

# **Ibischk4 Version 4.2.1 and Funny IBIS Models**

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# Version 4.2.1 Release

- IBISCHK4 version 4.2.1 complete
  - Source code delivered
  - Executables uploaded
    - 1 for dos32 (for Windows)
    - 4 for Unix (Sun\_5, Solaris\_6, Solaris\_8, HP\_11i)
    - 2 for linux (Redhat, SUSE)
    - Details in changes\_421.txt
- Major changes from 7 BUG reports
  - Monotonic checks – consistency for all versions
  - Caution flag – Quality Committee addition
  - [Receiver Thresholds] – correct a defect
  - Other – Model\_type Warning to Error, etc.

# Monotonic – Summations and Notes

- Warnings for non-monotonic summations only
  - E.g., [Pullup] and both clamp tables together for driving
  - For non-driving, both clamps together
  - Also for Submodel Clamps for the modes of interest
  - Model\_type and submodel mode logic considered
- Notes for all individual tables
  - Still allows locating the specific problem for analysis
  - Notes are less serious than Warnings
- Check same for IBIS Version 2.0 through 4.2
  - Version 3.2 and below used to give Warnings for each table



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# Example

- [IBIS Ver] 3.2 code for combined non-monotonicity:

```
IBISCHK4 V4.2.0
```

```
Checking bug94.ibs for IBIS 3.2 Compatibility...
```

```
WARNING (line    29) - Pulldown Typical data is non-monotonic
WARNING (line    29) - Pulldown Minimum data is non-monotonic
WARNING (line    29) - Pulldown Maximum data is non-monotonic
```

```
Errors   : 0
Warnings : 3
```

```
IBISCHK4 V4.2.1
```

```
Checking bug94.ibs for IBIS 3.2 Compatibility...
```

```
NOTE - Pulldown for Model: BUFFER Typical data is non-monotonic
NOTE - Pulldown for Model: BUFFER Minimum data is non-monotonic
NOTE - Pulldown for Model: BUFFER Maximum data is non-monotonic
Errors   : 0
```



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# However ... Version 4.2.2

- **BUG96**
  - Line numbers not reported in NOTEs
    - Post processing change versus first pass
    - Restore older Warning code and change to Notes
- **BUG97**
  - Larger file issue (Notes + Warnings) less than older Warnings
  - Need to understand



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# The -caution Flag

- Ibischk4 -caution syntax for .ibs, .pkg, and .ebd

```
Usage: ibischk4  -caution      <IBS filename>  
       : ibischk4  -caution -ebd <EBD filename>  
       : ibischk4  -caution -pkg <PKG filename>
```

- For all versions 2.0 through 4.2
- Placeholder for future tests
  - Caution because real exceptions exist such as with some PCIX models for Vmeas

```
IBISCHK4 V4.2.1  
  
Checking bug90.ibs for IBIS 4.2 Compatibility...  
  
CAUTION - Vmeas is >= Vinh for model DATA  
Errors   : 0  
Cautions: 1  
  
File Passed
```

# [Receiver Thresholds] Logic Fixed

- Several serious defects
  - Combined test for DDRII with [Diff Pin], [Model Selector] and single-end or differential subparameters under [Receiver Thresholds] incorrect
    - Practical situation with DDRII and selectable on die terminations
  - Differential subparameters not allowed when needed
    - Impossible to put in complete information
    - Models with missing information passed
    - [Model Selector] indirection not handled
- Warning messages used instead of Error messages
  - Allows existing flawed models to still be loaded
  - Expect Warning messages with ibisck4 Version 4.2.1 and above
- Both single-ended and differential subparameters allowed
  - Some DDRII
  - USB models



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# BUG93 Test – Fixed in Version 4.2.1

## with 0 Errors and 0 Warnings

IBISCHK4 V4.2.0

Checking bug93.ibs for IBIS 4.2 Compatibility...

