

IEEE Std. 1149.1 (JTAG) Boundary-Scan Support

All HardCopy devices provide JTAG boundary-scan test (BST) circuitry that complies with the IEEE Std. 1149.1-1990 specification. HardCopy[®] APEX[™] devices support the JTAG instructions shown in [Table 9–1](#).



The BSDL files for HardCopy devices are different from the corresponding APEX 20KE or APEX 20KC parts. Download the correct HardCopy BSDL file from Altera’s website at www.altera.com.

Table 9–1. HardCopy APEX JTAG Instructions

JTAG Instruction	Description
SAMPLE/PRELOAD	SAMPLE/PRELOAD allows a snapshot of signals at the device pins to be captured and examined during normal device operation and permits an initial data pattern to be output at the device pins. It is also used by the SignalTap [®] embedded logic analyzer.
EXTEST	Allows the external circuitry and board-level interconnections to be tested by forcing a test pattern at the output pins and capturing test results at the input pins.
BYPASS	Places the 1-bit bypass register between the TDI and TDO pins, which allows the BST data to pass synchronously through selected devices to adjacent devices during normal device operation.
USERCODE	Selects the 32-bit USERCODE register and places it between the TDI and TDO pins, allowing the USERCODE to be serially shifted out of TDO.
IDCODE	Selects the IDCODE register and places it between the TDI and TDO pins, allowing the IDCODE to be serially shifted out of TDO.

HardCopy APEX devices instruction register length is 10 bits; the USERCODE register length is 32 bits. [Tables 9–2](#) and [9–3](#) show the boundary-scan register length and device IDCODE information for HardCopy devices.

Table 9–2. HardCopy APEX Boundary-Scan Register Length

Device	Boundary-Scan Register Length
HC20K400	1,506
HC20K600	1,806
HC20K1000	2,190
HC20K1500	2,502

Table 9–3. 32-Bit HardCopy APEX Device IDCODE

Device	IDCODE (32 Bits) <i>Note (1)</i>			
	Version (4 Bits)	Part Number (16 Bits)	Manufacturer Identity (11 Bits)	1 (1 Bit) <i>(2)</i>
HC20K400	0000	1000 0100 0000 0000	000 0110 1110	1
HC20K600	0000	1000 0110 0000 0000	000 0110 1110	1
HC20K1000	0000	1001 0000 0000 0000	000 0110 1110	1
HC20K1500	0000	1001 0101 0000 0000	000 0110 1110	1

Notes to Table 9–3:

- (1) The most significant bit (MSB) is on the left.
- (2) The IDCODE's least significant bit (LSB) is always 1.

Figure 9–1 shows the timing requirements for the JTAG signals.

Figure 9–1. HardCopy JTAG Waveforms

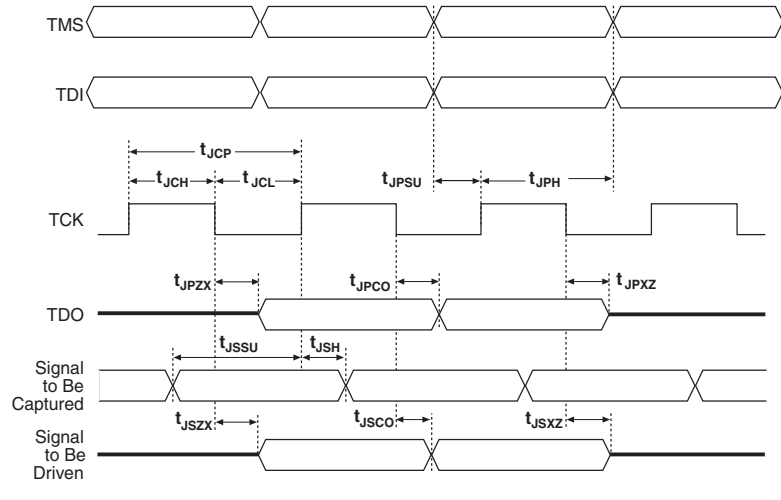


Table 9–4 shows the JTAG timing parameters and values for HardCopy devices.

Table 9–4. HardCopy APEX JTAG Timing Parameters and Values

Symbol	Parameter	Min	Max	Unit
t_{JCP}	TCK clock period	100		ns
t_{JCH}	TCK clock high time	50		ns
t_{JCL}	TCK clock low time	50		ns
t_{JPSU}	JTAG port setup time	20		ns
t_{JPH}	JTAG port hold time	45		ns
t_{JPCO}	JTAG port clock to output		25	ns
t_{JPZX}	JTAG port high impedance to valid output		25	ns
t_{JPXZ}	JTAG port valid output to high impedance		25	ns
t_{JSSU}	Capture register setup time	20		ns
t_{JSH}	Capture register hold time	45		ns
t_{JSCO}	Update register clock to output		35	ns
t_{JSZX}	Update register high impedance to valid output		35	ns
t_{JSXZ}	Update register valid output to high impedance		35	ns



For more information about using JTAG BST circuitry in Altera devices, refer to *Application Note 39 (IEEE Std. 1149.1 (JTAG) Boundary-Scan Testing in Altera Devices)*.

Document Revision History

Table 9–5 shows the revision history for this chapter.

Table 9–5. Document Revision History (Part 1 of 2)

Date and Document Version	Changes Made	Summary of Changes
September 2008, v2.3	Updated chapter number and metadata.	—
June 2007, v2.2	Minor text edits.	—
December 2006 v2.1	Updated revision history.	Updated revision history.
March 2006	Formerly chapter 11; no content change.	

Table 9–5. Document Revision History (Part 2 of 2)

Date and Document Version	Changes Made	Summary of Changes
January 2005 v2.0	Update device names and other minor textual changes.	—
June 2003 v1.0	Initial release of <i>Boundary-Scan Support</i> in the HardCopy Device Handbook.	—