

Jazz Semiconductor

Tape Out User Guide

Revision 7

TowerJazz Confidential
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Revision Number	Revision Description	Date
01	Initial release.	8/24/04
02	Added Jazz Data Acceptance Criteria. Document NPB PS-0572 is now obsolete. Added tape out waiver request form requirement. Added FSRF details and usage guidelines. Updated tape out tracking states names. Added table of contents. Added revision description table.	10/01/04
03	Documented new Save As feature Improved wording on required verification log files Improved "Special Instructions" documentation by adding more details to Reticle Floor plan and Mock tape out sections. Updated snap shots for file upload pages to include tape out waiver request form	6/07/05
04	Numbered all sections. Added Section for Submitting a Partial Tape-in. Added Dummy Fill Section. Added Viewing Your Post Layer Generation Data Section. Updated snap shots. Reordered paragraphs within sections. Updated methods of tape-in. Provided Jazz definition for data extents. Reworded and changed point of view to make entire document consistent.	11/02/07
05	Updated section 5.1 Part Type Updated section 5.2 Tape out Revision Instructions	1/15/08
06	Added ITAR and Trusted Foundry documentation to section 5.1	9/26/08
07	Modifed ITAR statement.	1/19/09

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Jazz Semiconductor Tape Out User Guide

1. Tape Out System Overview

Jazz Semiconductor offers an automated and secure online system to facilitate tape out submission. The tape out system is available on the Jazz Semiconductor eBizz website. Not all eBizz users are granted tape out access by default. To request eBizz website or tape out access, please email new-ebizz-account@jazzsemi.com or file an eBizz help ticket.

2. Accessing the Jazz Semiconductor Tape Out System

- Set your browser to <https://online.jazzsemi.com>
- Enter your username and password.
- After log in, click on the "Tape Out System" menu option.

2.1 About eBizz Security:

The Jazz eBizz website is Verisign® certified. It uses a Secured Socket Layer (SSL) 3.0 encrypted connection (https) to provide at least 128-bit encryption.

3. Tape Out System Functions

The Tape Out System Menu consists of the following items:

- Create Tape Out
- View Existing Tape Outs
- Tape Out Distribution List
- Foundry Services Request Form (FSRF)
- Tape Out User Guide
- Tape Out Waiver Request Form



Tape Out System

The Jazz tape out system provides a portal to enter, edit and view tape out and ordering information. The tool tracks the progress of all tape outs and provides cycle time and status reports. In addition, the tool allows users to add comments at any stage of a tape out.

Create Tape Out: Submit GDSII data and supporting files to Jazz.

View Existing Tape Outs: List, access and revise submitted documents and GDSII files.

Tape Out Distribution List: Create or modify an email distribution list. Customers may add eBizz users to this list and the Jazz Tape Out System will email status changes or comments to its members.

Foundry Service Request Form: The Jazz Foundry Service Request Form (FSRF) is required to accompany all tape outs to Jazz.

Tape Out User Guide: Use File Exchange to access the Jazz Tape Out User Guide. This document includes a Tape Out System instructional guide and the Jazz data acceptance criteria.

Tape Out Waiver Request Form: Use File Exchange to access the Tape Out Waiver Request Form. This form must accompany tape out submissions that contain verification violations.

3.1 Create Tape Out

Select this option to start a new tape out. This unique interface will allow the submission of all types of tape outs including single chip, multi chip, or multi project wafer (MPW) runs. For more information on MPW runs, please refer to www.jazzsemi.com. A step by step tape out example is presented in the end of this document. The system also provides a “Save As” feature that allows you to create a new tape out based on the general information entered in another tape out. For additional details on the “Save As” feature please refer to the “Tracking and Editing Tape Outs” section. There are limitations in the Ebizz system that prevent you from viewing an existing tape out while you are creating a new one. See details later in this document.

3.2 View Existing Tape Outs

Select this option to review saved and submitted tape outs. By default, the Tape Out System will only display active tape outs on this page. You may use the top right hand side drop down menu to select other view filters such as “All Tape Outs”, tape outs currently under Jazz data “Review”, etc. A snapshot of the “Tape Out State” menu is pictured on the right. A description of each of these states is presented in the following section.

Tape Out State: Active Tape Outs

- Active Tape Outs
- All Tape Outs
- Draft
- Submit
- Review
- Review Complete
- Sent to Mask Shop (Past 7 Days)
- Sent to Mask Shop
- Returned
- Hold

3.3 Tape Out Distribution List

The Jazz Tape Out System allows you to define a list of fellow eBizz users within your company that will be notified when a tape out is submitted and as it progresses through the tape out process. To access the Tape Out Distribution List interface, click on the link available in the tape out menu. To add a user to the distribution, click on the “Email Address” drop down menu, select the user you would like to add to the list and click on the “Add” button. Please follow this procedure for each user you wish to add. Once you are finished, click on the “Save Changes” button. This list will be saved for all future tape outs. To remove an address, click on the email address from the gray member list box, and click on the “Remove User” button. Finally, click on the “Save Changes” button.

Email Address

▼ Add

Distribution List

Anderson, Jane
Johnson, Bill
Smith, Bob

Remove User

bob.smith@abc.com

Save Changes

3.4 Foundry Services Request Form (FSRF)

The FSRF information can be found under the Help Ticket Section. A completed FSRF form is required for all tape outs and may be submitted through the eBizz website. FSRF's are the primary means of customer communication to Jazz.

FSRF's are used for the following tasks:

- Request lot start by providing Jazz information on customer part number, quantity needed, purchase order, process information, substrate type, date needed by, and special instructions.
- Request lot splits, experimental splits, lot holds, part number changes, lot releases from hold, PCM/wafer sort requirements and post fab processing such as backgrind/dicing.
- Provide ship to information or changes to ship to information.
- Request manufacturing expedites.
- Request any other changes to a lot.
- Specify processing details for MPW submissions.

3.5 Tape Out User Guide

This menu item links to this document.

3.6 Tape Out Waiver Request Form

Select this option to access the tape out waiver request form. A completed tapeout waiver request form is required for tapeouts with verification violations. This form must include waiver justifications for all verification violations in the tapeout. This file must be uploaded with the rest of the tapeout submission through the Data Files interface in the next step.

