



**Agilent Technologies**

**Advanced Design System 2002  
Vendor Component Libraries  
System Library**

**February 2002**

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# Chapter 1: System Library

The System Library consists of non-surface-mount amplifiers, mixers, and filters, power dividers and switches and surface-mount (SMT) amplifiers, crystals, filters, and mixers representing 1273 parts. The library directory structure and the components for each type are detailed in the following sections.

For non-surface-mount library components, refer to these sections:

- [“Amplifiers” on page 2-1](#)
- [“Filters” on page 3-1](#)
- [“Mixers” on page 4-1](#)
- [“Power Dividers” on page 5-1](#)
- [“Switches” on page 6-1](#)

For surface-mount system library components, refer to these sections:

- [“SMT Amplifiers” on page 7-1](#)
- [“SMT Crystals” on page 8-1](#)
- [“SMT Filters” on page 9-1](#)
- [“SMT Mixers” on page 10-1](#)





# Chapter 2: Amplifiers

## Schematic Design

This section describes the schematic design of the non-surface-mount system library amplifier components and describes the underlying model for each type of component.

Figure 2-1 shows how a amplifier component appears when placed into the Schematic design window. The schematic symbol artwork is derived from the standard 2-port GAIN1 symbol. The annotation consists of the component name and the default component ID prefix (in this case, S). No component parameters are displayed. The *label* field appearing at the top of the component parameter dialog box contains the selected component label. The *description* field below the label field reads *Nonlinear Model*.

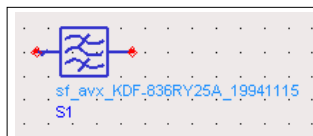


Figure 2-1. Amplifier Schematic Component Example

The amplifier component is an alias application of the standard S2D file-based data component. No schematic design subnetwork is associated with the component. The standard component name S2D is replaced by the selected amplifier library component name; for example, va\_qb\_QB-102\_19930601.

The S2D data file contains small-signal S-parameters, gain compression characteristics and, in some cases, noise figure or noise parameter data. The file is installed in the same library group subdirectory as the associated component.

The amplifier library components are suitable for placement in any RF/Analog schematic.

## Data

The Amplifier Library consists of nonlinear and linear models representing 357 amplifiers from 6 manufacturers. The models were extracted from linear and nonlinear measurements performed by the manufacturers.

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**Note** The library itself is a binary file named *AmplifierLibrary.library* which can be found in *\$HPEESOF\_DIR/ComponentLibs/models*.

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The amplifier library groups available for selection from the Schematic windows are:

- “Agilent Technologies Amplifiers” on page 2-3
- “Mini-Circuits Amplifiers” on page 2-9
- “NEC Amplifiers” on page 2-13
- “Q-bit Amplifiers” on page 2-15
- “TriQuint Amplifiers” on page 2-26
- “Watkins-Johnson Amplifiers” on page 2-27

# Agilent Technologies Amplifiers

For modeling specifications, see “[Schematic Design](#)” on page 2-1.

The Agilent Technologies Amplifiers include 89 components, representing individual parts. The naming convention for these components is *va\_hp\_<part number>*.

