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# JTAG-Booster for Intel XScale



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## **1. General**

The programs JTAG250.EXE, JTAG255.EXE, JTAG321.EXE and JTAG425 use the JTAG port of the Intel XScale processors in conjunction with the small JTAG-Booster:

- to program data into flash memory
- to verify and read the contents of a flash memory
- to make a memory dump
- to access an I<sup>2</sup>C Device
- to test CPU signals

All functions are done without any piece of software running in the target. No firmware or BIOS must be written. Bootstrap software may be downloaded to initially unprogrammed memories.

The JTAG-BOOSTER' s software is highly optimized to the JTAG chain of a specific target CPU. To give support for all processors of the Intel XScale family, there are three different programs on the distribution disk:

- JTAG250.EXE : Tool for Intel PXA210/250
- JTAG255.EXE : Tool for Intel PXA255/26x
- JTAG321.EXE : Tool for Intel IOP321
- JTAG425.EXE : Tool for Intel IXP425

Please contact us, if you need support for other members of the Intel XScale family.

For latest documentation please refer to the file README.TXT on the distribution disk.

### **1.1. Ordering Information**

The following related products are available

- 9003 JTAG-Booster Intel XScale, 3.3V, PXA210/250, PXA255/26X, IOP321, PXA425  
DOS/Win9x/WinNT/Win2000/WinXP,  
delivered with adapter type 285

### **1.2. System Requirements**

To successfully run this tool the following requirements must be met:

- MSDOS, WIN3.x, WIN9x, WinNT, Win2000 or WindowsXP  
(WinNT/Win2000/WindowsXP is supported with an additional tool, see  
chapter 5 “Support for Windows NT, Windows 2000 and Windows XP”)
- Intel 80386 or higher
- 205 kByte of free DOS memory
- Parallel Port

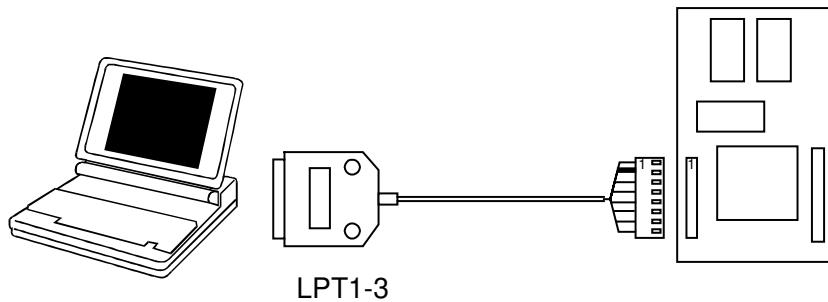
### **1.3. Contents of Distribution Disk**

- JTAG250.EXE      Tool for Intel PXA210/250  
  JTAG250.OVL
- JTAG250.INI      Template configuration file for Intel PXA210/250. See  
  chapter 1.11 "Initialization file JTAGxxx.INI"
- JTAG255.EXE      Tool for Intel PXA255/26x  
  JTAG255.OVL
- JTAG255.INI      Template configuration file for Intel PXA255/26x. See  
  chapter 1.11 "Initialization file JTAGxxx.INI"
- JTAG321.EXE      Tool for Intel IOP321  
  JTAG321.OVL
- JTAG321.INI      Template configuration file for Intel IOP321. See  
  chapter 1.11 "Initialization file JTAGxxx.INI"
- JTAG425.EXE      Tool for Intel IXP425  
  JTAG425.OVL
- JTAG425.INI      Template configuration file for Intel IXP425. See  
  chapter 1.11 "Initialization file JTAGxxx.INI"
- HEX2BIN.EXE      Converter program to convert Intel HEX and Motorola  
  S-Record files to binary. See chapter 4 "Converter  
  Program HEX2BIN.EXE"
- WinNT.zip        Support for Windows NT and Windows 2000. See  
  chapter 5 "Support for Windows NT, Windows 2000"
- JTAG\_V4xx\_FLAS   List of all supported Flash devices  
  HES.pdf
- README.txt      Release notes, new features, known problems



#### **1.4. Connecting your PC to the target system**

The JTAG-Booster can be plugged into standard parallel ports (LPT1-3) with a DB25-Connector.



