

# FrameMaker Template for *www.designers-guide.org* Submissions

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This document is a FrameMaker template for documents submitted for publishing on [www.designers-guide.org](http://www.designers-guide.org). This template not only serves as a starting point, but it also contains important information about how the documents should be written as well as helpful information on how to use FrameMaker. This template was created with version 7.1 of FrameMaker.

*Last updated on October 16, 2009. You can find the most recent version at [www.designers-guide.org](http://www.designers-guide.org). Contact the author via e-mail at [ken@designers-guide.com](mailto:ken@designers-guide.com).*

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## 1 Guidelines and Suggestions

*The Designer's Guide* website is dedicated to helping analog, RF, and mixed-signal design engineers, particularly in the area of simulation and modeling. Any submissions in these areas will be considered for publication. However, the focus is on giving practical and non-obvious advice to designers.

To increase the chance of publication, a submission should be well-written. Thus it should be clear, with a simple and direct presentation style. It should be free of grammatical and spelling errors. It should offer something of substantial practical value to practicing designers. In addition, the material presented should neither trivial nor widely known.

One should first present general principles before diving into specifics. This is particularly important for anything where the specifics might go out of date. Do not just give a recipe of how to do something, explain why. Doing so makes it more likely that the readers will be able use the ideas presented in your paper even if their situation does not exactly fit what you anticipated. Be liberal with your use of examples, and if appropriate, submit them as well for inclusion with your paper.

Finally, commercial products can be mentioned when it serves to enhance the material, but you must strive to be even handed and stop short of promoting products.

### 1.1 Target Audience

The target audience consists primarily analog, RF and mixed-signal circuit designers.

### 1.2 Updates

Papers should not be published on [www.designers-guide.org](http://www.designers-guide.org) until they are complete. Thus, they should self contained, reviewed for errors, and the authors should be very confident in their accuracy. However, one of the benefits of publishing on the web is that documents can be easily updated. If you make corrections or improvements to a paper that you had previously submitted successfully, please resubmit it with the updates.

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## 2 Use of This Template

We are trying to promote a common look to the documents published on [www.designers-guide.org](http://www.designers-guide.org), so you should try to use the paragraph and font styles that are available with this template without modification. You can add your own styles or overrides if necessary to do things we did not anticipate, but please keep them to a minimum.

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## 3 The First Page

The title is entered first, try to keep it short. The headers on the subsequent pages are keyed to the *Title* paragraph styles, so they should not be used anywhere else. Do not place carriage returns directly in the title. Instead, to manually control the line breaking

in the title, insert *shift returns*. In other words, hold down the shift key while pressing the carriage return (or enter) key.

The title is followed by the author or author list. With multiple authors, place each on its own line. If desired, you can give their affiliations at the bottom of the page.

Next is the version number and date. Start with a version number of one, and simply increment it by one each time the document changes is a meaningful way. Do not increment the version number if you correct minor errors (spelling, grammar, etc.), but do increment it if you are either adding or changing the actual content. Change the date whenever you increment the version number.

Next up is the summary. Use it to briefly describe the contents of the paper. In particular, describe what the reader can expect to gain by reading it. Try to keep it short, a few paragraphs at the most.

At the bottom of the first page is the author and document information and the license agreement. In this section, do not change the “Last updated” sentence. It contains a variable that is automatically updated whenever a change is made to the document. This date is different from the date next to the version number if any minor changes have been made to the document. Replace the E-mail address with your own, and add any comments you feel are appropriate about your affiliation or the publishing history of this paper. Do not modify the licensing agreement, it must be the same for all papers on the Designer’s Guide site.

### 3.1 Copyright Notice

Replace my name with yours in the copyright notice. To do so, change the *Copyright Owner* variable using *Special → Variable*. Select *Copyright Owner* and click on *Edit Definition*, change my name to yours, and then click on *Change, Done*, and *Done*.

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## 4 Paragraphs

Choose section and subsection titles so that they fit on one line. In addition, they must fit without conflicting with the paper title in the header at the top of the page.

Paragraphs are all given short unique abbreviations as a prefix in to their names. This makes easy to select them using only the keyboard. To do so, type the F9 key, then type the prefix and then type return. Doing so will tag the current paragraph with the desired tag. For example,

F9bo.  
|

would convert a paragraph to the *bo Body* style.

The template provides a variety of paragraph styles to choose from. Use *h1 Heading1* to introduce new major sections, such as this section on paragraphs. *h1n Heading1 NoNum* is used for sections at the end that are not numbered, like the sections for references or acknowledgements. *h2 Heading2* is used to introduce sub-sections. An example of *h2 Heading2* is ...

#### 4.1 Example of 'h2 Heading2'

There are two more lesser forms of section heads, the first being *h3 Heading3*.

##### 4.1.1 Example of 'h3 Heading3'

The *h3 Heading3* section heads do not have numbers and so should not be cross-referenced and will not appear in the table of contents.

*Example of 'hr HeadingRunIn'.* The least of the section heads it *hr HeadingRunIn*. As you can see, it is a run-in paragraph, meaning that it embeds itself at the beginning of the succeeding paragraph.