ERROR - Model DQS\_FULL Receiver Thresholds: Vth must be specified for single ended receivers  
ERROR - Model DQS\_FULL Receiver Thresholds: Vinh\_ac must be specified for single ended receivers  
ERROR - Model DQS\_FULL Receiver Thresholds: Vinl\_ac must be specified for single ended receivers  
ERROR - Model DQS\_FULL Receiver Thresholds: Vinh\_dc must be specified for single ended receivers  
ERROR - Model DQS\_FULL Receiver Thresholds: Vinl\_dc must be specified for single ended receivers  
ERROR - Model DQS\_FULL Receiver Thresholds: Tslew\_ac must be specified for single ended receivers  
WARNING - Model DQS\_FULL Receiver Thresholds: Vcross\_low must not be specified for single ended receivers  
WARNING - Model DQS\_FULL Receiver Thresholds: Vcross\_high must not be specified for single ended receivers  
WARNING - Model DQS\_FULL Receiver Thresholds: Vdiff\_ac must not be specified for single ended receivers  
WARNING - Model DQS\_FULL Receiver Thresholds: Vdiff\_dc must not be specified for single ended receivers  
WARNING - Model DQS\_FULL Receiver Thresholds: Tdiffslew\_ac must not be specified for single ended receivers  
ERROR - Model DQS\_HALF Receiver Thresholds: Vth must be specified for single ended receivers  
ERROR - Model DQS\_HALF Receiver Thresholds: Vinh\_ac must be specified for single ended receivers  
ERROR - Model DQS\_HALF Receiver Thresholds: Vinl\_ac must be specified for single ended receivers  
ERROR - Model DQS\_HALF Receiver Thresholds: Vinh\_dc must be specified for single ended receivers  
ERROR - Model DQS\_HALF Receiver Thresholds: Vinl\_dc must be specified for single ended receivers  
ERROR - Model DQS\_HALF Receiver Thresholds: Tslew\_ac must be specified for single ended receivers  
WARNING - Model DQS\_HALF Receiver Thresholds: Vcross\_low must not be specified for single ended receivers  
WARNING - Model DQS\_HALF Receiver Thresholds: Vcross\_high must not be specified for single ended receivers  
WARNING - Model DQS\_HALF Receiver Thresholds: Vdiff\_ac must not be specified for single ended receivers  
WARNING - Model DQS\_HALF Receiver Thresholds: Vdiff\_dc must not be specified for single ended receivers  
WARNING - Model DQS\_HALF Receiver Thresholds: Tdiffslew\_ac must not be specified for single ended receivers

Errors : 12

Warnings: 10

File Failed



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# However ... Version 4.2.2

## New False Warning Problem

- BUG95: Incorrect Warnings not in earlier versions

```
IBISCHK4 V4.2.1
```

```
Checking bug95.ibs for IBIS 3.2 Compatibility...
```

```
WARNING - Pin A2 is not defined as a Diff Pin though the  
associated Model Selector INOUT was determined to be  
Differential
```

```
WARNING - Pin B3 is not defined as a Diff Pin though the  
associated Model Selector INOUT was determined to be  
Differential
```

```
WARNING - Pin Z3 is not defined as a Diff Pin though the  
associated Model IN was determined to be Differential
```

```
WARNING - Pin Z4 is not defined as a Diff Pin though the  
associated Model IN was determined to be Differential
```

```
Errors : 0
```

```
Warnings: 4
```

```
File Passed
```



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# [Receiver Thresholds] De-rating Tables?

- Designed for single-ended and differential specifications
- Targeted for DDRII and above
- Needs de-rating tables for real adoption
  - Otherwise, vendor-specific syntax needed
  - Or code based de-rating (VHDL-AMS, etc.)
- A future BIRD?

# Other Fixes

- Other minor fixes including a parser crash
- BUG91 for Model\_type Open\_\* with non-zero content in the extra [Pullup] or [Pulldown] table
  - E.g., Open\_drain with non-zero [Pullup]
  - Elevated from Warning to Error
    - Based on real issue since model is ambiguous and the waveform check may be misleading
  - Cannot rely on EDA tool defaults

# Proposed ibischk4 Version 4.2.2

- BUG95 – Fix incorrect single-ended, differential Warnings
- BUG96 – Add line numbers to Notes
- BUG97 – Resolve differences in summation of Notes plus Warnings versus original Warnings



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# Investigate Parser Friendly Fixes

