- configure the micromodule such that the USB microcontroller will provide its default vendor ID and device ID to the USB host (i.e. S1 = OFF -- see paragraph "EZ-USB FX2 Microcontroller Firmware");
- connect the micromodule to the host computer through the USB interface;
- wait until the operating system detects new hardware and starts the hardware assistant;

- if S1 is not already switched to EEP-ROM, do it now;
- answer the hardware assistant questions as shown in the following example.

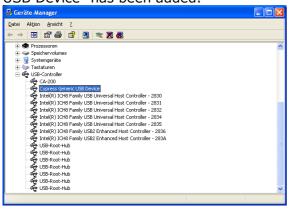
ssistent für das Suchen n	euer Hardware
	Willkommen
	Mit diesem Assistenten können Sie Software für die folgende Hardwarekomponente installieren:
	USB Device
	Falls die Hardwarekomponente mit einer CD oder Diskette geliefert wurde, legen Sie diese jetzt ein.
	Wie möchten Sie vorgehen?
	Software automatisch installieren (empfohlen)
	<ul> <li>Software von einer Liste oder bestimmten Quelle installieren (für fortgeschrittene Benutzer)</li> </ul>
	Klicken Sie auf "Weiter", um den Vorgang fortzusetzen.
	< <u>∠</u> uriück <u>W</u> eiter > Abbrechen







Check that in the "Device Manager" under "USB-Controller" the "Cypress Generic USB Device" has been added.



Now the USB microcontroller can be accessed from the host computer through dedicated software.

#### EZ-USB FX2 EEPROM Programming

First of all, check that S1 is actually switched to EEPROM.

The USB EEPROM can be programmed by opening the dedicated software "Cypress USB Console" (double click the "CyConsole.exe" file in the "1st\_program\CyConsole" folder).

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Click "Options > EZ-USB Interface" to Open EZ-USB Interface window.

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"S EEPROM" button refers to the small EEPROM (256 bytes) whereas the "Lg EE-PROM" refers to the large EEPROM (64 kB). Press the "Lg\_EEPROM" button, select the "USB.iic" file and press the "Open" button to start writing to EEPROM.

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Upgrade progress is displayed in status window and is completed when "Down-load Successful" text is displayed.

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0000 02 0000 78 0000 78 0000 BB 0000 BB 0010 06 0020 E5 0030 0D 0040 E9 0050 9F	0D 91 12 byte 7F 84 1 96 byte 01 0C 1 89 25 8 82 29 1 85 82 2 25 82 0 F5 F0 1	0 A)	d91 75 81 3 84e 75 82 1 22 BB 1 83 3A 1 85 83 3 BB FE 0	0 88 02 0 85 83 3 98 06 9 95 83 9 3A 95 8 05 89 2	3A F5 83 19 25 82 14 93 22 33 E8 F0 15 82 C8	F8 E2 F8 BE 22 50 F2 22	2 50 2 22 3 01 0 06 2 RB					
0000 02 0000 78 0000 78 0000 BB 0010 06 0020 ES 0020 C 0030 0D 0040 E9 0050 9F Foggle S	0D 91 12 byte 7F 84 8 96 byte 01 0C 1 89 25 8 82 29 1 85 82 2 25 82 0 F5 F0 1 051 Rese	0 A) as: addr= 6 D8 FD s: addr= 85 82 29 82 F8 86 75 82 E5 29 F5 82 85 92 52 28 F6 22 28 95 42 24 92 42 24 00)	tSetting d91 75 81 3 84e F5 82 1 22 BB 1 83 3A 1 25 83 3 BB FE 0 F0 E9 5	0 38 02 0 85 83 3 98 06 8 75 83 8 38 95 8 35 89 2 90 42 8	3A F5 83 19 25 82 14 93 22 33 E8 F0 15 82 C8	F8 E2 F8 BE 22 50 F2 22	2 50 2 22 3 01 0 06 2 RB					
0000 02 0000 78 0000 78 0000 88 0010 06 0020 85 0030 0D 0040 89 0050 9F Foggle 8	0D 91 12 byte 7F 84 1 96 byte 01 0C 1 89 25 8 82 29 1 85 82 0 85 82 0 75 F0 1 051 Rese ing file	0 A) 5 0 A) 5 0 8 FD 5 0 8 FD 5 0 2 29 5 0 2 ES 29 F5 0 2 ES 20 F6 2 2 28 F6 2 2 28 F6 2 2 28 F6 2 2 29 F5 0 2 ES 29 F5 0 2 ES 20 F6 2 2 20 F6	d91 75 81 3 84e FS 82 1 22 BB 1 83 3A 1 ES 83 3 BB FE 0 FO E9 5	0 38 02 0 85 83 3 FE 06 1 F5 83 1 3A F5 8 05 89 2 9D 42 1 0.11c	3A F5 83 19 25 82 14 93 22 33 E8 F0 15 82 C8	F8 E2 F8 BE 22 50 F2 22	2 50 2 22 3 01 0 06 2 RB					
0000 02 Download 0000 78 Download 0000 BB 0010 06 0020 E5 0030 0D 0040 E9 0050 9F Toggle 8 Toggle 8	0D 91 12 byte 7F 84 1 96 byte 01 0C 1 89 25 8 82 29 1 85 82 2 25 82 0 F5 F0 1 051 Rese ing 4096	0 A) as: addr= 6 D8 FD s: addr= 85 82 29 82 F8 86 75 82 E5 29 F5 82 85 92 52 28 F6 22 28 95 42 24 92 42 24 00)	d91 75 81 3 84e 75 81 2 83 3A 1 22 BB 1 83 3A 1 25 83 3 BB FE 0 F0 E9 5 300\usb 0 addr	0 88 02 0 85 83 3 98 06 8 95 83 9 34 95 8 90 42 9 0.110	3A F5 83 19 25 82 14 93 22 33 E8 F0 15 82 C8	F8 E2 F8 BE 22 50 F2 22	2 50 2 22 3 01 0 06 2 RB					

Disconnect the USB cable.

## Dedicated USB Firmware Driver Installation

Check the configuration switches against the following table:

DIP switch	on (left)	off (right)
S1	EEPROM	-
S2	Run	-
S3	FX2 PON	-
S4	Х	Х

Reconnect the USB cable to run the newly uploaded firmware in the USB microcontroller. Under the default switch configuration, the USB microcontroller is now ready to provide dedicated vendor ID and device ID. Wait until the operating system detects new hardware and starts the hardware assistant and answer the hardware assistant questions as shown in the following example.