The target end of the cable has the following reference:

1	2*	3	4	5	6	7	8
TCK	GND	TMS	TRST#	NC	TDI	TDO	+3.3V

\*PIN 2 can be detected by the thick cable.

To connect your design to the JTAG-BOOSTER you need a single row berg connector with a spacing of 2.54mm on your PCB. The names refer to the target: Pin 7 is the target's TDO pin and is an input on the JTAG-Booster's side.

The 3.3V version of the JTAG-Booster (FS part number 285) is delivered together with this package. Don't use the 5V version of the JTAG-Booster (FS part number 227) with a 3.3V target. **Don't apply 5V to the 3.3V version of the JTAG-Booster!**

Your target must be able to power the JTAG-Booster, it draws about 100mA.

Before you start the program, the JTAG-BOOSTER must be plugged to a parallel interface of your PC and to the 8 pin JTAG connector on the target.

The utility is started with the general command line format: JTAGxxx

JTAGxxx /function [filename] [/option\_1] ... [/option\_n].

Note that the function must be the first argument followed (if needed) by the filename.

If you want to cancel execution of JTAGxxx, press CTRL-Break-Key.

On any error the program aborts with an MSDOS error level of one.

### **1.5. First Example with Intel PXA210/250**

In the following simple example it is assumed that the JTAG-Booster is connected to LPT1 of your PC and target power is on.

Typing

```
JTAG250 /P MYAPP.BIN
```

at the DOS prompt results in the following output:

```
JTAG250 --- JTAG utility for Intel PXA210/250
Copyright © FS FORTH-SYSTEME GmbH, Breisach
Version 4.xx of mm/dd/yyyy

(1) Configuration loaded from file JTAG250.INI
(2) Target: Generic Target
(3) Using LPT at I/O-address 0378h
(4) JTAG Adapter detected

(5) 1 Device detected in JTAG chain
(6)   Device 0: IDCODE=39264013 Intel XScale PXA210/250
(7) Sum of instruction register bits : 5
(8) CPU position                    : 0
(9) Instruction register offset      : 0
(10) Length of boundary scan reg     : 385

Looking for a known flash device. Please wait..
(11) Dual Intel 28F128 StrataFlash, 3.3V detected
(12) Bus size is 32 Bit
(13) Erasing Flash-EPROM Block #:0
Programming File MYAPP.BIN
65536 Bytes programmed successfully

Erase Time       :      0.8 sec
Programming Time :     28.1 sec
```

- (1) The initialization file JTAG250.INI was found in the current directory.
- (2) The target identification line of the initialization file is printed here.
- (3) The resulting I/O-address of the parallel port is printed here. With WinNT/Win2000/WinXP you must specify the option /LPT2 to access to the standard address 378h.
- (4) A JTAG-Booster is found on the parallel port
- (5) The JTAG chain is analyzed. There may be several parts in the JTAG chain. The chain is analyzed and all parts except the Intel PXA210/250 are switched to bypass mode.
- (6) The revision (1<sup>st</sup> digit of the ID) is relevant for the PXA2xx family:  
Revision 0 -> PXA250 A0  
Revision 1 -> PXA250 A1  
Revision 2 -> PAA250 B0  
Revision 3 -> PXA250 B1  
Revision 4 -> PXA250 B2  
Revision 5 -> PXA26x B0, use JTAG255.EXE  
Revision 6 -> PXA255 A0, use JTAG255.EXE
- (7) The length of all instruction registers in the JTAG chain are added.
- (8) The position of the Intel XScale in the JTAG chain is assumed to be zero, if not specified in the command line (see option /CPUPOS=).
- (9) The position of the JTAG instruction register of the Intel XScale is assumed to be zero, if not specified in the command line (see option /IROFFS=).
- (10) The real length of the boundary scan register is displayed here and compared with the boundary scan register length of a Intel PXA210/250.
- (11) Two Flashes Intel 28F128 selected with CS0# where found.
- (12) The resulting data bus size is printed here.

