

**PTF Manager:  
Rules-Driven PTF Generation and Management**

**Chris Day**

**Motorola, Inc.**

**Christopher.Day@Motorola.com**

**CDNLive 2006 / Silicon Valley  
San Jose, CA.  
September 12 - 14, 2006**

**Session# 6.2**

## **Abstract**

Motorola, like other companies that have an established design process, may have central systems for maintaining component data – often referred to as the **Component Information System (CIS)**. These are often enterprise-level systems where data is managed for the entire organization. This information is rarely reused within the CAD space, so data is typically reentered during library development – creating duplication of efforts related to part metadata.

Moreover, there are other benefits to reusing the information that already exists within a company's **CIS**. Information such as, Life Cycle Status, Preferred Part status, RoHs compliancy, and part taxonomy (classification) may also be managed within the **CIS**. Business and parametric data are mastered in the **CIS**, and then integration enables this data to be leveraged in downstream processes, such as library development. This results in the reduction or even elimination of the librarian's task of manually entering PTF data. Data is "reused" not "reentered" - mitigating data entry mistakes during library development, increasing productivity.

The PTF Manager uses classification-based rules to synthesize PTF data for use in the component selection process and by other downstream processes. Data change is managed in the **CIS** with changes pushed into the library lifecycle process via the PTF Manager. This solution also provides integration with Allegro Design Workbench solution, through an XML interface.

This paper focuses on how the PTF Manager has helped Motorola realize quality and efficiency improvements in the library development process.

***Note:** The term **CIS** in this paper does not refer to the Cadence "OrCAD **CIS**" system - **CIS** is a generic acronym referring to any centralized system used to manage part data.*

## **Background**

At the 2003 Cadence User Conference, Motorola presented a paper that overviewed their enterprise-level architecture and integration between the Cadence tools and their various internal systems – demonstrating the benefits of integrating component, business, and CAD systems to enable efficiency in the overall hardware design process. One of the benefits from this solution is intelligent part selection – providing the right information to the engineer, early in the design process. Engineers would know during part selection (via PTF information) if their part met various criteria (i.e. preferred parts, RoHS compliance, etc.), prior to getting too far downstream in the process – mitigating design issues due to part churn.

The idea is that information included in the PTF data files is retrieved from a number of corporate systems, but primarily from the enterprise-level Component Information System (CIS). For Motorola, component data is maintained in the CIS by a Component Engineering group, responsible for the validation and quality of specific part data as it enters the system. What, why and how this data becomes information within a PTF as well as the associated benefits, will be covered in the pages that follow.

## **The Issues**

- **Manual PTF Entry**

There are basically two types of strategies related to building PTFs within the library process – manual and automated. Each method has their benefits as well as challenges. Issues associated with manually creating or editing PTF records are fairly straight-forward – manual editing is error-prone. Any time a user touches a PTF there is a risk of various issues arising, such as typos, pasting duplicate entries, forgetting to enter a required piece of data, etc. Depending on the type of data being placed into the PTF, records are subject to change more frequently (i.e. Preferred Status, RoHS compliancy, etc.). These types of changes are also examples of bulk update requirements to PTF data files, often impacting many or even all part numbers within a PTF.

Another type of change to a PTF is the addition or changing of the JEDEC\_TYPE and/or ALT\_SYMBOLS properties. This change can occur when an additional Allegro symbol is required due to a technology requirement, not known or missed during the original part creation. In some cases, a technology addition to the library requires a mass update to all PTF records for a given part classification. This can potentially impact hundreds of part records. Manually updating PTFs under these conditions is time consuming and extremely error-prone.

- **Leveraging Enterprise Data**

In the design capture portion of the hardware design process, the CAD space has been referred to as a “necessary evil”, but organizations are not realizing the full potential available from an integrated CAD environment and process. Companies may enter part data into various systems as required by their internal data management process, and also reference this data at various points during the product development process.

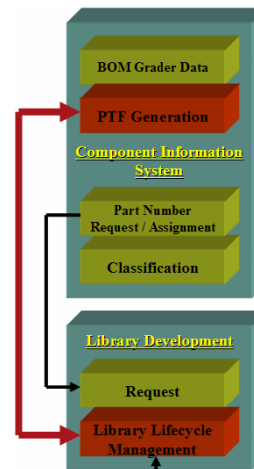
However, much of this data can be used earlier in the process to reduce the number of design spins for a product. Example – reviewing a parts list for RoHS compliance or preferred status, from a design that has already been prototyped is too late in process. In many cases, data like this is not made available to the CAD space, resulting in additional design reviews, prototype spins, or even factory-level changes. These all result in additional time and money.