If you were to use one or more appendices, they would follow the normal sections and precede the bibliography. For appendices, use *a1 Appendix1* in lieu of *h1 Heading1*, *a2 Appendix2* in lieu of *h2 Heading2*, and *a3 Appendix3* in lieu of *h3 Heading3*. For run-in heads, continue to use *hr HeadingRunIn* in appendices.

All headings should set in title case, meaning that all words will be capitalized. The only exceptions are words such as *a, of, the, and*, etc. if they are not the first word in the title.

The basic paragraph style for most of the text is *bo Body*. However, there are some specialty paragraphs. You can create bulleted lists using the *bu Bulleted* and *bs Bulleted-Sub*. Bulleted points can be continued using the *in Indented* and *i2 Indented2* paragraphs. For example,

- This would be a point.  
This would be the continuation of the second point.
- This would be another point.  
This would be the continuation of the subpoint.
- This would be a third point.  
- This is a subpoint.  
This would be the continuation of the subitem.

You should not cross-reference items in a bulleted list. Instead, use a numbered list. The first item in the list should use a paragraph style of *n1 Numbered1*. Subsequent items would use *nu Numbered*. For example, ...

1. This is the first item.  
This is the continuation of the second item.
2. This is the second item.  
This is the continuation of the subitem.
3. This is the third item.
  - a. This is a sub item.
  - b. This is another sub item.  
This is a continuation of the subitem.

The com Comment paragraph style is provided for you to use to make notes to yourself. There should be no paragraphs that use the Comment style in the final version. Since it will not be in the final version of your document, feel free to change it as you see fit.

## 4.2 Font Families

The document largely uses two basic font families. The serif font is Times and the sans-serif font is Helvetica. These font families may also be referred to as TimesNewRoman and Arial. If your computer does not have the Times and Helvetica font families, you may switch the paragraph styles to use TimesNewRoman and Arial, though usually this mapping is done automatically for you by Framemaker.

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## 5 Equations

To enter a stand alone equation, insert a blank line and set the paragraph style to *eq Equation*. This centers the equation and gives it a number that you can later refer to. If you do not do this, any equations you add will be inserted in line.

To insert the equation, bring up the equation palette by clicking on the  $\Sigma$  to the right. Then choose *Equations* → *New Medium Equation* (you can use the short cut of *esc mm*). You can poke through the equation editor to create your equation. One thing that is helpful to know is that you use the space bar to select portions of the equation. The more times you press it, the more of the equation you select. This is particularly helpful to know when you are trying to get the parentheses right. Superscripts and subscripts are under the *Operators* portion of the palette, but you can add superscripts using  $\wedge$ , and subscripts with *ctrl \_*. From a typographic perspective, it is important to remember that variables are italicized while units, labels, functions, etc. are not. Thus, use  $v_n$  if  $n$  represents a label, such as if were an abbreviation for noise, and  $v_n$  if  $n$  represents a variable, such as an index. Use *StartString* and *EndString* on the *Symbols* portion of the palette to create non-italicized labels. Also remember that it is important to not use multicharacter variable names, like  $F_c$ . Framemaker will typeset is as if it were two separate single character variable names, and the user will often be confused. For example, consider the expression  $4kTFcR$ . In this case it is better to use single character variable names with subscripts, such as  $F_c$ . Generally, any word or word fragments that are acting as labels should non-italicized subscripts, such as the “max” in  $I_{\text{max}}$ . To enter text into an equation, like the “max” in  $I_{\text{max}}$ , surround the text with quotes. For example, to enter  $I_{\text{max}}$  type

*I ctrl shift \_ “max” ↴*

When describing behavioral models, it is often useful to incorporate a parameter of a behavioral model into an equation. For example, imagine giving the equation for an amplifier with the gain being given by the parameter gain. To include this parameter into an equation, one would again use the quotes to enter the name as text, and this time you would go back and apply a font format to put it in the desired style, as follows

$$v_{\text{out}} = \text{gain } v_{\text{in}} \quad (1)$$

In this example, “gain ” was entered as text and then then the *Code* format was applied to it from the font catalog. Notice that an extra space was include in the text to achieve proper spacing from subsequent variables or operators.

When giving numbers with units, it is best to put a non-breaking space between the number and the units, for example 10 pF. The non-breaking space is entered using *cntl*  $\diamond$ , where  $\diamond$  represents a space. Finally, do not use asterixes, dots, or crosses to represent multiplication. So it should be  $g_m r_o$ , not  $g_m \cdot r_o$ ,  $g_m \times r_o$ , or  $g_m * r_o$ .

FrameMaker initially gives you plenty of room to build your equation, but you should “shrink-wrap” your equation before moving on. The short cut for this is *esc mp*. When editing an equation it is helpful to un-shrink-wrap the equation before operating on it, the shortcut for this is *esc me*. Here is an example of how an equation should look when you are done. Be sure to add the proper punctuation, as in

$$C(v) = \frac{dq(v)}{dv}. \quad (2)$$

If you are familiar latex, you might want to use FrameMaker’s ability to accept latex style mathematics. For example, to create  $\log x$ , I inserted an equation and then typed  $\backslash log \lrcorner x$ . Be sure to type the carriage return after latex code to get FrameMaker to accept it.