(13) In this example one block must be erased.

## **1.6. First Example with Intel PXA255/26x**

In the following simple example it is assumed that the JTAG-Booster is connected to LPT1 of your PC and target power is on.

Typing

```
JTAG255 /P MYAPP.BIN
```

at the DOS prompt results in the following output:

```
JTAG255 --- JTAG utility for Intel PXA255/26x
Copyright © FS FORTH-SYSTEME GmbH, Breisach
Version 4.xx of mm/dd/yyyy

(1) Configuration loaded from file JTAG255.INI
(2) Target: Generic Target
(3) Using LPT at I/O-address 0378h
(4) JTAG Adapter detected

(5) 1 Device detected in JTAG chain
(6)   Device 0: IDCODE=69264013 Intel XScale PXA255/26x
(7) Sum of instruction register bits : 5
(8) CPU position                    : 0
(9) Instruction register offset     : 0
(10) Length of boundary scan reg   : 410

Looking for a known flash device. Please wait..
(11) Dual Intel 28F128 StrataFlash, 3.3V detected
(12) Bus size is 32 Bit
(13) Erasing Flash-EPROM Block #:0
Programming File MYAPP.BIN
65536 Bytes programmed successfully

Erase Time      :      0.8 sec
Programming Time :     29.9 sec
```

- (1) The initialization file JTAG255.INI was found in the current directory.
- (2) The target identification line of the initialization file is printed here.
- (3) The resulting I/O-address of the parallel port is printed here.
- (4) A JTAG-Booster is found on the parallel port
- (5) The JTAG chain is analyzed. There may be several parts in the JTAG chain. The chain is analyzed and all parts except the Intel PXA255/26x are switched to bypass mode.
- (6) The revision (1<sup>st</sup> digit of the ID) is relevant for the Intel PXA2xx family:  
Revision 0 -> PXA250 A0, use JTAG250.EXE  
Revision 1 -> PXA250 A1, use JTAG250.EXE  
Revision 2 -> PAA250 B0, use JTAG250.EXE  
Revision 3 -> PXA250 B1, use JTAG250.EXE  
Revision 4 -> PXA250 B2, use JTAG250.EXE  
Revision 5 -> PXA26x B0  
Revision 6 -> PXA255 A0
- (7) The length of all instruction registers in the JTAG chain are added.
- (8) The position of the Intel XScale in the JTAG chain is assumed to be zero, if not specified in the command line (see option /CPUPOS=).
- (9) The position of the JTAG instruction register of the Intel XScale is assumed to be zero, if not specified in the command line (see option /IROFFS=).
- (10) The real length of the boundary scan register is displayed here and compared with the boundary scan register length of a Intel PXA255/26x.
- (11) Two Flashes Intel 28F128 selected with CS0# where found.
- (12) The resulting data bus size is printed here.
- (13) In this example one block must be erased.

## **1.7. First Example with Intel IOP321**

In the following simple example it is assumed that the JTAG-Booster is connected to LPT1 of your PC and target power is on.

Typing

```
JTAG321 /P MYAPP.BIN
```

at the DOS prompt results in the following output:

```
JTAG321 --- JTAG utility for Intel IOP321
Copyright © FS FORTH-SYSTEME GmbH, Breisach
Version 4.xx of mm/dd/yyyy

(1) Configuration loaded from file JTAG321.INI
(2) Target: Generic Target
(3) Using LPT at I/O-address 0378h
(4) JTAG Adapter detected

(5) 1 Device detected in JTAG chain
    Device 0: IDCODE=09267013 Intel XScale IOP321, Revision 0
(6) Sum of instruction register bits : 5
(7) CPU position                    : 0
(8) Instruction register offset     : 0
(9) Length of boundary scan reg    : 356

Looking for a known flash device. Please wait..
(10) Dual Intel 28F128 StrataFlash, 3.3V detected
(11) Bus size is 32 Bit
(12) Erasing Flash-EPROM Block #:0
    Programming File MYAPP.BIN
    65536 Bytes programmed successfully

Erase Time      :      0.8 sec
Programming Time :     26.0 sec
```