One of the other challenges that Motorola had to address was the volume of part numbers in their enterprise systems. With more than 2 million part numbers and 500 part classifications, it can easily become a maintenance nightmare – not using automated rules to extract critical part data would make the goal of managing part data in the CAD space unachievable.

- **Looking Outside the CAD Space**

Looking back at the Motorola Integration Architecture, the most important objective of this solution was to reuse data that had already been entered into an enterprise system, reducing or even eliminating data-related issues with duplicate data sources. Motorola believes that the information used in the generation of the PTF starts in the enterprise CIS, typically managed by a business's Component Engineering group. This part data is pulled into the Library Lifecycle Process, where additional information is added to support the CAD tools and hardware design process.

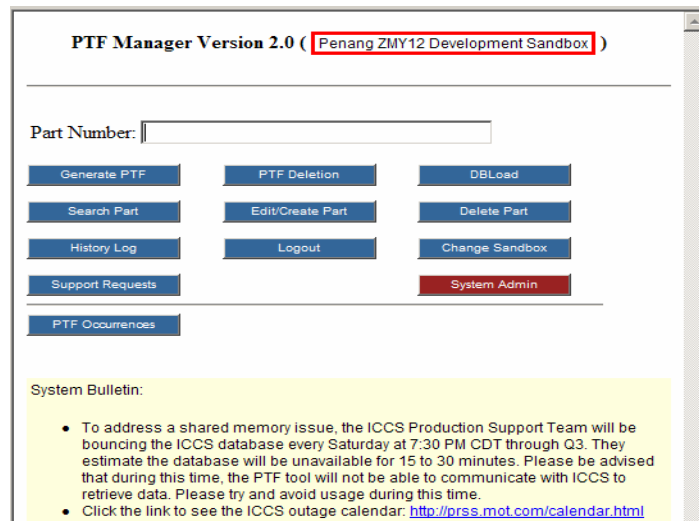
Parts created in the CAD library space are only as good as the data being entered – no surprise here. Librarians are responsible for creating the CAD symbol, identifying appropriate information needed in the CAD environment, and ensuring that this is entered into the Cadence PTF records for a given part number. If a librarian entered data into the PTF incorrectly, then the PTF record has little value to the engineer. Moreover, if the data is information that has already been entered and verified in another system, then time has been wasted and results in an intangible loss of money to the business.



### Introducing the PTF Manager

The solution Motorola developed is called the PTF Manager. It is a database-driven solution, using rules set in the CIS to determine what data to retrieve and how it will be used to generate PTF records. The end goal is still to generate and manage PTF information – the PTF Manager provides an easy mechanism for managing the data being passed through its system, from other systems.

To begin the process, the librarian will enter a part number into the main PTF Manager page, then select the function they wish to perform.



The PTF Manager contains 3 primary sections related to a given part number: The CIS section, Cadence/MCL section, and the PTF Properties section. The information that will be presented in these sections will provide the librarian with a holistic view of the part. This is essential to understanding the potential downstream benefits/impacts of a given part.

**CIS Data section** (The term ICCS shown in the form is the name of Motorola’s CIS database)

**Leaf Class Validation**  
 (MANDATORY FIELDS ARE IN RED BORDER)

ICCS DATA

ITEM NUMBER	D013952A71
PARENT CLASS	Component
LEAF CLASS	Metal Film Resistor
ITEM DESCRIPTION	RESISTOR,METAL FILM,5.3EOHM,1%, 1W,SM,0803,400PPM/CEL,PB-FREE
SHORT DESCRIPTION	RES.MF.5.3EOHM,1%, 1W,SM,0803,400PPM/CEL,PB-FREE
CM SYSTEM	PDM1
SECTOR ID	CORP
RESPONSIBLE LOCATION	SS
RESPONSIBLE LOCATION STATUS	FULL RELEASE
WORK FLOW STATUS	RELEASED
SOURCE ORGANIZATION	GLOBAL STD
SOURCING PART STATUS	NOT RATED
CORPORATE PREFERRED STATUS	NOT RATED
CGISS PREFERRED STATUS	NOT RATED
GTSS PREFERRED STATUS	NOT RATED
IEES PREFERRED STATUS	NOT RATED
PCS PREFERRED STATUS	NOT RATED
W18 COMPLIANCE 2 STATUS	PASS WITH EXEMPTIONS
W18 COMPLIANCE 2 INFRASTRUCTURE STATUS	PASS WITH EXEMPTIONS
W18 COMPLIANCE 2 SERVER STATUS	PASS WITH EXEMPTIONS
W18 COMPLIANCE 4 STATUS	PASS WITH EXEMPTIONS
REFLOW TEMPERATURE PROFILE	S80
IN MENTOR	Yes
IN CADENCE	