4. Tracking and Editing your Tape Outs

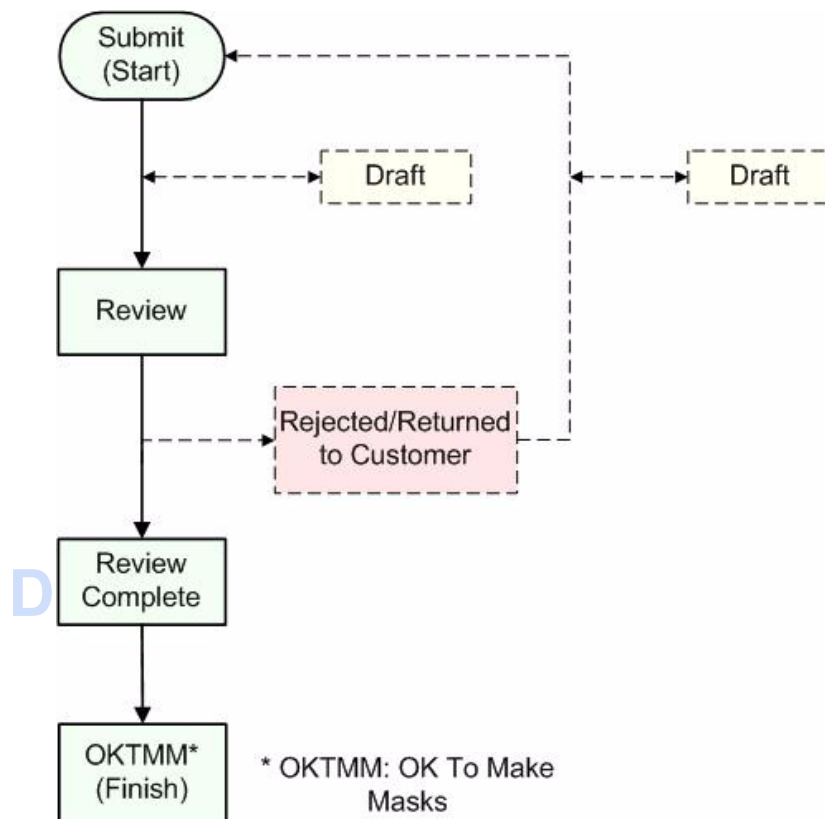
4.1 Tracking your Tape Out Status

All tape outs will go through a process defined by the tape out system:

- **Submit:** Customer has submitted the tape out to Jazz
- **Draft:** Customer has entered a tape out into the system and saved it as a draft, but has not submitted the tape out. **JAZZ WILL NOT PROCESS TAPE OUTS IN THE "DRAFT" STATE.**
- **Review:** The Jazz Tape Out Team has started the data review process.
- **Rejected/Returned:** Rejected: The Jazz tape out team has found non conformities in the tape out data with respect to the Jazz data acceptance criteria; the tape out has been returned to the customer. It is the customer's responsibility fix these errors and resubmit the tape out. Returned: the customer has requested Jazz to return the tape out in order to make changes.
- **Review Complete:** Jazz has accepted your data. Jazz MaskCAD is processing your data.
- **Hold:** The customer or Jazz has placed the tape out on Hold. Jazz will halt any activities until the Hold is removed.
- **OKTMM: (OK To Make Masks)** The Jazz MaskCAD team has begun shipment of mask data to the photomask manufacturer. The status of your tape out has been upgraded to OKTMM. The tapeout is completed, you are no longer able to make changes or place the tapeout on HOLD.

The tape out system will send email notification to the submitter and the members of the tape out distribution list as state transitions occur.

Tape outs may be edited when they are either in “Draft” or “Rejected/Returned” state. However, you may not edit a tape out while Jazz is processing the tape out data. If you need to edit and resubmit the tape out, please place the tape out on HOLD and request Jazz to return the tape out to you. To place the tape out on HOLD, click on the “Tape Out Functions” drop down menu and select the “Place Tape Out on Hold” option. Detailed instructions on how to edit your tape out or place it on hold are provided in the following sections. The following diagram illustrates the tape out system flow. A customer may place an active tapeout on hold at any stage prior to OKTMM.



4.2 Editing your Tape Outs and Resubmitting Rejected Data

The tape out system allows you to edit tape outs when they are either in “Draft” or “Returned/Rejected” state. Please note that you may not edit a tape out while Jazz is processing the tape out data. By clicking on the “Edit tape out” function, you will be directed to a view that resembles the Create Tape Out web page, but contains your tape out information in edit mode.

If you wish to resubmit the tape out without any modifications after it has been rejected, click on the “Re-Submit Tape Out to Jazz” option.



You cannot open another tapeout for view or edit once you have started editing a tapeout. Instead, view the other tapeout in another browser window or tab prior to editing a tapeout.

Revising your data files: To revise your GDS data files, select “Edit tape out” and proceed to the

Tape Out [General Info](#) - [Layer Selection](#) - [Verification](#) - [Special Instructions](#) - [Data Files](#) - [GDS Properties](#) - [Review](#) - [Complete](#)

Jazz Semiconductor Tape Out Request

Next >>

Data Files

File Type	Database #	File Name	Size	Rev	Upload Date
TARBALL	1	tapein_ca25qw3.tgz	420800	1	06/02/2004 10:28

Revise Files

“Data Files” segment. This page will display the previously uploaded file listed, including file type, name, size, revision, and date. To edit a file, click on the “Revise Files” button provided in the lower right hand section of the page. Once the file is uploaded, please complete the tape out sequence and submit. Your tape out page will reflect the new file revision, including file names, date, etc.

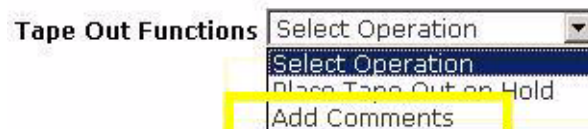
4.3 Placing a Tape Out on Hold

Placing the tape out on hold will tell Jazz to stop processing the tape out and wait for further instructions. You can place a tape out on hold at any point prior to the OKTMM state. To place the tape out on hold, select the option from the Tape Out Functions drop down menu as pictured below. In addition, you may remove a hold at any time by clicking on the “Release Tape Out From Hold” option.



4.4 Adding Comments and Communicating with Jazz

The tape out system is configured to email your Jazz account manager and tape out representative when any changes are made to your submission. Unlike standard email, adding comments through the tape out system guarantees all interested parties are notified. This includes all members of your custom “Distribution List”, Jazz tape out and MaskCAD teams. In addition, it will keep all communications in a central location within the tape out web page that may be accessed at any time, without the need of email or VPN access. You may add comments to a tape out by clicking on the Tape Out Functions drop down menu and selecting the “Add Comments” option.