- (1) The initialization file JTAG321.INI was found in the current directory.
- (2) The target identification line of the initialization file is printed here.
- (3) The resulting I/O-address of the parallel port is printed here.
- (4) A JTAG-Booster is found on the parallel port
- (5) The JTAG chain is analyzed. There may be several parts in the JTAG chain. The chain is analyzed and all parts except the Intel IOP321 are switched to bypass mode.
- (6) The length of all instruction registers in the JTAG chain are added.
- (7) The position of the Intel XScale in the JTAG chain is assumed to be zero, if not specified in the command line (see option /CPUPOS=).
- (8) The position of the JTAG instruction register of the Intel XScale is assumed to be zero, if not specified in the command line (see option /IROFFS=).
- (9) The real length of the boundary scan register is displayed here and compared with the boundary scan register length of a Intel IOP321.
- (10) Two Flashes Intel 28F128 selected with PCE0# where found.
- (11) The resulting data bus size is printed here.
- (12) In this example one block must be erased.

## **1.8. First Example with Intel IXP425**

In the following simple example it is assumed that the JTAG-Booster is connected to LPT1 of your PC and target power is on.

Typing

```
JTAG425 /P MYAPP.BIN
```

at the DOS prompt results in the following output:

```
JTAG425 --- JTAG utility for Intel IXP425
Copyright © FS FORTH-SYSTEME GmbH, Breisach
Version 4.xx of mm/dd/yyyy

(1) Configuration loaded from file JTAG425.INI
(2) Target: Generic Target with IXP425
(3) Using LPT at I/O-address 0378h
(4) JTAG Adapter detected

(5) 1 Device detected in JTAG chain
(6)   Device 0: IDCODE=09274013 Intel XScale IXP425, Revision 0
(7) Sum of instruction register bits : 7
(8) CPU position                    : 0
(9) Instruction register offset      : 0
(10) Length of boundary scan reg    : 498

Looking for a known flash device. Please wait..
(11) Intel 28F128 StrataFlash, 3.3V detected
(12) Bus size is 16 Bit
(13) Erasing Flash-EPROM Block #:0
Programming File MYAPP.BIN
65536 Bytes programmed successfully

Erase Time       :      0.8 sec
Programming Time :     72.6 sec
```

- (1) The initialization file JTAG425.INI was found in the current directory.
- (2) The target identification line of the initialization file is printed here.
- (3) The resulting I/O-address of the parallel port is printed here.
- (4) A JTAG-Booster is found on the parallel port
- (5) The JTAG chain is analyzed. There may be several parts in the JTAG chain. The chain is analyzed and all parts except the Intel IXP425 are switched to bypass mode.
- (6) There are different ID codes for the Intel IXP425:  
x9274013 -> Intel IXP425, 533 MHz  
x9275013 -> Intel IXP425, 400 MHz  
x9276013 -> Intel IXP425, ??? MHz (reserved)  
x9277013 -> Intel IXP425, 266 MHz  
Note: "x" identifies the silicon stepping
- (7) The length of all instruction registers in the JTAG chain are added.
- (8) The position of the Intel XScale in the JTAG chain is assumed to be zero, if not specified in the command line (see option /CPUPOS=).
- (9) The position of the JTAG instruction register of the Intel XScale is assumed to be zero, if not specified in the command line (see option /IROFFS=).
- (10) The real length of the boundary scan register is displayed here and compared with the boundary scan register length of a Intel IXP425.
- (11) One Flash Intel 28F128 selected with EX\_CS0# was found.
- (12) The resulting data bus size is printed here.
- (13) In this example one block must be erased.

## **1.9. Trouble Shooting**

Avoid long distances between your Host-PC and the target. If you are using standard parallel extension cable, the JTAG-BOOSTER may not work. Don't use Dongles between the parallel port and the JTAG-BOOSTER.

Switch off all special modes of your printer port (EPP, ECP, ...) in the BIOS setup. Only standard parallel port (SPP) mode is allowed.

