217Plus Application Note 3: Preparing Bills of Materials for Stress Analysis

The **217Plus** Application Notes 1 and 2 outlined procedures related to preparing Bills of Material (BOMs) for import into a **217Plus** for Parts Count Analysis.

For a **217Plus** Stress Analysis, electrical and/or thermal stress information must be provided for each 217Plus-modeled part in order to determine how the stresses affect reliability. Since a typical BOM usually has parts of 'like' value grouped together under a single item or part number, to perform a true part-by-part stress analysis, the BOM must be 'exploded' such that there will be only one part per line to allow for individual analysis. The procedure in this document identifies how common tools such as *MS Excel*® and *MS Word*® can aid in this effort.

The 217Plus **Import** function supports importing stress parameter data along with the BOM, which can save significant time as compared with manual par-by-part data entry. If importing of component model and/or stress data is desired, the user must know, or have access to, component specifications. The user will also either need to know to determine or obtain the component stress information for the design being analyzed.

This Application Note covers several related topics:

- **A method for preparing a BOM for a Stress Analysis Prediction 'Import'.** Using common tools (MS Word, MS Excel applications, and the ***217Plus_BOM_Tool-REV2.xls***), a method will be presented illustrating how a BOM can be exploded in preparation for a stress analysis.
- **Identifying 217Plus component model parameter data (data types, formats, limits, etc.)**. The user must be aware of the proper data types, format and limitations in order to avoid errors in the Import or analysis process.
- **A method for modifying the *217Plus_BOM_Tool-REV2.xls* or similar spreadsheet** to accommodate importing of the component parameter data with the BOM, *if desired*.
- **Defines how to import data and how to save and re-use a 'custom' Import Format.** By standardizing on a fixed data format and then defining a customized 217Plus Import Mapping File, all *future importing of BOM and Model/Stress parameter data into 217Plus* can be greatly simplified. This procedure illustrates how the user can define, save and re-use a customized 'mapping' file.

For those who choose not to use a fixed format import file, or may not want to import the parameter and stress data, the procedure that follows can accommodate such scenarios.

Regardless of whether the model parameter and stress data will or will not be imported, the user must become familiar with 217Plus' use of model parameters and stress data if they are to perform a Stress Analysis. It is recommended that the first time user refer to ***Appendix B: Model Parameters for Component Types*** beginning on page 24. For more detailed information, and they may want to refer to ***Appendix C– Component Stresses*** on page 29.

Importing a BOM for Stress Analysis

1. To prepare a BOM for import into **217Plus**, assign **217Part** and **217PartType** data to parts before the BOM is exploded. QSI's ***217Plus_BOM_Tool-REV2.xls*** is designed to assist in this process. The **217Plus** Application Note 1 (single BOM) Steps 1 - 4, or the **217Plus** Application Note 2 (Multiple BOMs) Steps 1 - 23, provides instructions on how these assignments can be made.

2. *If the user plans to add the component parameters to the BOM,* they should be added at this time. If the spreadsheet has not been set-up to support these parameters, refer to ***Appendix A: Developing a Complete Spreadsheet for Stress Analysis Import*** starting on page 21 before proceeding to Step 3. Once again, QSI's *217Plus_BOM_Tool-Rev2.xls* is formatted to support these parameters.

3. *Locate the column containing the Reference Designators. Select all cells in that column that contain information, starting with the header, on down to the last row of data. Select Copy (see Figure 1).*

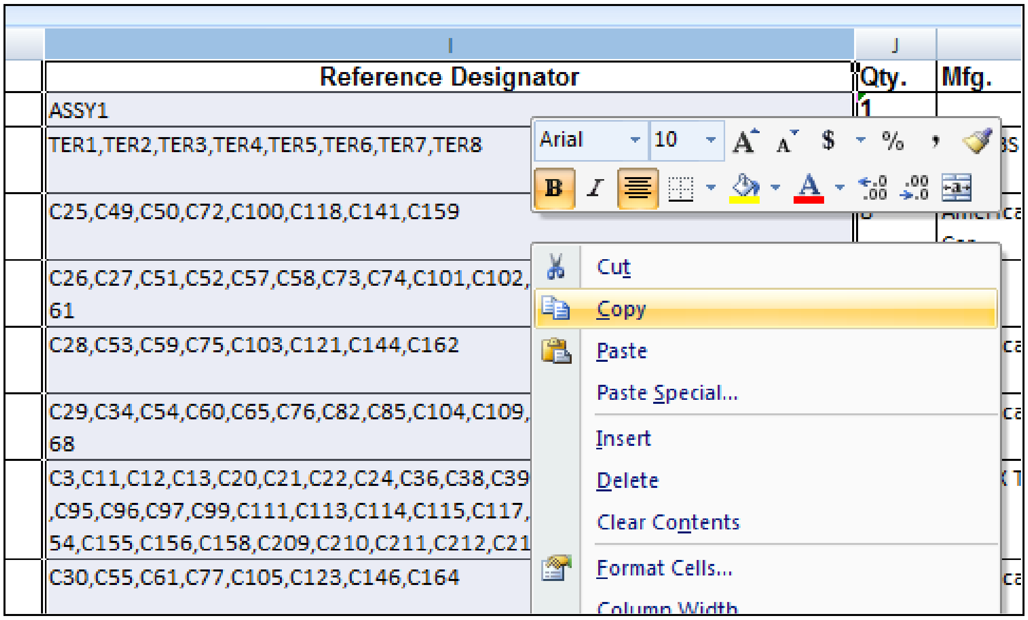


Figure 1. Copying "Reference Designators" from the Excel-based BOM Workbook

4. Open MS Word and create a blank document.

5. ***Paste*** the data into the WORD document. It should appear as a single column table, as in *Figure 2*.

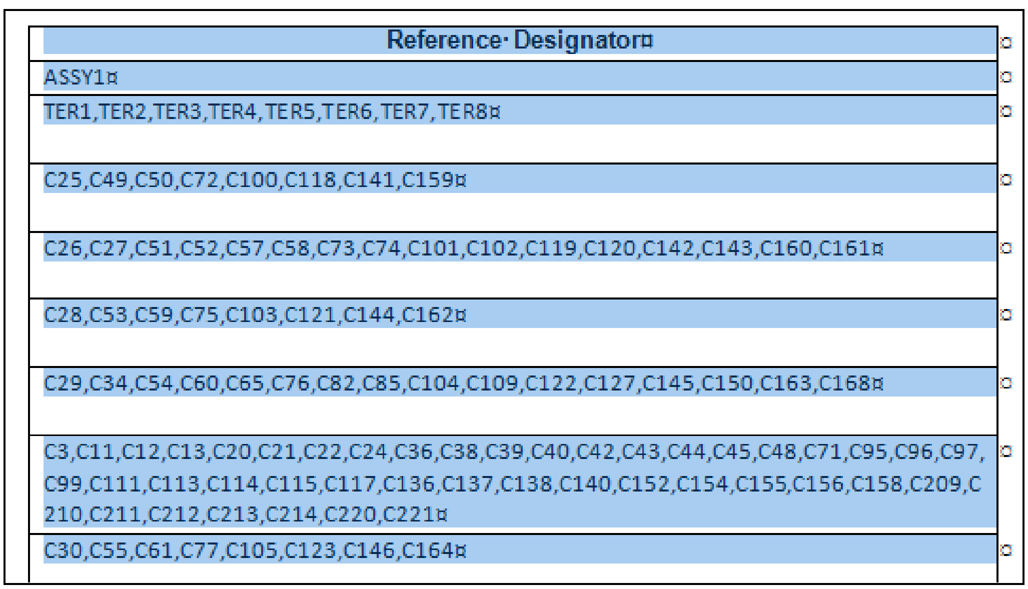


Figure 2. Copied "Reference Designators" Pasted into a Blank MS Word-format Document

6. With the table selected, apply Word's "**Convert Table to Text**" function. In pre-2007 versions of Word, this is found under the "**Table**" menu. In Office 2007 and later versions of Word, the highlighted table will bring up the **Table Tools** ribbon at the top of the screen, as in *Figure 3*. Select the **Layout** tab, and then select "**Convert to Text"** near the far right of the ribbon. A dialog box will appear; select **"Paragraph marks"** and click **OK**.

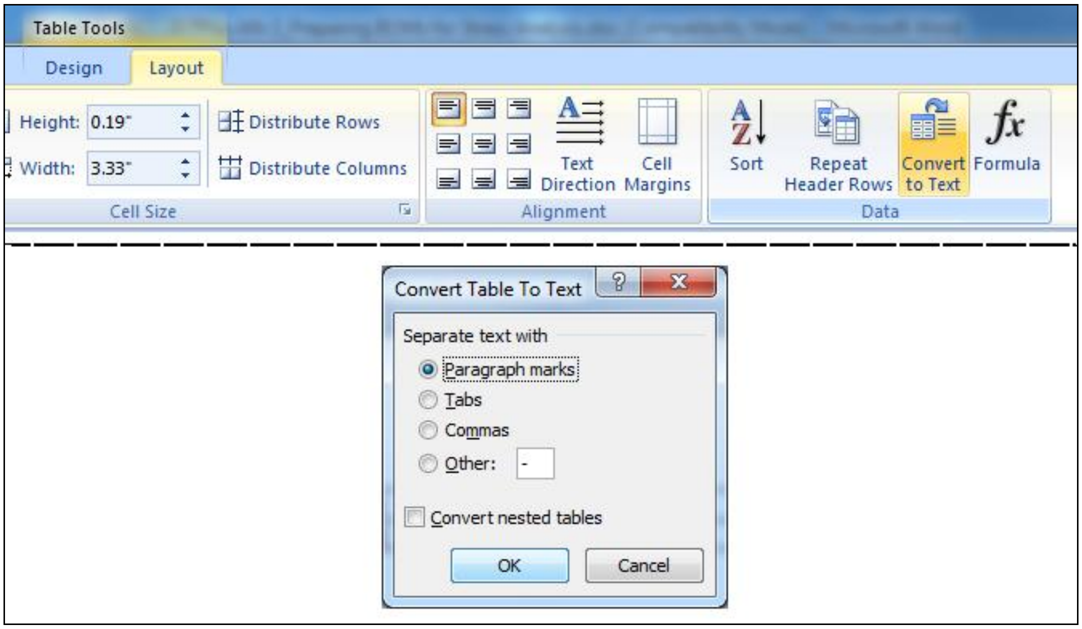


Figure 3. Converting Table to Text, using Paragraph Marks to Separate Row Data, in MS Word 2007

After the conversion, the reference designators for a part will be comma-delimited, and paragraph marks are used to separate the former rows of data. *Note: if the BOM database uses designation "shorthand' such as C5-C9 to represent a string of consecutive reference designators, the user will have to manually enter each of the included reference designators.*

7. **Select** (highlight) all of the data. Select the MS Word ***Replace*** function (referred to as "*Find and Replace*"). At "***Find what:"*** enter a 'comma' character; at "***Replace with*:"** enter **^p**. Click on ***Replace All*** (See *Figure 4*.)

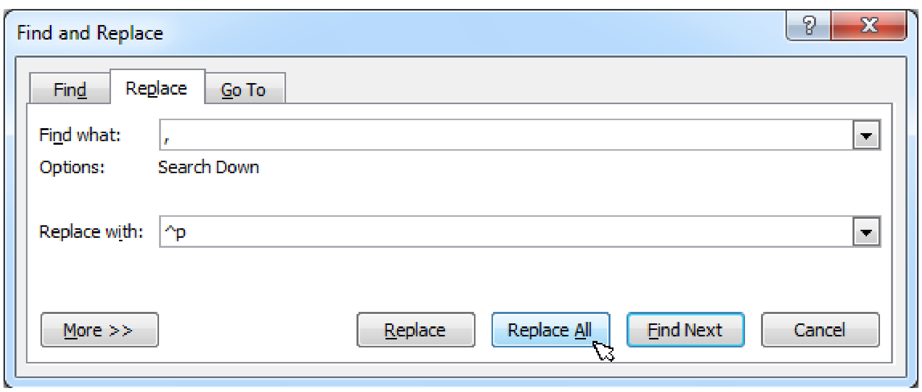


Figure 4. Replacing Commas with Paragraph Marks in the "Reference Designator" Text

8. The data will now show the header at the top, and one reference designator per line.

   NOTE*: Sometimes 'blank' lines may appear as the result of 'paragraph marks' in the original BOM data.* **Delete** *all blank lines before proceeding.*

   Note*: Some databases may use nomenclature such as "C4-C9" or "C4 thru C9" to indicate a consecutive string of reference designators (in this case C4, C5, C6, C7, C8 and C9). If so, these need to be manually replaced with individual reference designators; unfortunately, there is no automated function in either the Word or the Excel applications that can parse such data into individual entities.*

Select all of the data from the Word document. ***Copy*** and ***Paste*** it into the next <u>blank</u> Column of the spreadsheet. There will now be one data line per each Reference Designator (See *Figure 5*).