Table 2-1. Agilent Technologies Amplifiers

Component Name	Description
va_hp_AMT12433_19930601	Agilent AMT-12433, 7.0-12.4 GHz, Po1dBC=20.6dBm, NF=4.2dB, Model features SP, NF, 1dBC, IP3
va_hp_AMT12435_19930601	Agilent AMT-12435, 7.0-12.4 GHz, Po1dBC=19.3dBm, NF=3.34dB, Model features SP, NF, 1dBC, IP3
va_hp_AMT4071_19930601	Agilent AMT-4071, 2.0-4.0 GHz, Po1dBC=15.9dBm, NF=1.7dB, Model features SP, NF, 1dBC, IP3
va_hp_AMT8074_19930601	Agilent AMT-8074, 4.0-8.0 GHz, Po1dBC=21.3dBm, NF=2.09dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT11472_19930601	Agilent AWT-11472, 4.0-11.0 GHz, Po1dBC=13.8dBm, NF=2.11dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT12012_19930601	Agilent AWT-12012, 0.5-12.0 GHz, Po1dBC=10.4dBm, NF=4.9dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT13034_19930601	Agilent AWT-13034, 5.0-13.0 GHz, Po1dBC=17.6dBm, NF=3.7dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT18212_19930601	Agilent AWT-18212, 2.0-18.0 GHz, Po1dBC=15.1dBm, NF=4.47dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT18235_19930601	Agilent AWT-18235, 2.0-18.0 GHz, Po1dBC=11.8dBm, NF=6.8dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT18614_19930601	Agilent AWT-18614, 6.0-18.0 GHz, Po1dBC=14dBm, NF=2.2dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT18633_19930601	Agilent AWT-18633, 6.0-18.0 GHz, Po1dBC=20dBm, NF=4.6dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT18635_19930601	Agilent AWT-18635, 6.0-18.0 GHz, Po1dBC=18.7dBm, NF=4.76dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT18655_19930601	Agilent AWT-18655, 6.0-18.0 GHz, Po1dBC=22.2dBm, NF=4.38dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT19135_19930601	Agilent AWT-19135, 1.0-19.0 GHz, Po1dBC=10.4dBm, NF=7.6dB, Model features SP, NF, 1dBC, IP3

Table 2-1. Agilent Technologies Amplifiers (continued)

Component Name	Description
va_hp_AWT20233_19930601	Agilent AWT-20233, 2.0-20.0 GHz, Po1dB=12.22dBm, NF=7.08dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT20235_19930601	Agilent AWT-20235, 2.0-20.0 GHz, Po1dB=11.7dBm, NF=6.23dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT2032_19930601	Agilent AWT-2032, 0.5-2.0 GHz, Po1dB=14.1dBm, NF=2.04, Model features SP, NF, 1dBC, IP3
va_hp_AWT2033_19930601	Agilent AWT-2033, 0.5-2.0 GHz, Po1dB=15.9dBm, NF=2.29, Model features SP, NF, 1dBC, IP3
va_hp_AWT20833_19930601	Agilent AWT-20833, 8.0-20.0 GHz, Po1dB=16.1dBm, NF=6.58dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT20834_19930601	Agilent AWT-20834, 8.0-20.0 GHz, Po1dB=17.15dBm, NF=6.34dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT6035_19930601	Agilent AWT-6035, 2.0-6.0 GHz, Po1dB=17.1dBm, NF=2.44dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT8032_19930601	Agilent AWT-8032, 2.0-8.0 GHz, Po1dB=20.6dBm, NF=3.90dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT8035_19930601	Agilent AWT-8035, 2.0-8.0 GHz, Po1dB=19.5dBm, NF=3.4dB, Model features SP, NF, 1dBC, IP3
va_hp_AWT8053_19930601	Agilent AWT-8053, 2.0-8.0 GHz, Po1dB=22.9dBm, NF=3.68dB, Model features SP, NF, 1dBC, IP3
va_hp_HMMC-5022_19930601	Agilent HMMC-5022, 2.0-22.0 GHz, Po1dB=19dBm, NF=8.0dB, Model features SP, 1dBC, IP3
va_hp_HMMC-5026_19930601	Agilent HMMC-5026, 2.0-26.5 GHz, Po1dB=19dBm, NF=10.0dB, Model features SP, 1dBC, IP3
va_hp_INA-01100_19930601	Agilent INA-01100, 0.01-3 GHz, Po1dB=11dBm, NF=1.7dB, Model features SP, 1dBC, IP3
va_hp_INA-01170_19930601	Agilent INA-01170, 0.01-3.0 GHz, Po1dB=10dBm, NF=1.9dB, Model features SP, NP, 1dBC, IP3
va_hp_INA-02100_19930601	Agilent INA-02100, 0.01-3 GHz, Po1dB=11dBm, NF=2.0dB, Model features SP, 1dBC, IP3
va_hp_INA-02170_19930601	Agilent INA-02170, 0.01-3.0 GHz, Po1dB=10dBm, NF=2.4dB, Model features SP, NP, 1dBC, IP3
va_hp_INA-02184_19930601	Agilent INA-02184, 0.01-4 GHz, Po1dB=11dBm, NF=2.0dB, Model features SP, 1dBC, IP3
va_hp_INA-03100_19930601	Agilent INA-03100, 0.05-3.5 GHz, Po1dB=1dBm, NF=2.5dB, Model features SP, 1dBC, IP3

