



February 2011
PDK Layout Verification

© Agilent Technologies, Inc. 2000-2011

5301 Stevens Creek Blvd., Santa Clara, CA 95052 USA

No part of this documentation may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Agilent Technologies, Inc. as governed by United States and international copyright laws.

Acknowledgments

Mentor Graphics is a trademark of Mentor Graphics Corporation in the U.S. and other countries. Mentor products and processes are registered trademarks of Mentor Graphics Corporation. * Calibre is a trademark of Mentor Graphics Corporation in the US and other countries. "Microsoft®, Windows®, MS Windows®, Windows NT®, Windows 2000® and Windows Internet Explorer® are U.S. registered trademarks of Microsoft Corporation. Pentium® is a U.S. registered trademark of Intel Corporation. PostScript® and Acrobat® are trademarks of Adobe Systems Incorporated. UNIX® is a registered trademark of the Open Group. Oracle and Java and registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners. SystemC® is a registered trademark of Open SystemC Initiative, Inc. in the United States and other countries and is used with permission. MATLAB® is a U.S. registered trademark of The Math Works, Inc.. HiSIM2 source code, and all copyrights, trade secrets or other intellectual property rights in and to the source code in its entirety, is owned by Hiroshima University and STARC. FLEXlm is a trademark of Globetrotter Software, Incorporated. Layout Boolean Engine by Klaas Holwerda, v1.7 <http://www.xs4all.nl/~kholwerd/bool.html> . FreeType Project, Copyright (c) 1996-1999 by David Turner, Robert Wilhelm, and Werner Lemberg. QuestAgent search engine (c) 2000-2002, JObjects. Motif is a trademark of the Open Software Foundation. Netscape is a trademark of Netscape Communications Corporation. Netscape Portable Runtime (NSPR), Copyright (c) 1998-2003 The Mozilla Organization. A copy of the Mozilla Public License is at <http://www.mozilla.org/MPL/> . FFTW, The Fastest Fourier Transform in the West, Copyright (c) 1997-1999 Massachusetts Institute of Technology. All rights reserved.

The following third-party libraries are used by the NlogN Momentum solver:

"This program includes Metis 4.0, Copyright © 1998, Regents of the University of Minnesota", <http://www.cs.umn.edu/~metis> , METIS was written by George Karypis (karypis@cs.umn.edu).

Intel@ Math Kernel Library, <http://www.intel.com/software/products/mkl>

SuperLU_MT version 2.0 - Copyright © 2003, The Regents of the University of California, through Lawrence Berkeley National Laboratory (subject to receipt of any required approvals from U.S. Dept. of Energy). All rights reserved. SuperLU Disclaimer: THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

7-zip - 7-Zip Copyright: Copyright (C) 1999-2009 Igor Pavlov. Licenses for files are: 7z.dll: GNU LGPL + unRAR restriction, All other files: GNU LGPL. 7-zip License: This library is free software; you can redistribute it and/or modify it under the terms of the GNU Lesser General Public License as published by the Free Software Foundation; either version 2.1 of the License, or (at your option) any later version. This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU Lesser General Public License for more details. You should have received a copy of the GNU Lesser General Public License along with this library; if not, write to the Free Software Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA. unRAR copyright: The decompression engine for RAR archives was developed using source code of unRAR program. All copyrights to original unRAR code are owned by Alexander Roshal. unRAR License: The unRAR sources cannot be used to re-create the RAR compression algorithm, which is proprietary. Distribution of modified unRAR sources in

separate form or as a part of other software is permitted, provided that it is clearly stated in the documentation and source comments that the code may not be used to develop a RAR (WinRAR) compatible archiver. 7-zip Availability: <http://www.7-zip.org/>

AMD Version 2.2 - AMD Notice: The AMD code was modified. Used by permission. AMD copyright: AMD Version 2.2, Copyright © 2007 by Timothy A. Davis, Patrick R. Amestoy, and Iain S. Duff. All Rights Reserved. AMD License: Your use or distribution of AMD or any modified version of AMD implies that you agree to this License. This library is free software; you can redistribute it and/or modify it under the terms of the GNU Lesser General Public License as published by the Free Software Foundation; either version 2.1 of the License, or (at your option) any later version. This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU Lesser General Public License for more details. You should have received a copy of the GNU Lesser General Public License along with this library; if not, write to the Free Software Foundation, Inc., 51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA Permission is hereby granted to use or copy this program under the terms of the GNU LGPL, provided that the Copyright, this License, and the Availability of the original version is retained on all copies. User documentation of any code that uses this code or any modified version of this code must cite the Copyright, this License, the Availability note, and "Used by permission." Permission to modify the code and to distribute modified code is granted, provided the Copyright, this License, and the Availability note are retained, and a notice that the code was modified is included. AMD Availability: <http://www.cise.ufl.edu/research/sparse/amd>