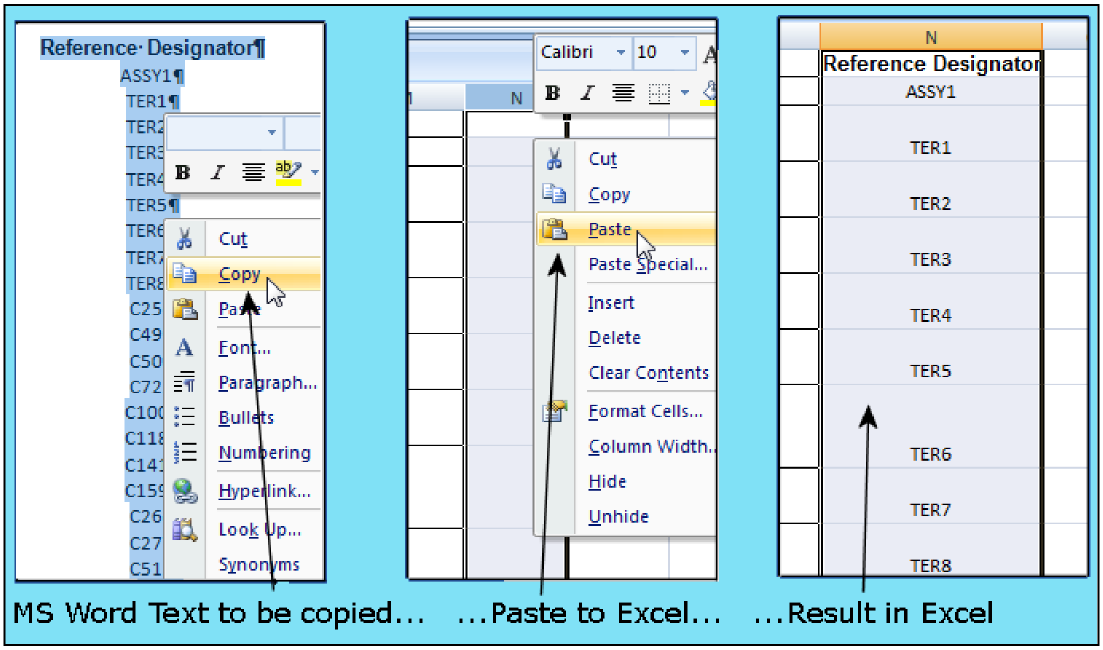


Figure 5. Copying the "Reference Designator" Text from Word and Pasting in Excel

9. Select All of the Header cells in the BOM worksheet related to the **217Part**, **217PartType** etc., through *all of the user's BOM header cells and component parameter cells*. ***Copy*** and ***Paste*** them to the right of the *new* **Reference Designator** header (*Figure 6*).

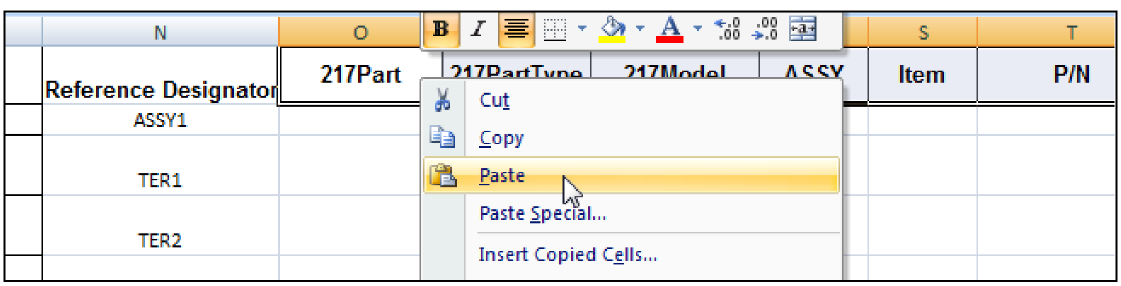


Figure 6. Copying the Original "Headers" from Excel and Pasting to New Columns in Excel

10. At the first *row of BOM data* (it should be in the spreadsheet Row 2), select all of the original BOM data fields, plus the **217Plus** data fields that were added, and select ***Copy***. Be sure to note the <u>last</u> Reference Designator assigned to that part.

11. ***Paste*** the item's data *at the cell to the right of* the item's associated Reference Designator in the new Reference Designator column. In the example, *Figure 7* shows the "Copy and Paste" corresponding to ASSY1 of Row 2.

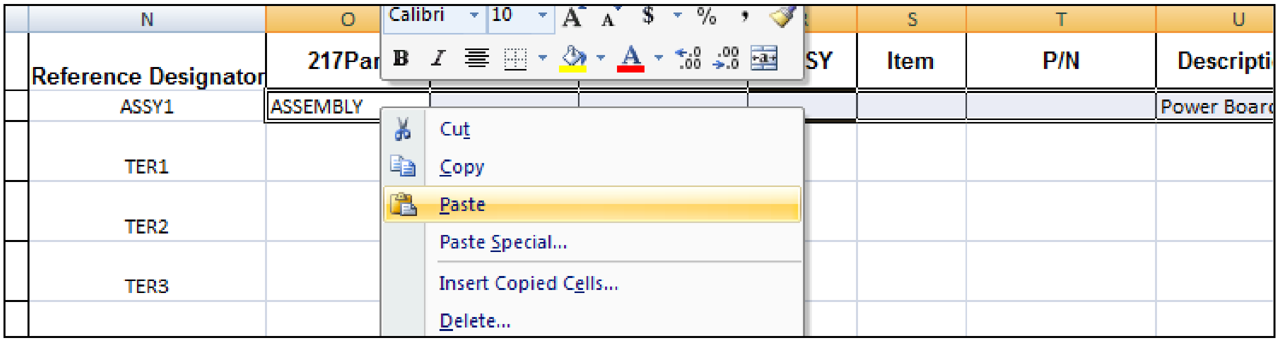


Figure 7. Pasting Assembly Data Next to its Reference Designator

Figure 8 shows a "copy and paste" for an item that has a quantity greater than 1. In the example shown, this part corresponds to TER1 through TER8, originally in Row 3 of the BOM. Since TER1 through TER8 are identical parts, the data gets copied from the original row of data, but is pasted to all 8 rows of data that correspond to the separate "TER1", "TER2".... up to "TER 8" designators in the 'new' Reference Designator column.

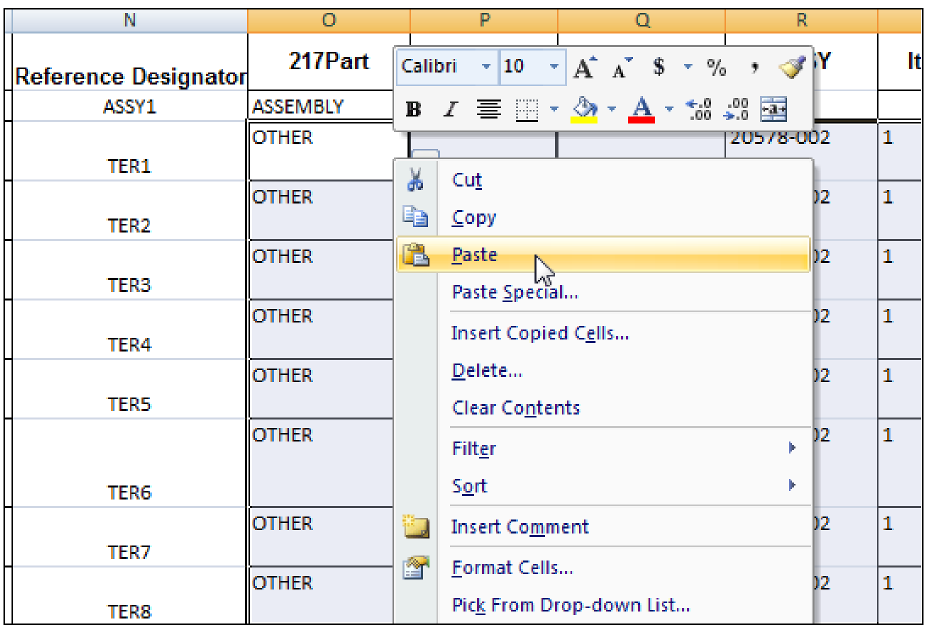


Figure 8. Pasting Part Data into Multiple Rows for Each of the Part Reference Designators

12. Return to the cells that were just copied (the Excel application should still have them selected), select a background fill color, and background-fill the cells to provide a visual indication that the part has been "copied and pasted"; in case work gets interrupted, the colored cells identify the last data that was copy and pasted.

13. Repeat Steps 9 through 11 for all parts in the BOM(s).

14. After all parts have been copied and pasted to the 'one part per row' section of the spreadsheet, ***Delete*** the original BOM columns, leaving only the 'new' columns. The new "Reference Designator" data will now be in Column A.

15. There will now be two "**Reference Designator**" columns, the new column with only one Reference Designator per line, and a copy of the original column. ***Cut*** the new Reference Designator column and ***Paste*** it over the old Reference Designator column. Then ***Delete*** the empty column A.

16. Since there is now only 1 part per row, set the **Quantity** for all *parts and assemblies* to"**1**".

17. *If the user wishes to include component stress information*, fill in the appropriate columns for the corresponding parts. Since *common parameter* data should have already been entered in Step 2, the data to enter at this point would be *stress* data specific to the part in the application. Depending upon the part, the data may include **Voltage Actual; Power Actual (dissipated); Current Actual; Temp Rise or Temp Case**. Such data is can usually be provided by the circuit designers.

    Refer to ***Appendix B: Model Parameters* for Component Types** beginning on page 24 for information required for the stress parameters per component type and calculation method.

18. **Save** the workbook. Select ***Save as*** and ***Other Formats***. In the ***Save As Type*** box, select "**Text (Tab delimited) (*.txt)"** from the list of formats, enter a file name and save the file (*Figure 9*).

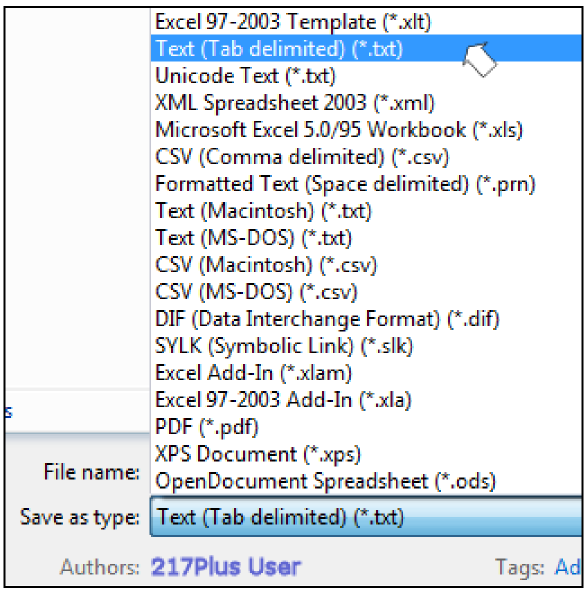


Figure 9. Save the Workbook Data as a Tab-Delimited Text File

There may be quite a few columns of data. *The user should make a note as to which columns are related to which parameters. This notation may prove to be useful when the importing of data is to begin.*

19. **Close** the workbook

20. ***Open*** the **217Plus** application

21. Select **File**, **Import** and select “**New System”**. Then select ***Next>>***.

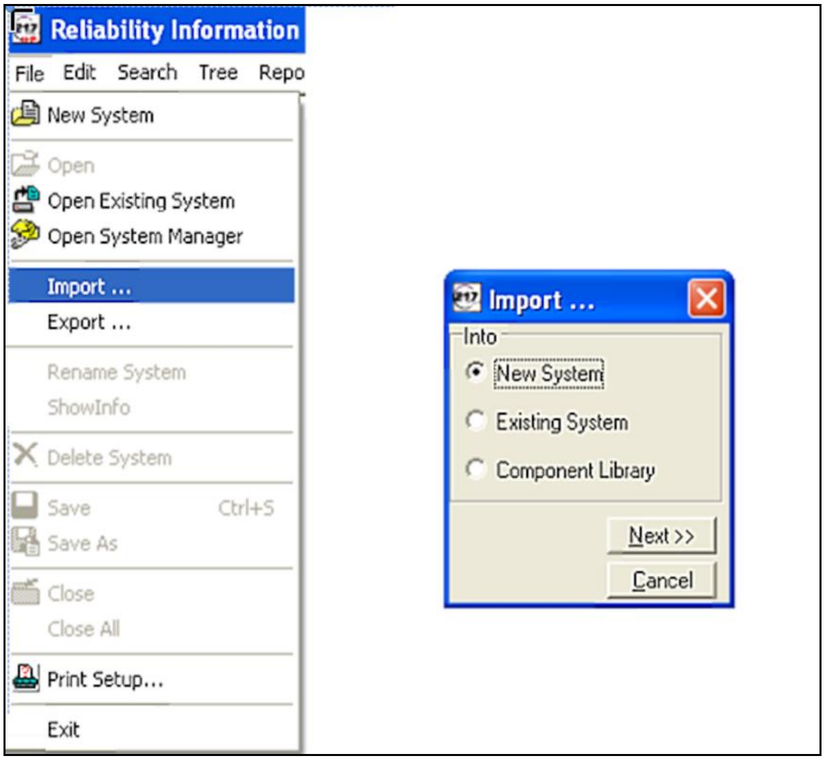


Figure 10. Initiating an Import to 217Plus

22. In the **System Import** dialog box, at the ***ALL files are*****:** drop-down, select “**Delimited ASCII Text File”** (Figure 11)

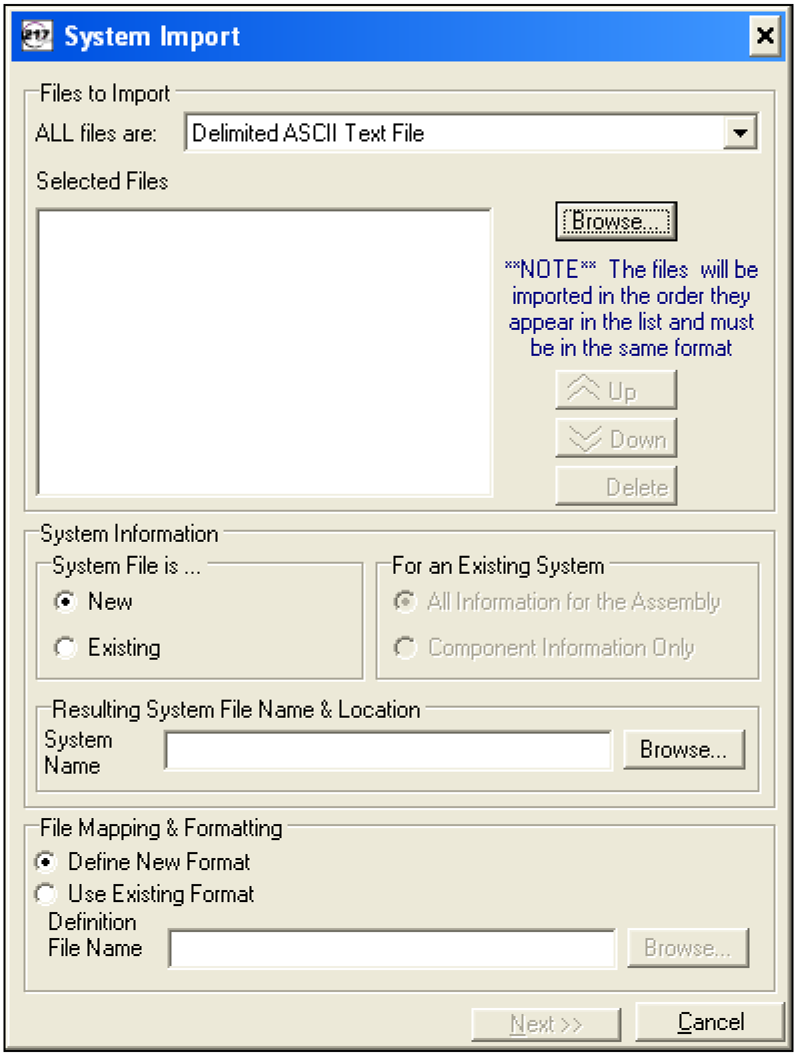


Figure 11. Select File Format Type

23. *Select* ***Browse…*** and go to the location that contains the text file saved in Step 18. Select the file, and then select ***Open*** *(See* Figure 12*).*