Assistent	für das Suchen neuer Hardware
	Willkommen
	Mit diesem Assistenten können Sie Software für die folgende Hardwarekomponente installieren:
	DeweSoft USB Device
	Falls die Hardwarekomponente mit einer CD oder Diskette geliefert wurde, legen Sie diese jetzt ein.
	Wie möchten Sie vorgehen?
	Software automatisch installieren (empfohlen)
	<ul> <li>Software von einer Liste oder bestimmten Quelle installieren (für fortgeschrittene Benutzer)</li> </ul>
Har dwar	einstallation
1	Die Software, die für diese Hardware installiert wird: DEWESoft USB Device hat den Windows-Logo-Test nicht bestanden, der die Kompatibilität mit Windows XP überprüft. ( <u>Warum ist dieser Test wichtig</u> 2)
	Das Fortsetzen der Installation dieser Software kann die korrekte Funktion des Systems direkt oder in Zukunft beeinträchtigen. Microsoft empfichlt strengstens, die Installation jetzt abzubrechen und sich mit dem Hardwarehersteller für Software, die den Windows-Logo-Test bestanden hat, in Verbindung zu setzen.
	Installation fortsetzen

Assistent für das Suchen neuer Hardware
Wählen Sie die Such- und Installationsoptionen.
Diese Quellen nach dem zutreffendsten Treiber durchsuchen
Verwenden Sie die Kontrollkästchen, um die Standardsuche zu erweitern oder einzuschränken. Lokale Pfade und Wechselmedien sind in der Standardsuche mit einbegriffen. Der zutreffendste Treiber wird installiert.
Wechselmedien <u>d</u> urchsuchen (Diskette, CD,)
Eolgende Quelle ebenfalls durchsuchen:
C:\TE0300\driver V Durchsuchen
○ Nicht suchen, sondern den zu installierenden Treiber selbst wählen
Verwenden Sie diese Option, um einen Gerätetreiber aus einer Liste zu wählen. Es wird nicht garantiert, dass der von Ihnen gewählte Treiber der Hardware am besten entspricht.
nork guarden, auss au romminer gerählte melder der haldware am besten erkepterk.
<u>≺Z</u> urück <u>W</u> eiter > Abbrechen

Assistent für das Suchen neuer Hardware		
	Fertigstellen des Assistenten	
	Die Software für die folgende Hardware wurde installiert:	
	DEWESoft USB Device	
	Klicken Sie auf "Fertig stellen", um den Vorgang abzuschließen.	
	< Zurück Fertig stellen Abbrechen	

Check that in the "Device Manager" under "USB-Controller" the "DEWESoft USB Device 0" has been added.

Datei Aktion Ansicht ?	
🗉 📾 Prozessoren	
😑 🥪 Speichervolumes	
😟 🕎 Systemgeräte	
🗉 🧓 Tastaturen	
🖃 🚔 USB-Controller	
ି 🙀 CA-200	
🚽 🙀 DEWESoft USB Device 0	
- 🙀 Intel(R) ICH8 Family USB Universal Host Controller - 2830	
- 😋 Intel(R) ICH8 Family USB Universal Host Controller - 2831	
- 😴 Intel(R) ICH8 Family USB Universal Host Controller - 2834	
🙀 Intel(R) ICH8 Family USB Universal Host Controller - 2835	
- General USB-Root-Hub	
USB-Root-Hub	

### FWU File Generation

The TE0300 micromodule can be configured by means of a firmware-upgrade (FWU) file (see next section "Micromodule Configuration" for further reference). The first step in generating the FWU file is to generate the *fpga.bin* file corresponding to a given FPGA design.

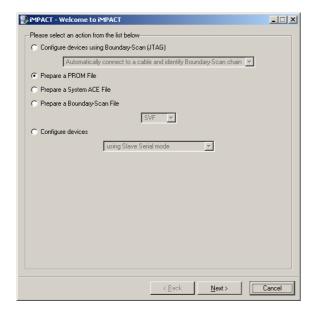
Open Xilinx IMPACT from Start / Programs / Xilinx ISE / Accessories / Impact

Select "create new project".

🕵 iMPACT Project		×
I want to		
C load most recent project	default.ipf 👻 Browse	
	Load most recent project file when iMPACT starts	
<ul> <li>create a new project (.ipf)</li> </ul>	default.ipf Browse	
	<u>QK</u>	

🐉 iMPACT - Prepare PROM Files	
I want to target a	
<ul> <li>Xilinx PROM</li> </ul>	
C Generic Parallel PROM	
C 3rd-Party SPI PROM	
C PROM Supporting Multiple Design Versions: Spartan3E MultiBoot	7
PROM File Format	
C MCS C TEK C UFP ('C'' format)	
C EXO C BIN C ISC	
C HEX 🗖 Swap Bits	
Charlenne Fill Arber (2014) Diskty ITT	
Checksum Fill Value (2 Hex Digits):  FF	
PROM File Name: fpga	
Location: C:Wilinx\	rowse
< <u>B</u> ack <u>N</u> ext >	Cancel

Select "prepare PROM file".



Set "PROM File Name" to "fpga" and change "Location" to a suitable name and location.

🐉 iMPACT - Specify Xilinx PROM Device	
Auto Select PROM	
Enable Revisioning	
Number of Revisions: 1	
Enable Compression	
Select a PROM (bits): Unspecifier	Add
Position Part Name	
Delete All	
< Back	Cancel

Check "Auto Select PROM".

Select "BIN" as output.



Navigate to your project's IMPLEMENTA-TION folder and select "download.bit".

Add Device

R

Look in: implementation

ache

File <u>n</u>ame: Files of <u>type</u>:

🗋 dcm\_0\_wrapper

\_\_\_\_dcm\_1\_wrapper \_\_\_\_debug\_module\_wrapper

dimb\_cntir\_wrapper

imb\_cntlr\_wrapper
imb\_wrapper
imb\_bram\_wrapper
imb\_bram\_wrapper
imb\_opb\_wrapper
imcroblaze\_0\_wrapper
imopb\_dma\_0\_wrapper
imopb\_fx2\_0\_wrapper
imopb\_fx2\_0\_wrapper
imopb\_fx2\_0\_wrapper

chipscope\_opb\_iba\_0\_wrapper

 Would you like to add another device file to

 Data Stream: 0

 Yes

### Congratulations!

<u> ? ×</u>

💌 🗢 🗈 🚽

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•

<u>O</u>pen

Cancel

opb\_intc\_0\_wrapper

spi\_adc\_0\_wrapper

spi\_adc\_o\_mappen spi\_mon\_0\_wrapper test\_mux\_0\_wrapper download.bit

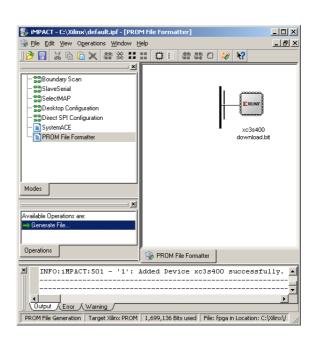
download\_cclktemp.bit

sdram\_16m×16\_wrapper

Crs232 wrapper



# Click GENERATE FILE or select from menu Operations / Generate file.



The following warning is normal :).

download.bit

FPGA Bit Files (\*.bit)

🌄 War	ning X
	WARNING:MPACT:2257 - Startup Clock has been changed to 'Cclik' in the bitstream stored in memory, but the original bitstream file remains unchanged.
	OK

This is probably the one and only file with your design.