UMFPACK 5.0.2 - UMFPACK Notice: The UMFPACK code was modified. Used by permission. UMFPACK Copyright: UMFPACK Copyright © 1995-2006 by Timothy A. Davis. All Rights Reserved. UMFPACK License: Your use or distribution of UMFPACK or any modified version of UMFPACK implies that you agree to this License. This library is free software; you can redistribute it and/or modify it under the terms of the GNU Lesser General Public License as published by the Free Software Foundation; either version 2.1 of the License, or (at your option) any later version. This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU Lesser General Public License for more details. You should have received a copy of the GNU Lesser General Public License along with this library; if not, write to the Free Software Foundation, Inc., 51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA Permission is hereby granted to use or copy this program under the terms of the GNU LGPL, provided that the Copyright, this License, and the Availability of the original version is retained on all copies. User documentation of any code that uses this code or any modified version of this code must cite the Copyright, this License, the Availability note, and "Used by permission." Permission to modify the code and to distribute modified code is granted, provided the Copyright, this License, and the Availability note are retained, and a notice that the code was modified is included. UMFPACK Availability: <http://www.cise.ufl.edu/research/sparse/umfpack> UMFPACK (including versions 2.2.1 and earlier, in FORTRAN) is available at <http://www.cise.ufl.edu/research/sparse> . MA38 is available in the Harwell Subroutine Library. This version of UMFPACK includes a modified form of COLAMD Version 2.0, originally released on Jan. 31, 2000, also available at <http://www.cise.ufl.edu/research/sparse> . COLAMD V2.0 is also incorporated as a built-in function in MATLAB version 6.1, by The MathWorks, Inc. <http://www.mathworks.com> . COLAMD V1.0 appears as a column-preordering in SuperLU (SuperLU is available at <http://www.netlib.org>). UMFPACK v4.0 is a built-in routine in MATLAB 6.5. UMFPACK v4.3 is a built-in routine in MATLAB 7.1.

Qt Version 4.6.3 - Qt Notice: The Qt code was modified. Used by permission. Qt copyright: Qt Version 4.6.3, Copyright (c) 2010 by Nokia Corporation. All Rights Reserved. Qt License: Your use or distribution of Qt or any modified version of Qt implies that you agree to this License. This library is free software; you can redistribute it and/or modify it under the terms of the GNU Lesser General Public License as published by the Free Software Foundation; either version 2.1 of the License, or (at your option) any later version. This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU Lesser General Public License for more details. You should have received a copy of the GNU Lesser General Public License along with this library; if not, write to the Free Software Foundation, Inc., 51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA Permission is hereby granted to use or copy this program under the terms of the GNU LGPL, provided that the Copyright, this License, and the Availability of the original version is retained on all copies. User

documentation of any code that uses this code or any modified version of this code must cite the Copyright, this License, the Availability note, and "Used by permission."

Permission to modify the code and to distribute modified code is granted, provided the Copyright, this License, and the Availability note are retained, and a notice that the code was modified is included. Qt Availability: <http://www.qtsoftware.com/downloads> Patches Applied to Qt can be found in the installation at:

\$HPEESOF_DIR/prod/licenses/thirdparty/qt/patches. You may also contact Brian Buchanan at Agilent Inc. at brian_buchanan@agilent.com for more information.

The HiSIM_HV source code, and all copyrights, trade secrets or other intellectual property rights in and to the source code, is owned by Hiroshima University and/or STARC.

Errata The ADS product may contain references to "HP" or "HPEESOF" such as in file names and directory names. The business entity formerly known as "HP EEsof" is now part of Agilent Technologies and is known as "Agilent EEsof". To avoid broken functionality and to maintain backward compatibility for our customers, we did not change all the names and labels that contain "HP" or "HPEESOF" references.