If there are problems with autodetection of the flash devices use the /DEVICE= option. To speed up autodetection specify one of the options /8BIT /16BIT or /32BIT.

Don't use hardware protected flash memories.

The used chip selects must be defined as output and inactive in the initialization file (see chapter 1.11 "Initialization file JTAGxxx.INI"). Also the address bits must be defined as output.

Use the option /NOWRSETUP to speed up flash programming.

### **1.10. Error Messages**

- **80386 or greater required**  
The JTAG-BOOSTER does not work on a 8088/8086 or a 80286 platform.
- **Cable not connected or target power fail**  
The JTAG-Booster (or one of the simple Parallel Port JTAG adapters selected with the options /LATTICE /WIGGLER /PLS /TRITON) wasn't found. Please check connection to parallel port and connection to target. Check target power. Check the command line options. Check your BIOS-Setup. If you are using this program with WinNT, Win2000 or WinXP you must specify /LPT2 or /LPT-BASE=378 to get access to the standard printer port.
- **Can't open x:\yyy\zzz\JTAGxxx.OVL**  
The overlay file JTAGxxx.OVL must be in the same directory as JTAGxxx.EXE.
- **Configuration file XYZ not found.**  
The file specified with the option /INI= wasn't found.
- **Device offset out of range**  
The value specified with the option /OFFSET= is greater than the size of the detected flash device.
- **Disk full**  
Writing a output file was aborted as a result of missing disk space.
- **Do not specify option /NOCS with any other chip select**  
There is a conflict in the command line.
- **Do not specify option /BYTE-MODE. Flash device does not have a byte mode pin.**  
The flash device specified with the option /DEVICE= does not support switching between 16 (or 32) bit mode and 8 bit mode. In practice it does not have a pin with the name BYTE#

- **Error creating file:**  
The output file could not be opened. Please check free disk space or write protection.
- **Error: *Pin-Name* is an output only pin**  
The specified pin cannot be sampled. Check the command line. Check the initialization file.
- **Error: *Pin-Name* is an input only pin**  
The specified pin cannot be activated. Check the command line. Check the initialization file.
- **Error: *Pin-Name* may not be read back**  
The specified pin can be switched to tristate, but cannot be read back. Check the command line.
- **illegal function:**  
The first parameter of the command line must be a valid function. See chapter 2 “JTAGxxx Parameter Description” for a list of supported functions.
- **illegal number:**  
The specified number couldn't be interpret as a valid number. Check the relevant number base.
- **illegal option:**  
See chapter 2 “JTAGxxx Parameter Description” for a list of supported options.
- **illegal Pin Type:**  
The name specified with the option /PIN= must be one of the list of chapter 1.11 "Initialization file JTAGxxx.INI"
- **illegal Flash Type:**  
The name specified with the option /DEVICE= must be one of the list of chapter 1.12 "Supported flash devices".
- **Input file not found:**  
The specified file cannot be found

- **Input file is empty:**  
Files with zero length are not accepted
- **" " is undefined**  
Please check the syntax in your configuration file. (See chapter 1.11 "Initialization file JTAGxxx.INI").
- **LPTx not installed**  
The LPT port specified with /LPTx cannot be found. Please check the LPT port or specify a installed LPT port. Check your BIOS setup. If you are using this program with WinNT, Win2000 or WinXP you 1<sup>st</sup> must install the WinNT support package as described in chapter 5 "Support for Windows NT, Windows 2000 and Windows XP
- **missing filename**  
Most functions need a filename as second parameter.
- **missing option /I2CCLK=**  
Some functions need the option /I2CCLK= to be defined.
- **missing option /I2CDAT=**  
Some functions need the option /I2CDAT= or the options /I2CDATO= and /I2CDATI= to be defined.
- **missing option /LENGTH=**  
Some functions need the option /LENGTH= to be defined.
- **missing option /PIN=**  
Some functions need the option /PIN= to be defined.
- **More than 9 devices in the JTAG chain or TDO pin stuck at low level**  
The JTAG chain is limited to 9 parts. Check target power. Check the target's TDO pin.
- **No devices found in JTAG chain or TDO pin stuck at high level**  
A stream of 32 high bits was detected on the pin TDO. TDO may stuck at high level. Check the connection to your target. Check the target power. Check the target's TDO pin.