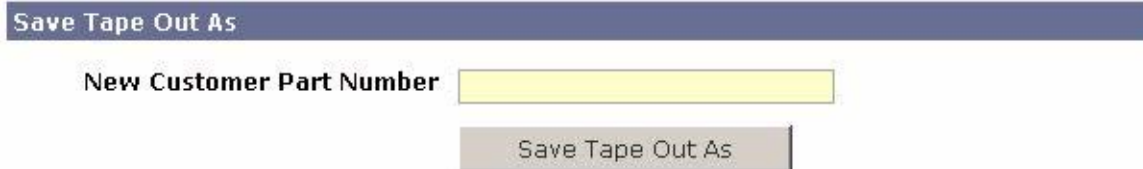


4.5 Using the Save As or “Clone” Function

In many cases, new tape outs are revisions or replicas of older tape outs that already exist in the system. To save time and unnecessary data reentry, the Tape Out System provides a Save As function. The Save As function will copy the General Information, Layer Selection, Verification, and Special Instructions tape out information and will save it to a new, editable tape out entry. To use this option, navigate to the tape out you wish to clone and select the Save As option from the Tape Out Functions drop down menu as shown below.



This action will open the Save As page. Under the “New Customer Part Number” enter the name for the new tape out and click on the “Save Tape Out As” button. The tape out will be saved as a Draft and will be accessible under the “View Tape Outs” page. You may then edit the draft tape out at any time.

A screenshot of a web application form titled 'Save Tape Out As'. The title is in a dark blue bar. Below the title, there is a label 'New Customer Part Number' followed by a yellow rectangular input field. Below the input field is a grey button with the text 'Save Tape Out As'.

[Expand All](#) | [Collapse All](#)

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5. Tape Out Submission Example

The following section illustrates the submission of a sample tape out. For this particular example, we will submit an SBC35QTX tape out consisting of a single GDS database.

Tape Out **General Info** - Layer Selection - Verification - Special Instructions - Data Files - GDS Properties - Review - Complete

To start a new tape out, log into eBizz and select the “Create Tape Out” option under the tape out system menu. The system will guide you through a sequence of serial steps that will lead to tape out submission. The information entered into each step of the system will dynamically build the rest of the tape out form as the submission process takes place. The procedure is made up of eight steps. The header of each page shows the eight step process and highlights the current step in the process. The snapshot below illustrates this header and displays a tape out currently in the “General Info” step.

5.1 General Info - Step 1

The first page of the tape out system entry contains several general information fields including part numbers, contact information, and general chip details. In the following section, we describe each field, including the information that should be entered.

Tape Out General Information

Customer Part Number: Enter the part number your company has assigned to this product. In this example, the sample company “Super Integrated Circuits” has entered part number SIC-123456.
Jazz Internal Part Number (A#####): Enter your assigned Jazz part number. If you do not know this number, please contact your Jazz account or sales manager. Jazz part numbers are made up of 5 characters beginning with the letter **A** and followed by **4 digits** (i.e. A1234). MPW customers can find the Jazz part number in our [MPW schedule](#). For this example the Jazz Part number has been set to A0987.

Customer Contacts: Fill in the relevant contacts from your company.

Circuit Details

Circuit Type: The type of circuit you wish to submit.

- **Single Chip:** Select this option if you wish to submit a single GDS file for a single dedicated production or engineering run.
- **Multi Chip Circuit:** Select this option if you wish to submit multiple gds files which will be arranged on the reticle. You must have two or more GDS files to select this option.
- **MPW:** Select this option if you wish to submit one or more GDS files to participate in a Jazz scheduled multi project wafer (MPW) run.
- **Part Type:** Select whether you wish to submit a new part or a revision to a part already manufactured at Jazz. Please note that a “new part” is defined from the Jazz point of view. If you are changing a subset of layers (i.e. there is at least one unchanged layer from a previous tape in), then you are submitting a revision. Conversely, if you are changing all layers and are considering your part to be a revision of a previous design fabricated at Jazz, since all layers are changing, this is a new mask set and must be identified by a new Jazz part number.
- **ITAR Statement:** You will be required to answer the following ITAR questions. Please note that you must answer both questions.

- I hereby declare that this tape in design is **not** intended for use in or related to any item that is or is intended to be designed, developed, configured, adapted or modified for a military application or use in any such item, or any radiation hardened or space application.
- I hereby declare that this tape in design **is** intended for use in or related to any item that is or is intended to be designed, developed, configured, adapted or modified for a military application or use in any such item, or any radiation hardened or space application.
- Trusted Foundry: If "Yes", then E-biz cannot be used for tape-out. Please contact the Jazz Design Support Manager.

Tape Out **General Info** - Layer Selection - Verification - Special Instructions - Data Files - GDS Properties - Review - Complete

Jazz Semiconductor Tape IN Request

Next >>

Tape In General Information

Customer Part Number*

Jazz Internal Part Number (A####)*

Customer Contacts

Primary Contact Person*

E-Mail Address*

Phone Number*

Pager or Cell Number

Secondary Contact Person

E-Mail Address

Phone Number

Pager or Cell Number

Circuit Details

Circuit Type* ☐ Single Chip ☐ Multi Chip Circuit ☐ MPW

Part Type* ☐ New Part ☐ Revision

ITAR Applicable* ☐ Yes ☒ No

Trusted Foundry* ☐ Yes ☒ No

* Required Field

Once you complete all required fields, click on the "**Next >>**" button located in the top right hand side of each tape out entry page to proceed to the next step. For this example we have chosen to submit a single chip, new part tape out.

The following snapshot illustrates the General Info page, including all the entered information from the example above.

5.2 Layer Selection - Step 2

The second page of the tape out sequence is dedicated to process and layer selection. To choose a process variant, select it from the "Process Variant Mask Layer Specification" drop down menu.

Number of GDS Databases for this Variant

▼

You will also be required to select the specific mask layers you are ordering or modifying through this tape out.

For new tape outs: Select all layers by clicking on the “Check All” button (default).

For tape out revisions: Select the layers you wish to revise by clicking on the “Include” box on the left hand side of each mask layer entry. Then enter the mask layer revision number. The system is set up to accept both alpha and numeric entries.

In the example below, the user selected the SBC35QTX variant, including all layers.

Tape Out [General Info](#) - [Layer Selection](#) - Verification - Special Instructions - Data Files - GDS Properties - Review - Complete

Jazz Semiconductor Tape IN Request

Next >>

Process Variant

Process Variant Mask Layer Specification

Please select only the masks you are ordering for this tapeout

SBC35QTX

☒ Check All

☐ Uncheck All

SBC35QTX: SBC35QTX process variant has four layers of metal, the metal 4 layer being ~3um thick for high Q inductors. The Via3 height is also taller (~2um) to further facilitate high Q inductors. The MIM capacitor density is 1fF/ym²

This process supports the polyimide overcoat option. If you wish to use polyimide, please select the option below. When polyimide is selected, the silox layer (9) will be replaced with the polyimide layer (99).