Warranty The material contained in this document is provided "as is", and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Agilent disclaims all warranties, either express or implied, with regard to this documentation and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Agilent shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Agilent and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

Technology Licenses The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license. Portions of this product include the SystemC software licensed under Open Source terms, which are available for download at <http://systemc.org/>. This software is redistributed by Agilent. The Contributors of the SystemC software provide this software "as is" and offer no warranty of any kind, express or implied, including without limitation warranties or conditions or title and non-infringement, and implied warranties or conditions merchantability and fitness for a particular purpose. Contributors shall not be liable for any damages of any kind including without limitation direct, indirect, special, incidental and consequential damages, such as lost profits. Any provisions that differ from this disclaimer are offered by Agilent only.

Restricted Rights Legend U.S. Government Restricted Rights. Software and technical data rights granted to the federal government include only those rights customarily provided to end user customers. Agilent provides this customary commercial license in Software and technical data pursuant to FAR 12.211 (Technical Data) and 12.212 (Computer Software) and, for the Department of Defense, DFARS 252.227-7015 (Technical Data - Commercial Items) and DFARS 227.7202-3 (Rights in Commercial Computer Software or Computer Software Documentation).

PDK Layout Verification Tool	5
Troubleshooting PDK Layout Verification Results	8

PDK Layout Verification Tool

The PDK Layout Verification Tool is an application that verifies PDK Layout components in the PDKs upgraded to ADS 2011 compatible format. This tool considers the ADS 2009U1 as the standard and compares the layout details of the component in ADS 2009U1 and ADS 2011.

The tool compares the following layout details:

- All shapes in all layers
 - Corresponding layer names
 - Corresponding layer purposes (assumes the layer purpose as drawing for the shapes drawn in ADS 2009U1)
 - Corresponding GDS II numbers
 - Coordinates of different shapes (radius and center in case of circle and arc)
- All pins
 - Corresponding pin location
 - Corresponding pin layers
 - Corresponding pin directions

The purpose of this tool is to allow users to easily verify their migrated PDKs and investigate for differences or errors (if any).

Pre-Requisites for Windows Operating System

Before start comparing the two PDKs you need to check for the Pre-requisites for Windows Operating System. Following are the pre-requisites:

- Locally install ADS2009U1 and ADS2011_01.
- Install PDK Layout Verification AddOn or Plugin (version 350.501) for 2009U1.
- Install WinMerge at the following location *C:\ProgramFiles\WinMerge*. This is the default location of the Winmerge installation.

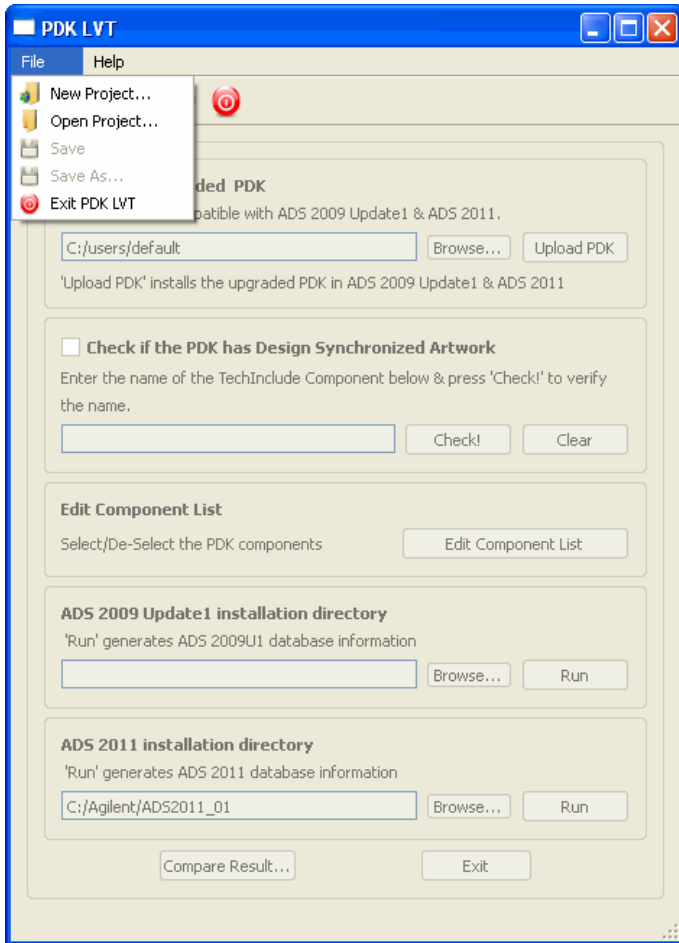
Note
Winmerge is a freeware easily available for download.