**Table 2-1. Agilent Technologies Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
va_hp_INA-03170_19930601	Agilent INA-03170, 0.05-3.5 GHz, Po1dBC=2dBm, NF=2.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MGA-61000_19930601	Agilent MGA-61000, 2.0-18.0 GHz, Po1dBC=14dBm, NF=6.0dB, Model features SP, 1dBC, IP3
va_hp_MGA-61100_19930601	Agilent MGA-61100, 6.0-18.0 GHz, Po1dBC=14dBm, NF=6.0dB, Model features SP, 1dBC, IP3
va_hp_MGA-62100_19930601	Agilent MGA-62100, 1.0-18.0 GHz, Po1dBC=14dBm, Model features SP, 1dBC
va_hp_MGA-63100_19930601	Agilent MGA-63100, 4.0-16.0 GHz, Po1dBC=22dBm, Model features SP, 1dBC
va_hp_MGA-64135_19930601	Agilent MGA-64135, 0.5-10.0 GHz, Po1dBC=12dBm, NF=7.5dB, Model features SP, 1dBC
va_hp_MGA-65100_19930601	Agilent MGA-65100, 2.0-18.0 GHz, Po1dBC=24dBm, Model features SP, 1dBC
va_hp_MGA-66100_19930601	Agilent MGA-66100, 2.0-6.0 GHz, Po1dBC=13dBm, NF=7.5dB, Model features SP, 1dBC
va_hp_MSA-0100_19930601	Agilent MSA-0100, 0.1-5.0 GHz, Po1dBC=1.5dBm, NF=5.4dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0104_19930601	Agilent MSA-0104, 0.1-5.0 GHz, Po1dBC=1.5dBm, NF=5.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0135_19930601	Agilent MSA-0135, 0.1-5.0 GHz, Po1dBC=1.5dBm, NF=5.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0170_19930601	Agilent MSA-0170, 0.1-5.0 GHz, Po1dBC=1.5dBm, NF=5.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0185_19930601	Agilent MSA-0185, 0.1-5.0 GHz, Po1dBC=1.5dBm, NF=5.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0200_19930601	Agilent MSA-0200, 0.1-6.0 GHz, Po1dBC=4.5dBm, NF=6.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0204_19930601	Agilent MSA-0204, 0.1-6.0 GHz, Po1dBC=4.5dBm, NF=6.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0235_19930601	Agilent MSA-0235, 0.1-6.0 GHz, Po1dBC=4.5dBm, NF=6.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0270_19930601	Agilent MSA-0270, 0.1-6.0 GHz, Po1dBC=4.5dBm, NF=6.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0285_19930601	Agilent MSA-0285, 0.1-6.0 GHz, Po1dBC=4.5dBm, NF=6.5dB, Model features SP, NP, 1dBC, IP3

Table 2-1. Agilent Technologies Amplifiers (continued)