Enable polyimide option ☐

Include	Layer	Description	Number
<input checked="" type="checkbox"/>	BL	N+ Buried Layer	4
<input checked="" type="checkbox"/>	A	Active	2
<input checked="" type="checkbox"/>	DT	Deep Trench	41
<input checked="" type="checkbox"/>	CS	Collector Sink	10
<input checked="" type="checkbox"/>	F	Field	3
<input checked="" type="checkbox"/>	W	Well	1
<input checked="" type="checkbox"/>	RB	Resistor Block	26
<input checked="" type="checkbox"/>	FP	First Poly	5
<input checked="" type="checkbox"/>	NI	N+ Implant	6
<input checked="" type="checkbox"/>	PK	PLDD	59
<input checked="" type="checkbox"/>	SB	Salicide Block	40
<input checked="" type="checkbox"/>	LC	Local Collector	12
<input checked="" type="checkbox"/>	SC	Spacer Clear	21
<input checked="" type="checkbox"/>	HS	High Speed NPN Implant	34
<input checked="" type="checkbox"/>	EW	Emitter window	33
<input checked="" type="checkbox"/>	EP	Emitter Poly	29

In the case of multi chip or MPW tape outs with multiple GDS databases, this page will provide a field to enter the number of databases to be included during the file upload.

To select the number of databases, click on the “Number of GDS Databases for this Variant” drop down menu and select the desired number. In the snapshot below, the user has selected one database. Therefore one GDS file will be expected during file upload

This section will also allow the user to select whether the part should be processed using polyimide passivation. Polyimide is not included in the standard process. Please refer to the electrical specification document for additional details on polyimide. If polyimide is selected, the tape out process name will be updated to include a letter “Z” at the end (i.e. SBC35QTXZ)

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5.3 Verification - Step 3

The third stage of the tape out sequence contains a short physical verification questionnaire plus details regarding your design kit and tape out data formats.

Circuit Verification Information

Verification Software: Select from the two supported tools: Mentor Calibre® or Cadence Assura®. You must perform verification using one of these two tools for data to be accepted by Jazz.

Extraction Software: Select what extraction routine was performed on your circuit from one of the four possible options.



Tape Out [General Info](#) - [Layer Selection](#) - **Verification** - [Special Instructions](#) - [Data Files](#) - [GDS Properties](#) - [Review](#) - [Complete](#)

Jazz Semiconductor Tape IN Request

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Circuit Verification Information

Verification Software	<input checked="" type="radio"/> Calibre	<input type="radio"/> Assura
Extraction Software	<input type="radio"/> Xcalibre	<input checked="" type="radio"/> Calibre XRC
	<input type="radio"/> Assura RCX	<input type="radio"/> None
Did you run LVS (Layout v. Schematic)?	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Did you run Corner Simulations?	<input checked="" type="radio"/> Yes	<input type="radio"/> No

Verification Tests (Logfile Required)

Did You Execute:	DRC	Antenna	ESD/LUP	Soft ERC	Stress	Density
Yes - with NO violations detected	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Yes - with violations waived by customer	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
No - did not execute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Jazz Design Kit Version

The current Jazz SBC35QTX design kit version is **sbc35x_20061220**.

Did you run the circuit verification routines above using this design kit or decks? ☐ Yes ☒ No

If the not, please enter the Jazz design kit version

sbc35x_20051220

Tape In Data Format

Tape In File Format ☐ Specify Individual Files ☒ Compressed Tarfile (.tar.gz)

Note: You will be required to include all log or summary files for each verification run with the final GDS data

Did you run LVS: Select whether you have run these tests.

Did you run Corner Simulations: Select whether you have run these tests.

Verification Tests (Log files Required)

Per the Jazz data acceptance criteria, all tape outs to Jazz must include a verification log file for DRC, Antenna, ESD/LUP, Soft ERC, Stress and Density tests. You must run these tests for Jazz to accept your data for review. Calibre users must upload *.sum verification summary files from the run (default design kit naming convention). Assura users must upload *.log verification summary files from the run (default design kit naming convention).

Data File Naming Requirements:

- * File names are case sensitive. All of your files must follow the same upper and lower case spelling that you use for your top cell layout.
- * For each design you submit, you must provide a GDS file and a separate log file for each of the
 - DRC runs (antenna, density, DRC, LUP/ESD, ERC/SoftERC, and stress).
- * All file extensions (*.gds, *.log, etc.) must be lower case.
- * GDS files must use file extension *.gds. The GDS files must not be compressed, tar'ed, or zipped.
- * Verification log files must end with either *.log (for Assura) or *.sum (for Calibre) filename suffixes. The Verification log file must include the top cell name and the DRC run type (antenna, density, DRC, LUP/ESD, ERC/SoftERC, or stress).
- * All files must have unique names, even if you place them into a separate subdirectories.

Jazz

places all files into a single directory before validating the content of your submission. Any duplicated file names will be overwritten and lost.

You must note whether these tests have reported any rule “violations” or additional non-conformities. If your design does not pass all verification routines, these errors may be formally waived. This is done by accepting the terms listed in the waiver pop up box and uploading the corresponding log files. In addition, you must complete a tape out waiver request form and include justification for all verification error waivers. Please refer to the data acceptance criteria requirements at the end of this document for additional details.

Jazz Design Kit Version

The tape out system will display the latest design kit version available for the chosen process variant. For the example below, the kit version is sbc35x_20051220. In addition, you must select whether you have run circuit verification routines using the latest design kit or the decks included in this design kit. If you have not used this kit, please enter the version used. Our data acceptance criteria imposes the requirement that the kit you use must not be more than 8 months old, unless there is no newer design kit release. If you are not sure what design kit version you have installed, launch Cadence and type *jazzKitVersion* in the Command Interpreter Window (CIW), then press Enter. Your design kit version will be displayed in the CIW as shown below.

Tape out Data Format

The eBizz Tape Out System allows for data to be transferred using two options:

Option 1: Specify Individual Files (Optional Method) - **Not Recommended**

Select this option if you wish to upload the required files individually. If you select this option, the tool will provide individual upload fields where you can browse for each of the required files. Keep in mind that in addition to the gds, we require 6 log files (7 total) per database. A 5 database tape out will require 7 x 5 or 35 files to be individually selected and uploaded. Also you will not be given the opportunity to include additional files, such as a proposed reticle floor plan.

Option 2: Compressed Tarfile (.tar.gz) - **Recommended Method**

Select this option to upload your entire tape out file set as a single compressed tar file. This includes the gds, the log files, the waiver and any other additional documentation. This method is preferred since it will limit the amount of files and time required for the secure transfer. If you choose this option please keep in mind the following rules:

- Your file must be created in tar.gz format.
- The GDS files included in the.tar.gz file MUST follow the *.**gds** convention. i.e. sbc35tapeout.gds. *Other file conventions such as sbc35tapeout.strm or sbc35tapeout.dat will NOT be accepted*
- GDS file inside the tarball must not be individually compressed.
- Your GDS files may not be placed inside tar files inside the tar.gz file compilation. In other words, do not place tar or compressed files inside the tar file you submit toJazz.