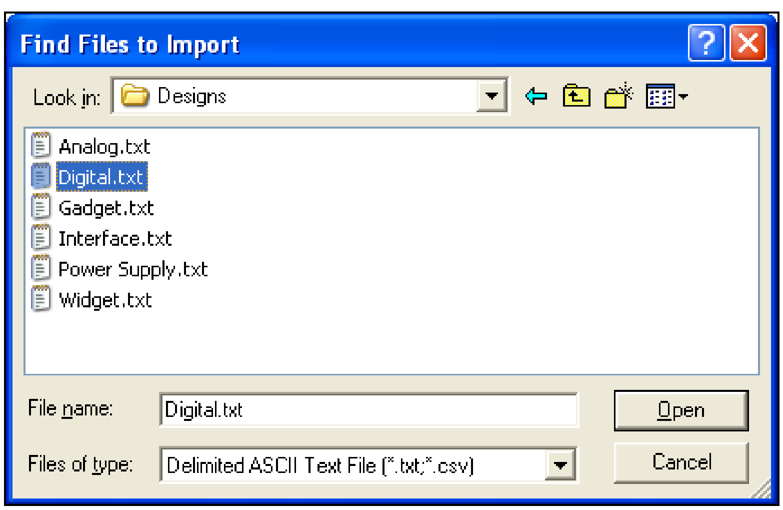


Figure 12. Select File to be Imported

If multiple BOMs of the same format are to be imported, select the additional BOM files. *If the BOMs are to be imported according to a hierarchy, add them to the list according to the hierarchy. That is, a subassembly should be added to the list only after its upper level assembly has been added. Following this rule will facilitate re-creation of the system hierarchy within 217Plus.*

24. Set ***System file is..:*** **"New".** If the file is to be saved in a location of the user's choice**, Browse..** to that location and then enter a ***System Name.*** To save the file in the default location, simply enter the ***System Name.***

    If a File Mapping Format was previously defined, go to **Using a Pre-Defined Import File** on page 19. If an import format has not yet been defined, continue below.

25. At the ***File Mapping & Formatting*** option, select "**Define New Format**", then select **Next>>** (See Figure 13).

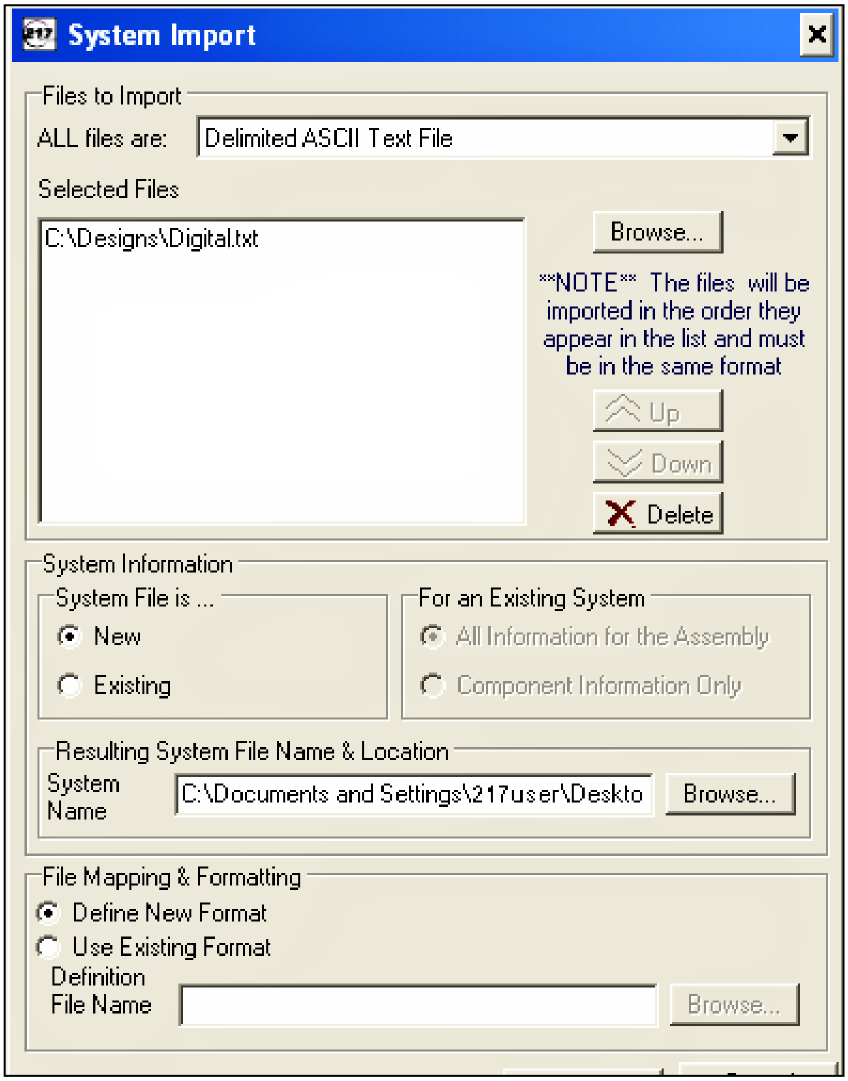


Figure 13. Selecting System Import File Information

26. The **File Delineation** box will appear, as shown in *Figure 14*. This allows for the setting of the **Delimiter** character used in the text file and the **Text Qualifier** character that may be used to enclose text strings. For files exported from an Excel-based workbook such as ***217Plus_BOM_Tool-REV2.xls*** as "Tab Delimited" text files, the **File Delineation** settings will always be the same, and will be as follows:

Select ***Delimiter*** as "**Tab".** Select ***Text Qualifier*** as " (quotation mark) and enter a ***Begin at row*** value of "**1**". Select ***Next>>***.

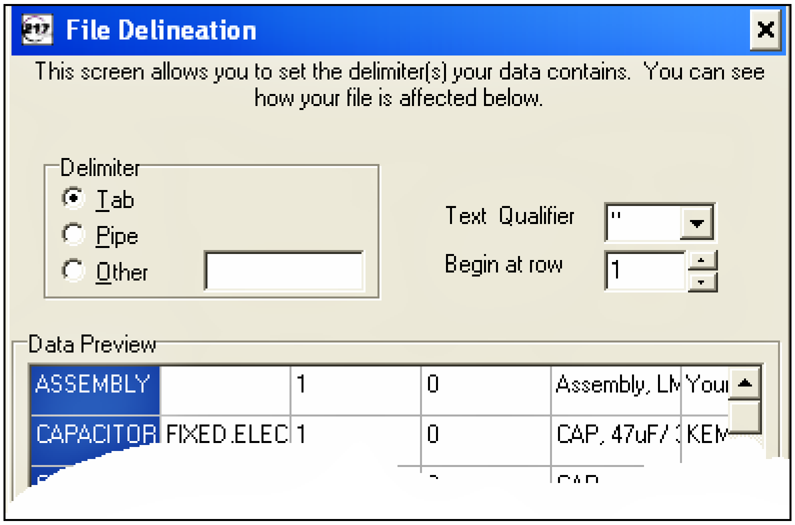


Figure 14. Selecting the Text File Data Delineation Criteria

27. The **Column Mapping – Non-Parameter Fields** window will appear (*Figure 15)*. 217Plus will highlight the column ready for assignment. If the user noted the column assignments as advised in Step 18, this notation can aid in identifying which columns pertain to which forms of data.

The BOM may have three general classes of information:

a) ***BOM related* data that 217Plus supports** (part type, part category, quantity, description, reference designator, OEM part number, manufacturer, etc.)

b) ***Model Parameter* data** to be used for stress analysis (e.g., rated voltage, applied voltage, temperature rise, etc.)

c) **Data or notations not required or supported by 217Plus** (typical types of data sometimes seen include purchase quantities, lead-times, assembly notes, device package style, layout foot-print, etc.)

If a data column on the BOM is not needed by 217Plus, as in "**c)",** check the ***Skip Column*** box.

If a data column corresponds to a device model parameter to be used in a stress analysis, as in "**b)"**, check the ***Model Parameter Column*** box.

For BOM/Part data, such as in "**a)"**, select the appropriate 217Plus data field using the ***Column Type*** drop-down selection.

The BOM's "**217Part**" data column *must* be assigned to "**Part Category".**

The BOM's "**217Parttype**" data column *must* be assigned to "**Part Type"**.

The "**Quantity"** field is also required. Assign other optional BOM data, such as "**Reference Designator",** "**Description"**, "**Manufacturer"**, "**OEM Part Number",** etc.**,** as desired.

After selecting a field (or checking either **Skip Column** or **Model Parameter Column**), click on the next column of data to be assigned, and check or assign the field as instructed above. Use the horizontal scroll bar at the bottom of the dialog box to view columns that may be outside of the present Data Preview window.

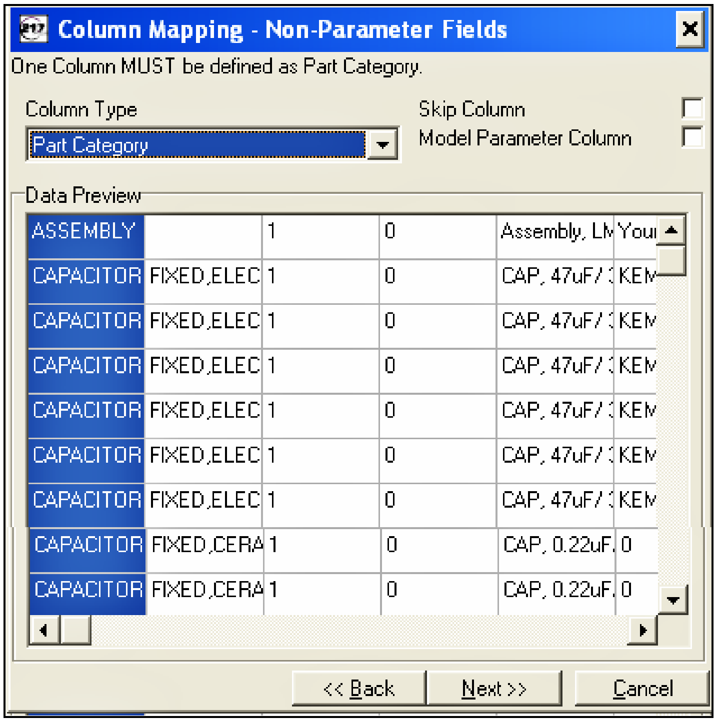


Figure 15. Mapping Text File Columns to 217Plus Data Columns

Review all of the columns to ensure that each has either been assigned, **Skip**ped, or set as a **Model Parameter.** *Any column that is not assigned or checked will cause an import error*. Click ***Next>>***.

28. The **Column Mapping – Components** screen (*Figure 16*) appears to allow for assignment of the selected **Model Parameter** columns to the 217Plus modeled components.

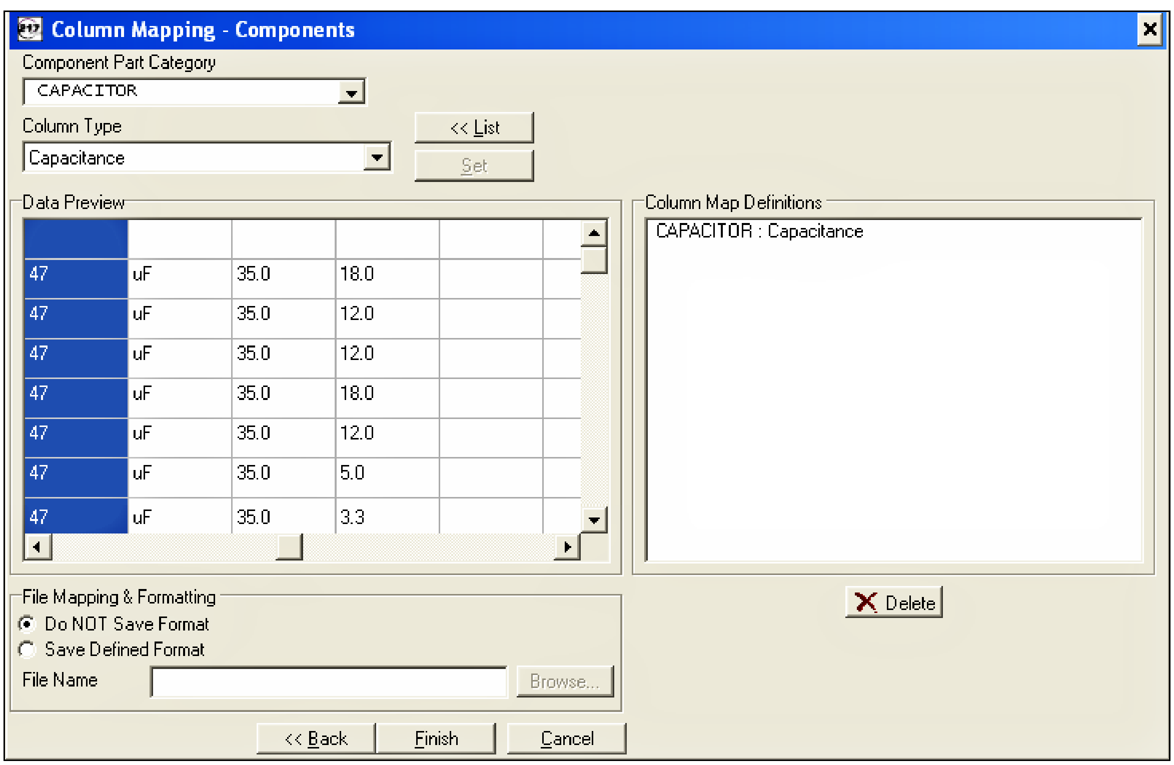


Figure 16. Assigning Model Parameters

217Plus will 'highlight' the first column of data that the user defined as a '**model parameter**' field. Use the horizontal scroll control to find the highlighted column.