OK Cancel

When a part number is entered (Generate Mode), the first activity for the PTF Manager is to connect to the CIS and retrieve a standard set of information for that part, which is presented in the form as shown (left). The attributes in this section are part-agnostic – not part of a part classification. This section does provide important information about the validity of the part (Preferred Status, RoHS compliancy, etc.).

At this point, the PTF Manager will attempt to determine the appropriate Classification (**Leaf Class**) for that part. The librarian needs to ensure that this is the appropriate classification for that part. The Leaf Class field is a required field, as it is used to determine what CIS rule will be used to populate future pages.

*Note: Any field outlined in a red box indicates a required field to the librarian.*

If the librarian enters a part number that is not in the CIS, this page will not get populated, since there is no CIS data to retrieve. This could be a legitimate situation when using temporary part numbers (used in some processes). The librarian would still be required to select an appropriate Leaf Class for the part, so that the tool can still attempt to populate the other pages.

**Cadence/MCL section (MCL – Motorola/Cadence Library)**

In this section, the librarian must know information specific to the CAD symbol – information in the chips.prt file, Allegro footprint name(s), Class, etc. The Vendor information is automatically populated, if available, from the enterprise PDM system. The vendor information is directly related to the construction of the CAD symbols (pin definitions, physical dimensions, etc.), which is the reason for placing it in the section. This is the section where the librarian will interact most with the tool. Notice that the JEDEC\_TYPE and ALT\_SYMBOLS fields are grayed out – the librarian cannot assign these values here. Assignment of these values is accomplished via the JEDEC Pair Name. This will be discussed later in the paper. Refer to the “JEDEC Pairs” section for full details of this functionality.

CADENCE MCL DATA

PART NAME	RESISTOR
BODY NAME	RESISTOR
JEDEC PAIR NAME	RES0402-HT0_35
JEDEC TYPE	RES0402-HT0_35_WV
ALT_SYMBOLS	RES0402-HT0_35_HD,RES0402-HT0_35_FL,RES0402-HT0_35_HH,ACOUS8_15K
CLASS	DISCRETE
VENDOR	MULTIPLE
VENDOR.PN	MULTIPLE
DISPLAY NAME	RES
COMPONENT TYPE	CHIP_0402
RCL	NO

## PTF Properties section

This is the section where the primary **Key** and **Injected** properties are defined for output into the actual PTF record (.ptf), which will be used by the core Cadence tools. These property names will become the PTF **Key** and **Injected** property headers when the record is written to a file. When the librarian writes the PTF record to a file, the PTF Manager will format the record (based on the Leaf Class rules) so that the outputted data is formatted consistently.

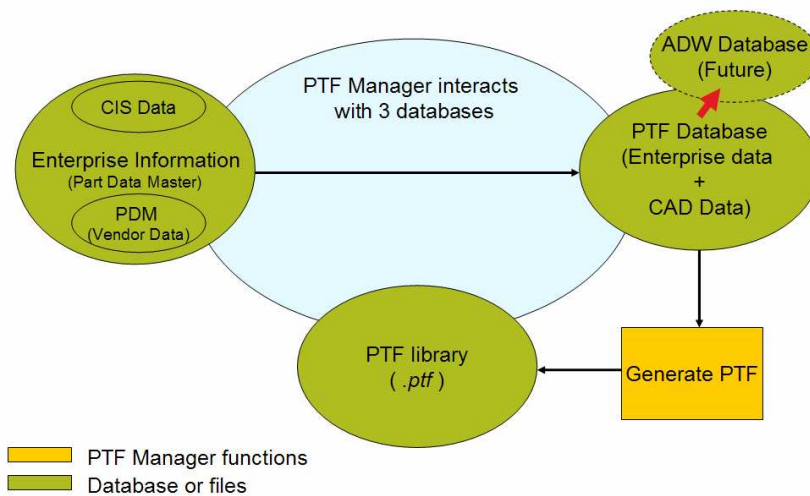
Additional information will also be added to the outputted PTF record as **Optional Injected** or **Added** properties. These additional properties include RoHS/W18 compliancy, Preferred Status, to list a few. This information is simply reused from the CIS data presented in the CIS page for a given part (see **CIS Data section** above). Refer to Cadence's documentation for more information about Optional Injected properties.