You are done.

iMPACT - C:\Xilinx\default.ipf -		- 🗆 🗵
Ele Edit View Operations Wind		- 비스
] 🖻 🔚 🗶 🛱 🎘	: # # @ F   # # O   🌾 😽	
Comparison of the second	xcf02a B1 02% Full downtoad.bt	
Available Operations are: Generate File Operations	PROM File Generation Succeeded	
- uperations	PROM File Formatter	
Writing file "C:\Xi. Writing file "C:\Xi. ( Uutput <u>Emor</u> Warring		• •
Ready	PROM File Generation Target Xlinx PROM 1,699,136 Bits used File: fpga in Location: C	:\Xilinx\/

Don't forget to save your project for further use

🐉 Exit iMPACT		×		
Do you want to save project file before exiting?				
Yes	No	Cancel		

Once you have got your *fpga.in* file, you can proceed and generate your FWU file. The FWU file is a ZIP file containing 3 files:

- Bootload.ini booting settings
- fpga.bin FPGA programming file
- usb.bin FX2 firmware

To create your FWU file, you need to

 replace the existing USBFWUTool\FWUs\fpga.bin with the latest fpga.bin (Bootload.ini and usb.bin are always unchanged)

- zip the 3 files
- change the .zip file extension to .fwu
- upload the file as explained in the next section (Micromodule Configuration).

**Warning!** file and path names are given and must NOT be changed!

#### Micromodule Configuration

The micromodule can now be programmed with its dedicated firmware upload tool. Turn S1, S2, S3 and S4 on. Open the dedicated firmware upgrade tool "USB Firmware Upgrade Tool" (double click the "USBFirmwareUpgrade-Tool.exe" file in the "USBFWUTool" folder).

🗟 ) USB Firn	ware Upgrade Tool	
Device:	JSB Device	
File name:		Upload
		Version: 2.6

Press the "..." button corresponding to the "File name" field and select for instance the sample firmware upload file "TE0300\_v1012.fwu" in the "USB-FWUTool\FWUs" folder.

Öffnen		? 🗙
<u>S</u> uchen in:	🔁 FWUs 💌 🗢 🗈 📸 📰 •	
Zuletzt verwendete D	TE0300_v0s12.fwu	
Desktop		
Eigene Dateien		
Arbeitsplatz		
<b>S</b>		
Netzwerkumgeb ung		Ü <u>f</u> fnen
	Dateityp: FW Update Files (*.fwu)	bbrechen

🛢 ) USB Firn	nware Upgrade Tool	×
Device:	USB Device	
File name:	C:\TE0300\USBFWUTool\FWUs\TE0300_v1012.	d
	Version: 2.	6

Press the "Upload" button to upload the micromodule firmware and check the "FPGA uploading..." progress bar.

🗊 USB Firmware Upgrade Tool 🛛 🚺			
Device:	USB Device		
File name:	C:\TE0300\USBFWUTool\FWUs\TE0300_v1012.		Upload
FPGA upload	ing (22%)	v	ersion: 2.6

After successful completion of the firmware upload procedure, the following message should pop up.

USB Firmware Upgrade Tool 🔀		
Firmware upgrade successful!		
OK 1		
<u>.</u>		

Reboot the micromodule with the new firmware by disconnecting and reconnecting the USB cable. You may want to test the sample application "TE0300\_API\_Example.exe" in the "TE0300\_API\_Example\Debug" folder.

To generate your own firmware upload file, please read the document "Generating\_FWU\_file.doc" in the "USBFWUTool" folder.

# SPI Direct In-System Programming (ISP)

Make sure S2 is switched to "Reset"(off) during programming.

Connect the host computer to the micromodule through both the SPI flying leads cable and the USB cable.

Start Xilinx ISE iMPACT. The following example shows the case of iMPACT 9.2. If the "iMPACT Project" window pops up, press the "Cancel" button.

💱 iMPACT Project					×
I want to					
Ioad most recent project	default.ipf		~	Browse	
		Load most recent project	ct file when iMPAC	T starts	
<ul> <li>create a new project (.ipf)</li> </ul>	default.ipf			Browse	
	<u>O</u> K	Cancel			

Double click the "Direct SPI Configuration" option in the "Modes" panel.

😂 ІМРАСТ	
Bie Esk Yew Operations Oppiens Output Debug Window Halp	
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Flows X NPACT Picesses X	
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ShowSer al	
- 10 Select VAP - 10 Desites Configuration	
Direct SEI Configuration	
SystemACE	
- E PRUM Fre Formater	
	http://www.xinx.com
Nores Operators	ing management
X Welcome to iMPACT	X
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2 O.por Ena Waning	
	lill a

Right click the "Direct SPI Configuration" panel to add a device and select "Add SPI Device".

🐉 IMPACT - [Direct SPI Configurati		
😼 Be Edit Ziaw Ogerations Opjons :	Quiput Debug ∭raby Help	
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Non         X           Image: Scan Scan Scan Scan Scan Scan Scan Scan	brBatt Increases 🗙 Aradauk Operador y ant.	Ade Brienstein, Consol Gale Max Scored Gale Max,
Nodes	Operations	Se Cierc SP Configuration
Figure 3. HPACT // *** BACK BD : meth // *** BACKB CHD : seel // *** BACKB CHD : seel		
A Deput Ins Waning		8
		No Cable Connection

You can now select the file corresponding to your device. In the following example, we will show how to select the micromodule reference device "blinking.mcs" in the "TE0300" folder.

Add Device 

 Suchen in:
 TE0300
 Control

 Suchen in:
 TE0300
 Control

 Suchet in:
 TE0300
 Control

 Suchet in:
 Tensor
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 Suchet in:
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 Suchet in:
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 Suchet in:
 Tensor
 Tensor

Desktop Desktop Eigene Dateien Arbeitsplatz

-

Abbrechen

Select the part name corresponding to the SPI flash present on the module (STMicroelectronics M25P32, a 32 Mbit (4M x 8) Serial Flash memory).

All Design Files (\*.mcs \*.exo)

💱 Select Device Part Name 🛛 🔀				
Select PROM				
Part Name:	M25P32			
<u>D</u> K	<u>C</u> ancel Help			

iMPACT should now look like this.