At the **Component Part Category** drop-down, select the first component type associated with the data field, and then use the **Column Type** drop-down to select the parameter associated with the selected part.

Select **Set.**

If the data column also contains model data for other components, repeat the **Component Part Category,** the **Column Type,** and the **Set** selection sequence for all components that have parameter data in the currently highlighted column.

> *(*It is recommended that the user click on the **LIST>>** button, which will display the **Column Map Definitions** assigned to the present column. This can help keep track of the parameter assignments that have been made. The window can also be used to **delete** an assignment that may have been made in error. To delete an assignment, click on the errant assignment shown in the **Column Map Definitions** window**,** and click on the **Delete** button).

29. Once the user completes assigning data for a parameter column, select the next parameter column by clicking on the desired column.

30. Repeat steps 28 and 29 for all parameter columns until all of the parameter model information has been assigned. Review the selections by going back through the columns and observing the assignments made as displayed in the **Column Map Definitions** window.

31. After the BOM and parameter columns are mapped, select **Save Defined Format** as in *Figure 17*.

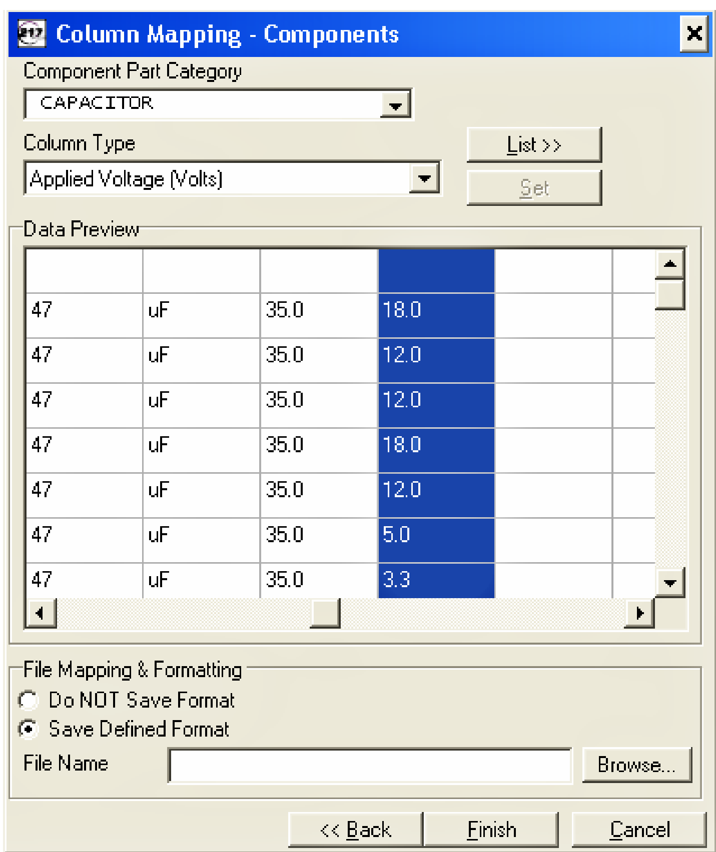


Figure 17. Selecting Save Defined Format

Click **Browse…** and select where the file is to be saved. A dialog box (*Figure 18*), will appear.

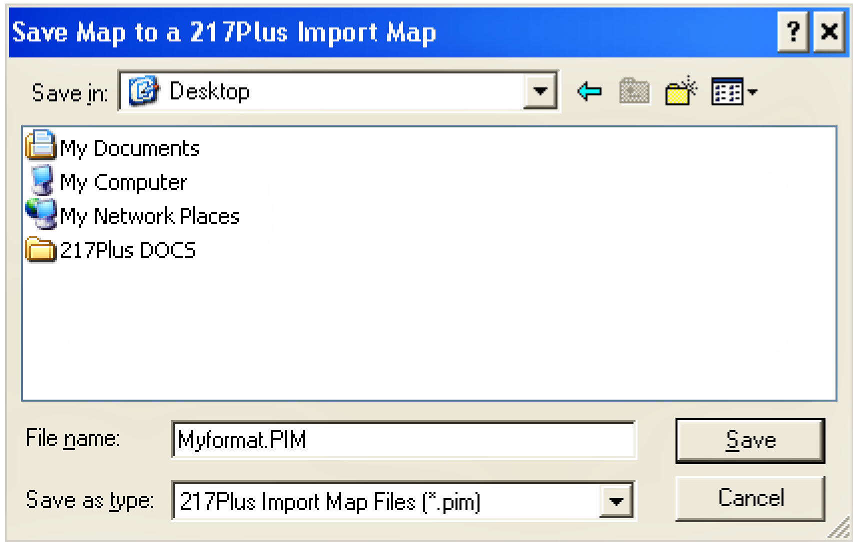


Figure 18. Naming the Custom Import File

Enter a **File name**. In this example, ”***Myformat”*** was entered as the file name. Note that the file will be saved as a “***217Plus Import Map File***”, and will be given the file extension “***.PIM***”.

32. Click **Save**, and the application will return to the screen of *Figure 17*.

    Click on **Finish** to finalize the new file creation. The file data import will then begin.

33. The Import function begins placing BOM data under the System Level.

    If the BOM contains multiple assemblies, or if multiple BOM files are being imported at the same time (See Step 23), when the import function encounters any assembly *after the first assembly*, a **Record Placement** prompt as in *Figure 19* will appear, requesting the user to select where they wish to have the ‘new’ assembly placed with respect to the System and other assemblies. The drop down list will show the System’s name (or ’new system’) and the names of all of the assemblies that have already been imported during the current Import session. This feature facilitates reconstruction of the BOM according to the BOM hierarchy of the system, its assemblies and sub-assemblies.

    Find the appropriate ‘Parent’ from the drop-down list, and **Select** it.

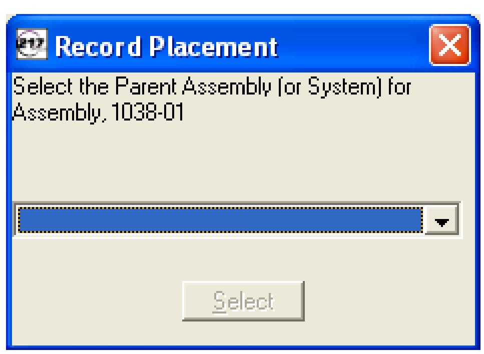


Figure 19. Record Placement

Note: The Import function only “knows” of assemblies as it encounters them in the import sequence. This means that if the ‘parent’ for an assembly has not yet been imported, it will not be on the list. In such a case, assign the assembly to the System level. The assembly can later be moved using the “***Copy***” and “**Paste**” features of 217Plus after importing has been completed,.

Note: If an “Import Error” is encountered, refer to the Import Error section at the end of this document (see **Appendix D: Import Errors**) for possible causes of the error.

34. When the file import completes, the 217Plus application will show the BOM structure in a graphical ‘tree’ format in the left-hand pane of the 217Plus screen, and the ‘**Item Properties**’ tabs will be in right-hand pane. **Click** on the first *component* (e.g. capacitor, resistor, etc.) listed in the graphical BOM structure.

    Then select the **Model Parameter** tab to view the model parameters associated with that component.

    *Although the user may have imported some or all of the desired model parameters, **217Plus will initially have the ‘default’ parameters applied. To apply the imported parameters, it is necessary to de-select the defaults.***

    After turning off the “default” selection(s), if any of the model or stress parameters were not imported, the data must now be entered manually in order to perform the Stress Analysis.

    For components such as resistors, semiconductors and ICs that support multiple Temperature Calculation methods, the desired method must be selected based upon the forms of data available. Refer to *Figure 20* and *Figure 21*.

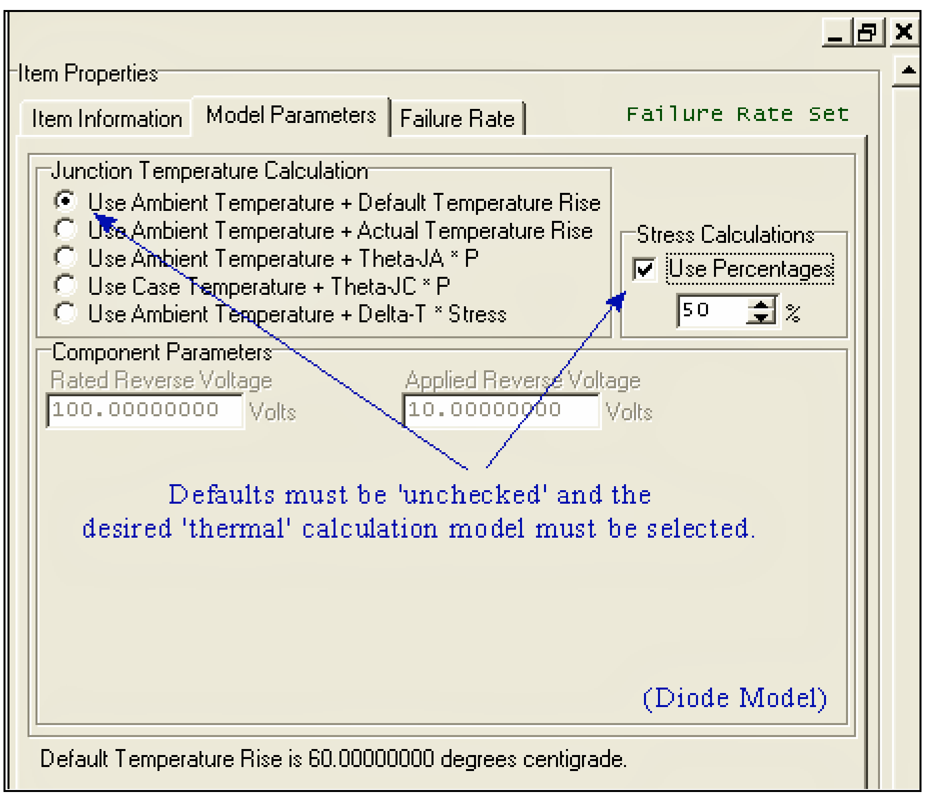


Figure 20. Defaults Applied Upon Import (Diode example)

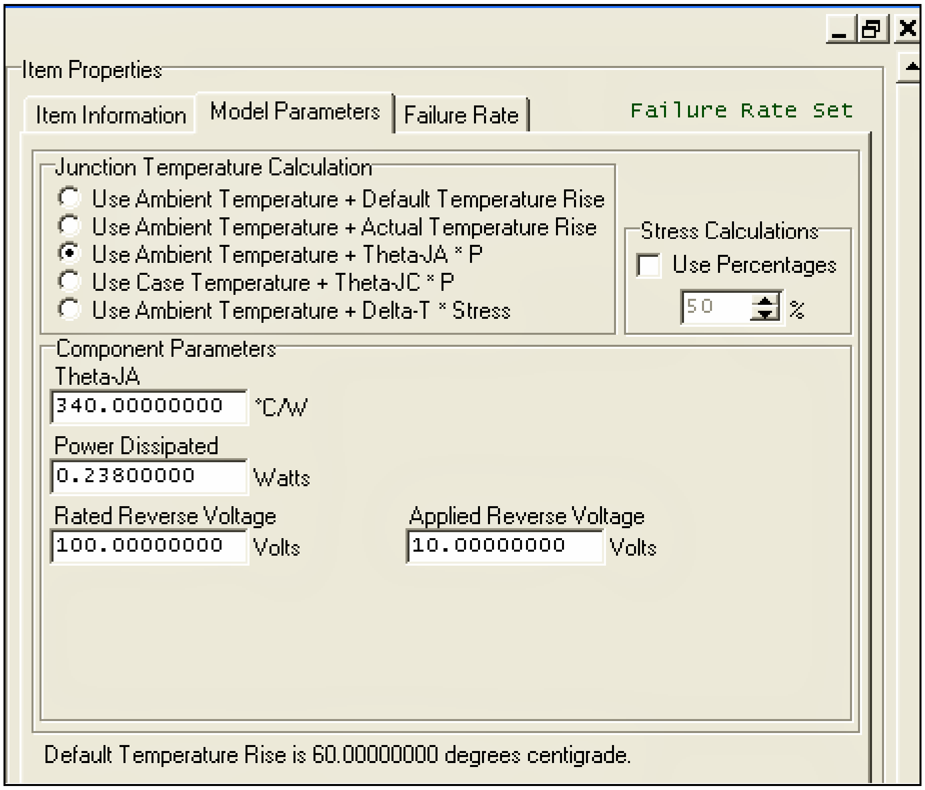


Figure 21. Same Component as in Figure 20 with Defaults Removed and Imported Parameters Applied

The user can manually add stress data for other 217Plus parts not yet supported by the Import function (connectors, inductors, relays, switches, transformers), or they may continue to use the defaults for such parts.

35. **'Other' Part Types** - For parts not modeled by 217Plus that were categorized as "Other', the user can select the Part Type from the built-in database of Part Type names. See *Figure 22* for an example.

