Update of IEEE P1500 Core Wrapper Architecture

Presented by
Erik Jan Marinissen
on behalf of CTAG Working Group

Design, Automation, and Test Europe (DATE’03)
Munich, Germany – March 5, 2003
Topics

- Wrapper Overview & Applications
- Wrapper Architecture & Instructions
- Wrapper Harness Cells
- Summary
Block Level Overview of a P1500 Wrapper

User Defined Port for Test Flexibility

Wrapper Parallel Control

Optional Wrapper Parallel Port (WPP)

Wrapper Parallel Input

Core

Wrapper Parallel Output

Wrapper

Wrapper Serial Input

Wrapper Serial Control

Wrapper Serial Output

Required Wrapper Serial Port (WSP)

Standardized Port for Plug & Play

P1500 Wrapper Configuration Examples

User Defined Test Access Mechanisms (TAM)

Standardized Plug&Play Wrapper Serial Ports

P1500 Wrapper Configuration Examples

Daisychained TAM

Standardized Plug&Play Wrapper Serial Ports

P1500 Wrapper Configuration Examples

Direct Access TAM

Standardized Plug & Play Wrapper Serial Ports

Wrapper Architecture & Instructions
View of the Required P1500 Wrapper Architecture

Functional Inputs

Functional Outputs

CTO

CFI

Cell

CFO

CTI

Core

Test Enable(s)

FI

FI

FO

FO

W

BR

W

BR

WSI

1

1

Bypass

WIR

Update

Shift

WSC

7

(WRST, WCLK, SelectWR, Capture, Shift, Update, Transfer)

P1500 Wrapper Test Instructions

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Required/Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS_BYPASS</td>
<td>Required</td>
</tr>
<tr>
<td>WS_PRELOAD</td>
<td>Optional</td>
</tr>
<tr>
<td>WP_PRELOAD</td>
<td>Optional</td>
</tr>
<tr>
<td>WS_CLAMP</td>
<td>Optional</td>
</tr>
<tr>
<td>WS_SAFE</td>
<td>Optional</td>
</tr>
<tr>
<td>WS_INTEST_RING</td>
<td>Optional</td>
</tr>
<tr>
<td>WS_INTEST_SCAN</td>
<td>Optional</td>
</tr>
<tr>
<td>WP_INTEST_RING</td>
<td>Optional</td>
</tr>
<tr>
<td>WP_INTEST_SCAN</td>
<td>Optional</td>
</tr>
<tr>
<td>WH_INTEST</td>
<td>Optional</td>
</tr>
<tr>
<td>WS_EXTEST</td>
<td>Required</td>
</tr>
<tr>
<td>WP_EXTEST</td>
<td>Optional</td>
</tr>
<tr>
<td>WH_EXTEST</td>
<td>Optional</td>
</tr>
</tbody>
</table>

* Example of an optional user-defined instruction


At Least One Optional INTEST is Required
# P1500 Wrapper Test Instructions

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Controlling Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS_BYPASS</td>
<td>WSP</td>
</tr>
<tr>
<td>WS_PRELOAD</td>
<td>WSP</td>
</tr>
<tr>
<td>WP_PRELOAD</td>
<td>WPP</td>
</tr>
<tr>
<td>WS_CLAMP</td>
<td>WSP</td>
</tr>
<tr>
<td>WS_SAFE</td>
<td>WSP</td>
</tr>
<tr>
<td>WS_INTEST_RING</td>
<td>WSP</td>
</tr>
<tr>
<td>WS_INTEST_SCAN</td>
<td>WSP</td>
</tr>
<tr>
<td>* WP_INTEST_RING</td>
<td>WPP</td>
</tr>
<tr>
<td>* WP_INTEST_SCAN</td>
<td>WPP</td>
</tr>
<tr>
<td>WH_INTEST</td>
<td>WSP and/or WPP</td>
</tr>
<tr>
<td>WS_EXTEST</td>
<td>WSP</td>
</tr>
<tr>
<td>WP_EXTEST</td>
<td>WSP or WPP</td>
</tr>
<tr>
<td>WH_EXTEST</td>
<td>WSP and/or WPP</td>
</tr>
</tbody>
</table>
Instruction Field Naming Conventions