## 5.1 More Equations

I’ve heard many people say that equations are a weak point for FrameMaker, particularly relative to LaTeX. While it is true that aesthetically FrameMaker’s equations are not up to those typeset by LaTeX, particularly the superscripts and subscripts on summations and integrals, if you take advantage of the many short cuts, entering equations can be done as efficiently, and you get the benefit of a WYSIWYG environment. I won’t explain all of the shortcuts, but I will give you an example that illustrates the point. Hopefully it is enough to get you started.

Consider the equation

$$x(t) = a(\alpha \cos \omega_1 t + \beta \cos \omega_2 t). \quad (3)$$

If  $\diamond$  represents pressing the space bar, and  $\lrcorner$  represents a pressing return, then this equation can be entered with the following sequence of keystrokes (try it).

*esc mm x(t\diamond\diamond\diamond=a(\alpha\lrcorner\cos\omega\_1\diamond\ctrl shift \_1\diamond\diamond\diamond\diamond\diamond+\beta\lrcorner\cos\omega\_2\diamond\ctrl shift \_2\diamond\diamond\diamond\diamond\diamond*

It may seem odd just looking at it in this way, but if you try it out I think you will find that it becomes fairly natural in relatively short order.

Another thing about equations that is non-obvious is how to break equations over multiple lines. FrameMaker does have a line-break feature in the equation editor, but I have never found it to be satisfactory. Instead, I generally break the equations into sub-equations as follows:

$$\begin{aligned} x(t) &= a(\alpha \cos \omega_1 t + \beta \cos \omega_2 t) + \\ &c\left(\frac{\alpha^3}{4}(3 \cos \omega_1 t + \cos 3 \omega_1 t) + \frac{3\alpha^2\beta}{2}(1 + \cos 2 \omega_1 t) \cos \omega_2 t + \right. \\ &\left. \frac{3\alpha\beta^2}{2} \cos \omega_1 t (1 + \cos 2 \omega_2 t) + \frac{\beta^3}{4}(3 \cos \omega_2 t + \cos 3 \omega_2 t)\right). \end{aligned} \quad (4)$$

I've done several things to make this work and look right. First I broke the equation into three separate equations, each on their own line. FrameMaker naturally balances parentheses within an equation, so I explicitly used an unbalanced left parenthesis in the second sub-equation and an unbalanced right parenthesis in the third. Be sure to select enough of the expression before adding the unbalanced parenthesis so that FrameMaker can determine how big to make the parenthesis. For example, on the last equation, I selected the whole sub-equation before adding the unbalanced right parenthesis to assure that it used a parenthesis that was large enough to cover the tall fractions. FrameMaker will also not end an equation with a binary arithmetic operator (such as +), so I pulled those outside the sub-equations.

I placed the first sub-equation on a line that used an *emf EquationMultFirst* paragraph format. This format includes an equation number and left justifies the equation with an indent. Using a left justified equation will reduce the amount of re-positioning of the subsequent equations I would have to do when I edit the first. This paragraph format also adds no space below the paragraph so that the sub-equations are not too far away. All the subsequent sub-equations except the last, which is just one in this case, are placed on a line that uses the *emm EquationMultMiddle* format. This paragraph format eliminates the space above and below, and includes a single tab setting (more about this in a bit). The last sub-equation is on a line that used the *eml EquationMultLast* paragraph format. This provides no space above and provides the normal amount of space below, and also includes a single tab stop.

Each sub-equation, except the first, should be preceded with a tab character. To line up the equations properly, I used *View→Rulers* to display the rulers and then individually adjust the position of the tab stops. This allows me to visually line up the equations so as to convey the proper nesting. You can do this simply by selecting the arrows on the ruler that denote the tab stops and simply dragging them either left or right until the sub-equation properly lines up with the one above it.

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## 6 Floating Objects

With FrameMaker, tables are used for any floating objects that need a caption. This includes tables, figures and listings. You insert tables by selecting *Insert Table* from the *table* menu, and then specify type of object you want in the *Table Format* field.

**Captions.** Captions should be complete sentences, preferably a single sentence that is contained on a single line. They should be set in sentence case (only the first word, formal names, and acronyms are capitalized) and should be properly punctuated.

**Table Anchors.** You delete or move a table by deleting or moving its anchor point. However, it can sometimes be difficult to find its anchor point. To do so, enable the viewing of text symbols by selecting *View → Text Symbols* and look for an upside down block **T**. The one associated with Table 1 immediately follows the period at the end of this sentence. To confirm that the anchor is associated with the right table, drag the mouse over the anchor while pressing the left mouse button, the desired table should highlight. You can delete a table by deleting its anchor, you can move the table by cutting and pasting its anchor.

TABLE 1 Time required for a tablet of Alka Selzer to completely dissolve in water.