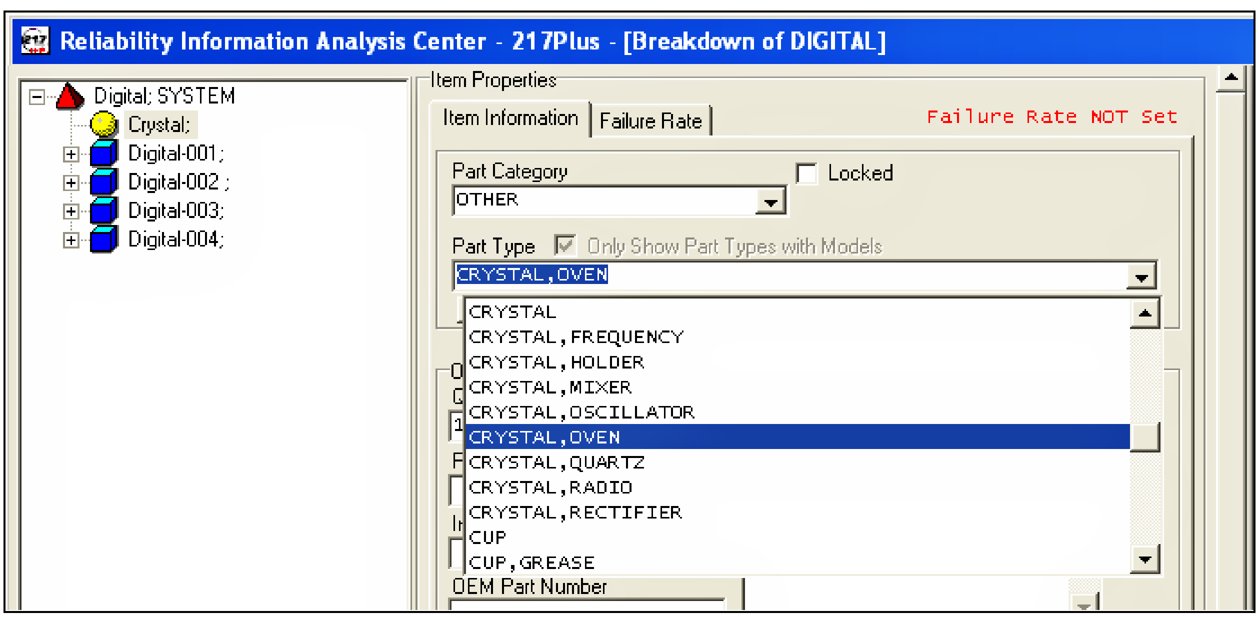


Figure 22. Selecting a Non-Modeled Part Type Name

On the Failure Rate tab, enter either a '***User Defined'*** failure rate (from field experience or a manufacturer) by checking the ***'User Defined'*** radio box selection and entering a **User Defined** failure rate value, or check the '**RIAC Data'** radio box, **Search** the built-in RIAC database for failure rates associated with the Part Type, and select a value from the part(s) that best match the design's part type. Data from the RIAC databases often have additional descriptors such as 'Environment' and 'Quality' that permit selection of parts that most accurately match the application.

Note: For **User Defined** parts, select **Source** and enter information that describes the source of the User Defined data. For RIAC Parts, its **Source** function displays the Source of the RIAC data.

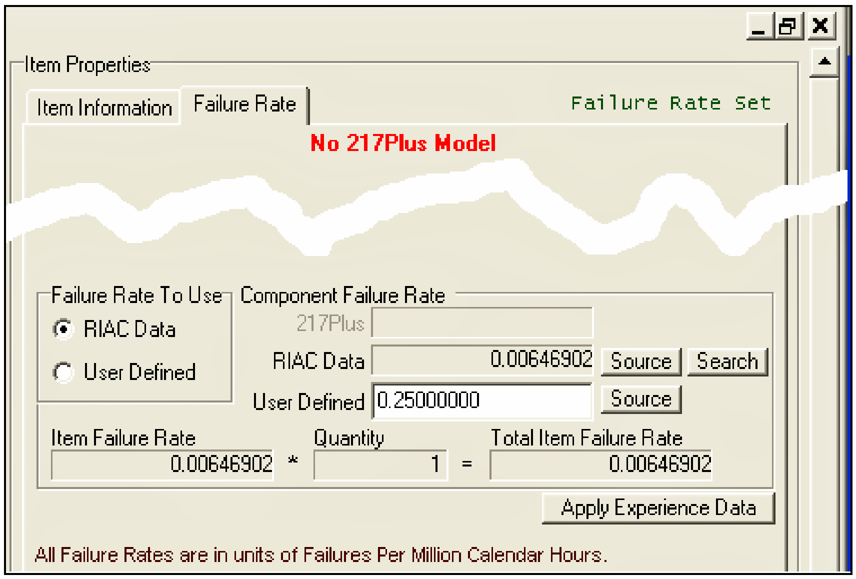


Figure 23. Selecting/Entering Failure Rate Values for 'Other' Parts

All User Defined failure rates, λ, must be expressed in terms of 10^6 **Calendar hours**. Reliability information for a purchased item/assembly is often provided in terms of an MTBF value ($MTBF_{MANUFACURER}$), and is usually expressed in expressed in operating hours.

Note: There is no simple method to precisely convert a failure rate from one prediction method to different method. The following provides *approximation* correction factors. Any parts so converted should be identified and recorded.

The MTBF data first must be converted to a failure rate ($\lambda_{MANUFACTURER}$)

$$\lambda_{MANUFACTURER} = 10^6/MTBF_{manufacturer}$$

If the failure rate was provided in term of FITs (Failures In Time, which is in units of 10^9 hours), the FIT value must be multiplied by 10^3 such that the result is in terms of failures per 10^6 hours

The failure rate then needs to be converted to a calendar hour failure rate ($\boldsymbol{\lambda_{CAL}}$), by multiplying the Operating Failure Rate by the Duty Cycle of the design being analyzed. Further, the item's reliability information may have been calculated assuming a temperature and/or environment that is different than the temperature/ environment of the intended product application. Refer to the *RIAC System Reliability Toolkit* topic 6.4.1.4, for guidance as to how to select the appropriate temperature and/or environment correction factor(s). Note that the since the factors in the reference are shown as *MTBF multipliers*; for failure rate, one must <u>divide</u> by the correction factor(s).

$$\lambda_{CAL} = \lambda_{MANUFACTURER} * \text{Duty Cycle}/(\text{Temperature Correction Factor} * \text{Environment Correction Factor})$$

In the User Defined "Source" field, the user should define the source of the data, the source data's assumptions (temperature and environment), and should identify how the data was converted to a calendar hour basis.

36. **Setting Global Parameters** - In the left pane of the 217Plus screen, select (click on) the system icon (the red pyramid). In the system's "**Item Properties**" pane, set the **Environment** and **Operational Profile** settings that best reflect the design's application (See *Figure 24*). 217Plus provides a wide selection of 'typical' environments and operating profiles. *However, it is recommended* that the user review the resulting parameters (**Operating Temperature**, **Dormant Temperature**, **Humidity**, **Vibration**, **Duty Cycle**, **Cycling Rate**, etc.) to ensure that they represent the conditions of the application. *If they do not, modify the numerical values as appropriate*.

    After selecting and/or modifying the parameters, select '**Trickle Down'**. This allows the system-common conditions to be applied to the 217Plus modeled components throughout the system.

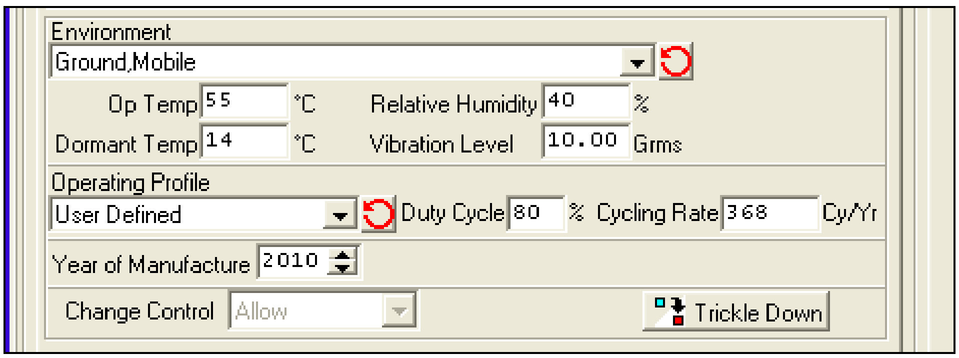


Figure 24. Global Parameters on the System "Item Properties" Pane

When **Trickle Down** completes, failure rates will be updated according to the global settings, along with the imported component parameters.

Caution: In some designs, the parameters (especially operating temperature), may be different from assembly to assembly. In such cases, the user may should now check each assembly, make the appropriate Environment adjustments for that assembly, and then apply Trickle Down from the assembly level.

If a change is made to a part in the system that may affect the system failure rate, the failure rate will need to be summarized again by clicking on the Σ **Summarize** button at the System level.

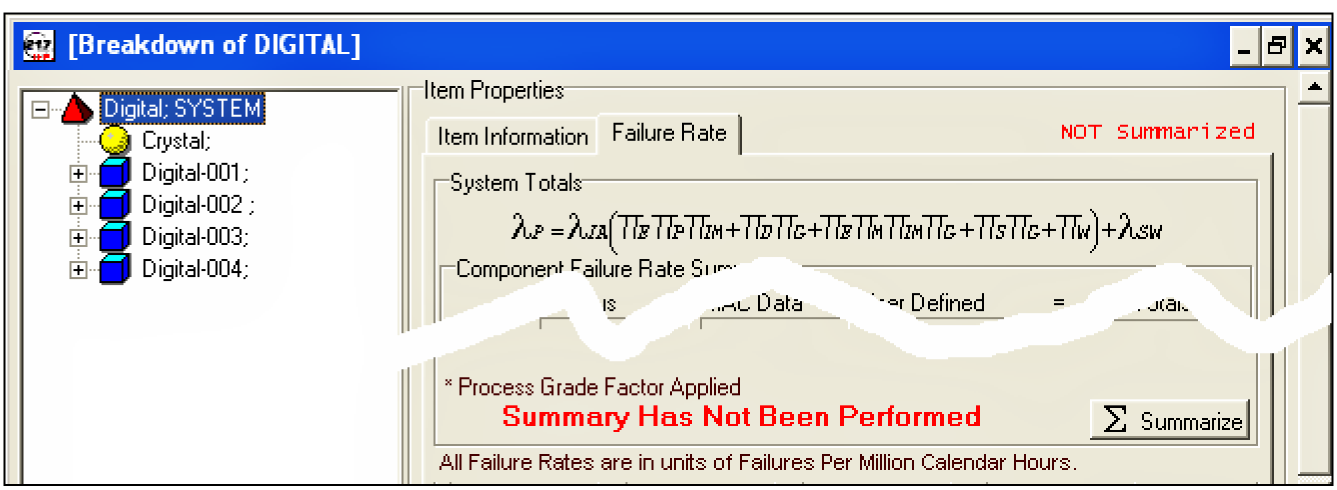


Figure 25. System Failure Rate Not Summarized

The user can view individual failure rates, the failure rate of assemblies, and of the system.

The Stress Analysis is now complete. Save the file.

Reports can be generated, or other functions performed, as indicated in the 217Plus Manual.

End of "Importing a BOM fo Stress Analysis"

Using a Pre-Defined Import File

(From Step 24) If an Import Mapping format was defined previously as in Step 31, check "**Use Exising Format**", then"**Browse…"** on the ***File Mapping & Formatting*** screen to navigate to where the mapping file was saved. **Click** on the file (the file will have the name that the user assigned, but with a **".PIM**" file extension). Select **Next>>**.

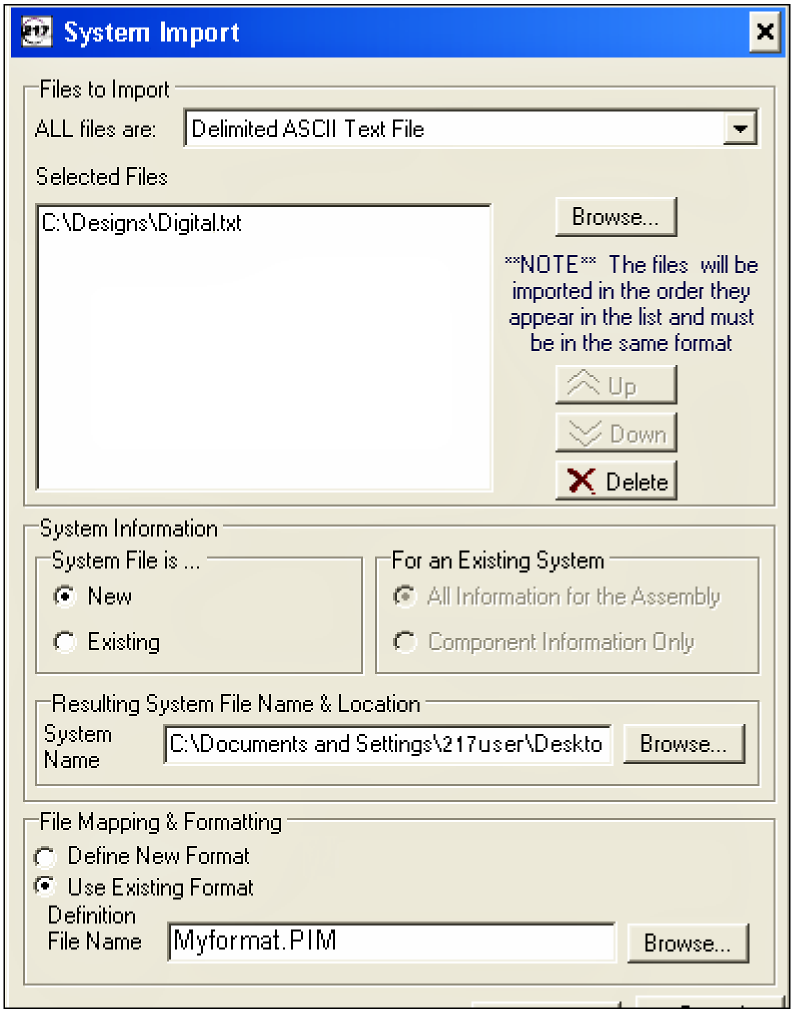


Figure 26: Selecting a Saved Import File Format

The **File Delineation** screen will open. The "**Delimiter"** character, the "**Text Qualifier"** character and the "**Begin a Row"** value must be selected (*these parameters are not saved in the custom Import File*).