By Mark Carlow Captor Land Kang Hydro Perform     C       By Mark Carlow Captor Land Kang Hydro Perform     By Mark Carlow Captor Land Kang Hydro Perform       By Mark Carlow Captor Land Kang Hydro Perform     By Mark Captor Captor Land Kang Hydro Perform       By Mark Carlow Captor Land Kang Hydro Perform     By Mark Captor Captor Land Kang Hydro Perform       By Mark Captor Captor Land Kang Hydro Perform     By Mark Captor Captor Land Kang Hydro Perform       By Mark Captor Land Kang Hydro Perform     By Mark Captor Captor Land Kang Hydro Perform       By Mark Captor Land Kang Hydro Perform     By Mark Captor Captor Land Kang Hydro Perform       By Mark Captor Land Kang Hydro Perform     By Mark Captor Captor Land Kang Hydro Perform       By Mark Captor Land Kang Hydro Perform     By Mark Captor Captor Land Kang Hydro Perform       By Mark Captor Land Kang Hydro Perform     By Mark Captor Perform       By Mark Captor Per	🖻 🖬 👗 🕸 🖺 🗙 💠 :			-
Starting Start     The Starting Startigen Starting Starting Starting Startigen Starting Starting Starti				
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By Service     By Service       By Service <td></td> <td></td> <td></td> <td></td>				
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Openant         Openant           Pricement to IBST         Pricement to IBST	PRUM Fie Fomater			
We have a use users in the set of	-		MS0	
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<pre>// ** IACC OD : setMes spi /** IACC OD : setMes spi INTO.URIXYTON ''''''''''''''''''''''''''''''''''''</pre>			Construction of the second sec	
// ** ELCCI CDD : satisfies -====================================				
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11: Londing fLie (Ex/TONCO/Linkin.son) EffoilBACT - Lopec tuan = 0 sec. // *** LLCCI CD : setAttribute -position 1 -ettr packageNess -value **			coconfully.	
DTOLUTEAT - Lopes tue - 0 pec. // Tri ELTCI CD : setLatribute -position 1 -ettr packageNees -volue ""				
DETO UMFACT - Expend ture - 0 pro. // Tit EACCH CDD : metaturihate -position i -attr parkageNume -velke ""				
// ** L/CEICB = metAltEfbete -position 1 -ettr packageNeme -value **				
// TY ELTER CD : meriterikets -josizien i -ette packapdium -etist ""		ed time = 0 sec.		
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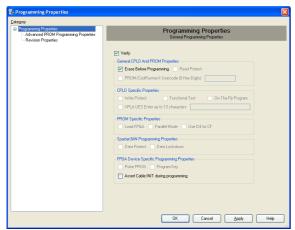
Right click the SPI PROM device and select the "Program" operation.

😺 INPACT - [Direct SPI Configurat					
😼 Bie Edit View Operations Options	Quaput Debug Window Help			_ <u>7</u> X	
📴 🖬 👗 🕸 🖺 🗙 🛱 茶 🖬					
	HYACIT         Control         X           Availabit Operations are:         Fragment         Fragment           HyACIT         Herein         Herein           HyACIT         Herein         Herein           Herein         Herein         Herein           Herein         Herein         Herein	NO 8 WC0 NC0 NC0 PROM MC0 Bieler.nco	Program. Vivity E1969 Ban, Check Hendhark Assian Yean Car (Kupelan Mile		
Nores	Operations	🛞 Deect 5-1 Configuration			
'1': Losding file 'E:/" INFO:1MFACT - Elaysed 1 Grae.	lude -spi Added Device %15F12 succes			8	
				× .	
2 Output Ens Waning				<u>×</u>	
				No Cable Connection	

In the "Programming Properties" window, just leave the default settings and press the "OK" button.

ung

Dateityp



iMPACT will first erase the memory (notice the mismatch between the two progress indicators)

? 🛛
Cancel

and then write it (notice the match between the two progress indicators).

ialog [10%]	? 🛛
mand	
10%	
	Cancel
	110%] nand 10%

After successful programming, you should read the message "Program Succeeded" popping up for a few seconds in the "Direct SPI Configuration" panel.

🐉 IMPACT - [Direct SPI Configuratio	nj	
😼 Bie Edit View Operations Gutput We	ndox Brb	L B X
i 🖻 🕅 👗 🕸 📋 🗙 🛱 💥 🖬 i		
	NPACT Plueses X	
Stankier al     Select VAP     Decites Configuration     Decites FEI Configuration	Avakate Good on an of the finance of	
	ingereatrit	
Fortze valideted muces 11: Europa Portas 11: Europa Portas 11: Europa Portas 11: Europa Portas 11: Portas de Vice Contra bare 11: Portas de Vice Contra Processe Di - End Gree 11: Europa - Canada Anna 11: Europa Europa Europa 11: Programma Portas 11: Programma Por	el Operation. component sec.	•
11: Varification romple PLOCRESS END End Croro Elapsed time - 40 se	stics.	
c		>
2 OAper Enn Waning	Configuration Patrions Cable US	0 C Mile Just-hs

Switch S2 back to the "Run" position. In case you uploaded the test design, you should see the on-board led blinking at 0.5 Hz.

For further information about direct (pure SPI) in-system programming of SPI Flash memories, please see Xilinx Application Note XAPP951 "Configuring Xilinx FPGAs with SPI Serial Flash".

# SPI Indirect In-System Programming (ISP)

Check the configuration switches against the following table:

DIP switch	on (left)	off (right)
S1	Х	Х
S2	Run	
S3	-	PON
S4	Х	Х

Connect the host computer to the micromodule through both the SPI flying leads cable and the USB cable.

Start Xilinx ISE iMPACT. The following example shows the case of iMPACT 10.1. If the "iMPACT Project" window pops up, press the "Cancel" button.

😻 iMPACT Project				X
I want to				
<ul> <li>load most recent project</li> </ul>	default.ipf		~	Browse
		Load most recent proje	ect file when iMPAC	T starts
<ul> <li>create a new project (.ipf)</li> </ul>	default.ipf			Browse
_	21			
	<u>Ω</u> K	Cancel	ļ	

Double click the "Boundary Scan" option in the "Modes" panel.

🐉 нираст	
Bie Edit Sjew Operations Oppions Output Decog Window Eale	
■ 22 回 G X 単体 詳計 非 1 単 目 単 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
Description         X         Model Name         X           Strate Statut         Strate Statut         Strate Statut         Strate Statut           Strate Statut         Strate Statut         Strate Statut         Strate Statut	
Nules Querafuns	http://www.xiins.com
<ul> <li>Telcame 12 JBMCT</li> <li>199/L7 Version: 30.1</li> </ul>	
August Tro Warning	>
2 Deput Tro. Waning	

Right click the "Boundary Scan" to initialize the chain and select "Initialize Chain".