Temperature	Time
<i>Hot Water</i>	
116° F	11 s
117° F	13 s
115° F	12 s
<i>Temperate Water</i>	
66° F	32 s
66° F	34 s
66° F	37 s
<i>Cold Water</i>	
37° F	120 s
32° F	105 s
30° F	120 s

It is often best to place table anchors at the end of paragraphs so that the table does not split the paragraph.

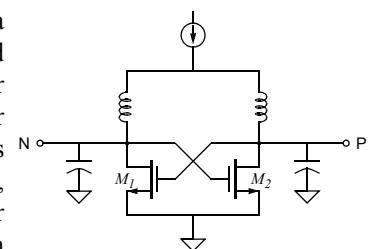
## 6.1 Tables

There is wide variety in tables, and we cannot provide one that will fit everyone's needs. When creating tables, try to make them visually appealing. A table with sub-headings is shown in Table 1. The *Table → Custom Ruling and Shading* were used to draw (or erase) the lines. Turn off borders using *View → Borders* to see what the table will look like when printed.

You may need to add extra empty columns to the right and left in order to properly center the table while still having a full termination line. You may also need an extra empty row at the end to properly space the termination line from the table itself. This is shown in Table 1. Effectively, the table that the reader sees is embedded in a larger table that fills the width of the page.

## 6.2 Figures

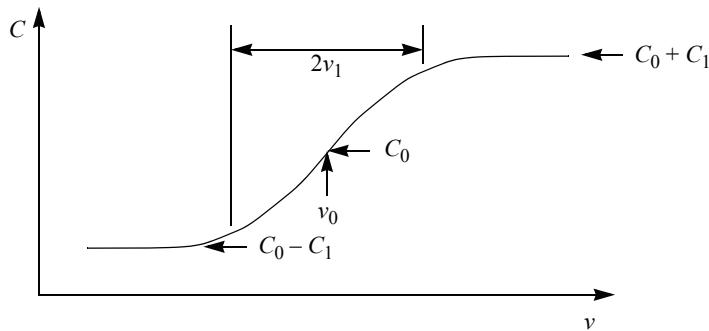
There are two types of figures you can add. One is a run-in figure. These figures should be fairly small and do not have captions, so you would not use them for figures that might need to be referenced from other parts of your paper. You create run-in figures, as shown on the right, by inserting an *Anchored Frame*, and then placing the figure within it. You can either draw the figure using the drawing palette (the button on the right with the right triangle on it), or import a figure using *File → Import → File*. When importing files, be sure to specify that they be *copied into the document* rather



than being *imported by reference*. When creating the anchored frame, select *Run into Paragraph* and then select which side it should be on.

Most figures will be floating figures. These figures have captions. To insert floating figures, select *Insert Table* from the *table* menu, and then specify *Figure* for the table format. This creates a one-cell table with a caption, as shown in Figure 1. Within the table,

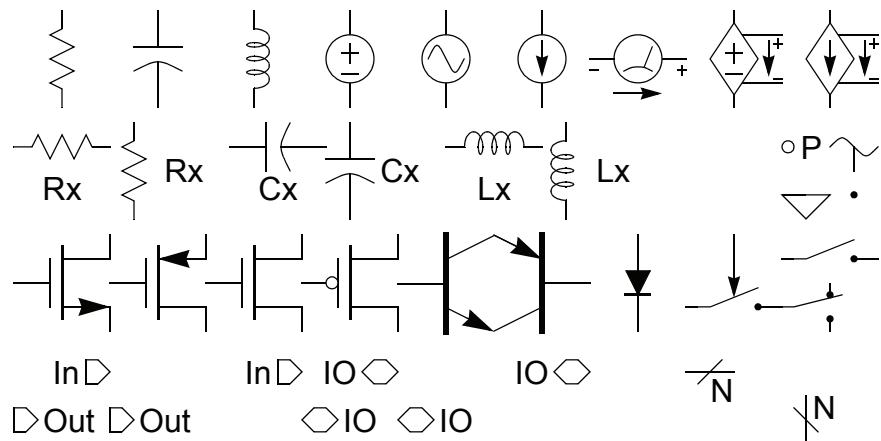
**FIGURE 1** Capacitance as a function of voltage.



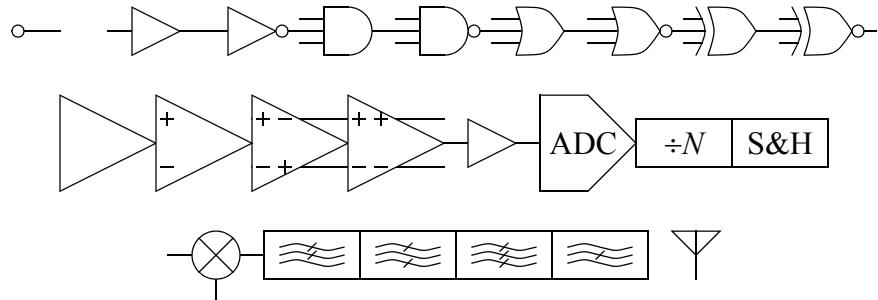
you insert an anchored frame to hold the graphics. This time specify that the anchored frame be placed *at the insertion point* with a 0 distance above baseline. Now add the graphics to the frame as before. Be sure to add a caption and a reference to the figure within the text. More about this later.