- Parser code suggestions for EDA tool integration
  - Unique file names (e.g., ibisxx\_string.h versus string.h)
  - Printf for command line mode needs to be globally edited for parser integration
  - Filter Errors, Warnings for complete file for specific model of interest
  - Other issues with names, globals, undefined code, etc.
- If accepted, then targeted beyond Version 4.2.2

# Funny Models

- 0.ibs
  - As many 0's as possible (or 1f)
  - Ibischk4 does not check everything
  - Uncommon developer and customer issues
  - Pathological cases shows what can be missed
- inverse.ibs

# 0.ibs

```

• [IBIS Ver]      4.0
• [File Name]    0.ibs
• [File Rev]     0
• [Date]         0
• [Source]       0
• [Disclaimer]   0
• [Notes]        0
• [Copyright]    0
• |
• [Component]    0
• [Manufacturer] 0
• [Package]
• R_pkg          0          0          0
• L_pkg          0          0          0
• C_pkg          0          0          0
• |
• [Pin] signal_name model_name R_pin L_pin C_pin
• 0      0          0          0      0      0
• 00     0          0          0      0      0

• [Diff Pin] inv_pin vdiff tdelay_typ tdelay_min tdelay_max
• 0          00      0      0          0          0
• |
• [Model]      0
• Model_type    I/O
• Vinh = 0
• Vinl = 0
• Vmeas = 0
• Rref = 0
• Vref = 0
• |
• C_comp          0      0      0
• C_comp_pullup   0      0      0
• C_comp_pulldown 0      0      0
• C_comp_gnd_clamp 0      0      0
• C_comp_power_clamp 0      0      0
• |
• [Temperature Range] 0      0      0
• [Voltage Range]      0      0      0
• [Pullup Reference]   0      0      0
• [Pulldown Reference] 0      0      0
• [Gnd Clamp Reference] 0      0      0
• [Power Clamp Reference] 0      0      0
• [External Reference] 0      0      0
• |
• [TTgnd] 0 0 0
• [TTpower] 0 0 0
• |
• [Pulldown]
• 0 0 0 0
• 1f 0 0 0
• |
• [Pullup]
• 0 0 0 0
• 1f 0 0 0
• |
• [Gnd Clamp]
• 0 0 0 0
• 1f 0 0 0
• |
• [Power Clamp]
• 0 0 0 0
• 1f 0 0 0
• |

```



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# 0.ibs Problems

- Problems
  - I-V tables 0.0 and voltage references 0.0
  - Waveform tables from 0.0 to If, passes waveform check
  - Redundant V-T tables not checked
  - All subparameters and text information set to 0
- 0.ibs – 0 Errors, 0 Warnings 0 Cautions
- But still produces waveform in some tools and errors in others!
- Not worth fixing

```
• [Ramp]
• dV/dt_r      1f/1f      1f/1f      1f/1f
• dV/dt_f      1f/1f      1f/1f      1f/1f
• R_load=0
• |
• [Rising Waveform]
• R_fixture=0
• V_fixture=0
• C_fixture=0
• L_dut=0
• R_dut=0
• C_dut=0
• 0 0 0 0
• 1f 0 0 0
• |
• [Rising Waveform]
• R_fixture=0
• V_fixture=0
• C_fixture=0
• L_dut=0
• R_dut=0
• C_dut=0
• 0 0 0 0
• 1f 0 0 0
• |
• [Falling Waveform]
• R_fixture=0
• V_fixture=0
• C_fixture=0
• L_dut=0
• R_dut=0
• C_dut=0
• 0 0 0 0
• 1f 0 0 0
• |
• [End]
```