Component Name	Description
va_hp_MSA-0300_19930601	Agilent MSA-0300, 0.1-6.0 GHz, Po1dBC=10dBm, NF=6.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0304_19930601	Agilent MSA-0304, 0.1-6.0 GHz, Po1dBC=10dBm, NF=6.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0335_19930601	Agilent MSA-0335, 0.1-6.0 GHz, Po1dBC=10dBm, NF=6.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0370_19930601	Agilent MSA-0370, 0.1-6.0 GHz, Po1dBC=10dBm, NF=6.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0385_19930601	Agilent MSA-0385, 0.1-6.0 GHz, Po1dBC=10dBm, NF=6.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0400G_19930601	Agilent MSA-0400G, 0.1-5.0 GHz, Po1dBC=16dBm, NF=6.6dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0400_19930601	Agilent MSA-0400, 0.1-5.0 GHz, Po1dBC=16dBm, NF=6.4dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0404_19930601	Agilent MSA-0404, 0.1-5.0 GHz, Po1dBC=11.5dBm, NF=6.9dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0420_19930601	Agilent MSA-0420, 0.1-5.0 GHz, Po1dBC=16dBm, NF=6.4dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0435_19930601	Agilent MSA-0435, 0.1-5.0 GHz, Po1dBC=12.5dBm, NF=6.4dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0470_19930601	Agilent MSA-0470, 0.1-5.0 GHz, Po1dBC=12.5dBm, NF=6.4dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0485_19930601	Agilent MSA-0485, 0.1-5.0 GHz, Po1dBC=12.5dBm, NF=7.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0500_19930601	Agilent MSA-0500, 0.005-4.0 GHz, Po1dBC=23dBm, NF=6.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0504_19930601	Agilent MSA-0504, 0.005-3.0 GHz, Po1dBC=18dBm, NF=6.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0520_19930601	Agilent MSA-0520, 0.001-4.0 GHz, Po1dBC=23dBm, NF=6.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0600_19930601	Agilent MSA-0600, 0.1-5.0 GHz, Po1dBC=1.5dBm, NF=3.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0635_19930601	Agilent MSA-0635, 0.1-5.0 GHz, Po1dBC=1.5dBm, NF=3.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0670_19930601	Agilent MSA-0670, 0.1-5.0 GHz, Po1dBC=1.5dBm, NF=3.0dB, Model features SP, NP, 1dBC, IP3

**Table 2-1. Agilent Technologies Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
va_hp_MSA-0685_19930601	Agilent MSA-0685, 0.1-5.0 GHz, Po1dB=1.5dBm, NF=3.1dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0700_19930601	Agilent MSA-0700, 0.1-6.0 GHz, Po1dB=5.5dBm, NF=4.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0735_19930601	Agilent MSA-0735, 0.1-6.0 GHz, Po1dB=5.5dBm, NF=4.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0770_19930601	Agilent MSA-0770, 0.1-6.0 GHz, Po1dB=5.5dBm, NF=4.5dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0785_19930601	Agilent MSA-0785, 0.1-6.0 GHz, Po1dB=5.5dBm, NF=5.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0800_19930601	Agilent MSA-0800, 0.1-6.0 GHz, Po1dB=12.5dBm, NF=2.7dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0835_19930601	Agilent MSA-0835, 0.1-6.0 GHz, Po1dB=12.5dBm, NF=2.7dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0870_19930601	Agilent MSA-0870, 0.1-6.0 GHz, Po1dB=12.5dBm, NF=2.7dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0885_19930601	Agilent MSA-0885, 0.1-6.0 GHz, Po1dB=12.5dBm, NF=3.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-0910_19930601	Agilent MSA-0910, 0.0005-8.0 GHz, Po1dB=11.5dBm, NF=6.1dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-1000_19930601	Agilent MSA-1000, 0.001-3.0 GHz, Po1dB=27dBm, NF=7.0dB, Model features SP, 1dBC, IP3
va_hp_MSA-1023_19930601	Agilent MSA-1023, 0.0005-3.0 GHz, Po1dB=27dBm, NF=7.0dB, Model features SP, 1dBC, IP3
va_hp_MSA-1100_19930601	Agilent MSA-1100, 0.0005-3.0 GHz, Po1dB=17.5dBm, NF=4.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-1104_19930601	Agilent MSA-1104, 0.0005-3.0 GHz, Po1dB=17.5dBm, NF=4.1dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-1110_19930601	Agilent MSA-1110, 0.0005-5.0 GHz, Po1dB=17.5dBm, NF=4.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-1120_19930601	Agilent MSA-1120, 0.0005-5.0 GHz, Po1dB=17.5dBm, NF=4.0dB, Model features SP, NP, 1dBC, IP3
va_hp_MSA-2035_19930601	Agilent MSA-2035, 0.1-6.0 GHz, Po1dB=9.5dBm, NF=3.7dB, Model features SP, 1dBC, IP3
va_hp_MSA-2085_19930601	Agilent MSA-2085, 0.1-6.0 GHz, Po1dB=9.0dBm, NF=3.7dB, Model features SP, 1dBC, IP3