I have placed a collection of potentially useful schematic symbols in Figure 2 that you can copy and paste into your schematics. The symbols should be on the grid. Most symbols include an invisible square that makes it easy to realign the symbols to the grid. If you have *View→Borders* set the boundary of these squares are shown using dashed lines. Those borders are not visible when printing or if *View→Borders* is not set. They also include white background in the appropriate places to make it easy to wire the symbols by routing the wires underneath them.

**FIGURE 2** Useful schematic symbols.



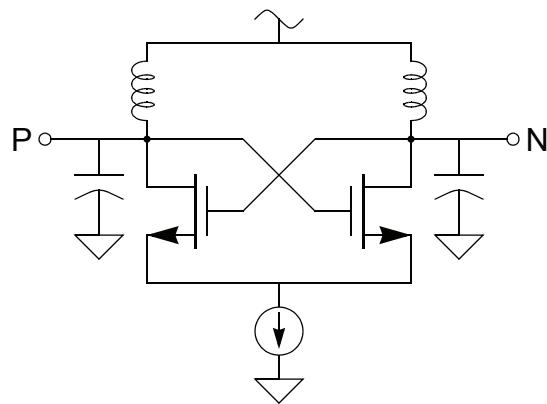
---

FIGURE 2 *Useful schematic symbols.*

One issue with Framemaker is that if you resize the frame that contains a drawing such as a schematic, it can cause the objects to no longer fall on the grid. If this occurs, simply select an object in the drawing, type *cntl-A* to expand the selection to include all the objects, and then drag them until they snap on to the grid (this assumes that *Graphics→Snap* is enabled). This works as long as every object will naturally align to the same grid. If some of the objects were off grid before the grid was changed, then it is hard get the objects that should be on the grid back on to the grid. This is often the case with text labels on schematics, where the schematic symbols want to be on the grid, but the labels do not. If you select both the symbols and the labels, you will not be able to drag them onto the grid. This problem can be avoided by encapsulating the labels within invisible boxes that align with the grid. To encapsulate a label it should be completely within the box, and the label and the box should be grouped.

A typical schematic is shown in Figure 3 to illustrate schematic drawing conventions.

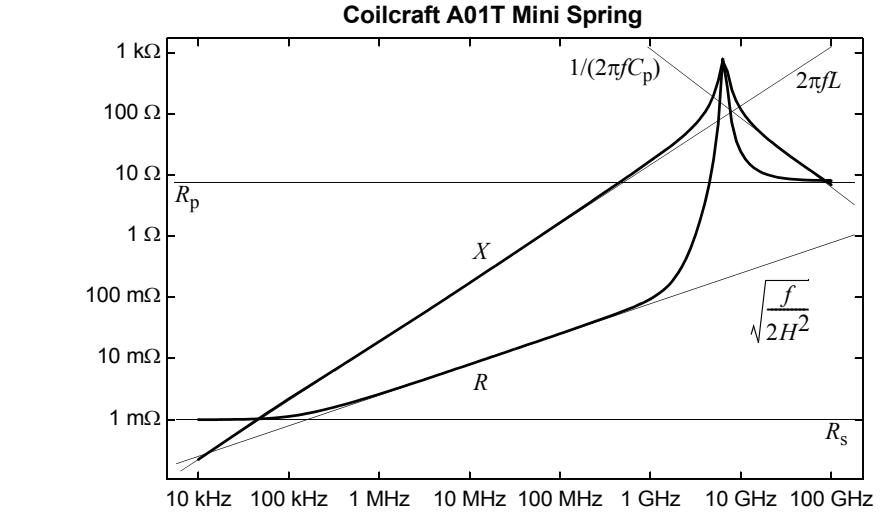
---

FIGURE 3 *A typical schematic.*

If you need to graph measured data, such as waveforms, transfer functions, etc., you can download a unix program from [www.designers-guide.org/submissions.html](http://www.designers-guide.org/submissions.html) that will allow you to create graphs that can be imported into FrameMaker and edited. An example of this is shown in Figure 4. The program is called *xgraph*. It takes a file of *xy* pairs and plots them. It has been enhanced to generate a *MIF* (Maker Interchange Format) file of the plot though its hardcopy facility, which can be imported into FrameMaker. Once

imported, you can ungroup the figure and modify as you wish. That was done with Figure 4, where the axis labels were enhanced, and asymptotes and labels added. Alternatively you can use Gnuplot ([www.gnuplot.info](http://www.gnuplot.info)) and set the output type to *mif*.

FIGURE 4 Modeled impedance of an RF inductor separated into real (*R*) and imaginary (*X*) parts.