Tape Out: [General Info](#) - [Layer Selection](#) - [Verification](#) - [Special Instructions](#) - Data Files - GDS Properties - Review - Complete

Jazz Semiconductor Tape Out Request

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Seal Ring

Note: Jazz will place a die seal ring around the outside of the drawn circuit data. Please refer to the tapeout guidelines for Jazz seal ring details.

Layer Generation

Do you want Jazz to place post-layer-generation gds data in your Ebizz directory? ☐ Yes ☒ No

Additional Special Instructions

We will be taping out our SIC-123456 tomorrow. Please be on the look out.

To create a tar.gz file, first copy all required files to a directory, then tar and gzip that directory. Here is an example showing a directory “jazz_tape_out”. The Unix command “tars” the directory, then gzips the tar file:

```
tar -cf - jazz_tape_out | gzip > jazz_tape_out.tar.gz
```

This command will create a *jazz_tape_out.tar.gz* file including the entire contents of the *jazz_tape_out* directory. Note that you will need to be in the same hierarchy level as your *jazz_tape_out* directory to execute this command.

Tape Out [General Info](#) - [Layer Selection](#) - [Verification](#) - **Special Instructions** - [Data Files](#) - [GDS Properties](#) - [Review](#) - [Complete](#)

Jazz Semiconductor Tape Out Request

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Tape Out Waiver Request

A completed [tape out waiver request form](#) is required for tape outs with verification violations. This form must include waiver justifications for all verification violations in the tape out. This file may be uploaded with the rest of the tape out submission through the Data Files interface in the next step.

Dummy Fill

Layer	Jazz to Perform Dummy Fill?
Active (2)	Yes (Required)
First Poly (5)	Yes (Required)
M1 (8)	<input checked="" type="radio"/> Yes <input type="radio"/> No
M2 (18)	<input checked="" type="radio"/> Yes <input type="radio"/> No
M3 (28)	<input checked="" type="radio"/> Yes <input type="radio"/> No
M4 (38)	<input checked="" type="radio"/> Yes <input type="radio"/> No
M5 (48)	<input checked="" type="radio"/> Yes <input type="radio"/> No
M6 (58)	<input checked="" type="radio"/> Yes <input type="radio"/> No

Note: Active and Poly Dummy Fill are required. Only Jazz may perform Dummy Fill on these layers.

Polyimide Overcoat

You have selected to use the polyimide overcoat option for this tape out. Please refer to the process design rules for polyimide verification details. If you do not wish to use this option, please navigate to the **Layer Selection** page and deselect the **Enable polyimide option** check box.

Seal Ring

Note: Jazz will place a die seal ring around the outside of the drawn circuit data. Please refer to the tape out guidelines for Jazz seal ring details.

Layer Generation

Do you want Jazz to place post-layer-generation gds data in your Ebizz directory?

☐ Yes ☒ No

Additional Special Instructions

Please use a 10um spacing (instead of the standard 17.5um spacing) from metal1 circuitry to Jazz dummy fill to meet the 30% metal1 density requirement.

Please refer to the “Data Files” section for additional file upload instructions.

5.4 Special Instructions - Step 4

The fourth stage in the tape out flow is dedicated to Special Instructions. Through this page, you may enter any requests that deviate from standard processing. The tape out system will dynamically construct the special instructions page based on entered information such as number of databases, dummy fill process requirements, etc. If you are doing a mock tape-out, for example, you should indicate 'Amock' or 'A0XXX' in the Jazz part # to indicate it is a mock tape-out, as well as putting a comment in the special instructions.

Tapeout Waiver Request

A completed tapeout waiver request form is required for tapeouts with verification violations. This form must include waiver justifications for all verification violations in the tapeout. This file must be uploaded along with the rest of the tapeout submission data through the Data Files interface in the next step.

Reticle Floor plan

If you have selected to tape out two or more databases, the tape out system will ask if you require Jazz to arrange your circuits following a predetermined floor plan. If you do, the tape out system will request that you upload a snapshot and a cell location summary file in the "Data Files" section. This information is necessary for Jazz to generate a compliant floor plan. If you do not have a pre-determined floor plan, you can request that Jazz create a floor plan

Jazz Semiconductor Tape Out Request

[Next >>](#)

Revising Files

Database #1

GDS File	<input type="text"/>	Browse...
DRC File	<input type="text"/>	Browse...
ANTENNA File	<input type="text"/>	Browse...
ESD/LUP File	<input type="text"/>	Browse...
Soft ERC File	<input type="text"/>	Browse...
STRESS File	<input type="text"/>	Browse...
Tape Out Waiver Form	<input type="text"/>	Browse...

for you. To have the floor plan created for you, specify the quantity of each of the different databases you need. For example, request an equal number of each database, or request two copies of database A for each copy of database B.

Dummy Fill

By default Jazz will perform dummy fill on select processes. Jazz prefers that customers do not perform fill, and allow our MaskCAD department to perform the optimized fill routines. In the event that you do NOT want Jazz to perform dummy fill, the tape out system will provide the option of asking Jazz NOT to perform Dummy Fill on your circuit. Please note that Active Dummy Fill is required. Only Jazz may perform Active and Poly (processes at and below 0.18um node) Dummy Fill. Please refer to the design rule document for additional details on

density and dummy fill requirements. The Dummy Fill requirement window is pictured below.

Jazz Semiconductor Tape Out Request

Next >>

Revising Files

Please include the following set of files in the tar file:

- GDS Stream file (use .gds extension)
- DRC summary file (use _drc.sum extension)
- Antenna summary file (use _ant.sum extension)
- ESD/Latch Up summary file (use _esd_lup.sum extension)
- Soft ERC summary file (use _softerc.sum extension)
- Stress summary file (use _stress.sum extension)
- Tape Out Waiver Request Form

Filename

Browse...

Please use tar - gzip format.

tured below. Please refer to section 7 for full details on the Jazz Dummy Fill methodology.

Seal Ring

Jazz will place a die seal ring around the outside of your drawn circuit data. Jazz strongly recommends you do not create your own seal ring. Please contact your Jazz applications engineer for additional details. Also see the Design Rule Document for specific details regarding the seal ring size and scribe lane.

Sub-Dicing Considerations

The tape out system provides an option which allows you to choose your Sub-dicing requirements. This information helps a great deal in MPW floor planning. Jazz will provide you with a 5x5mm tile for your MPW design (you can purchase multiple tiles) and offers sub-dicing of the tile for an incremental charge for each additional cut. You will receive approximately 50 tiles upon completion of the MPW. If the 5x5mm tile needs to be diced into two sub-tiles, then 100 tiles/die will be delivered.