<snip>

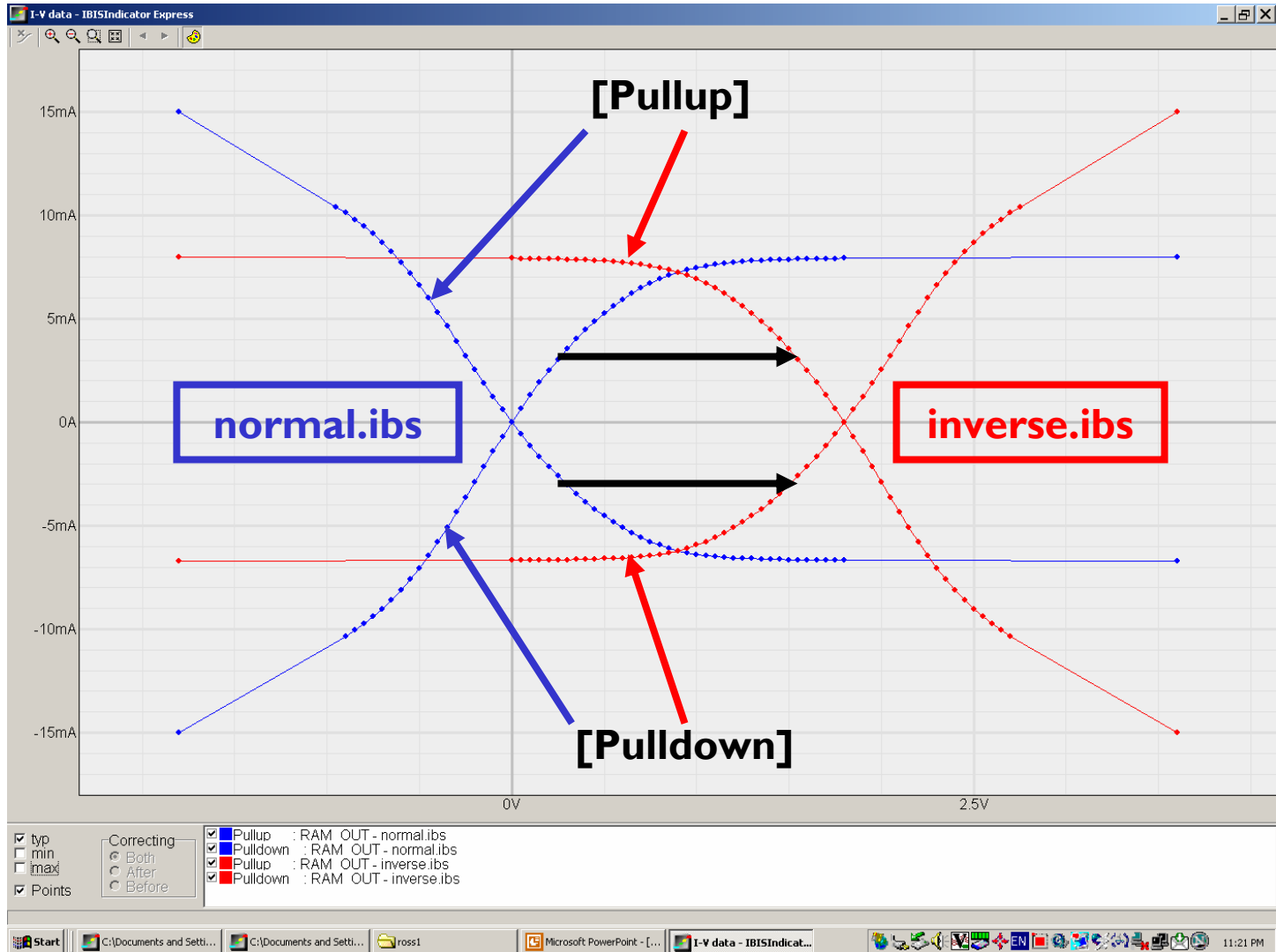


# inverse.ibs

- Inspired by real IBIS file creation issue
  - Pulldown in [Pullup] table and visa-versa
    - $V_{table2} = V_{dd} - V_{table1}$
  - Gnd Clamp in [Power Clamp] table and visa-versa
    - $V_{table2} = V_{dd} - V_{table1}$
  - Rising Waveform in [Falling Waveform] table and visa-versa
    - Change Rising to Falling and Falling to Rising
  - Polarity Inverting
    - Moves “low” state to High, and “high” state to Low
- Passes IBISCHK4 Version 4.2.1
  - Cannot fix timing test load Warning
- Simulations identical
  - Brute force way to avoid the Polarity subparameter!
- Strange, but technically correct model