### 6.3 Listings

Listings are used to hold code. An example of a listing is shown in Listing 1. It is Verilog-A model of a varactor. A listing typically contains two paragraph styles, *co Code*, and *cif CodeFirst*. The two styles are the same, except that *cif CodeFirst* adds a small amount of space above it. You should use this space to separate out logically distinct sections of the code. Comments should be italicized.

LISTING 1 Varactor model.

```
'include "discipline.h"

module varactor(p, n);
inout p, n;
electrical p, n;
parameter real c0 = 1p from (0:inf); // nominal capacitance
parameter real c1 = 0.5p from [0:c0];
parameter real v0 = 0;
parameter real v1 = 1 from (0:inf);
real q, v;

analog begin
v = V(p,n);
q = c0*v + c1*v1*ln(cosh((v - v0)/v1));
I(p,n) <+ ddt(q);
end
endmodule
```

Both of the code styles support tabs every 0.25 inch. However, tabs entered within tables cause FrameMaker to step to the next cell in the table, which is not what is

desired in this case. To indent code in a listing, either copy a tab and repeatedly paste it before the line, or type *Esc Tab*.

If possible, try to keep listings to a page or less. However, if needed you can create a listing that spans more than one page by inserting multiple rows in a listing. Recall that a listing is a table that contains one cell. Click in that cell and use *Table → Add Rows or Columns* to add more rows to the table; Framemaker will then be able to break the listing between the rows. This idea is shown in Listing 2. When creating listings that span multiple pages, divide the listing between the rows so as to completely fill the all but the last page.

For code fragments, you will probably want to have the listings embedded in the text. In this case, use the *ci CodeInline* and *cif CodeInlineFirst* paragraph styles directly in the text. For example, the heart of Listing 2 is

```
v = V(p,n);
q = c0*v + c1*v1*ln(cosh((v - v0)/v1));
l(p,n) <+ ddt(q);
```

When referring to code from within a paragraph, use the *Code* font from the font library. For example, here is a reference to *ddt(q)*.

When creating listings, you should to treat multiplication and subtraction symbols as being special. If you use a simple asterisk for multiplication, it will look like this  $x*y$ . Instead, it is better to use the symbol version of the asterisk, to get  $\times\cdot y$ . To get a symbol version, simply type an asterisk, then select it, access the font catalog (the *f* button on the right), and then select *Symbol*. To type a minus sign, do not use a simple dash, which ends up looking like  $x - y$ . Instead, use a true minus sign, which is accessed using *Ctrl Q Shift P*, doing so results in  $x - y$ . To avoid having Framemaker put a line break between a minus sign and a number, go to *Format → Document → Text Options ...* and remove  $\backslash=$  from the *Allow Line Breaks After:* field if it is present.

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## 7 Symbols

Table 2 contains a collection of symbols that might be useful for copying and pasting. In addition, Table 3 contains directions on how to access various types of spaces.

To create a ‘much greater than’ or ‘much smaller than’ sign, use two greater than or less than signs, but adjust the spread on the first to  $-30\%$  (the spread is specified using the character designer, which is accessed using the button on the right side of the document window that is labeled with a script *f*). This gives either  $\ll$  or  $\gg$ .

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## 8 References

Never refer directly to the identification number of an object (equation, figure, citation, etc.). These numbers will change as additional material is added to your paper. Instead, use cross references. To add a cross reference, use *Special → Cross-Reference*. This brings up a form that allows you to chose the object you would like to reference. Begin by assuring that the *Document* is *Current*, and the *Source Type* is *Paragraphs*. Then,

**LISTING 2** Quadrature Differential VCO model that includes FM jitter.

```

// Quadrature Differential VCO with Jitter

// The model starts by calculating the gain and then converting the input to frequency.
// Then the frequency is bounded to fall within Fmin and Fmax.
// This is optional, if not desired, simply comment out this section of the model.
// The frequency is dithered to account for phase noise (dT comes from a previous step)
// The frequency is converted to phase by integrating, modulo 2π
// Finally the phase is partitioned into four bins, and the output changes when the phase
// transitions from one bin to another. Transition also causes new dT to be generated.

'include "discipline.h"
'include "constants.h"

module quadVco (Plout,Nlout, PQout,NQout, Pin,Nin);
electrical Plout, Nlout, PQout, NQout, Pin, Nin;
output Plout, Nlout, PQout, NQout; input Pin, Nin;

parameter real Vmin=0;
parameter real Vmax=Vmin+1 from (Vmin:inf);
parameter real Fmin=1 from (0:inf);
parameter real Fmax=2*Fmin from (Fmin:inf);
parameter real Vlo=-1, Vhi=1;
parameter real jitter=0 from [0:0.25/Fmax];
parameter real ttol=1u/Fmax from (0:1/Fmax);
parameter real tt=0.01/Fmax;

real freq, phase, dT, lout, Qout;
integer i, q, seed;

analog begin
  @(initial_step) seed = 133;
  // compute the freq from the input voltage
  freq = (V(Pin,Nin) - Vmin) * (Fmax - Fmin) / (Vmax - Vmin) + Fmin;
  // bound the frequency (this is optional)
  if (freq > Fmax) freq = Fmax;
  if (freq < Fmin) freq = Fmin;
  // add the phase noise
  freq = freq/(1 + dT*freq);

  // phase is the integral of the freq modulo 2π
  phase = 2*'M_PI*idtmod(freq, 0.0, 1.0, -0.5);

  // update jitter where phase crosses π/2
  // 2=sqrt(K), K=4 jitter updates per period
  @(cross(phase - 3*'M_PI/4, +1, ttol) or
    cross(phase - 'M_PI/4, +1, ttol) or
    cross(phase + 'M_PI/4, +1, ttol) or
    cross(phase + 3*'M_PI/4, +1, ttol)) begin
    dT = 2*jitter*$dist_normal(seed,0,1);
    i = (phase >= -3*'M_PI/4) && (phase < 'M_PI/4);
    q = (phase >= -'M_PI/4) && (phase < 3*'M_PI/4);
  end