PTF PROPERTIES	
VALUE	5.38
POSTOL	1%
NEGTOI	1%
POWER	100MW
TC1	350
SLOPE	RSMAX
MAX_TEMP	155
TYPE	METAL FILM
PACKAGE	SM
PACKAGE_SIZE	--
SM_SIZE	0803
SM_SIZE_METRIC	1608

Update Database and Generate PTF Cancel

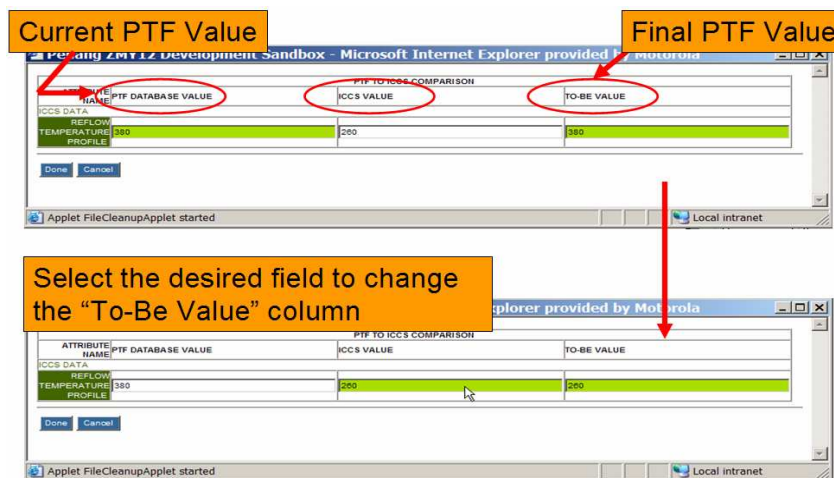
## PTF Manager Features

- **Part Number driven**  
Use of the PTF manager requires a part number, as the corporate CIS references all part data by its associated part number.
- **Create/Update/Delete a Part/Database record**  
The PTF Manager only manages part data. One of its outputs is a master Cadence PTF record. Librarians can add, change or delete part information associated with a specified part number. Example: Deleting a Part record from within the PTF Manager is different from deleting a PTF record.
- **Create/Update/Delete a PTF record**  
A librarian has the same data management capability (add/change/delete) for PTF records as they do with part records. Librarians never change a PTF record – updating a PTF record implies the record is being regenerated based on the current part data in the PTF database. This ensures PTF records are always generated programmatically – ensuring consistency in PTF record generation.
- **Separate database**  
Using a separate database to manage part/PTF data provides isolation of issues associated with enterprise systems – librarians typically have no control over the enterprise systems. Enterprise system outages and errors in CIS data are two examples of the types of issues that can impede the library creation process.



- **Differences Engine.**

As mentioned, the PTF Manager maintains a copy of the enterprise data within its database, providing isolation from the enterprise systems once the part has been entered into its database. However, if a change is made to either the PTF Manager database (overriding a CIS field) or a CIS change needs to be incorporated into the PTF record, it is handled through an internal differences engine that runs each time a part number is being worked.



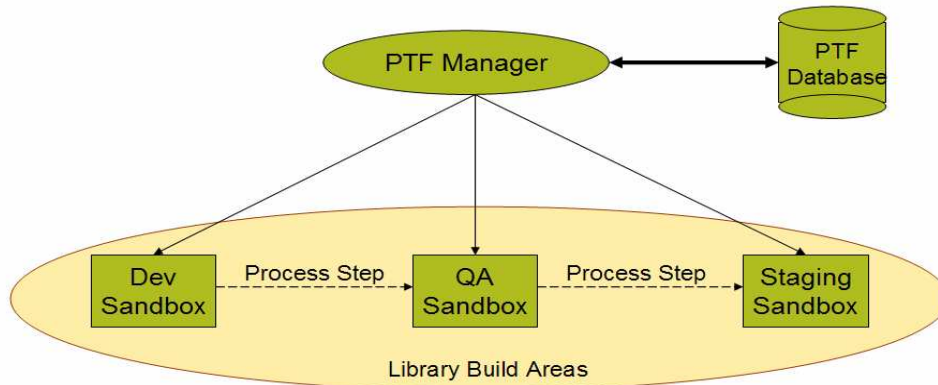
When a part number is entered in the PTF Manager, the differences engine looks for any difference between the data in the PTF Manager database and the CIS. If any differences exist, the librarian is presented with a form that describes the differences. The librarian then selects which entry is to be kept (to-be value) and accepts the change.