[ Field 1 ] [ Field 2 ] [ Field 3 ] [ Field 4 ]

Wrapper

Test Access

Test Mode

Configuration

Serial = S
Parallel = P
Hybrid = H

Bypass
Preload
Clamp
Safe
Intest
Exttest
User

Ring
Scan
User

WS_Intest_Ring

Wrapper Serial Preload (WS_Preload) Instruction
Wrapper Parallel Preload (WP_Preload) Instruction

WPC signals are User-Defined

WPO
WPI
Mission Mode

WPO
WPI
Mission Mode

WPO
WPI
Mission Mode

WSI
Bypass
WIR
WSC
WSO

WPP Data Paths indicated in Green

Wrapper Serial Clamp (WS_Clamp) Instruction

Inputs may also be controlled to preloaded states

Preloaded States

WS_Clamp is preceded by WS/P_Preload

Wrapper Serial Safe (WS_Safe) Instruction

Inputs may also be controlled to safe states

Forced Safe States

Disabled
Core
Test Enable(s)

FI FO
FO FI

WSI
Bypass
WIR

WSC
WS_Safe

WSO

Forced Safe States

WS_Safe does not require WS/P_Preload

Wrapper Serial Intest Ring (WS_Intest_Ring) Mode

Test is applied via WSC Controlled WBR Scan Path

Wrapper Serial Intest Scan (WS_Intest_Scan) Mode

Test is applied via WSC Controlled WBR & Internal Scan Path

WSC  
Bypass  
WIR

WSI  
WSO

Core

Internal Scan

Test Enable(s)

FI  FO  FI  FO

Wrapper Parallel Intest Ring (WP_Intest_Ring) Mode

Test is applied via WPC Controlled WBR Segments

Under Consideration as a Standard Instruction

Wrapper Parallel Intest Scan (WP_Intest_Scan) Mode

Test is applied via WPC Controlled WBR & Internal Scan Segments

Under Consideration as a Standard Instruction

Wrapper Hybrid Intest (WH_Intest) Mode

Test is applied via WSC & WPC Controlled WBR Segments

WSC

WH_Intest

Wrapper Serial Extest (WS_Extest) Mode

Test is applied via WSC Controlled WBR Scan Path

Disabled
Core
Test Enable(s)

UDL
UDL
UDL

WSI
Bypass
WIR

WSC

WSO

Wrapper Parallel Exttest (WP_Exttest) Mode

Test is applied via WSC Controlled WBR Segments

Wrapper Hybrid Extest (WH_Extest) Mode

Disabled Core

Test Enable(s)

Test is applied via WSC & WPC Controlled WBR Segments

WPC

WPO

UDL

WPI

WPI

UDL

WPO

UDL

WSI

Bypass

WIR

WSO

WSC

WH_Extest

Wrapper Harness Cells
Applying Wrappers to Test Only Inputs & Outputs

Reduced Functionality Harness Cells

Functional Inputs

Functional Outputs

Test Inputs (TI)

Core

Test Outputs (TO)

Test Enable(s)

WIR

WSI

WBR

Reduced Functionality Harness Cells

Functional Outputs

Functional Inputs

Bypass

WSO

WSC

Pass/Scan-Through Harness Cells

Example Using Pass-Through Harness Cells

Pass-Through Harness Cells

WPI → WBR → TI → TO → WBR → WPO

Core

WBR

Test Enable(s)

WBR

Bypass

WSI → WIR → WSO

WSC

WH_Intest

Example Using Scan-Through Harness Cells
Example of Pass/Scan Through Cells in Pass Mode

Pass/Scan-Through Harness Cells in Pass Mode

Enables Factory Testing using Parallel Access

Example of Pass/Scan Through Cells in Scan Mode

Pass/Scan-Through Harness Cells In Scan Mode

Enables In-System Testing using Serial Access

Summary

- A Standard Core Wrapper has been presented
- Its Architecture is Simple and Extendable
- Its Serial Port is Plug&Play for Standardized Testing
- Its Parallel Port is User Defined for Test Flexibility
- Its Instruction Set is Well Defined and Expandable
- A Draft is in preparation for Ballot in 2003