👺 IMPACT - [Boundary Scan]			
😼 Be Edit Ziow Ogerations Opjons (	ucput Debug ∭ndov Help		
🔰 🖬 🕹 🖻 🕼 🗙 😂 🗱 🖬		9	
Num         X           Strendsy Scan         Strendsy Scan           Strendsy Strendsy Scan         Strendsy Scan	APADE Provider van	M Blanc Center, Orbit, Ad Blandar Center, Orbit, Bridain Center, Orbit, Celle And Screent, Celle And Screent, Celle And Screent, Orbit, Orbit, Orbit, Orbit, Orbit, Orbit, Orbit, Orbit, Orbit, Orbit,	
Nules	Operations	Se Rounday/Scan	
<ul> <li>Biccome is 12PACT</li> <li>BiCcome is 12PACT</li> <li>BiDCC Version 30.1</li> <li>// *** BiCCL CED 1 and</li> <li>// *** BiCCL CED 1 and</li> </ul>			8
A Dept Dros Warning			8
		No Cable Connection   No File	e Open

An "Assign New Configuration File" dialog window should pop up automatically. You can now select the file corresponding to your design. In the following example, we will show how to select the micromodule reference design "blinking.bit" in the "TE0300" folder. Do not forget to select the "Enable Programming of SPI Flash Device Attached to this FPGA" option in the same window.

😻 Assign New Configuration File	? 🗙
Look jn: 🔄 E:/TE0300/ 💌 🗲 🖻	
<b>a</b>	
Ist_program     Ist_binkin.bit	
blinkin1600.bit	
File name: blinkin.bit	<u>O</u> pen
File type: All Design Files (*.bit *.rbt *.nky *.isc *.bsd)	Cancel
Cancel <u>A</u> ll	<u>B</u> ypass
None	
<ul> <li>Enable Programming of SPI Flash Device Attached to this FPGA</li> </ul>	
C Enable Programming of BPI Flash Device Attached to this FPGA	

An "Add PROM File" dialog window should pop up automatically. You can now select the file corresponding to your design. In the following example, we will show how to select the micromodule reference design "blinking.mcs" in the "TE0300" folder.

Add PROM File					? 🛛
<u>S</u> uchen in:	bemp_TE030	0	•	+ 🗈 💣 🎟	•
Zuletzt verwendete D Desktop	i blinkin.mcs				
Eigene Dateien					
Arbeitsplatz					
Netzwerkumgeb ung	Datei <u>n</u> ame: Datei <u>t</u> yp:	blinkin.mcs MCS Files (*.mcs)		•	Üffnen Abbrechen

Select now the SPI Flash corresponding to the one present on the module (STMicro-electronics M25P32 in the example, a 32 Mbit (4M x 8) Serial Flash memory).

🐉 FPGA SPI Flash Association 🛛 🛛 🔀			
Select SPI Flash FPGA xc3s1200e	SPI Flash M25P32		
<u>D</u> K			

y undary-Scan		
Device 1 (FPGA, xc3s1200e ) Device 1 (Attached FLASH, M25P32 )	Property Name	Value
	Verily	
	General CPLD And PROM Properties	
	Erase Before Programming	
	FPGA Device Specific Programming Properties	
	Assert Cable INIT during programming	
	After programming Flash	automatically load FPGA with currently assigned bits
	ОК	Cancel Apply Help

iMPACT should now look like this.

# Image: Second Data Concernation and Second Provided Provid

Right click the "Flash" device and select the "Program" operation.

🐉 IMPACT - [Direct SPI Configurati				
Be Edit Ziew Operations Oppiens (	Quaput Debug Window Help			L D X
🖻 🗟 👗 🗅 🐧 🗙 🖶 🎋 💷	III III III III III III III III III II			
Bill Sunday Scon     Scon     Son     Son	IVBAIL         Norman         X           Avalaute Opensien z. and         Hybridgen         Hybridgen           Hybridgen         Hybridgen         Hybridgen	SCLK MOSI SS_P N2002 Distan YOS MSO	Program. Verfy Date Nové Pravis Resélecc Xeágr New Cerfiguraton File	
Nodes	Operations	Se Eine: SP Configuration		
': : Loading file 2:/T HWF0:1NPAUT - Elepsed t come.	fods -api Added Device MSSP82 owerco			8
				×
2 Dupit Dros Warring				8
			,	No Cable Connection

In the "Device Programming Properties" window, just leave the default settings and press the "OK" button.

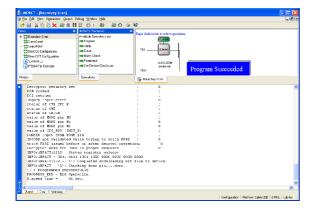
iMPACT will first erase the memory

🐉 Progress Dialog [1%]	? 🛛
Executing command	
1%	
	Cancel

and then write it.

😵 Progress	Dialog [10%]	? 🔀
Executing com	mand	
	10%	
		Cancel

After successful programming, you should read the message "Program Succeeded" popping up for a few seconds in the "Boundary Scan" panel.



Switch S3 back to the "FX PON" position. In case you uploaded the reference design, you should see the on-board led blinking at 0.5 Hz.

For further information about indirect (SPI over JTAG) in-system programming of SPI Flash memories, please see Xilinx Application Note XAPP974 "Indirect Programming of SPI Serial Flash PROMs with Spartan-3A FPGAs".

# Changes from TE0300-00 to TE0300-01

# Clocks

TE0300-00 has a 50MHz secondary clock, whereas TE0300-01 has a 125MHz secondary clock.

# **Volatile Memory Interface**

TE0300-00 could access the DDR SDRAM *only* with Xilinx OPB (on-chip peripheral bus) cores.

TE0300-01 can *also* access the DDR SDRAM through the dedicated Xilinx MIG (memory interface generator) memory interface.

# **B2B Connectors**

Contact 14 of connector J5 has been extended from an input in TE0300-00 to an I/O in TE0300-01. Therefore hardware designs developed for the TE0300-00 are compatible with the TE0300-01 whereas those developed for the TE0300-01 are compatible with the TE0300-00 if that contact is configured as input.

Contact 76 of connector J5 has mistakenly been described as I/O in TE0300-00, but it has always been an input-only contact as documented for TE0300-01.

Connector J4 has not been changed.

## LED

With TE0300-00, the LED is lit when the U\_LED line on pin T15 is set high whereas with TE0300-01 the LED is lit when the U\_LED line on pin R10 is set high.