```

*Continued on next page.*

---

LISTING 2 *Quadrature Differential VCO model that includes FM jitter.*

*Continuing from previous page.*

```
// Generate I and Q outputs
V(Plout) <+ transition(i ? Vhi : Vlo, 0, tt);
V(Nlout) <+ transition(i ? Vlo : Vhi, 0, tt);
V(PQout) <+ transition(q ? Vhi : Vlo, 0, tt);
V(NQout) <+ transition(q ? Vlo : Vhi, 0, tt);

end
endmodule
```

---

specify the *Paragraph Tag* of the object to be referenced and select the specific object from the list of *Paragraphs*. Finally, choose the appropriate *Format*.

As you make changes to your paper, the cross references may go out of date. This is generally not a problem because they are automatically updated if you save or print the document. However, at times it can become confusing. To manually update the cross references, use *Edit → Update References* and choose *All Cross References*.

Occasionally you may delete a target of a cross reference. When you go to update the references FrameMaker will warn you about one or more *unresolved cross-references*. In this situation search for and repair the references. To do so, use *Edit → Find/Change*. In the *Find* section of the form, choose *Unresolved Cross-Reference*. Once you find the reference, open it by double-clicking it. Then, change the *Source Type* from *Cross-Reference Markers* to *Paragraph Tags* and then specify a new target.

**Tables, Figures, Listings, and Sections.** Consider referencing Table 3. In this case, the *Paragraph Tag* would be set to *tc TableCaption* and, since the table is close by, the *Format* would be set to *Table Number*. If we were referring to Table 1 on page 8, the format would be set to *Table Number & Page* to give the reader some help finding the table.

One references figures and listings in a manner similar to tables.

**Equations.** There are two basic types of equation references. Normally one uses a format of *Eqn* to reference an equation. This format places the equation number within parentheses, as in the following reference to (2). However this is a bit awkward to use at the beginning of a sentence. In this case, set the format to *Equation*. Equation 2 uses this format. Finally, if the equation is a long ways away, consider using a format of *Equation & Page*, which results in Equation 2 on page 6.

**Bibliographic Citations.** When referencing bibliographic citations, always use a format of *BibCitation* regardless of how far it is to the citation. For example, [1]. If citing several reference in the same place, combine them. In this case, you would not use the *BibCitation* format. Rather, you construct the citation manually. Type in the brackets, then individually add the references separated by commas. Each would use the *Number Only* format. For example, here is a collection of AMS references [2, 3, 4].

TABLE 2 A useful collection of symbols.

Text	Shift	${}^{\wedge}Q$	Shift ${}^{\wedge}Q$	Symbol	Shift	${}^{\wedge}Q$	Shift ${}^{\wedge}Q$
a	A	.	í	α	A	⟨	ſ
b	B	,	¬	β	B	®	ℳ
c	C	„	Đ	χ	X	©	℘
d	D	%o	f	δ	Δ	™	⊗
e	E	À	Ý	ε	Ε	Σ	⊕
f	F	Ê	ý	φ	Φ	∫	∅
g	G	Á	«	γ	Γ	—	∩
h	H	È	»	η	Η	—	cup
i	I	É	…	ι	I	—	▷
j	J	Í	þ	φ	Θ	—	≡
k	K	Î	À	κ	K	—	¤
l	L	Ї	Ã	λ	Λ	—	≤
m	M	Í	Õ	μ	M	{	⊆
n	N	Ó	Œ	ν	N	—	ε
o	O	Ô	œ	ο	Ο	—	₪
p	P	š	—	π	Π	□	∠
q	Q	Ó	—	θ	Θ	>	∇
r	R	Ú	“	ρ	P	—	®
s	S	Û	”	σ	Σ	—	©
t	T	Ù	‘	τ	T	—	™
u	U	€	’	υ	Υ	—	Π
v	V	^	÷	ϖ	ζ	—	√
w	W	~	þ	ω	Ω	—	·
x	X	—	ÿ	ξ	Ξ	—	—
y	Y		Ŷ	ψ	Ψ	—	∧
z	Z	Ž	/	ζ	Z	—	∨
1	!	±	°	1	!	±	γ
2	@	ð	¸	2	≡	”	ℳ
3	#	Š	£	3	#	≥	≤
4	\$	¥	§	4	Ξ	×	/
5	%	µ	•	5	%	∞	∞
6	^	¹	?	6	⊥	∂	⇒
7	&	²	¶	7	&	•	f
8	*	³	TM	8	*	÷	♠
9	(	¼	®	9	(	≠	♦
0	)	×	©	0	)	◦	♥
-	-	-	?	-	-	↑	↓
=	+	¾	'	=	+	—	↔
'	~	‡	Ž	TM	~	◊	—
[	{	¤	°	[	{	⇒	—
]	}	›	”	]	}	↑↑	—
\		⟨	,	∴		≤=	—
;	:	a	½	;	:	≈	≡
‘	“	ß	¢	TM	®	♣	,
,	<	..	º	,	<	←	...
.	>	Æ	æ	.	>	→	—
/	?	Ø	ø	/	?	↓	↓