- **Concurrent editing enabled**

The Edit/Create Part mode enables multiple librarians to work on the part at the same time. Some librarians may only be responsible for entering logical CAD information, while other librarians are only responsible for the physical (PCB) information. This mode enables both to work on the same part. **Note:** This mode does not connect to the corporate CIS, so it automatically becomes isolated from enterprise-level impact.

- **Supports multiple work areas (sandboxes)**

A librarian sandbox is simply a work area that is generally isolated from the production library. There can be multiple sandboxes that exist across multiple sites. The PTF Manager is aware of the librarian's work area – a librarian will select the appropriate sandbox prior to working on a part. When the librarian generates a PTF record, the record is written to a PTF file for that librarian's sandbox. Other sandboxes are unaware of this PTF record, allowing isolation in the library creation process phases (i.e. build, QA, release). The main PTF Manager page always displays the current sandbox to the librarian.



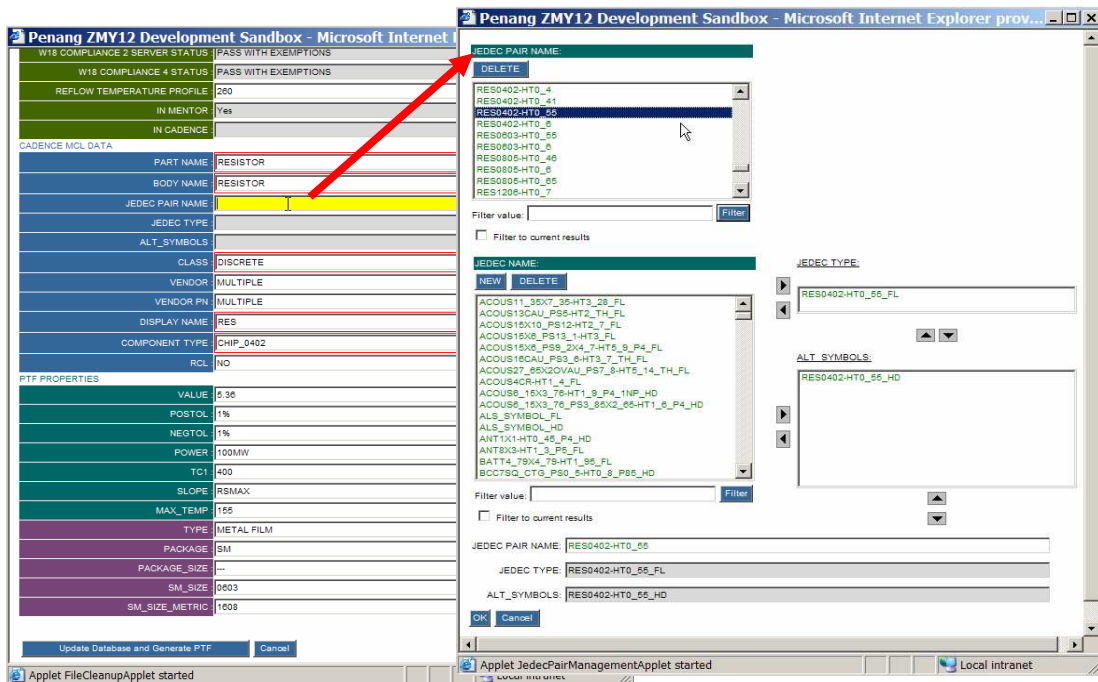
- **Where-used enabled**

The **PTF Occurrences** feature enables a librarian to see, if any, where there are other PTF files that contain duplicate records for a given part number. A librarian may have been working on a part in one sandbox (i.e. Build or Dev), and another librarian may have been responsible for the next process step (i.e. QA). The PTF in the “build” or “dev” sandbox still exists, so the QA librarian can use the PTF Occurrences feature to see that there are multiple PTF records for the same part number. Since the part has been promoted to the next process step, the build librarian would need to delete their PTF record as a cleanup step. The PTF Manager will not allow a Part to be deleted from the database if there are no related PTF records existing in external files.