# normal.ibs and inverse.ibs

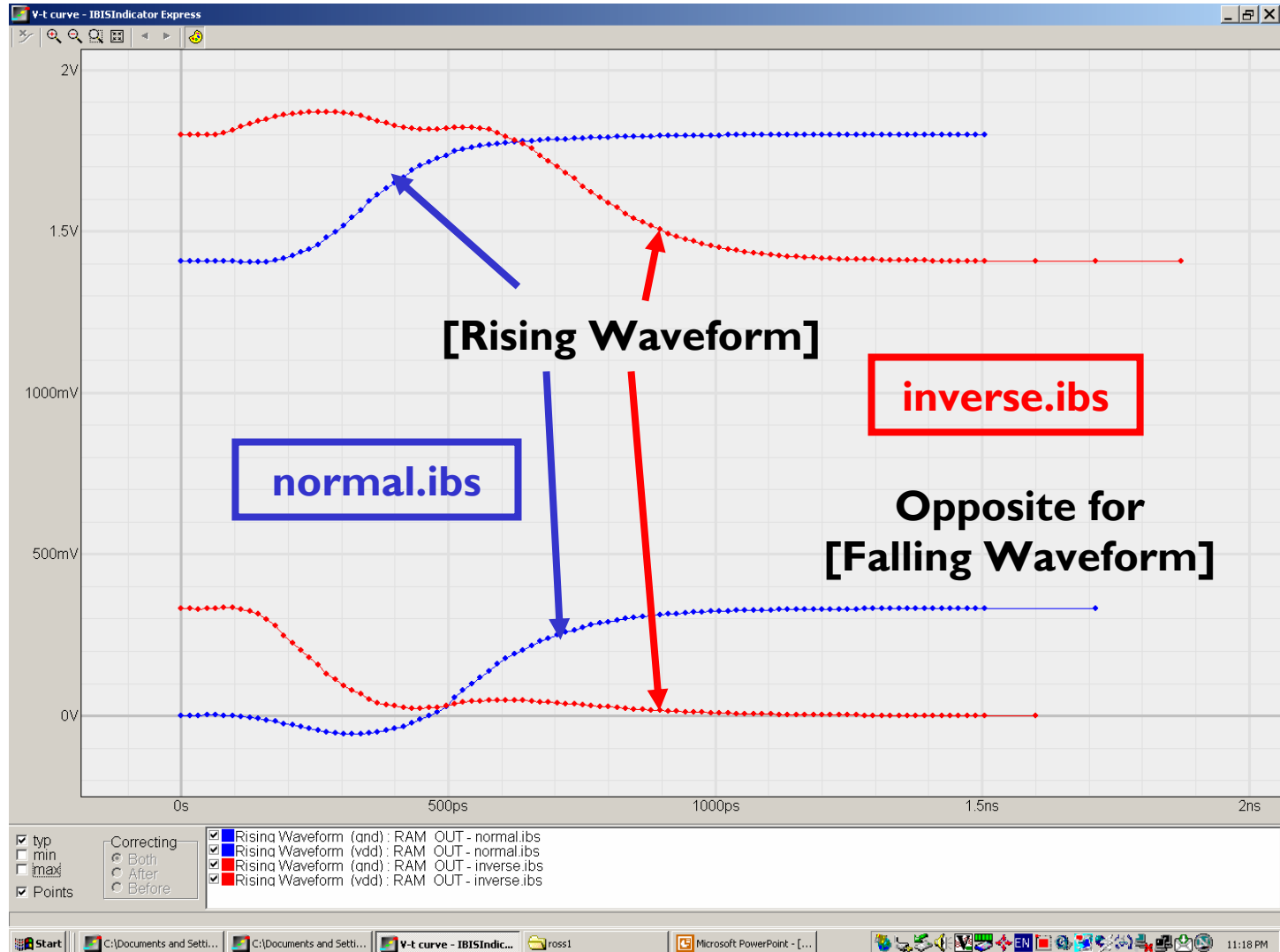
## [Pulldown] and [Pullup] Tables



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# normal.ibs and inverse.ibs

## [Rising/Falling Waveform] Tables



# Conclusions

- Ibischk4 Version 4.2.1
- Fixes for expected Version 4.2.2
- Pathological cases show that
  - Ibischk4 does not check everything
  - EDA tools may trap some funny cases
  - Some might turn out to be tricks
  - Uncommon, not worth fixing