



LSI LOGIC®

IBIS Quality Committee Report

IBIS Summit, Feb 1, 2007

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25
YEARS

Active Committee Members

- Michael LaBonte, Cisco Systems (Chair)
- Bob Ross, Teraspeed Consulting
- Roy Leventhal, Leventhal Design and Communications
- David Banas, Xilinx
- Moshiul Haque, Micron Technology
- Kim Helliwell, LSI
- Eckhard Lenski, Siemens
- Radovan Vuletic, Qimonda

IBIS Quality Spec (Sample Pages)

1/11/2007

IBIS QUALITY SPECIFICATION Revision 1.1 (draft)

Revision History

| | | | |
|------|-------------|---------------|--|
| 1.0a | 31-mar-2004 | Bob Haller | Initial version |
| 1.0b | 04-jan-2005 | Mike LaBonte | Review update |
| 1.0c | 15-feb-2005 | Mike LaBonte | Review update |
| 1.0d | 08-mar-2005 | Mike LaBonte | Review update |
| 1.0e | 05-apr-2005 | Bob Haller | Review update |
| 1.0f | 12-apr-2005 | Mike LaBonte | Review update |
| 1.0g | 02-aug-2005 | Mike LaBonte | Review update |
| 1.1a | 14-aug-2006 | Moshiul Haque | Modified section 1, 2, 3, 4 and 5 with the new IQ numbering scheme Added "Receiver Threshold" as an optional requirement in section 4 |
| 1.1b | 31-oct-2006 | Mike LaBonte | Convert to MSWord format. |
| 1.1c | 27-nov-2006 | Mike LaBonte | Review update |
| 1.1d | 12-dec-2006 | Mike LaBonte | Review update |
| 1.1e | 09-jan-2007 | Mike LaBonte | Formatting. More formatting work needed beginning at 4.3.10. |

Purpose

The purpose of the IBIS Specification is to provide a standard for model data exchange and thus to enhance the value of modeling and simulation. The purpose of the IBIS Quality Specification is to provide a standard for validating model data against the IBIS Specification and a means of objective measures of correlating model simulation results with measurements or other model simulations. By providing standards for validating, correlating, and replicating simulation results we seek to enhance the value of modeling and simulation.

Neither standard is a means, by itself, for guaranteeing quality. The quality of models and simulations are largely the result of market forces. Standards serve to enhance the exchange of data.

1/11/2007

1. IBIS Quality Summary

The quality of an IBIS file can be determined by checking its data for correctness, and by correlating the data to a reference. Correctness is defined as conforming to a designated version of the IBIS Specification and the component data sheet. A number of individual checks are performed, and the overall file quality is represented with a designator such as "IQ3S", which would mean data for basic simulation and timing analysis have been checked, and the IBIS model has been correlated to a reference simulation. Information from the checking process should be embedded in the IBIS file as comments.

1.1. IBIS Quality Level Definitions

The quality level is defined as a combination of correctness checks and correlation checks. The correctness level is a number, and other special designations such as correlation are shown as appended letters. Some examples:

- **IQ0** - No IQ checking at all.
- **IQ1** - Passes IBISCHK without errors or unexplained warnings.
- **IQ2** - IQ1 + data for basic simulation checked.
- **IQ3** - IQ2 + data for timing analysis checked
- **IQ4** - IQ3 + data for power analysis checked
- **IQ3M** - IQ3 + correlated against hardware measurements
- **IQ3MS** - IQ3 + correlated against measurements and simulation
- **IQ4X** - IQ4, but exception(s) to check(s) commented in file

The 5 recognized levels of correctness checks and 3 levels of correlation checks are discussed below. Details of the referenced checks and correlation tests are given in sections 2 through 6.

1.1.1. IQ0 - Not Checked

An IQ0 file has not been checked, or at least the checking has not been documented. This is a placeholder level useful for showing which files are queued for checking. Tools that create IBIS files should put IQ0 comments in the files.

1.1.2. IQ1 - Passes IBISCHK

An IQ1 file has been checked with IBISCHK parser 3.2.9 or later.

- The version of ibischk used must be documented in the Quality Summary.
- IBISCHK must report 0 Errors
- All IBISCHK warnings must be explained if they cannot be eliminated. Ideally, there should be no warnings, but it is recognized that some warnings cannot be eliminated. It is not necessary to flag exceptions with an IQ1X designation in this case.