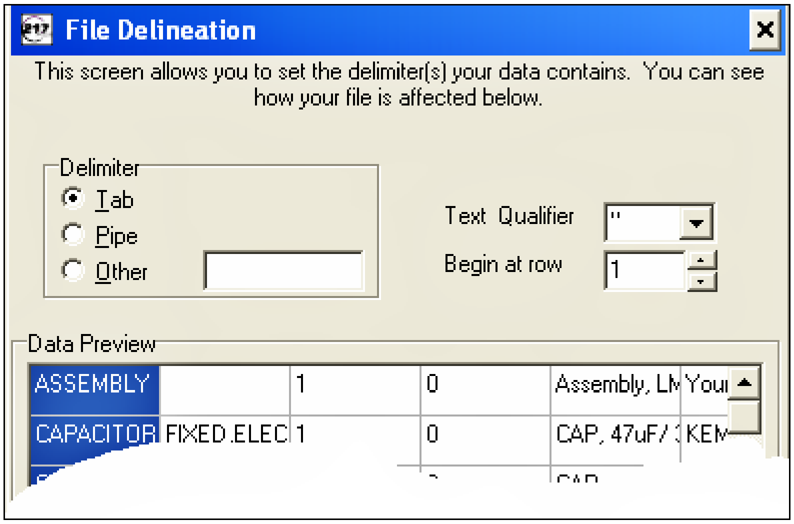


Figure 27. Selecting the Text File's Data Delineation Criteria

Select **Next>>**. The file will now begin to be imported according to the saved import format. Refer back to **Step 33** for instructions on how to complete the Import.

End of "Using PreDefined Format"

Appendix A: Developing a Complete Spreadsheet for Stress Analysis Import

Importing component model parameters related to electrical and thermal stress greatly reduces the manual entries required within the 217Plus application. However, importing the model parameters can only be accomplished at the same time that the BOM is imported. One can develop their own spreadsheet solution, or they can obtain QSI's ***217Plus_BOM_Tool-REV2.xls*,** which is pre-formatted to support the selection of proper 217Plus Part Categories, 217Plus Part Types, supports all of the necessary component parameter fields, and provides data columns in which the user can 'paste' the essential elements of their BOM (description, quantity, reference designators, manufacturer, etc.). The **217Plus_BOM_Tool-REV2.xls** also provides a sheet designed to support importing data to the 217Plus Component Library, and provides reference data as to the acceptable data range limits for the various component parameters. This spreadsheet, or an equivalent, could be expanded to accommodate the required model parameters.

For users' not yet familiar with the component model parameters used by 217Plus, please refer to *Table B-1* through *Table B-8*..

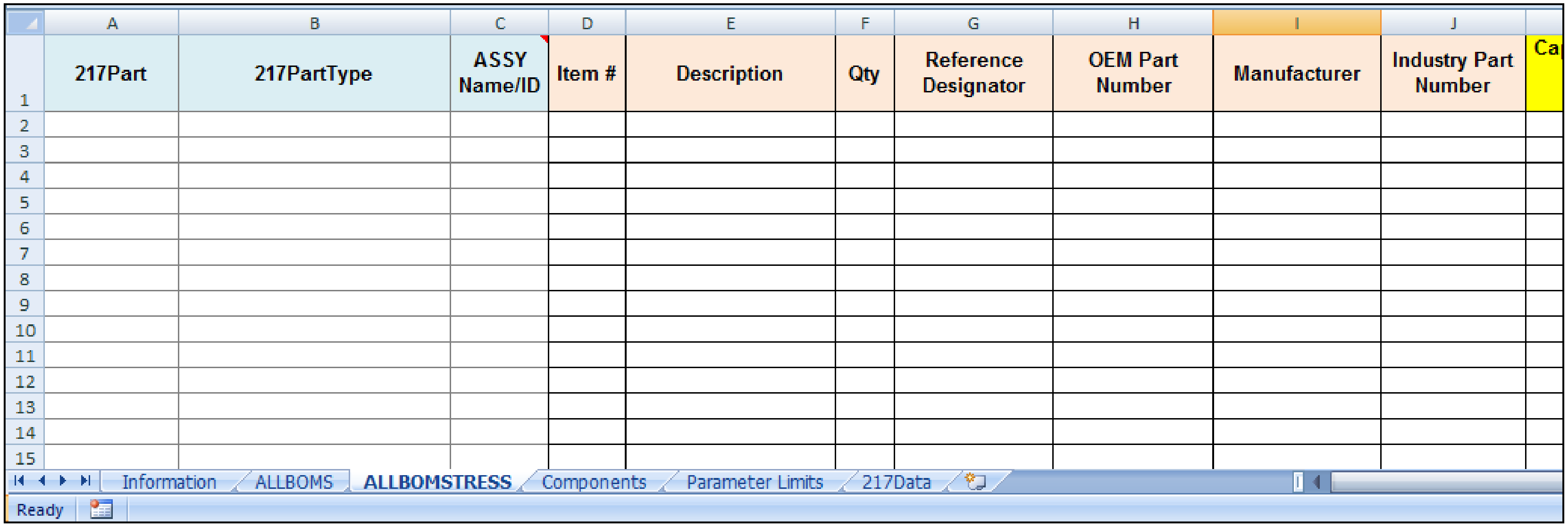
A review of the various model parameters shows that they can be reduced to fourteen (14) common data fields, as shown in *Table B-9*.

For more in-depth description of how the model parameters are used by 217Plus, refer to ***Appendix C– Component Stresses**,* starting on page 29.

The following model parameter *columns* are included in the ***217Plus_BOM_Tool-REV2.xls*** spreadsheet; they should be included in the user's spreadsheet as well if the user is not using ***217Plus_BOM_Tool-REV2.xls***:

Cap Value	(capacitor value)
Cap Multiplier	(capacitor multiplier characters (pF, nF, uF or F)
Voltage Rated	
Voltage Actual	
Power Rated	
Power Actual	(power dissipated)
ΘEA, ΘJA	
ΘEC, ΘJC	
Temp Rise	(temperature rise at the junction of an IC or semiconductor, at the body for other devices)
Temp Case	(Case temperature – at the body of an IC or semiconductor)
Current Rated	
Current Actual	
Delta Temp	(the junction temperature differential between no power dissipated & full power dissipated)
Herm.	(Hermetic package code: H = hermetic; N = non hermetic)

The result will be an expanded "BOM" spreadsheet similar to the one in the example of *Figure A-1*, which shows a modified ***217Plus_BOM_Tool-REV2.xls*** layout for BOM Import.

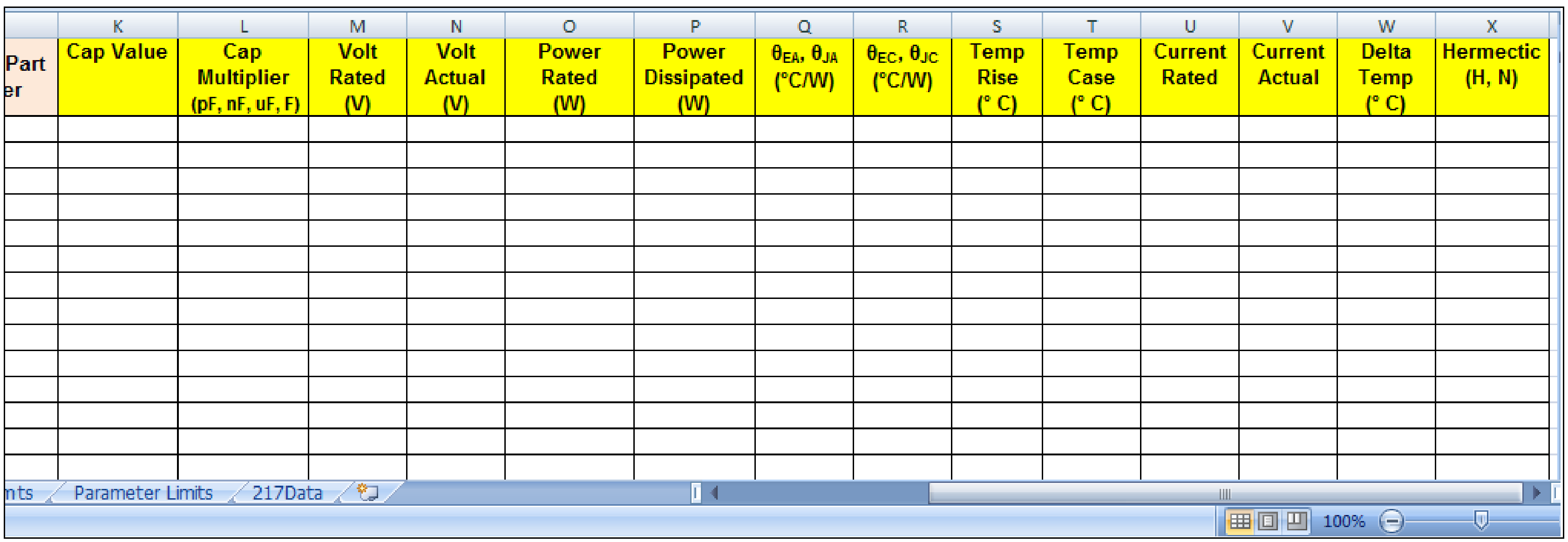


	A	B	C	D	E	F	G	H	I	J	
1	217Part	217PartType	ASSY Name/ID	Item #	Description	Qty	Reference Designator	OEM Part Number	Manufacturer	Industry Part Number	Ca
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											

Information | ALLBOMS | ALLBOMSTRESS | Components | Parameter Limits | 217Data

Ready

Figure A-1. Sample Portion of 217Plus_BOM_Tool-REV2.xls Spreadsheet, Accommodating Select BOM fields



	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
Part er	Cap Value	Cap Multiplier (pF, nF, uF, F)	Volt Rated (V)	Volt Actual (V)	Power Rated (W)	Power Dissipated (W)	θ_{EA}, θ_{JA} (°C/W)	θ_{EC}, θ_{JC} (°C/W)	Temp Rise (° C)	Temp Case (° C)	Current Rated	Current Actual	Delta Temp (° C)	Hermectic (H, N)

nts | Parameter Limits | 217Data

100%

Figure A-2. Portion of 217Plus_BOM_Tool-Rev2.xls Spreadsheet, Accommodating Component Parameters

Figure A-1 and *Figure A-2* illustrate the ALLBOMSTRESS sheet ***217Plus_BOM_Tool-REV2.xls,*** which is already modified to support a generic BOM data along with component parameters. (*NOTE: The actual ALLBOMSTRESS sheet provides all of the Part ID fields supported by the 217Plus software; the example shown in Figure A-1 is a reduced version showing the most typical fields*). Users may add/delete rearrange or rename columns as necessary to support their particular requirements. Regardless of which fields a user decides are necessary for his/her organization, it will be beneficial to adopt a **fixed format** for the spreadsheet that can then be used for *all* BOM imports. This suggestion is made because the **217Plus** capability to save (as in Step 31) and recall a custom Import format (as in **Using a Pre-Defined Import File**) can reduce the work-effort and help to ensure consistency, repeatability and accuracy.

Once the user has defined and formatted the workbook to meet their import requirements, it should be saved and used as their reference workbook for all future imports, along with their custom import mapping file. *Note that the new format and the mapping file can also be used in Parts Count analyses, except the user would not need to enter data into any of the model parameter columns).*

Adding "Common" Model Parameters.

A. After the BOM data is recorded (which for our example, would be in Columns "A" through "J"), use columns 'K through X" to fill-in the parameters that represent the 'fixed' (rated) values for a component as defined on the component specification sheet.

   For example, a capacitor's "Cap Value", "Cap Multiplier" and "Voltage Rated" are fixed by the component's specification sheet. This is also true for most of the other 'rated' parameters.

   Depending upon which calculation method(S) one decides to use to evaluate the thermal stress, not all of the rated values are necessary. Refer to ***Appendix B: Model Parameters for Component Types****,* beginning on page 24, to become familiar with the parameter required for each of the desired method(s).

B. Return to Step 3, on page 2

End of "Developing a Complete Spreadsheet for Stress Analysis Import"

Appendix B: Model Parameters for Component Types

The component models in 217Plus incorporate either electrical stress parameters or thermal stress parameters – or both – which are used to evaluate how these stresses affect the reliability of the component. In some instances, the device rating is also a factor in the component's reliability model.

217Plus provides the user with the option of using 'default' values for any or all of the stress parameters, or the user can import or enter the exact stress parameters when they desire a more "accurate" assessment of device reliability at the actual stress level.

The following Tables illustrate, by component type, the various combinations of electrical and/or thermal stress data supported by 217Plus, and define the data limits per each of the parameters.