- The kit must contain both ATF and AEL files.

Verifying ADS2009U1 and ADS2011_01 PDKs

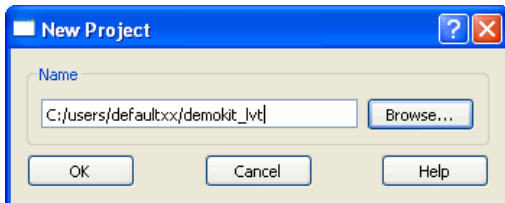
Following are the steps to open the PDK Layout Verification Tool and compare ADS2009U1 and ADS2011_01 PDKs:

1. Click **Start > All Programs > Advanced Design System 2011.01 > ADS Tools->PDK Layout Verification Tool** to open the PDK Layout Verification Tool.
2. Click **File > New Project...** from the PDK Layout Verification Tool.

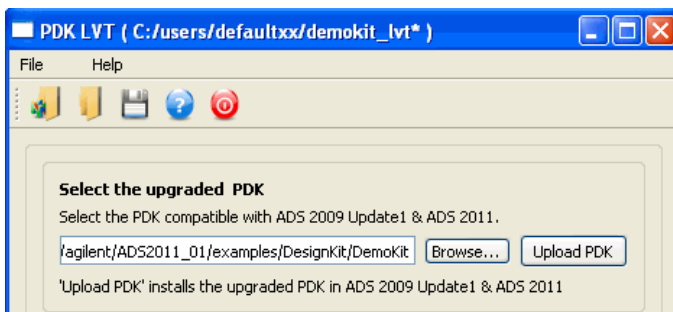


2.

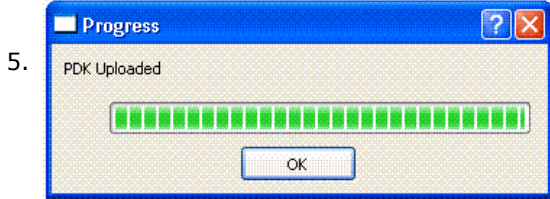
3. Type Project Name and click **OK**.



4. Click **Browse...** to select the PDK. The selected PDK should be compatible with both ADS 2009U1 and ADS 2011_01.

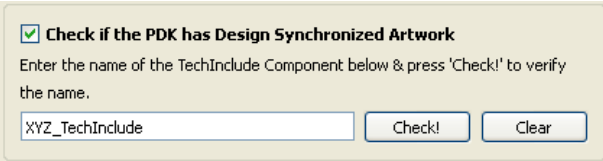


5. Click **Upload PDK** to upload the Selected PDK. Uploading the PDK would automatically install the PDK and set the technology of the upraged PDK in both ADS 2009U1 and ADS2011_01. A confirmation message appears once the PDK is successfully uploaded.



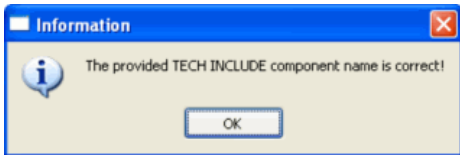
Note
Ignore Step 6 to Step 8 if the uploaded PDK does not include a Design Synchronized Artwork.

6. Select **Check If the PDK has Design Synchronised Artwork.**
7. Type the TechInclude component name.

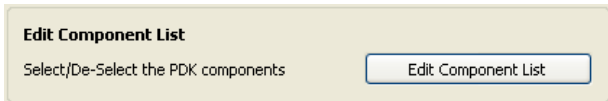


Note
The TechInclude component name must be same as provided in the create_item of the TechInclude component.

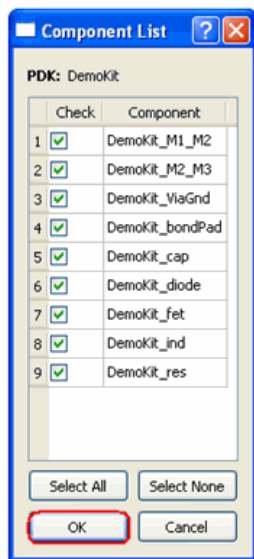
8. Click **Check!** to verify the name of the TechInclude component.
If the name is correct and the component is present in the kit then a confirmation message is displayed.