1.1.3. IQ2 - Suitable for Waveform Simulation

IBIS Quality Checklist

Microsoft Excel - IQ_checklist_summit.xls

File Edit View Insert Format Tools Data Window Help

Type a question for help

B1 IBIS Quality Checklist

| | A | B | C | D | E |
|----|----|---|---------------------|-----------------|-----------------------------------|
| 1 | IQ | IBIS Quality Checklist | | | |
| 2 | IQ | | | | |
| 3 | IQ | This checklist will help validate the quality of an IBIS file. | | | |
| 4 | IQ | Copy the Comp and Model tabs below so that this spreadsheet contains one tab | | | |
| 5 | IQ | for each [Component] and [Model]. Fill in the tabs to determine the quality level for | | | |
| 6 | IQ | each item, then complete the summary of IQ levels below to determine the overall | | | |
| 7 | IQ | IQ level | | | |
| 8 | IQ | More information: http://www.sissoft.com/ibis-quality/docs/IQ_specification.txt | | | |
| 9 | IQ | | | | |
| 10 | IQ | FILE: | iqsample.ibs | | |
| 11 | IQ | SOURCE: | ACME website | | |
| 12 | IQ | CHECKER: | Wile E. Coyote | | |
| 13 | IQ | DATE: | 21-Sep-04 | | |
| 14 | IQ | | | | |
| 15 | IQ | | Name | IQ Level | |
| 16 | IQ | Overall IQ Level | | IQ2S | |
| 17 | IQ | File Header | | 2+ | Must PASS to achieve at least IQ2 |
| 18 | IQ | Comp | IQ_SAMPLE | 2 | |
| 19 | IQ | Model | SAMPLE_OUT | 3S | |
| 20 | IQ | Model | SAMPLE_IN | 3S | |
| 21 | IQ | Model | SAMPLE_OE | 3S | |
| 22 | IQ | | | | |
| 23 | IQ | | IBISCHK Information | | |
| 24 | IQ | IBISCHK VERSION: | V4.0.2 | | |
| 25 | IQ | ERRORS: | 0 | | |
| 26 | IQ | WARNINGS: | 0 | | |
| 27 | IQ | | | | |
| 28 | IQ | File Header: | | | |
| 29 | IQ | In column B below mark each item PASS, FAIL, or N/A. | | | |
| 30 | IQ | The IQ level is the highest level number for which all checks PASS. | | | |
| 31 | IQ | The IQ level is FAIL if no level completely passes. | | | |
| 32 | IQ | See IQ_specification.txt for complete descriptions of the checks. | | | |
| 33 | IQ | | | | |
| 34 | IQ | STATUS | CHECK NUMBER | LEVEL | DESCRIPTION |
| 35 | IQ | PASS | 2.1 | 2 | File passes IBISCHK |
| 36 | IQ | PASS | 2.2 | 2 | Latest [IBIS ver] used |
| 37 | IQ | PASS | 2.3 | 2 | Do not use [Comment Char] |
| 38 | IQ | PASS | 2.4 | 2 | [File Name] is correct |
| 39 | IQ | PASS | 2.5 | 2 | [File Rev] is correct |
| 40 | IQ | PASS | 2.6 | 2 | [Date] is correct |
| 41 | IQ | PASS | 2.7 | 2 | [Source] is complete |
| 42 | IQ | PASS | 2.8 | 2 | [Notes] is complete |
| 43 | IQ | PASS | 2.9 | OPTIONAL | [Disclaimer] and [Copyright] |
| 44 | IQ | | | | |

Summary / Comp IQ_SAMPLE / Model SAMPLE_OUT / Model SAMPLE_IN / Mc

Ready

OLD Quality Classification Scheme

- Numbers indicate level:
 - 0: Passes IBISCHK and some basic automated checks
 - 1: Passes numerous “manual” checks for presence, completeness and correctness of data
 - 2: Correlation with simulated or measured data
 - a. Correlates with simulation
 - b. Correlates with measurements
 - 3: Both simulation and measurement correlation was done
 - So: $IQ2\ a+b = IQ3$, essentially.

Problems With OLD Scheme

- Provides no way to designate an unchecked model
 - (-1?)
- Meanings of various levels were hard to keep straight
- The two letter designations were hard to keep straight
 - Does “a” refer to simulation or measurement?
- Having $2ab = 3$ might be good algebra, but it’s not a good classification scheme.
- Passing IBISCHK does not occupy its own level
 - Taking this one step further: any “automated” check we can imagine should, in principle, be added to IBISCHK.
- No “room” to add new levels for timing, power, etc.