# **Ordering Information**

For the latest product details and available options, please visit:

www.trenz-electronic.de

shop.trenz-electronic.de

# **Revision History**

Rev	Date	Who	Description
0.1	2008-04-24	FDR	created
1.0	2008-08-01	FDR	completed
1.01	2008-08-08	Π	50MHz to 125MHz clock
1.02	2008-10-17	FDR	U_LED for TE0300-00
1.03	2008-10-17	FDR	updated FUT from 1.9 to 2.6
1.04	2008-10-27	FDR	DIP switches overview
1.05	2008-10-29	FDR	stacking height

Rev	Date	Who	Description
1.06	2008-12-08	FDR	DIP switches revised
1.07	2009-02-16	FDR	fixed DIP switches overview picture
1.08	2009-03-09	FDR	clarified warning regarding 3.3 V power-rail
1.09	2009-03-16	FDR	fixed and improved switch settings
1.10	2009-06-03	FDR	added "FWU File Generation" sec- tion
1.11	2009-07-23	FDR	clarified changes/LED section
1.12	2009-08-24	FDR	added FPGA signal details for main user signals
1.13	2009-09-01	FDR	improved "On- board Memories" chapter
1.14	2009-09-03	FDR	improved clock, memory and con- figuration chapters
1.14	2009-10-23	FDR	PREPARE_FW de- scription removed
1.15	2010-05-14	FDR	Added reference design summaries.
1.16	2010-01-20	FDR	Fixed JTAG image.
1.17	2010-01-21	FDR	Fixed pin-out de- scription for pin 57 (B0_L08_N). Addd note on offset hole connectors.
1.18	2011-03-25	FDR	Updated Hirose connectors part numbers

Table 17: revision history.

# **Appendix**

The following tables reports pin-out information of B2B (board-to-board) receptacle connectors J4 and J5 respectively.

The reference design summaries report the resources needed by the reference design on TE0300 modules of different dimensions (1200 and 1600 versions).

pin	B2B	FPGA	FPGA	ba	dir	sup	di			dir	ba	FPGA	FPGA	B2B	pin
-	name	pin	name	nk	1	ply	ff	ff	ply	Ŧ	nk	name	pin	name	-
1	VccIO	-	VccO	0	I	-	-	-	-	I	0	VccO		VccIO	2
3	VccIO	-	VccO	0	I	-	-	-	-	I	0	VccO	-	VccIO	4
5	B3_L01_P	C1	IO_L01P	3		3.3 V	Y	Y	3.3 V	IO	3	IO_L07P	G6	B3_L07_P	6
7	B3_L01_N	C2	IO_L01N	3	IO	3.3 V	Y	Y	3.3 V	IO	3	IO_L07N	G5	B3_L07_N	8
9	B3_L02_P	D1	IO_LO2P	3	IO	3.3 V	Y	Y	3.3 V	IO	3	IO_L03N	E1	B3_L03_N	10
11	B3_L02_N	D2	IO_L02N / VREF	3	IO	3.3 V	Y	Y	3.3 V	IO	3	IO_L03P	E2	B3_L03_P	12
13	GND													GND	14
15	B0_IO_C3	C3	IO_L25P	0	IO	VccIO	Ν	Υ	VccIO	IO	0	IO_L19_P	F7	B0_L19_P	16
17	B0_L24_N	B4	IO_L24_N	0	IO	VccIO	Y	Y			0	IO_L19N / VREF	E7	B0_L19_N	18
19	B0_L24_P	A4	IO_L24P	0		VccIO		Υ	VccIO		0	IO_L21N	E6	B0_L21_N	20
21	B0_IO_C4	C4	IO	0	IO	VccIO	Ν	Υ	VccIO	IO	0	IO_L21P	D6	B0_L21_P	22
23	GND													GND	24
25	B0_L23_N	D5	IO_L23N / VREF	0	IO	VccIO	Y	Y	VccIO	IO	0	IO_L18N / VREF	D7	B0_L18_N	26
27	B0_L23_P	C5	IO_L23P	0	IO	VccIO	Υ	Υ	VccIO	IO	0	IO_L18P	C7	B0_L18_P	28
29	B0_L20_P	B6	IO_L20P	0	IO	VccIO	Υ	Υ	VccIO	IO	0	IO_L17N	F8	B0_L17_N	30
31	B0_L20_N	A6	IO_L20N	0	IO	VccIO	Υ	Υ	VccIO	IO	0	IO_L17P	E8	B0_L17_P	32
33	3.3 V													3.3 V	34
35	B0_IO_A7	A7	IO	0	IO	VccIO	Ν	Ν	VccIO	IO	0	IO	A8	B0_IO_A8	36
37	B0_I0_G9	G9	IO	0	IO	VccIO	Ν	Y	VccIO	IO	0	IO_L14N / GCLK11	D9	GCLK_L14_N	38
39	GCLK_L13_P	B8	IP_L13P / GCLK8	0	I	VccIO	Y	Y	VccIO	IO	0	IO_L14P / GCLK10	C9	GCLK_L14_P	40
41	GCLK_L13_N	B9	IP_L13N / GCLK9	0	Ι	VccIO	Y	Y	VccIO	IO	0	IO_L11N / GCLK5	E10	GCLK_L11_N	42
43	GND							Y	VccIO	IO	0	IO_L11P / GCLK4	D10	GCLK_L11_P	44
45	GCLK_L12_P	B10	IO_L12P / GCLK6	0	IO	VccIO	Y							GND	46
47	GCLK_L12_N	A10	IO_L12N / GCLK7	0	IO	VccIO	Y	Y	VccIO	IO	0	IO_L09N	D11	B0_L09_N	48
49	B0_L15_P	E9	IO_L15P	0	IO	VccIO	Υ	Υ	VccIO	IO	0	IO_L09P	C11	B0_L09_P	50
51	B0_L15_N	F9	IO_L15N	0	IO	VccIO	Υ	Ν	VccIO	IO	0	IO	A11	B0_I0_A11	52
53	2.5 V													2.5 V	54
55	B0_L08_P	E11	IO_L08P	0	IO	VccIO		Ν		IO	0	IO/VREF	B11	B0_I0_B11	56
57	B0_L08_N	F11	IO_L08N	0				Ν		IO	0	IO	A12	B0_I0_A12	58
59	B0_L05_P	A13	IO_L05P	0	IO	VccIO	Y	Υ	VccIO	IO	0	IO_L06P	F12	B0_L06_P	60
61	B0_L05_N	B13	IO_L05N / VREF	0	IO	VccIO	Y	Y	VccIO	IO	0	IO_L06N	E12	B0_L06_N	62
63	GND													GND	64
65	B0_L04_N	A14	IO_L04N	0	IO	VccIO	Υ	Ν	VccIO	IO	0	IO	D13	B0_I0_D13	66
67	B0_L04_P	B14	IO_L04P	0		VccIO			VccIO			IO	E13	B0_I0_E13	68
69	B0_L03_N	C14	IO_L03N / VREF	0		VccIO			3.3 V	Ι	2	TDI	A2	TDI	70
71	B0_L03_P	D14	IO_L03P	0	IO	VccIO	Y		3.3 V	0	2	TDO	C16	TDO	72
73	1.2 V			-	-					-		_	_	1.2 V	74
75	B0_L01_N	A16	IO_L01N	0	IO	VccIO	Υ		3.3 V	Ι	2	TCK	A17	TCK	76
77	B0_L01_P	B16	IO_L01P	0		VccIO			3.3 V	Ι	2	TMS	D15	TMS	78
79	GND							-						GND	80