Tape Out [General Info](#) - [Layer Selection](#) - [Verification](#) - [Special Instructions](#) - [Data Files](#) - [GDS Properties](#) - Review - Complete

Jazz Semiconductor Tape Out Request

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GDS Properties

DB Number	GDS File Name	Top Cell Name	Data Extents			
			Lower Left		Upper Right	
			X1	Y1	X2	Y2
1	RFIC.gds	RFIC	0	0	2400	2400

Layer Generation

Jazz by default does not upload Post Layer Generation GDS data to customers. Please indicate in your special instructions whether you want Jazz to place post-layer-generation GDS data in your eBizz directory. **Note that this option is not available for MPW tape outs.**

(Refer to section 8 “Viewing Your Post Layer Generation Data” for information regarding new layers introduced during the layer generation process)

Additional Special Instructions

Enter any additional deviations from standard processing. Illustrate your instructions in as much detail as you can. Jazz will contact you via a tape out system comment if we require more information.

5.5 Data Files - Step 5

The fifth stage of the tape out system provides an interface to upload the required tape out files set. The Data Files page format will depend on whether you selected to upload individual files or a compressed tarball in the Verification page (3).

Option 1: Specifying individual Files

Tape Out [General Info](#) - [Layer Selection](#) - [Verification](#) - [Special Instructions](#) - [Data Files](#) - [GDS Properties](#) - [Review](#) - [Complete](#)

Please review your tapeout information below. You may correct any inaccuracy by clicking on the appropriate stage of the tapeout navigation bar above. In addition, you may submit or save the tapeout through the Tapeout Functions drop down menu.

Jazz Semiconductor Tape Out Request

Tape Out Functions

Select Operation ▼

General Info

Customer Part Number	SIC-123456
Customer	Super-ic
Jazz Part Number	A0987

Select Operation
Save as Draft
Submit Tape Out to Jazz

[Expand All](#) | [Collapse All](#)

Customer Contacts

Primary Contact Person	Johny Smithe
E-Mail Address	Johny.Smithe@super-ic.com
Phone Number	(111) 432-1234
Pager or Cell Number	(111) 123-4567
Secondary Contact Person	
Phone Number	
E-Mail Address	
Pager or Cell Number	

Circuit Details

Circuit Type	SINGLE CHIP
Part Type	NEW PART

Variant SBC35QTX

- + Layers (SBC35QTX Layers)
- + Verification
- + Data Files
- + GDS Properties
- + Special Instructions

This view provides a set of file upload fields that can be used to browse for and select the desired files. The page will provide a set of fields proportional to the number of databases you have selected to tape out. In the example below, only a single database has been selected.

If you have selected more than one database, or requested a specific floor plan, this page will provide additional, clearly labeled upload fields. Please note that if the selected process variant requires poly or metal dummy fill, the system will ask for density summary files. Please refer to the design rule documents for additional information. Finally, if you have reported a verification violation the tape out system will ask for a tapeout waiver request form.

Option 2: Compressed Tarball (.tar.gz) - **Recommended**

This view provides a single file upload field. Please use it to upload a single tar.gz file that contains all the required information as illustrated in the end of the Verification section of this document. This page will also display the set of files that are expected inside this compressed tar file.

Please remember to include exactly the same number of GDS files you entered in the Number of Databases drop down in page 2.

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5.6 GDS Properties - Step 6

The GDS properties stage will display a listing of all the GDS files that were included during the upload process. You must enter the top cell (root structure) name and data extents for each file. In the example below, there is only one database RFIC.gds that contains the RFIC top cell with (0, 0) (2400, 2400) data extents.

***NOTE: Data extents are set by actual layers which become mask layers such as the nwell, active, poly, or metal layers. Please note that Jazz does not always view marking layers as layers that set the data extents. The one exception is for the BCD35 process where the marking layer, Chip Boundary (gds layer 39) is used to set the data extents. If you would like Jazz to set your data extents using a marking layer other than the aforementioned nwell, active, etc. layers, please add a comment in your special instructions to this effect. If you do not let us know that your

intended data extents are set by a particular marking layer (such as layer 63), then this can cause delays in verifying your data extents.

5.7 Review - Step 7

The review stage provides a single page view of all the information entered through the tape out process. If you wish to make a change, click on the stage you wish to edit in the Tape Out Navigation menu. Remember that due to the interactive nature of the tape out, you will be required to pass through each stage in order to return to the “Review” stage by clicking on the “Next >>” button.

Once you have verified the contents of the tape out submission, select from one of the two tape out function options

- **Save as Draft**
- **Submit tape out to Jazz**

The “Save as Draft” function will save all data and allow you to edit the tape out at a later date. The “Submit Tape Out to Jazz” function will forward the tape out entry to the Jazz tape out and MaskCAD teams for processing. Once a tape out is submitted, you **will not be able to edit it**. If you wish to make changes, please place the tape out on HOLD and request the Jazz team to return the tape out to you. A snapshot of the review page is pictured below.

5.8 Submitting a Mock Tape Out

If you wish to submit a “mock” or test tape out, follow the tape out sequence and select the “Save as Draft” option. In addition, you should clearly state that this is a mock tape out in the special instructions section. If you do not have a sample data set available, please use the [sample tape out file](#) available for download in the Jazz eBizz website. This file is tailored for a single chip tape out using the tar.gz file upload option. It also provides actual top cell and data extent information. You must have eBizz access in order to download this file. To request a review of your mock tape-out, please add a comment for Jazz to perform a review.

6. Procedure for Submitting a tape out with Front-end only Layers

Jazz will allow customers to submit a tape out with Front-End-Of-Line (FEOL) layers only, separate from the Back-End-Of-Line (BEOL) layer submission. Jazz places the following requirements on the subsequent tape out/s whether it is the BEOL layers, completing the mask set, or a Revision to an earlier tape out.

1. A different Customer Part Number must be used.
examples:
 - a) “RF_08_DES_BEOL” where the initial part number was “RF_08_DES”.
 - b) “RF_08_DES_002” for a second revision.
2. The same Jazz Part Number, A0XXX, must be used.