NEW Quality Classification Scheme

- Numbers indicate level
 - 0: unchecked, unverified file.
 - 1: passes IBISCHK with no errors or warnings (explained warnings are allowed).
 - 2: Suitable for basic waveform simulation.
 - 3: Suitable for timing analysis.
 - 4: Suitable for power integrity analysis.
- Appended letters indicate further qualifications
 - “S”: has been correlated with simulation results.
 - “M”: has been correlated with measured results.
 - “X”: an exception exists in the file (must be documented).
- Examples:
 - IQ1: passes IBISCHK
 - IQ2S: can be used for waveform simulation and has been correlated with simulation results.
 - IQ3MS: Can be used for timing analysis, and has been correlated with both simulation and measured results.

Advantages of NEW Scheme

- Each level has a specific meaning.
- There is a level that means “not checked.”
- Letter designations have meaning (therefore can be remembered more easily).
- Scheme is open ended: more “levels” can be added if necessary, and more letter designations can be added as required.
- Letter designations can be appended to ANY level as appropriate.

IBIS Quality Task Group Parser Bugs

- Non-Monotonic Warnings for Combined Tables in All Versions
 - Currently, only 4.0 and higher levels get checked for nonmonotonicity of the combined tables.
 - This check is useful whatever the file version is.
 - Proposes that this check be extended to all versions, and that nonmonotonic single tables be flagged as “Info” rather than “Warning”.
- Parser Permits Vmeas not Between Vinh and Vinl
 - Often indicates a problem with the model.
 - Parser does not flag this in any way.
 - Example of a new check that can be automated.
 - Should only be a “Caution,” “Warning” is too strong, since there are cases where this legitimately will occur.

Level 2 Checks (Note: this list is still under discussion)

(Suitability for waveform analysis)

- All pins must be defined and validated for correct logical/physical/model mapping.
- [Model selector]s must be validated.
- [Diff Pins] must be present if required.
- C_comp values must be checked.
- Component [Package] parasitic values reasonable
- V-T tables must be defined for all output drivers.
- All I-V and V-T tables must be inspected.
- On-die termination must be properly modeled if present.
- Typ/Min/Max values must be present and in correct order for all tables and parameters.
- Ramp Data must be validated in accordance with IBIS spec.
- Ramp data must be validated against appropriate V-T tables if available.

Level 3 Checks (Note: this list is still under discussion)

(Suitability for Timing Analysis)

- Vinl/Vinh must be defined on receivers
- Standard Load/Vmeas must be defined on drivers.
- Must have at least signal pin RLC parasitics.
- All package parasitics must be checked.
- All model spec waveforms and standard load parameters must be defined and validated.
- All output models must be simulated into standard load and switch through Vmeas.

Level 4 Checks...

(Note: this list is still under discussion)

(Suitability for Power Integrity Analysis)

- [Pin Mapping] must be present and correct
- Power and Ground pin parasitics present
- Need BIRD95 to be fully capable

Meaning of “X”

- Used to declare that a file is suitable for a particular analysis even if a required check is not passed by strict standards.
 - Not intended as a “free pass” to distribute a substandard model.
- Reason for the X designation must be documented in the file itself.
 - Users should open the file and check the documentation for the reason for the “X”
- Example: IBISCHK gives a warning for scrambled typ/min/max order on component curves even when combined curves are OK.
- Example: For certain topologies, the pulldown table will not cross the 0-V, 0-current line for an output buffer, which is flagged as a warning, yet this is expected normal behavior for those topologies.
- Example: Parser problems, as in Bug93 ([Model Selector] receiver thresholds for differential receivers result in errors and warnings)
- Should be used only for warnings that are not possible to resolve, and errors that result from known parser bugs.

Where to get more information...

[About](#)[Specification](#)[Checklist](#)[Parser Bugs](#)[Work Archive](#)[Meeting](#)[Minutes](#)

IBIS Quality Task Group

The IBIS Quality Task Group exists to create documents and tools to promote the creation of quality IBIS files.

The chair of the Task Group is Mike LaBonte (milabont@cisco.com).

Task Group Products

To see individual working documents produce by the Task Group see the [Work Archive](#). Collections of "release" products are listed below.

IBIS Quality Products

- The IBIS Quality Specification, which describes the details of checks that should be performed on IBIS files before they are used.
- The IBIS Quality Checklist, which helps to organize the process of checking an IBIS file, and produces a checking summary that can be pasted into each IBIS file.
- IBIS Golden Parser bug reports to request enhancements to the ibischk program.

Email discussion

To join the email discussion list, visit: <http://www.freelists.org/list/ibis-quality>. There you can signup to receive list email, and visit the archive of messages.

Meetings

An IBIS Quality Task Group teleconference is held bi-weekly on Tuesdays from 11:00am to 12:00pm Eastern Time. Meeting notices including call-in information are sent to the discussion list. [Meeting minutes](#) are archived here and on the discussion list.