receptacle connector J4 pinout information

pin	B2B name	FPGA pin	FPGA name	ba nk	dir	sup ply		di ff	sup ply	dir	ba nk	FPGA name	FPGA pin	B2B name	pin
1	5Vb2b		Indiffe		I	PTY				Ι				5Vb2b	2
3	5Vb2b				Ī					Ī				5Vb2b	4
5	5V				Ō					I				/MR	6
7	B2B_D_P				IO		Υ			0				/RESET	8
9	B2B_D_N				IO		Υ			0				RESET	10
11	GND													GND	12
13	B3_L22_P	P3	IO_L22P	3	IO	3.3 V			3.3 V			IO_L24P	T2	B3_I0_T2	14
15	B3_L22_N	P4	IO_L22N	3	IO	3.3 V			3.3 V			IO_L21N	P1	B3_L21_N	16
17	B2_IP_V4	V4	IP_L02P	2	Ι				3.3 V			IO_L21P	P2	B3_L21_P	18
19	B3_L20_P	N4	IO_L20P	3		3.3 V			3.3 V			IO_L23N	R2	B3_L23_N	20
21	B3_L20_N	N5	IO_L20N	3	IO	3.3 V	Y	Y	3.3 V	IO	3	IO_L23P	R3	B3_L23_P	22
23	GND			_							_			GND	24
25	B2_L04_N	Т5	IO_L04N	2	IO	3.3 V	Y	N	3.3 V	10	3	IO_L18N	М3	B3_IO_L18N	26
				_							_	IO_L03P			
27	B2_L04_P	R5	IO_L04P	2	10	3.3 V	Y	N	3.3 V	10	2	/ DOUT / BUSY	U4	B2_IO_L03	28
29	B2_L05_P	R6	IO_L05P	2	IO	3.3 V	Y	Ν	3.3 V	IO	2	IO / VREF	U5	B2_IO_U5	30
31	B2 L05 N	P6	IO L05N	2	IO	3.3 V	Y	v	3.3 V	IO	2	IO LOGP	V5	B2 L06 P	32
												IO_L06N			
33	B2_IO_V7	V7	IO	2	IO	3.3 V	Ν	Y	3.3 V	IO	2	/ VREF	V6	B2_L06_N	34
35	3.3 V													3.3 V	36
37	B2_L07_N	P7	IO_L07N	2	IO	3.3 V	Y	Ν	3.3 V	IO	2	IO	U6	B2_IO_U6	38
39	B2_L07_P	N7	IO_L07P	2	IO	3.3 V	Y	Y	3.3 V	IO	3	IO_L17N / VREF	L5	B3_L17_N	40
41	B2_GCLK12	M9	IO_L12N / D6 / GCLK12	2	Ι	3.3 V	N	Y	3.3 V	IO	3	IO_L17P	L6	B3_L17_P	42
43	GND													GND	44
45	B2_L10_N	T8	IO_L10N	2		3.3 V			3.3 V		2	IP_L08P	T7	B2_IP_T7	46
47	B2_L10_P	R8	IO_L10P	2	IO	3.3 V	Y	Ν	3.3 V	Ι	2	IP_L11P	U8	B2_IP_U8	48
49	B2_GCLK_L13_N	V9	IO_L13N / D3 /	2	IO	3.3 V	Y	Y	3.3 V	IO	3	IO_L19P	M5	B3_L19_P	50
51	B2_GCLK_L13_P	U9	GCLK15 IO_L13P / D4 /	2	IO	3.3 V	Y	Y	3.3 V	10	3	IO_L19N	M6	B3 L19 N	52
		0.5	GCLK14	-		0.0		-	0.0						
53	2.5 V					3.3 V								2.5 V	54
55	B2_L18_N	N11	IO_L18N	2	IO	3.3 V	Υ	Υ	3.3 V	IO	2	IO_L09P	P8	B2_L09_P	56
57	B2_L18_P	P11	IO_L18P	2		3.3 V		Υ	3.3 V	IO		IO_L09N	N8	B2_L09_N	58
59	B2_L20_N	R12	IO_L20N	2		3.3 V			3.3 V		2	IO	P9	B2_IO_P9	60
61	B2_L20_P	T12	IO_L20P	2	IO	3.3 V	Y	Ν	3.3 V	IO	2	IO	R11	B2_IO_R11	62
63	GND													GND	64
65	B2_L19_N	V13	IO_L19N / VREF	2	IO	3.3 V	Y	N	3.3 V	IO	2	IO_L15N / D1 / GCLK3	P10	B2_IO_P10	66
67	B2_L19_P	V12	IO_L19P	2	IO	3.3 V	Y	N	3.3 V	IO	2	IO / D5	R9	B2_IO_R9	68
69	B2_L22_N	R13	IO_L22N / A22	2	IO	3.3 V	Y	Y	3.3 V	IO	2	IO_L21N	P12	B2_L21_N	70
71	B2_L22_P	P13	IO_L22P / A23	2	IO	3.3 V	Y	Y	3.3 V	IO	2	IO_L21P	N12	B2_L21_P	72
73	1.2 V									L	L			1.2 V	74
75	B2_L24_P	T14	IO_L24P	2	IO	3.3 V	Y	м	3.3 V	Ι	2	IP_L23P	V14	B2_IP_V14	76
			/ A21 IO_L24N												
77	B2_L24_N	R14	/ A20	2	IO	3.3 V	Y	N	3.3 V	10	2	IO	U13	B2_I0_U13	78
79	GND													GND	80