TABLE 3 *Spaces.*

<b>em</b>	<b>en</b>	<b>numeric</b>	<b>thin</b>	<b>non-breaking</b>
esc-space-m	esc-space-n	esc-space-l	esc-space-t	ctrl-space

## 9 Hypertext Links

When mentioning a website, you should add a hypertext link to that website. To do so, select the reference to the website, and use *Special → Hypertext* to bring up the hypertext menu. Set the command to *Go to URL*. FrameMaker will then add the *message URL* to the text entry box. Add a the path to the website after this text while following example given on the form. So for example, if you wanted to reference *www.designers-guide.org*, you would enter *http://www.designers-guide.org*. Then click *New Hypertext Marker*. To edit a hypertext marker, use *View → Text Symbols* to see the marker's identifying symbol. It looks like a block **T**. Bring up the hypertext menu and then select this symbol to see and edit the details of the marker.

## 10 Change Bars

During the editing process, it is helpful to enable change bars. To do so in FrameMaker, use *Format → Document → Change Bars* to enable or reset the change bars. In addition, there are two entries in the font catalog (accessible with the *f* button on the right), *Changed* and *Unchanged* that can be applied to text in order to either activate or clear the change bar for that text.

## 11 Footnotes

To add footnotes, place the cursor where you want the reference to the footnote, and use *Special → Footnote*.<sup>1</sup>

## 12 Conclusion

It is a good idea to add the following “if you have questions” paragraph to the end of your paper.

### 12.1 If You Have Questions

If you have questions about what you have just read, feel free to post them on the *Forum* section of *The Designer’s Guide Community* website. Do so by going to *www.designers-guide.org/Forum*.

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1. A footnote looks like this.

This is the second paragraph of the same footnote.

---

## Appendix A Editing

This section was formatted as an appendix simply as an example.

Papers are published as is, without editing. So it is very important that you do a very careful job of editing your document before submitting it. Of course the first thing is to use FrameMaker's spell checker to catch the first-order errors. Microsoft Word has a more sophisticated grammar checker. I have been known to use this by first entering a draft of the text into Word, correcting the spelling and grammar errors it finds, and transferring the text into FrameMaker. Another helpful thing to do is to use text-to-speech software and have the computer read your writing to you a paragraph at a time. It is surprising how many mistakes you will find this way, even in a paragraph that you have already carefully edited. There are several commercial text-to-speech engines available. A free one is available from [www.readplease.com](http://www.readplease.com).

### A.1 Read It Again

Finally, once you have completed and carefully edited your paper, put it aside for a few days to a week. Then read it again and carefully look for more errors.

---

## References

Notice that the *References* section is not numbered.

When giving references, it is best to give those that would be most helpful to the reader. Thus, give references that are easily found, that will be around for a long time, that have the most useful information, that are clearest and easiest to read, and that are correct. Avoid references to articles in non-archival magazines. Also, avoid references that would be included solely to acknowledge the original source of an idea, especially if the original source is hard to find, difficult to read, or does not contain much information.

When citing material, try to follow the examples given below. When referring to a website, make the name of the website a hypertext link (See "Hypertext Links" on page 16).

- [1] K. S. Kundert. *The Designer's Guide to SPICE and Spectre*. Kluwer Academic Publishers, 1995.
- [2] E. Christen, K. Bakalar. VHDL-AMS — a hardware description language for analog and mixed-signal applications. *IEEE Transactions on Circuits and Systems II: Analog and Digital Signal Processing*, vol. 46, no. 10, Oct. 1999, pp. 1263-1272.
- [3] *Definitions of Analog and Mixed-Signal Extensions to IEEE Standard VHDL*. IEEE Standard 1076.1-1999.
- [4] *Verilog-AMS Language Reference Manual: Analog & Mixed-Signal Extensions to Verilog HDL*, version 2.0. Open Verilog International, 2000. Available from [www.eda.org/verilog-ams](http://www.eda.org/verilog-ams).
- [5] The Designer's Guide, [www.designers-guide.org](http://www.designers-guide.org).
- [6] Ken Kundert. A test bench for differential circuits. [www.designers-guide.org/Analysis](http://www.designers-guide.org/Analysis).