

Application Note 00701

In-Circuit Programming of Altera MAX devices

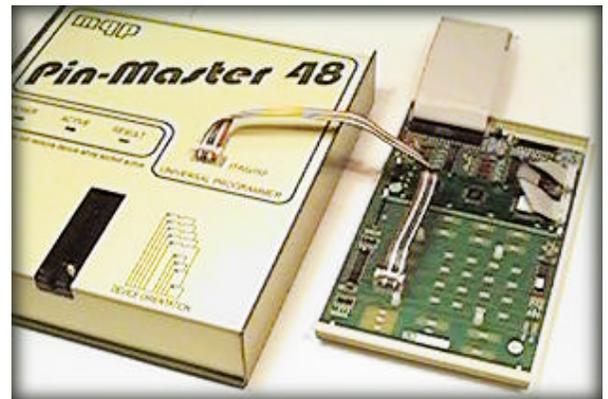
This application note describes how Altera MAX devices may be programmed in-circuit using the dedicated JTAG connector on the Pin-Master 48 universal programmer. The programming cable and programming procedures are described.

INTRODUCTION

An increasing number of devices have an in circuit programming capability, allowing the devices to be programmed while soldered onto a system board.

The programming data is transmitted and received over a serial interface. On many devices this interface conforms to the JTAG (IEEE Std 1149.1) standard or in some cases to a proprietary standard.

The Pin-Master 48 universal programmer has a dedicated JTAG connector fitted to the top of the unit. A cable made up to the users own requirements connects the socket to the target board.



Altera' MAX series parts can very easily be programmed using this JTAG interface. The simplest way is for the target board to be laid out to match the Pin-Master 48 JTAG connector.

Alternatively the designer may have chosen to use the Altera recommended pin-out. This application note describes how to interconnect the Pin-Master 48 and the MAX connector.

The JTAG method can also be extended to allow the programming of a chain of JTAG devices.

PIN-MASTER 48 JTAG SOCKET

The socket is a standard 10 way 0.1" header. A diagram of the socket is shown below:

Viewed from top, front of programmer

2	4	6	8	10
GND	GND	GND	GND	GND
1	3	5	7	9
TCK	TMS	TDI	TDO	TRST*

* May be Enable, Vpp, or No Connect

1	TCK	Test Clock	Device input
2	GND	Ground	
3	TMS	Test Mode Select	Device input
4	GND	Ground	
5	TDI	Test Data Input	Device input
6	GND	Ground	
7	TDO	Test Data Output	Device output
8	GND	Ground	
9	TRST*	Test Reset	Device input
10	GND	Ground	

* TRST is an optional signal on a JTAG interface. On some devices it is used for an ENABLE or Vpp high voltage signal. It is not used on Altera MAX devices.

ALTERA MAX CONNECTOR

The socket is a standard 10 way 0.1" header. A diagram of the plug is shown below:

Viewed on end of pins

2	4	6	8	10
GND	VCC	nc	nc	GND
1	3	5	7	9
TCK	TDO	TMS	nc	TDI

1	TCK	Test Clock	Device input
2	GND	Ground	
3	TDO	Test Data Output	Device output
4	VCC		Output from target board
5	TMS	Test Mode Select	Device input
6	nc		
7	nc		
8	nc	-	
9	TDI	Test Data Input	Device input
10	GND	Ground	

CABLE

A ribbon cable with alternate wires connected to ground is used between the Pin-Master 48 and the target board. The cable should be kept as short as possible (maximum length 1.5m).

Signal Name	Pin-Master 48	MAX
TCK	1	1
TMS	3	5
TDI	5	9
TDO	7	3
TRST	9	nc
GND	2, 4, 6, 8, 10	2, 10
VCC	nc	4

The re-arrangement of signals necessary should occur at the MAX end of the cable to preserve the transmission line effect of the alternate GND signals.

We recommend that the grounds should all be connected together at the MAX end of the cable and then joined to the MAX ground.

TCK SIGNAL

Most in-system programming failures are caused by a noisy TCK signal. Keep the cable and track lengths to a minimum; try to minimise coupling from adjacent tracks. Altera recommends connecting a pull down resistor of approximately 1K Ω to the TCK signal.

TARGET BOARD

The target board should be equipped with a suitable connector. This could be most simply achieved with a connector and pin layout similar to that used at the programmer end of the cable.

For target boards designed to Altera MAX specification the connections shown above should be followed.

A JTAG interface implies the use of internal pull up resistors on input pins. The user would be advised to check the device specification before deciding if external resistors are required.

Please note that during programming all normal outputs on the device will be tri-stated. The design of the target board should be such that this does not cause any problems to any other circuitry.

PREPARING FILES

The current Pin-Master 48 support for in system programming of Altera MAX devices is by the use of JAM format files. JAM format files for MAX devices can be generated using the Altera MAX+PLUS II software.

When using PROMDRIVER with the Pin-Master 48, simply open the JAM file and click on the required function button. Please note that only certain functions are available when using JAM files, typically PROGRAM and VERIFY.

PROGRAMMING PROCEDURE

As no power is provided by the programmer, the target board must be independently powered.

To avoid earth potential differences the programmer and target board should be connected to a common mains supply.

- Connect the cable to the target board and the programmer.
- Power up the target board and proceed with programming in the normal way.

For further information contact:

MQP Electronics,
Park Road Centre,
Malmesbury,
Wilts, SN16 0BX, UK

Tel: **+44 (0) 1666 825 666**

Fax: **+44 (0) 1666 825 141**

email: **sales@mqp.com**

web site: **http://www.mqp.com**