3. Both a different gds file name and a different top cell name must be used for a BEOL or Revision to an earlier tape out. If you submit a tape out with an identical gds file name to a previous gds file name submission, Jazz will reject the tape out due to the possibility of confusing the two databases with the same name. When the original gds file name was RF_08_DES.gds, suggested gds file names for BEOL or revised data are RF_08_DES_BEOL.gds and RF_08_DES_002.gds, respectively. Similarly, the top cell name can be changed to RF_08_DES_BEOL and / or RF_08_DES_002 from the original RF_08_DES name.
4. Submit a XOR result file comparing BEOL or revised data to the original data with tape out data.
examples:
a) "RF_08_DES_BEOL.sum" for a Calibre XOR result file.
b) "RF_08_DES_BEOL.log" for an Assura XOR result file.
5. All layers must be present in the gds file of subsequent tape outs. This requirement is critical since the generation of dummy fill and generated layers is dependent upon having all of the proper marking layers. In addition, all the layers in the gds file are needed for Jazz to perform the complete DRC and Density verification checks.
6. Check only the mask layers ordered in the eBizz tape out system. Depending upon the layers that are changed, you may be required to order additional mask layers beyond those changed. For example, you may have changed only the active layer, but will also need to order at least the reverse active and perhaps the poly masks (due to poly dummy fill). In addition, other generated mask layers (i.e. dn, dp, pk, nk, etc.) may need to be ordered depending upon the change.
7. All the verification test routines must be run using verification decks from the latest Jazz Design Kit even though a simple, single mask layer change is made. Please refer to the Jazz Data Acceptance Criteria section of this document.
8. The Waiver Justification Form must be filled out even though the errors are not related to the mask layers on order.

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7. Dummy Fill

7.1 Dummy Fill Treatment

Jazz will provide the following dummy fill treatment for each the following process nodes.

<u>Process Node(s)</u>	<u>Jazz Default Dummy Fill Treatment</u>
C05H, CP05, and BCD35	Add metal fill by default
SBC35 & BC35	Customer must meet 22% metal density requirement.
C25	Add Active and metal fill by default
0.18u	Add Active, Poly, and metal fill by default
0.13u	Add Active, Poly, and metal fill by default
BCD25	Add metal fill by default

For the process nodes where Jazz performs dummy fill by default, it is recommended that you do not perform their own dummy fill and allow Jazz to generate dummy fill using our optimized fill routines. In the event that you do not want Jazz to generate dummy fill, the tape out system provides the option of asking Jazz NOT to add Metal Dummy Fill. **Note that when active and / or poly dummy fill is required, only Jazz may perform the optimized fill routine to add active**

and poly dummy fill. There is not an option for Jazz NOT to generate active or poly dummy fill. Please refer to the design rule document for additional details regarding density and dummy fill requirements. The Dummy Fill requirement window from our tape out system is pictured below.

7.2 Troubleshooting Density Violations

If your design does not meet Jazz Density requirements, some helpful suggestions follow. Please keep in mind that the design rule document for your particular process contains rules for the dummy fill size and space requirements.

- Add metal slotted plates under DC bond pads and / or MIM caps.
- Remove or reduce the dummy fill block area, L_cell and analog block (ABLB) marking layer areas where possible.
- Jazz uses a standard 17.5 um spacing from circuitry to add dummy fill. You can request 10um spacing from a circuit feature to dummy fill for a particular metal layer that does not satisfy the density requirements. This smaller spacing normally results in an increase in density by approximately one to three percent, depending upon the particular design. When requesting 10um spacing for a particular metal layer, please note this request in both the Waiver Request Form and the Special Instructions section of the tape out system.

7.3 Adding dummy fill to a design using Calibre or Assura Tools

Steps to manually add dummy fill using the Calibre Interactive tool:

1. Select the Calibre / Run DRC pull down in a new layout cell containing your top cell where you want to add dummy fill. Please note that it is not desirable to add flat dummy fill data inside your top cell directly; therefore, you should preserve the top cell and add dummy fill to a new “dummy_fill_top_cell” containing your top cell. If desired, the new “dummy_fill_top_cell” layout can be later inserted inside of the standard “top cell” after the addition of dummy fill has been completed and the top cell instance reference is removed from the “dummy_fill_top_cell” layout.
2. In the Customization Settings pop-up, Select DRC Run Options: DENSITY
3. In the Calibre Interactive menu, select the Setup / DRC Options pull down.
4. Select the Output tab of the DRC Options form. Change the “Max errors generated per check” field from the default value of “1000” to the value of “All”. This step is needed to allow generation of all dummy fill geometries for each layer. If the default value of 1000 is used, the dummy fill will be incomplete.
5. Click the Run DRC button to start the DENSITY verification run and generation of optimum dummy fill.
6. Once the density run has completed, first ensure that your layout cell is in Edit not Read mode. In the Calibre - DRC RVE:cellname.drc.results window, select the Tools / Export to Layout pull down. A new pop up window, Export to Layout, will appear. To add dummy metal1 fill, as an example, please select the show_dummymet1 - ### Errors entry next to the Checks in Cell: field. In the Export to Layer: field type in “metal1 fill”. Please note that if you are using our SBC35 / BC35 process node, the entry will be met1 fill. The goal is to enter the proper layer name along with the purpose name, which for most process nodes will be the “fill” purpose. Using the “fill” purpose instead of the drawing purpose will avoid floating metal Soft ERC errors. Next, select Export all errors in selected cluster (cell + check), and click on Export. The dummy metal1 patterns will now appear in your layout window. Note that you may need to zoom in close to see these dummy fill patterns. Continue the process until all the metal density patterns have been generated and added for each of the metal layers in your particular process nodeSteps to manually add dummy fill using the Assura tool.

Steps to manually add dummy fill using Assura:

1. Select the Assura / Run DRC pull down in a new layout cell containing your top cell where you want to add dummy fill. Please note that it is not desirable to add flat dummy fill data inside your top cell directly; therefore, you should preserve the top cell and add dummy fill to a new “dummy_fill_top_cell” containing your top cell. If desired, the new “dummy_fill_top_cell” layout can be later inserted inside of the standard “top cell” after the addition of dummy fill has been completed and the top cell instance reference is removed from the “dummy_fill_top_cell” layout.
2. In the Run Assura DRC pop-up, Select Rule Set: DENSITY
3. Select OK to start the DENSITY verification run and generation of optimum dummy fill.
4. Once the density run has completed, first ensure that your layout cell is in Edit not Read mode. In your Cadence Library Manager window, please note that a new library has been created and is named “dummy_metal_fill”. The new “dummy_metal_fill” library will have your layout cell name, “dummy_fill_top_cell” inside of it with the added metal dummy fill. To add dummy metal1 fill into your new layout cell, for example, simply copy the metal1 from new library cell ensuring that you copy to the “metal1 fill” layer purpose pair from the metal1 drawing (dg) layer purpose pair. ***Please note that if you are using our SBC35 / BC35 process node, the entry will be met1 fill. The goal is to enter the proper layer name along with the purpose name, which for most process nodes will be the “fill” purpose. Using the “fill” purpose instead of the drawing purpose will avoid floating metal Soft ERC errors.