9. Click **Edit Component List** to Select or De-select the PDK components.



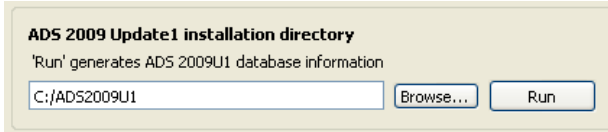
10. Select the component from the component list as shown below.



Layout verification tool executes only for the selected componets. By default all the components are selected. Click **Select All** or **Select None** to select or de-select all the components in a single click.

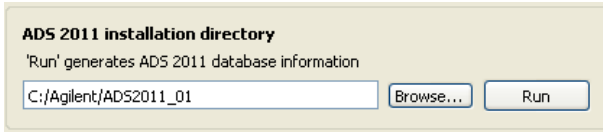
11. Click **OK** to finalize the component you need to verify.
12. Click **Run** to generate the ADS2009U1 database information.

12.



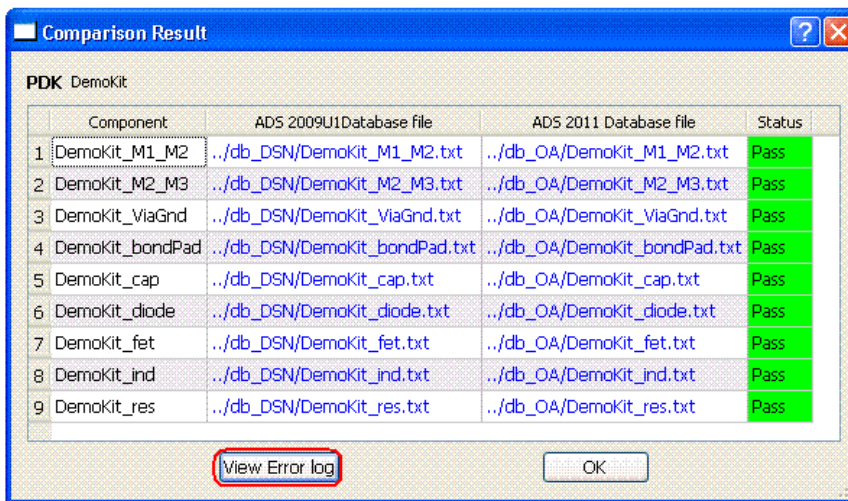
All the generated information is saved in a .txt format. A confirmation dialog box appears once the required database is generated and automatically exits ADS2009U1.

13. Click **Run** to generate the ADS2011_01 database information.



All the generated information is saved in a .txt format. A confirmation dialog box appears once the required database is generated and automatically exits ADS2011_01.

14. Click **Compare Result** to view the details of the layout comparison for the two ADS versions. Following window shows the details and the result.



15. Click **View Error log** to view the errors encountered during the verification process.

Troubleshooting PDK Layout Verification Results

Question: What kind of results are expected in the final results window?

Solution: Three kind of results are expected. Following are the results:

- **Pass:** Specifies that the component has no mismatches in the layout. You can safely assume that the component layout is exactly the same in both ADS 2009U1 and ADS 2011.
- **Mismatch:** Specifies that there are one or more than one mismatches in the component layout in ADS 2009U1 and ADS2011.