Table B-1. Capacitor Model Parameters and Data Formats

Capacitor *Value* Options					
Option		Data Required	Format	Limits MIN	Limits MAX
1	**Default**	**None**			
2	**Capacitance** **Capacitance Multiplier**	**Numeric Value** **Value Multiplier**	Non-signed numeric Text	0.01 pF nF	500000 uF F

Capacitor *Electrical Stress* Options					
Option		Data Required	Format	Limits MIN	Limits MAX
1	**Default**	**None**			
2	**Voltage Stress**	**Working Voltage Rated** **Voltage Applied**	Non-signed numeric Non-signed numeric	0.01 0	50000 50000

Table B-2. Resistor Model Parameters and Data Formats

Resistor *Electrical Stress* Options					
Option		Data Required	Format	Limits MIN	Limits MAX
1	**Default**	**None**			
2	**Device Power Rating**	**Power Rated**	Non-signed numeric	0.01	300

Resistor *Thermal Calculation* Options					
Option		Data Required	Format	Limits MIN	Limits MAX
1	**Default**	**None**			
2	**Actual Temperature Rise**	**Device Temperature Rise above Ambient**	Non-signed numeric	0.00	400
3	**Temp Rise based on Power Dissipation & Θ_{EA}**	**Power Dissipation Actual** **Θ_{EA}**	Non-signed numeric Non-signed numeric	0.00 0.01	300 1000
4	**Temp Rise based on Power Dissipation, Θ_{EC} and Case Temperature**	**Power Dissipation Actual** **Θ_{EC}** **Case Temperature**	Non-signed numeric Non-signed numeric Numeric	0.00 0.01 -100	300 1000 200
5	**Temp Rise based on Power Dissipation, and Delta T**	**Power Dissipation Actual** **Delta T (Temp @ Max Pd – Temp @ Min Pd)**	Non-signed numeric Non-signed numeric	0.00 0.00	300 300

Table B-3. Diode Model Parameters and Data Formats

Diode *Electrical Stress* Options					
Option		Data Required	Format	Limits MIN	MAX
1	Default	None			
2	Voltage Stress	V_R (Reverse Voltage) Rated V_R (Reverse Voltage) Applied	Non-signed numeric numeric	0.01 -500	5000 5000

Diode *Thermal Calculation* Options					
	Option	Data Required	Format	Limits MIN	MAX
1	Default	None			
2	Actual Temperature Rise	Junction Temperature Rise above Ambient	Non-signed numeric	0	200
3	Temp Rise based on Power Dissipation & Θ_{EA}	Power Dissipation Actual Θ_{EA}	Non-signed numeric Non-signed numeric	0 0.01	500 1000
4	Temp Rise based on Power Dissipation, Θ_{EC} and Case Temperature	Power Dissipation Actual Θ_{EC} Case Temperature	Non-signed numeric Non-signed numeric Numeric	0 0.01 -100	500 1000 250
5	Temp Rise based on Power Dissipation and Delta T	I_f (Forward Current) Rated I_f (Forward Current) Actual Delta T (Temp @ Max Pd – Temp @ Min Pd)	Non-signed numeric Non-signed numeric Non-signed numeric	0.0001 0 0	5000 5000 300

Table B-4. Thyristor Model Parameters and Data Formats

Thyristor *Electrical Stress* Options					
Option		Data Required	Format	Limits MIN	MAX
1	Default	None			
2	Voltage Stress	V_R (Reverse Voltage) Rated V_R (Reverse Voltage) Applied	Non-signed numeric numeric	0.01 -500	2000 2000

Thyristor *Thermal Calculation* Options					
	Option	Data Required	Format	Limits MIN	MAX
1	Default	None			
2	Actual Temperature Rise	Junction Temperature Rise above Ambient	Non-signed numeric	0	200
3	Temp Rise based on Power Dissipation & Θ_{EA}	Power Dissipation Actual Θ_{EA}	Non-signed numeric Non-signed numeric	0 0.01	500 1000
4	Temp Rise based on Power Dissipation, Θ_{EC} and Case Temperature	Power Dissipation Actual Θ_{EC} Case Temperature	Non-signed numeric Non-signed numeric Numeric	0 0.01 -100	500 1000 250
5	Temp Rise based on Power Dissipation and Delta T	I_f (Forward Current) Rated I_f (Forward Current) Actual Delta T (Temp @ Max Pd – Temp @ Min Pd)	Non-signed numeric Non-signed numeric Non-signed numeric	0.0001 0 0	200 200 300

Table B-5. Bipolar Transistor Model Parameters and Data Formats

Bipolar Transistor *Electrical Stress* Options					
Option		Data Required	Format	Limits MIN	MAX
1	Default	None			
2	Voltage Stress	V_{CE} Rated V_{CE} Actual	Non-signed numeric numeric	0.01 -500	5000 5000

Bipolar Transistor *Thermal Calculation* Options					
	Option	Data Required	Format	Limits MIN	MAX
1	Default	None			
2	Actual Temperature Rise	Junction Temperature Rise above Ambient	Non-signed numeric	0	200
3	Temp Rise based on Power Dissipation & Θ_{EA}	Power Dissipation Actual Θ_{EA}	Non-signed numeric Non-signed numeric	0 0.01	500 1000
4	Temp Rise based on Power Dissipation, Θ_{EC} and Case Temperature	Power Dissipation Actual Θ_{EC} Case Temperature	Non-signed numeric Non-signed numeric Numeric	0 0.01 -100	500 1000 250
5	Temp Rise based on Power Dissipation and Delta T	I_C Rated I_C Actual Delta T (Temp @ Max Pd – Temp @ Min Pd)	Non-signed numeric Non-signed numeric Non-signed numeric	0.0001 0 0	200 200 300

Table B-6. MOSFET/FET Transistor Model Parameters and Data Formats

MOSFET/FET *Electrical Stress* Options					
Option		Data Required	Format	Limits MIN	MAX
1	Default	None			
2	Voltage Stress	V_{CE} Rated V_{CE} Actual	Non-signed numeric numeric	0.01 -500	5000 5000

MOSFET/FET *Thermal Calculation* Options					
	Option	Data Required	Format	Limits MIN	MAX
1	Default	None			
2	Actual Temperature Rise	Channel Temperature Rise above Ambient	Non-signed numeric	0	200
3	Temp Rise based on Power Dissipation & Θ_{EA}	Power Dissipation Actual Θ_{EA}	Non-signed numeric Non-signed numeric	0 0.01	500 1000
4	Temp Rise based on Power Dissipation, Θ_{EC} and Case Temperature	Power Dissipation Actual Θ_{EC} Case Temperature	Non-signed numeric Non-signed numeric Numeric	0 0.01 -100	500 1000 250
5	Temp Rise based on Power Dissipation and Delta T	I_C Rated I_C Actual Delta T (Temp @ Max Pd – Temp @ Min Pd)	Non-signed numeric Non-signed numeric Non-signed numeric	0.0001 0 0	200 200 300

Table B-7. Integrated Circuit Model Parameters and Data Formats

Integrated Circuit *Device* Options					
Option		Data Required	Format	Limits MIN	Limits MAX
1	**Default**	**None**			
2	**Package Integrity**	**Hermetic /Non-Hermetic**	Text or Numeric	N 0	H 1
Note: To denote whether the package is Hermetic or Not hermetic, 217Plus will accept either the text designations (**H** for hermetic, **N** for Non hermetic, or the numeric designation (**1** = Hermetic, **0** = Non-hermetic). If left blank, the package will be assumed to be non-hermetic)					

Integrated Circuit *Thermal Calculation* Options					
	Option	Data Required	Format	Limits MIN	Limits MAX
1	**Default**	**None**			
2	**Actual Temperature Rise**	**Junction Temperature Rise above Ambient**	Non-signed numeric	0	150
3	**Temp Rise based on Power Dissipation & Θ_{EA}**	**Power Dissipation Actual** **Θ_{EA}**	Non-signed numeric Non-signed numeric	0 0.01	5 1000
4	**Temp Rise based on Power Dissipation, Θ_{EC} and Case Temperature**	**Power Dissipation Actual** **Θ_{EC}** **Case Temperature**	Non-signed numeric Non-signed numeric Numeric	0 0.01 -100	5 1000 250

Table B-8. Devices Not Yet Supported for Import into 217Plus, but are Supported via Manual Entry

Relay / Switch / Connector / Inductor and Transformer Device *Thermal* Options					
Option		Data Required	Format	Limits MIN	Limits MAX
1	**Default**	**None**			
2	**Actual Temperature Rise**	**Device Temperature Rise**	Non-signed numeric	0	200

A review of the data in preceding tables will show that many of the component types use the same forms of data parameters when evaluating electrical and/or thermal stresses. As a result, the number of parameter fields to be imported can be greatly reduced by combining data fields that are of a similar nature.

Table B-9 is a matrix of the 217Plus modeled components vs. the component parameters,, which shows that the common forms of data can be reduced to a maximum of fourteen (14) fields.

Table B-9. Model Parameters per Component, per Stress Calculation Method (Stress Calculation Method ‘Code’ Shown in the Cell)

Model Parameters / Component	Capacitor Value	Capacitor Multiplier (pF,nF,uF,F)	Voltage Rated (V)	Voltage Actual (V)	Power Rated (W)	Power Actual (W)	Θ_{EA} Θ_{JA} (°C/W)	Θ_{EC} Θ_{JC} (°C/W)	Temp Rise (°C)	Temp Case (°C)	Current Rated (A)	Current Actual (A)	Delta Temp (°C)	Herm. (H, N)
Capacitor	X	X	X	X										
Resistor					X	X	X	X	X	X			X	
Diode,			X	X		X	X	X	X	X	X	X	X	
Thyristor			X	X		X	X	X	X	X	X	X	X	
Bipolar Transistor			X	X		X	X	X	X	X	X	X	X	
MOSFET Transistor						X	X	X	X	X	X	X	X	
IC						X	X	X	X	X				X
Relay (future)									X					
Connector (future)									X					
Switch (future)									X					
Inductor (future)									X					
Transformer (future)									X					

QSI’s ***217Plus-BOM-Tool-Rev2.xls*** is already laid-out in this format, and therefore can fully support importing of all of the 217Plus component parameters that could be used in a Stress analysis.

End of “Model Parameters per Component Type”

Appendix C– Component Stresses

A Stress Analysis of a component uses electrical and/or thermal stress parameters associated with that component to determine how the stresses will accelerate the failure rate of parts in a given design. The RIAC **217Plus** software supports importing these parameters for most of the 217lus modeled component types. To perform a stress analysis, the user should be acquainted with the stress parameters that can be applied by 217Plus for each of the various components. The units of measure and definitions used in this discussion(and by 217Plus) are:

Temperature:	Celsius (°C)
Voltage:	Volts
Power:	Watts
Current:	Amperes
Capacitance:	pF, nF, uF or F (pico-Farads, nano-Farads, micro-farads and Farads, respectively)
Thermal Resistance:	°C/Watt (or °K/Watt)

Definitions

Thermal resistance: A temperature difference per unit of heat energy that develops between materials when heat flows through the material(s). The thermal resistances of a device and its interfacial materials determines how effectively the device can transfer its self-generated heat to external devices (such as a heat-sink) or to the environment. The traditional parameters are represented by the symbol theta (θ), along with subscripts that define how the parameters are associated with a part/material. For example, θ_{JA} = 'junction-to-ambient' thermal resistance, while θ_{JC} = ''junction-to-case' thermal resistance. *Some device manufacturers have begun adopting the JEDEC (Joint Electron Device Engineering Council) methods for determining overall thermal resistances for some devices, which are usually depicted by the symbol ψ (PSI). When available, the appropriate ψ values should be used in place of the ϑ values.*

Temperature Rise: An increase in device temperature above ambient while the device is in operation. For ICs and semiconductors, the temperature rise at the device junction must be used. For most other devices, temperature rise is measured at the 'hottest' portion of the device's body or element.

Delta T (or ΔT) The difference between the temperature of a device when full power is dissipated minus the temperature of the device when no power is dissipated.

Ambient: *For reliability purposes*, the ambient temperature should be considered to be the temperature of the circuitry environment while the design is in operation, while packaged in the product, and with the product operating at the specified 'external ambient' temperature. This is necessary due to the fact that a circuit operating within the product packaging almost invariably will cause the ambient temperature inside the package to be greater than that of the external environment. A reliability analysis that fails to account for this temperature rise will result in a prediction that will be overly optimistic, or may fail to indicate when a part has exceeded its rating (overstressed).

Derating: *When referred to on a device specification sheet*, derating refers to a form of diminished performance capability, usually as a function of temperature or some other parameter such as frequency, time, current, etc. *Figure C-1* is typical of a manufacturer's use of the term 'derating', which illustrates the relative power dissipation capability vs. temperature for a commercial-grade film resistor.

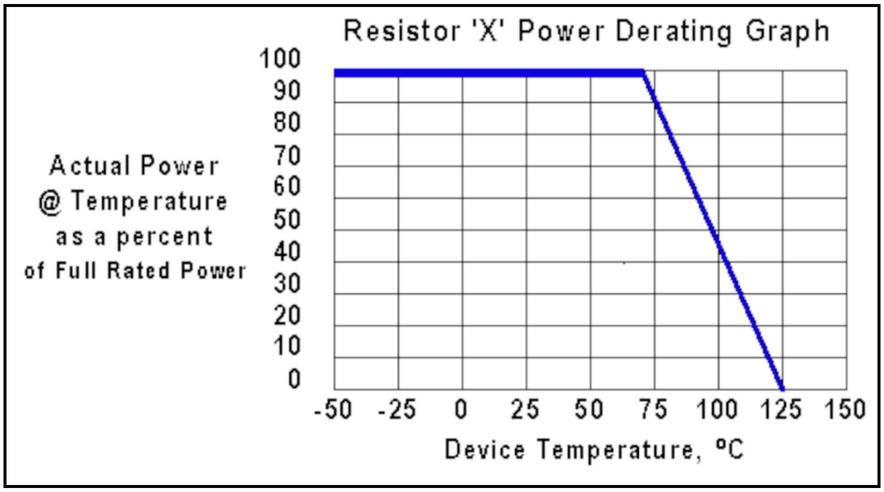


Figure C-1 Typical 'Commercial' Film Resistor Power Dissipation Derating

As indicated in *Figure C-1*, a resistor of this type that is "rated" for 1 watt begins to derate at 70°C, and could dissipate only about 0.45W at a device temperature of 100°C. The *temperature specification* for the device may be stated as being from -50 to 125C. While technically correct, the 'specification' may give the novice designer a perception that all of the device's rated parameters apply throughout the temperature range.