- **Option /CPUPOS= out of range**  
The number specified with the option /CPUPOS= must be less or equal to the number of parts minus 1.
- **Option /IROFFS= out of range**  
Please specify a smaller value
- **Part at specified position is not a Intel XScale**  
The option /CPUPOS= points to a part not a Intel XScale
- **Pins specified with /I2CCLK= and /I2CDAT= must have different control cells**  
The pin specified with the option /I2CDAT= must be able to be switched to high impedance while the pin specified with option /I2CCLK= is an active output. See chapter 1.11 "Initialization file JTAGxxx.INI".
- **Pins specified with /I2CCLK= and /I2CDATI= must have different control cells**  
The pin specified with the option /I2CDATI= must be able to be switched to high impedance while the pin specified with option /I2CCLK= is an active output. See chapter 1.11 "Initialization file JTAGxxx.INI".
- **Pins specified with /I2CDATO= and /I2CDATI= must have different control cells**  
The pin specified with the option /I2CDATI= must be able to be switched to high impedance while the pin specified with option /I2CDATO= is an active output. See chapter 1.11 "Initialization file JTAGxxx.INI".
- **Specify only one of these options:**  
Some options are exclusive (i.e. /8BIT and /16BIT). Don't mix them.
- **Sum of instruction register bits to low. Should be at least 5 bits for a Intel XScale (7 bits for the IXP425)**  
The sum of all instruction register bits in the JTAG chain does not fit to the Intel XScale. Check the target connection. Check the target CPU type. Check the settings for /IROFFS= and /CPUPOS= , if there are several parts in the JTAG chain.



- **Target no longer connected**  
There is a cyclic check of the JTAG chain. Check target power. Check target connection.
- **There are unknown parts in the JTAG chain. Please use the option /IROFFS= to specify the instr. reg. offset of the CPU.**  
If there are unknown parts in the JTAG chain, the program isn't able to determine the logical position of the CPU's instruction register.
- **There is no Intel XScale in the JTAG chain**  
No Intel XScale was found in the JTAG chain. Check the target power. Try with option /DRIVER=4 again.
- **Value of option /FILE-OFFSET out of range**  
The value of the option /FILE-OFFSET= points behind end of file.
- **wrong driver #**  
The value specified with the option /DRIVER= is out of range.
- **Wrong Flash Identifier (xxxx)**  
No valid identifier found. Check the specified chip select signal and the bus width. Try with the option /DEVICE= .
- **Wrong length of boundary scan register. Should be 385 for a Intel PXA210/250. (Should be 410 for a Intel PXA255/26x/Should be 356 for a Intel IOP321/ Should be 498 for a Intel IXP425.)**  
The length of the boundary scan register of the selected part (if there are more than one in the chain) does not fit to the Intel XScale. Check the target connection. Check the target CPU type. Check the settings for /IROFFS= and /CPUPOS= , if there are several parts in the JTAG chain.

### **1.11. Initialization file JTAGxxx.INI**

This file is used to define the default direction and level of all CPU signals. This file **must be carefully adapted** to your design with the Intel XScale. The Target-Entry is used to identify your design which is displayed with most commands.

When the program JTAGxxx.EXE is started it scans the current directory for an existing initialization file named JTAGxxx.INI. If no entry is found the default values are used. You may also specify the initialization file with the option /INI= . If the specified file isn't found, the program aborts with an error message.

The CPU pins can also be used with the functions /BLINK (chapter 2.9), /PIN? (chapter 2.10) and /SAMPLE (chapter 2.11) to test the signals on your design.

The sample file below represents the values which are used for default initialization when no initialization file could be found in the current directory and no initialization file is specified with the option /INI=.

Changes to the structure of the file could result in errors. Remarks can be added by using //.