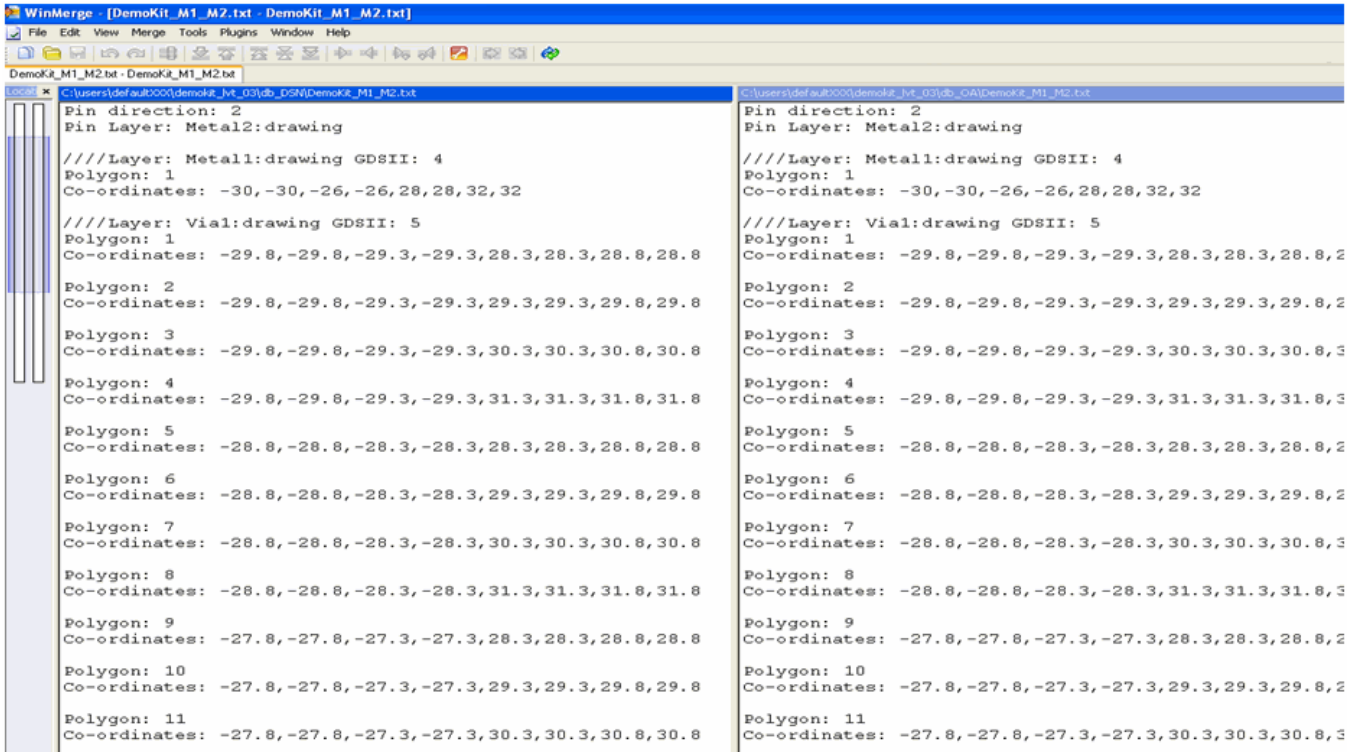
Note
Mismatch does not necessarily mean that there is an error in ADS 2011. It might be an issue with ADS 2009U1 or with the PDK. So, we need to investigate the reason of mismatch before arriving to a conclusion.

- **N.A:** Specifies that the component could not be either placed in ADS 2009U1 or ADS 2011. Further investigation is required to reach to a conclusion.

Question: How do I get into the details of the comparison?

Solution: Click on the *Status* column of the component in the Comparison Result window.

For example, if the result is **Pass** then click on **Pass** to open the *Winmerge* window:

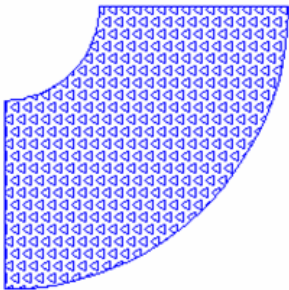


Question: Can I ignore any kind of a mismatch?

Solution: PDK LVT rounds off the coordinate value to second decimal place. So you might sometimes see the rounding off mismatched in the second decimal place. You can safely ignore such mismatches.

At times ADS 2009U1 returns fewer number of coordinates (than actually present) for a polygon. Ignore such mismatches

For example, Polygon shown in the below snapshot should have atleast 8 coordinates (4 points).



But in ADS 2009U1 the number of coordinates returned are 4 (2 points) See the figure below:

```

////Layer: ME1:drawing GDSII: 15
Polygon: 1
Co-ordinates: -30,-30,20,40
    
```

```

////Layer: ME1:drawing GDSII: 15
Polygon: 1
Co-ordinates: -30,-30,-20,0,20,40,50,50
    
```

```

////Layer: VIA2:drawing GDSII: 16
Polygon: 1
Co-ordinates: -30,-30,21,39
    
```

```

////Layer: VIA2:drawing GDSII: 16
Polygon: 1
Co-ordinates: -30,-30,-19,-1,21,39,50,50
    
```