Stress Derating: Refers to a *Design for Reliability (DFR) practice* of ***limiting the stress*** placed on a component to less than 'x'% of the device rating, where 'x' < 100%. Since electrical and thermal stresses accelerate device failure-rates, limiting stresses to values below the device rating enhances the reliability of the device. A *reliability derating* of 60% for the resistor of the previous figure would appear as indicated by the dashed line in *Figure C- 2.*

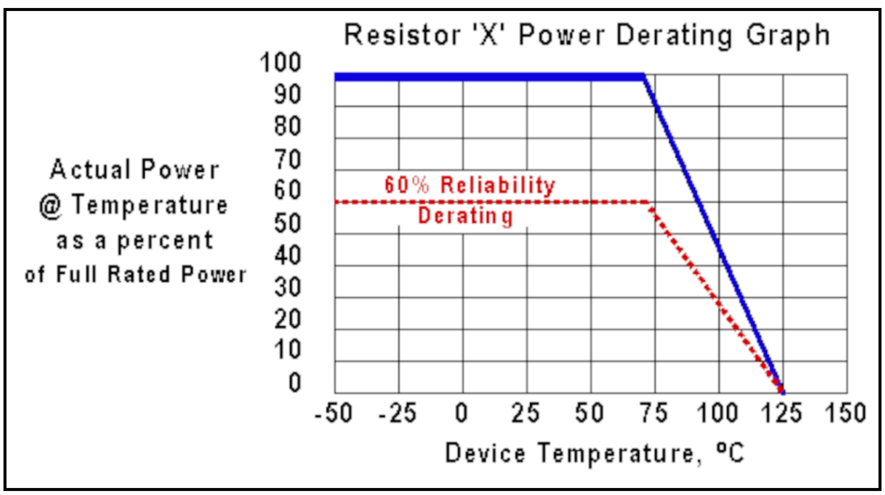


Figure C- 2 60% Stress Derating of a 'Commercial' Film Resistor's Power Dissipation

In *Figure C- 2* above, a 60% stress derating for the 1-Watt resistor of the previous example limits dissipation to about 0.27W at 100°C.

This is an example only. Other derating methods, such as the NAVSEA SD-18 document, may be more conservative and may derate multiple parameters simultaneously, depending upon the part-type. Several other standards exist (e.g. EEE-INST-002) providing guidance for stress derating in certain applications. The RIAC ***System Reliability Toolkit*** Topic 5.1.2 (available at www.theriac.org) provides guidance in setting up derating rules based upon a criticality scoring method.

Electrical Stress

The electrical stress deemed to have the greatest impact on device reliability is dependent upon the device type. Table C-1 identifies the electrical stresses that are the *basis* for the electrical stress factors in the **217Plus** component failure rate models (additional coefficients or exponents may apply, depending upon the component type).

Table C-1. Electrical Stress Ratios Used within the 217Plus Device Model Formulas

Device	Basic Stress Ratio
Resistors	**Power** dissipated) / (**Power** rated)
Capacitors	(**Voltage** applied *including ripple*) / (**Voltage** rated)
Bipolar Transistors	(**Vce** Applied) / (**Vce** Rated)
Diodes	(**Vr** Applied) / (**Vr** Rated)
Thyristors	(**Vr** Applied) / (**Vr** Rated)

Thermal Stress

For many electronic parts, device temperature is considered to be an important stress factor affecting device reliability.

Resistors, Inductors, Transformers – For these devices, the '***hot spot'*** is the temperature of interest. For large devices, the construction of the device and the design of the circuit board can cause non-uniform thermal rise on the device body. The hot-spot can be directly measured. For small, low power surface-mount resistors and inductors, a uniform temperature rise can often be assumed.

Other Non-Semiconductor Devices – Devices such as connectors, relays and switches can often use the **217Plus** 'default' temperature rise values as good approximations. An exception may be devices that pass high currents with respect to the current rating, or where multiple medium current conductors are concentrated within a few adjacent or nearby pins. In these cases, worst case conditions should be evaluated; temperature measurements are preferred over calculated methods, as the circuit board layout, product packaging and the cooling regime implemented will affect the actual temperatures .

Semiconductors – The temperature of primary importance to the reliability of semiconductors is the ***device junction*** temperature. Since direct measurement of the junction temperature cannot be performed on packaged devices, its temperature can be estimated based upon known attributes of the device, its package, power dissipation and/or external temperature measurements. The junction/element temperature of a component can be calculated in several ways, depending upon what data is available, and which method is most applicable to a given device.

The **217Plus** models support up to five (depending upon the part type) methods to calculate the device's junction or element temperature. They are:

A **Temperature Rise Default (T_R') + Ambient Temperature (T_A)**

This estimates a junction/element temperature based on the circuit ambient temperature, plus a *default* temperature rise assigned to the component by **217Plus**. The default values are generally conservative and are most useful in a *Parts Count* reliability prediction.

B **Temperature Rise (T_R) + Ambient temperature (T_A)**

This method is similar to A, except that actual temperature rise values are substituted in place of default values. The rise can be estimated via calculations pertinent to the device. In other instances, the device specification may provide a graph of temperature rise vs. a set of operating conditions, or it may provide a power dissipation formula particular to the specific device and application.

C **Junction-to-Ambient Thermal Resistance (θ_{JA}) * Power Dissipated (P) + Ambient Temperature (T_A)**

This method assumes that heat is dissipated by convection to the ambient environment, and uses the formula $\mathbf{T_J = P^* \, \theta_{JA} + Ta}$ to determine the junction temperature. It can also be used to estimate the temperature of a resistive element if $\boldsymbol{\theta_{EA}}$ is known. This method is frequently expressed on IC/semiconductor device data sheets and can often be applied with reasonable results (If available, substitute ψ_{JA} in place of θ_{JA} for a better estimation of the junction temperature).

D **Junction-to-Case Thermal Resistance (θ_{JC}) * Power Dissipated (P) + Case Temperature (T_C)**

With this approach, the case temperature is measured while the device is in operation, *and with the circuit ambient temperature at the temperature to be used in the reliability analysis*. The method is well suited for devices that depend upon a heat-sink or circuit board for heat dissipation. Since in-situ measurements are performed, the method has the potential for smaller 'unknown' factors than the other methods.

One drawback of the method is that, *if the user desires to change the circuit ambient conditions, the case temperatures must be re-measured under the new conditions*.

For some devices, $\boldsymbol{\theta_{JC}}$ may be a very low value. With these same devices, other thermal resistances (heat-sink pad, compound, etc.) have thermal resistances that can become significant fractions of the total thermal resistance. In these instances, the $\boldsymbol{\theta_{JC}}$ value on the device specification *should be adjusted to account for additional thermal resistances and variances*.

E **Temperature Delta (ΔT) * Stress (S) + Ambient Temperature (T_A)**

This method assumes that there is a linearly proportional relationship between electrical stress and the device temperature, as the Temperature Delta is defined as the difference between the **temperature at full power dissipation** and the **temperature at 'zero power' dissipation**. This may be a fair approximation for some devices, but may not be practical in all applications. Devices that exhibit power derating vs. temperature have power dissipation values that are temperature dependant, which means that "full power dissipation" is at a temperature that can be significantly lesser than the maximum device temperature of the device (in fact, a good number of discrete parts exhibit maximum power dissipation a 25C). Other problematic examples are:

- ***MOSFET/FET*** – This 217Plus model assumes that Drain-Source current is the stress parameter. In higher speed switching applications, MOSFET power dissipation is often a function of gate capacitance and switching frequency. As a result, this approach may not always be appropriate for high frequency MOSFETs, although it can often work well when a MOSFET is used as a DC power switch, where the effect of gate capacitance on power dissipation is minimized.

- ***Zener Diode*** – Power dissipation for this device is a function of the Zener voltage and the applied Zener current, neither of which are used as stress factors in the 217Plus component model.

Method A is most useful for Parts Count analysis. The 'default' temperature rises are usually greater than the temperature rises seen in actual designs (from the author's experience in evaluating hundreds of designs) and will, therefore, usually yield a conservative failure rate.

Methods B through D are usually preferable for stress analysis.

Method E can be useful for devices that are known to be operating in the non-derated portion of their temperature performance chart, and where the device stresses are known to approximate a linearly proportional relationship to power dissipation. However, the examples mentioned above illustrate why Method E must be used with caution.

The Tables in ***Appendix B: Model Parameters for Component Types*** beginning on page 24 identify part parameters that can be imported or manually entered into 217Plus in order to perform a part stress analysis. The allowable values and data limits for each parameter are also shown to help prevent errors.

End of "Component Stresses"

Appendix D: Import Errors

During the System Import process, 217Plus may indicate an Import Error. All Import Errors seen to date are the result of BOM or Model Parameter data fields that are missing, misidentified, or contain invalid data. The common types of Import Errors that have been observed include.

Missing Part Category or Missing Part Type, or Invalid Name Data

The **Part Type** and **Part Category** are two separate fields that define a part. Together, they are used by 217Plus to identify the reliability model and parameters that need to be applied to each part. If either field is missing, or if the data in these field does not conform with the 217Plus defined names for Part Categories and Part Types, the Import will fail, since 217Plus cannot assign a model if it cannot properly identify the part.

Using a pre-formatted workbook, such as QSI's ***217lus_BOM_Tool-REV2.xls*** which contains only the proper names and formats, will help prevent naming errors.

Invalid Data Types and Limits

Data fields such as Quantity and the Model Parameter settings must be of the appropriate data type, and must adhere to the acceptable limits, as indicated in *Table B-1* through *Table B-7*

A few users have attempted to mix numeric and text (such as "50V" for a voltage) in fields that only support numeric data, while others have entered incorrect text formats, such as "uf" for a Capacitor multiplier (uF would be the correct setting in this instance).

Improper Import Settings

A BOM text file generated by an external application separates data fields through the use of **Delimiter** characters, such as a TAB, Pipe(|), Comma, etc. he application may also enclose text strings with **Text Qualifier** characters, such as a quotation mark, such that characters in the string will not be misinterpreted. For example, the 217Plus CAPACITOR part type may appear in the text file as "CAPACITOR", which is not a valid 217Plus name because of the quotation marks. Therefore, the (") characters need to be stripped out of the file.

The **File Delineation** screen allows the user to identify which character was used as a Delimiter and which character (if any) is a Qualifiers in a text file. 217Plus will parse and filter the data according to these settings.

Comma Separated Value (CSV) Files

Some BOM fields (usually Description, Reference Designators, and sometimes Part Numbers) may contain commas to separate information within a single data field. Using a comma-delimited file format should be avoided, as it could cause data to be incorrectly parsed (separated into fields).

Incorrect Model Parameter Assignments

Incorrect model parameter assignments (selecting the wrong BOM column to map to the model parameter) can cause an Import Error if, by chance, the incorrectly mapped data does not match the data type or data limits of the mapped parameter. *Worse, though, is an incorrect mapping that is not seen as 'invalid'. Such an error may go unnoticed, and will likely cause the part to have an incorrect failure rate assigned to it.*

Import Errors can be avoided through the use of the ***217Plus_BOM_Tool-REV2.xls****, which can* ensure that BOMs will be of a fixed and consistent formats, and by following the **217Plus Application Notes 1, 2 and 3,** as applicable.

End of "Import Errors"

Appendix E: Known ‘Bugs’ in 217Plus Version 2.0.3.2x

All commercial software programs have bugs to some extent. With 217Plus, every effort has been made to find and fix major bugs as expeditiously as possible. The following lists the known bugs in the 217Plus Version 2.0.3.2x software. Fortunately, there are workarounds for each, as long as the user is aware of them.

A) Losing Data while Moving Assemblies within a Hierarchy (*fixed in version 2.0.25 and higher*)

Problem: The 217Plus interface was meant to allow assemblies to be moved using “drag-and- drop” or “cut-and-paste”. However, it has been observed that moving assemblies in this manner can *sometimes* cause component data for that assembly to ‘disappear’ or be corrupted (versions prior to 2.0.3.25).

Solution/Workaround Steps:

1. Always save the ‘system file’ before moving any data. This will allow data to be recovered from the original file should it become lost in the working file. (Whenever a file is saved after any major change, **save it under a revised file name** ; this will prevent original data from being overwritten).
2. After saving the file, instead of moving the assembly, use **Copy** and **Paste** of the assembly**,** and then check the integrity of the pasted assembly (all components). Once the pasted assembly has been verified to be intact, **Delete** the original assembly.
3. **Save the new system file** using a revised name.

B) Updating the Failure Rate of an ‘Other’ Part Does Not Flag 217Plus That a New Summarization is Required

Problem: When revising a user defined failure rate value of an “Other” part, 217Plus is unaware of the value change. It will not prompt the user to perform a new summary. The new value will not be reflected in the system failure rate.

Solution:

1. After making the value adjustment, change the item’s “Qty” setting, and then change it back to its original value. The system will now recognize that an update was made, and will notify the user that the failure rate has not been summarized.
2. Click on the Σ **Summarize** button

C) Changing an Assembly’s Quantity to a Value Other than “1” May Report the Wrong Failure Rate on a Tree Report, but Will Display Correctly on the Screen

Problem: If the Quantity of an assembly is changed in value to anything other than “1”, the correct failure rate is shown on the screen, but a Tree Report ***may*** report the multiple assembly failure rate as being the square of the Quantity times the failure rate. For example, if the Quantity was changed to “2”, the Tree Report total failure rate for that assembly may be calculated as **4x** the failure rate of the single assembly). *Note that the rolled up System Failure Rate will be correct*.

Solution 1:

- Regenerate the Tree Report (This sometimes corrects the miscalculation)

Solution 2:

- If Solution 1 fails, save the file under a revised file name, close the file, and then open it again. Generate the Tree Report. To date, this has always cleared the problem.

As a precaution, always check the Tree Report failure rate values of assemblies if the system has any assembly where the Quantity is greater than 1.

D) A PDF of an Assembly Report May Have Report Header Data in the Wrong Location on the Report

Problem: The present PDF generator used by 217Plus may cause an Assembly report to have some header data appear midway down a report page.

Solution 1:

- Use a different report type, such a Tree Report

Solution 2:

- Output the report to a different file format, such as .doc, .csv or .tsv

  Note: ".csv" refers to a "Comma Separated Values" format, while ".tsv" refers to a 'Tab Separated Values format. Both .cvs and .tsv files are forms of text files that can be imported into a Word or Excel application.

E) A PDF of a Tree Report May Shift Some Failure Rate Data into the Page Margins

Problem: Due to a large number of characters in a component description and/or reference designator fields, the length of the text data string when combined with format "shifting" due to the indented system hierarchy, may cause data to be "too wide" for the normal print area, resulting in a misalignment of data in the Failure Rate column.

Solution 1:

- Use a different report type such as an Assembly Detail Report, or,

Solution 2:

- Output the report into a different format (.doc, .csv, .tsv)