- **JEDEC Pairs**

The idea of JEDEC Pairs is a new concept for managing the relationship between the JEDEC\_TYPE and ALT\_SYMBOLS properties by linking them together through a database object name. JEDEC pairing provides a one-to-many relationship between part numbers and Allegro footprints – one JEDEC pair record can be associated to many parts in the PTF database. Example: Changing one JEDEC pair record will automatically update any part in the database that uses that object name. This solves the time-intensive task of updating potentially hundreds of PTF records because a manufacturing technology requires an additional allegro footprint be added to the PTF.





When using the JEDEC Pairing solution, JEDEC\_TYPE and ALT\_SYMBOLS are never directly assigned to a part number. The JEDEC Pair object name becomes the reference to the appropriate Allegro symbol names. A new JEDEC Pair name is derived by the first selection of the JEDEC\_TYPE entry in the JEDEC Pair form. The JEDEC Pair name is not directly assigned, but can be manually changed if needed. Motorola's naming convention for Allegro footprints include the technology as the suffix to the base name (**fl** for Flex, **hd** for High Density, etc.).

The librarian can add the JEDEC\_TYPE and ALT\_SYMBOLS (as many as needed), and reorder, remove or move an ALT\_SYMBOLS value to the JEDEC\_TYPE value. The bottom of the form keeps track of the changes and is used to populate the Cadence/MCL data section in the previous form.

### Misc. Features

- **Search Part**

This feature allows any authorized user to search the database for a specified part number and view existing information about that part. If the part is in the PTF Manager database, the user will be presented with the 3-section page (CIS Data, Cadence/MCL and PTF Properties), containing the part's current information.

- **Support Requests**

When help is needed, this function enables the user to send a help request directly to the PTF Manager-support group. This expedites responses as issues can be addressed, in some cases, before the user is contacted.

- **Message Center (System Bulletin)**

If a message needs to reach all PTF Manager users, it is placed in the PTF Manager Message Center (on the main PTF Manager page).

- **Web-based**  
This is an industry standard use model for ease-of-use solutions. It provides a common interface that is familiar to the user.
- **RSYNC**  
All PTF files, generated from the PTF Manager, are mastered in a single location. However, this area is structured to understand the various library sandboxes (if any) and their physical locations (the actual library work area is not physically located where the mastered data resides). Motorola uses an open-sourced tool, called RSYNC, to provide replication of the mastered PTF file to its appropriate location. RSYNC boasts intelligent incremental file synchronization between its source and destination file. It quickly updates only the changed information within a file, controllable to the block-level of a file.
- **ADW-enabled**  
The solution has been architected so that it can be integrated into Cadence's **Allegro Design Workbench**® (ADW) solution. The ADW database will replace the PTF Manager database.

The PTF manager provides all information, associated with a specified part number, to the librarian – reducing the time spent reentering information into the PTF and allowing them to focus more on the CAD specific data that is not available in the enterprise CIS. Since the PTF Manager has its own database, it maintains all the information.

## **PTF Overrides/Managing Differences**

Turnaround time in generating CAD parts is a critical part of the design process, and engineers are rarely patient in waiting for CAD symbols needed for their design. Sometimes, there are errors detected in the part data located in the enterprise CIS. Getting this information corrected can take time, as ECNs can be required to make changes to part records. Librarians need a mechanism to facilitate changing the data that is discovered to be incorrect, so they can continue with the library creation process and meet their delivery commitments. The PTF Manager provides this capability. Note that the internal process should include procedures for loop closure of incorrect data discovered in the CIS.

## **Business/Engineering ROI**

The PTF Manager solution was architected to align with the “big picture” vision of the **Motorola Engineering Tools and Solutions (METS)** group, which is that the integrated solution includes a holistic view of the product development process. The following is a list of immediate benefits that can be realized by the PTF Manager:

- Efficiency by generating consistent, repeatable, reusable data, via integration to enterprise systems.
- Error mitigation – minimizes manual intervention.
- JEDEC Pairing – manage many-to-one relationships between part numbers and Allegro footprints.
- Multiple librarian work areas.
- Extending capability of the CAD environment.
- Architected for future integration.