receptacle connector J5 pinout information

#### **Reference Design Summary: Xilinx Spartan-3E 1200**

\_\_\_\_\_

platgen -p xc3s1200efg320-4 -lang vhdl -lp x:/xxx/ system.mhs Release 11.5 - platgen Xilinx EDK 11.5 Build EDK\_LS5.70 (nt) Copyright (c) 1995-2009 Xilinx, Inc. All rights reserved. \_\_\_\_\_ Command Line: platgen -p xc3s1200efg320-4 -lang vhdl -lp Running post-placement packing... Design Summary: Number of errors: 0 Number of warnings: 16 0 Logic Utilization: Number of Slice Flip Flops:5,885 out of 17,34433%Number of 4 input LUTs:8,041 out of 17,34446% Logic Distribution: Number of occupied Slices: 6,622 out of 8,672 76% Number of Slices containing only related logic: 6,622 out of 6,622 100% Number of Slices containing unrelated logic: 0 out of 6,622 0% \*See NOTES below for an explanation of the effects of unrelated logic. Total Number of 4 input LUTs: 8,424 out of 17,344 48% Number used as logic: 6,066 Number used as logic: 6,066 Number used as a route-thru: 383 Number used for Dual Port RAMs: 1,812 (Two LUTs used per Dual Port RAM) Number used as Shift registers: 163 The Slice Logic Distribution report is not meaningful if the design is over-mapped for a non-slice resource or if Placement fails. 74 out of 250 29% Number of bonded IOBs: IOB Flip Flops: 36 1 IOB Master Pads: IOB Slave Pads: 1 Number of ODDR2s used: 22 Number of DDR ALIGNMENT = NONE 22 Number of DDR ALIGNMENT = C0 0 Number of DDR ALIGNMENT = C1 0 Number of RAMB16s: 25 out of 28 89% 

 5 out of
 24
 20%

 1 out of
 8
 12%

 1 out of
 1
 100%

 3 out of
 28
 10%

 Number of BUFGMUXs: Number of BSCANs: Number of DCMs: Number of MULT18X18SIOs: Number of RPM macros: Average Fanout of Non-Clock Nets: 3.57 \_\_\_\_\_

\_\_\_\_\_

Initializing temperature to 85.000 Celsius. (default - Range: -40.000 to 100.000 Celsius) Initializing voltage to 1.140 Volts. (default - Range: 1.140 to 1.320 Volts)

Device speed data version: "PRODUCTION 1.27 2010-02-13".

Design Summary Report:

Number of External IOBs	74 out of 250 29%
Number of External Input IOBs	10
Number of External Input IBUFs Number of LOCed External Input IBUFs	10 10 out of 10 100%
Number of External Output IOBs	36
Number of External Output DIFFMs Number of LOCed External Output DIFFMs	1 1 out of 1 100%
Number of External Output DIFFSs Number of LOCed External Output DIFFSs	1 1 out of 1 100%
Number of External Output IOBs Number of LOCed External Output IOBs	34 34 out of 34 100%
Number of External Bidir IOBs	28
Number of External Bidir IOBs Number of LOCed External Bidir IOBs	28 28 out of 28 100%
Number of BUFGMUXs5Number of DCMs1Number of MULT18X18SIOs3Number of RAMB16s25	out of 1100%out of 2420%out of 812%out of 2810%out of 2889%out of 867276%out of 433625%
	out of 6622 1% out of 1088 3%
Overall effort level (-ol): High Router effort level (-rl): High	

\_\_\_\_\_

#### **Reference Design Summary: Xilinx Spartan-3E 1600**

\_\_\_\_\_

platgen -p xc3s1600efg320-4 -lang vhdl -lp x:/xxx/ system.mhs Release 11.5 - platgen Xilinx EDK 11.5 Build EDK LS5.70 (nt) Copyright (c) 1995-2009 Xilinx, Inc. All rights reserved. \_\_\_\_\_ Command Line: platgen -p xc3s1600efg320-4 -lang vhdl Running post-placement packing... Design Summary: 0 Number of errors: Number of warnings: 16 Logic Utilization: 
 Number of Slice Flip Flops:
 5,885 out of 29,504
 19%

 Number of 4 input LUTs:
 8,038 out of 29,504
 27%
 Logic Distribution: Number of occupied Slices: 6,424 out of 14,752 43% Number of Slices containing only related logic: 6,424 out of Number of Slices containing only related logic:6,424 out of6,424 100%Number of Slices containing unrelated logic:0 out of6,4240% \*See NOTES below for an explanation of the effects of unrelated logic. Total Number of 4 input LUTs:8,421 out of 29,50428%Number used as logic:6,063Number used as a route-thru:383Number used for Dual Port RAMs:1,812 (Two LUTs used per Dual Port RAM) Number used as Shift registers: 163 The Slice Logic Distribution report is not meaningful if the design is over-mapped for a non-slice resource or if Placement fails. Number of bonded IOBs: 74 out of 250 29% IOB Flip Flops: 36 IOB Master Pads: 1 IOB Slave Pads: 1 Number of ODDR2s used: 22 Number of DDR ALIGNMENT = NONE 22 Number of DDR ALIGNMENT = C0 0 Number of DDR ALIGNMENT = C1 0 25 out of 36 69% Number of RAMB16s: Number of BUFGMUXs: 5 out of 24 20% 
 1 out of
 8
 12%

 1 out of
 1
 100%

 3 out of
 36
 8%
 8 12% 1 100% Number of DCMs: Number of BSCANs: Number of MULT18X18SIOs: Number of RPM macros: 1 Average Fanout of Non-Clock Nets: 3.57 \_\_\_\_\_

\_\_\_\_\_

Initializing temperature to 85.000 Celsius. (default - Range: -40.000 to 100.000 Celsius) Initializing voltage to 1.140 Volts. (default - Range: 1.140 to 1.320 Volts)

Device speed data version: "PRODUCTION 1.27 2010-02-13".

Design Summary Report:

Number of External IOBs	74 out of 250 29%
Number of External Input IOBs	10
Number of External Input IBUFs Number of LOCed External Input IBUFs	10 10 out of 10 100%
Number of External Output IOBs	36
Number of External Output DIFFMs Number of LOCed External Output DIFFMs	1 1 out of 1 100%
Number of External Output DIFFSs Number of LOCed External Output DIFFSs	1 1 out of 1 100%
Number of External Output IOBs Number of LOCed External Output IOBs	34 34 out of 34 100%
Number of External Bidir IOBs	28
Number of External Bidir IOBs Number of LOCed External Bidir IOBs	28 28 out of 28 100%
Number of BUFGMUXs5Number of DCMs1Number of MULT18X18SIOs3Number of RAMB16s25Number of Slices6424Number of SLICEMs1090Number of LOCed Slices65	out of 1       100%         out of 24       20%         out of 8       12%         out of 36       8%         out of 14752       43%         out of 7376       14%         out of 6424       1%         out of 1090       3%
Number of LOCed SLICEMS43Overall effort level (-ol):HighRouter effort level (-rl):High	OUT OT 10A0 32

\_\_\_\_\_