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8. Viewing Your Post Layer Generation Data

Jazz will upload Post Layer Generation (PLG) GDS data to the customers' eBizz file exchange site only upon request.

8.1 General Info – Post Layer Generation & GDS File Naming Convention

For frame data:

Top cell name: merge_frame_mdie

gds file name: a#####_merge_frame_mdie.gds - here a##### is your Jazz assigned part number.

For a single design:

Top cell name: customers top cell name

gds file name: a#####_#_O##.strm

- Here the “#” in “_#_” is a letter signifying the specific design, such as design “a” or “b”; if there are two designs submitted.
- The “#” in “_O##.gds” signifies the revision number, i.e. _001 if it is the first revision. Therefore, a single PLG design file will be named a0907_a_001.strm for a Jazz Part Number a0907, design a, and revision 001.

For 0.18 um technologies and below:

Jazz creates separate frame data files for the poly and metal1 layers each, after Optical Proximity Correction (OPC) algorithms are applied. This data is not easily viewable due to the nature of the model based OPC treatment.

8.2 Nature of Data in Post Layer Generation Files (Hierarchy Issues)

Please note that both the merged frame mdie and design PLG gds files represent mask data, not design data; hence, the cell hierarchy will be different from your design data. It is possible that during layer generation, a contact and / or via may be moved from one level of hierarchy to another. Therefore, a lower level cell may not LVS or DRC correctly. In addition, please note that when dummy fill is generated, the levels of hierarchy are altered; some portions of dummy fill may be placed at the top level while others may be placed down inside lower level cells.

8.3 PLG Layer Details

The layers present in the PLG file will be different from your design data. For example, depending upon your process variant, there will be newly generated layers added and also design layers moved to other newly defined layers. For the particulars of your process variant, please refer to the appropriate design rule document. In general, without going into a great amount of detail, for 0.25 um technologies and below dummy metal layers are written out to data type 1 for each respective metal layer. For 0.18 um technologies and below, the following layer manipulation is applied. Note that not all generated layers are shown below.

<u>Drawn Layer</u>	<u>Post Layer Generation Layer ID</u>	<u>Layer / Data Type</u>	<u>LSW Layer / Purpose</u>
active	original active	0 / 2	L0 / P2
N/A	active dummy fill	2 / 0	L2 / dg
poly	original poly	0 / 5	L0 / P5
N/A	poly dummy fill	5 / 1	L5 / P1
metal1	original metal1	0 / 8	L0 / P8
N/A	metal1 dummy fill	8 / 1	L8 / P1
metal2	metal2 + Serifs	18 / 0	L18 / dg
metal3	metal3 + Serifs	28 / 0	L28 / dg

Chamfers will be applied to the thick top metal layer and the PLG layer number and data type will remain the same as the drawn data. If the customer attempts to run DRC's on PLG data, these added serifs and chamfers will present design rule violations.

8.4 Post Layer Generation GDS File Viewing

GDS file viewer allow for quick review of PLG data and are recommended. If you do not have access GDS file viewer, you can stream-in the after layer generation gds file using a gds editor. Please note that the PLG data stream-in time can be long since the file size is large with flat data. The key to a successful stream-in will be to import the PLG GDS file such that all of the extra layers generated by Jazz during the Layer Generation process are imported. When using Cadence, the easiest way to read-in all layers is to define/create the PLG library during the stream-in process. Note that a new library name must be used since you do not want to overwrite existing design data. In the "Virtuoso Stream In" Options form, set the following option values:

<u>Option</u>	<u>Setting</u>
"Skip Undefined Layer-Purpose Pair"	UNSELECTED
"Merge Undefine Purpose to drawing"	UNSELECTED.

In addition, ensure that the library is not attached to an existing technology file or technology library. Otherwise the new PLG layers will not be read-in. After opening the layout top cell, the new layers including dummy fill layers will be visible. The format of the layers in your Cadence LSW is given in the table above. For example, “L8 / P1” is the Layer Name / Purpose for GDS layer 8, datatype 1. This represents the Metal 1 dummy fill. If the design kit layer names and fill patterns plus colors, such as “metal1” instead of “L8”, left to right fill code and blue color, outline, and yellow color, is desired, then you must create a stream mapping file to include the all the layers plus dummy fill layers as well as all the newly generated layers. In addition, a technology file will be needed upon stream in to display the regular design kit names such as metal1, active, poly, etc. The Virtuoso Stream In / Stream In User-Defined Data option, Layer Map Table entry must be filed in with the appropriate layer mapping file and ASCII Technology File Name entry completed with the tech file dumped from the design kit.

9. Need additional help?

If you require additional help or assistance, please contact your Jazz account manager or assigned applications engineer. You can also file a help ticket through the eBizz website. If you are not sure who your Jazz account manager or applications engineer is and do not have access to Help Ticket, please email us at online@jazzsemi.com.

10. Jazz Data Acceptance Criteria

All Tapeouts must be submitted through the eBizz Tapeout System available at online.jazzsemi.com. Please note that the use of file exchange, FTP, email attachments, or any other means to submit data is not supported. **Any submissions received outside the Tapeout System will cause delays and may not be processed.**

Customers must run the following verification routines using Mentor Graphics Calibre® or Cadence Assura® on the database top cell with no rules or cells ignored. Customers must provide verification summary files for the following tests:

- DRC
- Antenna
- Stress
- Latchup
- SoftERC
- Density

Verification must be run using decks released no earlier than 8 months prior to tapeout date, unless there is no newer deck released by Jazz.

Failure to provide any of these required files will result in rejection of tapeout data.

For designs with violations:

1) To Resolve Violations

Please contact your assigned Jazz design support engineer or account manager prior to the scheduled tapeout date for assistance to resolve violations. Jazz will make an effort to review

customer design data but cannot guarantee data with violations will be accepted without modifications.

2) To Waive Violations

If you wish to waive violations a [tapeout waiver request form](#) must be completed. In this form, a waiver clear justification must be provided for all violations. Please refer to the tapeout waiver request form for additional details. Jazz does not guarantee that it will accept tapeouts with waived violations. **However, if Jazz does accept tapeouts with waived violations, Jazz does not guarantee yield, reliability, or performance of such tapeouts.**

Jazz will notify customer of data acceptance or rejection within 24 hours of submission via a tapeout system email. If rejected, a detailed reason for rejection will be provided.

10.1 For MPW Submissions

Tapeout submission through the eBizz Tapeout System must be completed by **5 PM PST** on the MPW tape out deadline (as posted on the [Jazz MPW Schedule](#)). Jazz cannot guarantee MPW submissions will be accepted if received after the posted deadline. Please check with your Jazz Account Manager for late MPW tape out options and costs.

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