Table 2-1. Agilent Technologies Amplifiers (continued)

<b>Component Name</b>	<b>Description</b>
va_hp_MSA-3135_19930601	Agilent MSA-3135, 0.1-6.0 GHz, Po1dBC=9.3dBm, NF=3.2dB, Model features SP, 1dBC, IP3
va_hp_MSA-3185_19930601	Agilent MSA-3185, 0.1-6.0 GHz, Po1dBC=9.0dBm, NF=3.5dB, Model features SP, 1dBC, IP3
va_hp_MSA-9970_19930601	Agilent MSA-9970, 0.02-7.0 GHz, Po1dBC=14.5dBm, Model features SP, 1dBC, IP3



# Mini-Circuits Amplifiers

For modeling specifications, see “[Schematic Design](#)” on page 2-1.

The Mini-Circuits Amplifiers include 58 components, representing individual parts. The naming convention for these components is *va\_mc\_<part number>*.

Table 2-2. Mini-Circuits Amplifiers

Component Name	Description
va_mc_AMP-11-2_19930601	Mini-Circuits AMP-11-2, 5-1000 MHz, Po1dBC=-3.5dBm, NF=3dB, Model features SP, 1dBC, IP3
va_mc_AMP-15_19930601	Mini-Circuits AMP-15, 5-1000 MHz, Po1dBC=8dBm, NF=2.8dB, Model features SP, 1dBC, IP3
va_mc_AMP-2000_19930601	Mini-Circuits AMP-2000, 10-2000 MHz, Po1dBC=15dBm, NF=5dB, Model features SP, 1dBC, IP3
va_mc_AMP-3G_19930601	Mini-Circuits AMP-3G, 30-3000 MHz, Po1dBC=9.5dBm, NF=3.5dB, Model features SP, 1dBC, IP3
va_mc_AMP-74_19930601	Mini-Circuits AMP-74, 5-500 MHz, Po1dBC=7.0dBm, NF=5dB, Model features SP, 1dBC, IP3
va_mc_AMP-75_19930601	Mini-Circuits AMP-75, 5-500 MHz, Po1dBC=12dBm, NF=2.4dB, Model features SP, 1dBC, IP3
va_mc_AMP-76_19930601	Mini-Circuits AMP-76, 5-500 MHz, Po1dBC=13.5dBm, NF=3.1dB, Model features SP, 1dBC, IP3
va_mc_AMP-77_19930601	Mini-Circuits AMP-77, 5-500 MHz, Po1dBC=16dBm, NF=3.3dB, Model features SP, 1dBC, IP3
va_mc_MAN-11AD_19930601	Mini-Circuits MAN-11AD, 2-2000 MHz, Po1dBC=-2.75dBm, NF=6.5dB, Model features SP, 1dBC, IP3
va_mc_MAN-1AD_19930601	Mini-Circuits MAN-1AD, 5-500 MHz, Po1dBC=6.5dBm, NF=7.2dB, Model features SP, 1dBC, IP3
va_mc_MAN-1HLN_19930601	Mini-Circuits MAN-1HLN, 10-500 MHz, Po1dBC=15dBm, NF=3.7dB, Model features SP, 1dBC, IP3
va_mc_MAN-1LN_19930601	Mini-Circuits MAN-1LN, 0.5-500 MHz, Po1dBC=8dBm, NF=2.8dB, Model features SP, 1dBC, IP3
va_mc_MAN-1_19930601	Mini-Circuits MAN-1, 0.5-500 MHz, Po1dBC=8dBm, NF=4.5dB, Model features SP, 1dBC, IP3
va_mc_MAN-2AD_19930601	Mini-Circuits MAN-2AD, 2-1000 MHz, Po1dBC=-2dBm, NF=6.5dB, Model features SP, 1dBC, IP3

Table 2-2. Mini-Circuits Amplifiers (continued)

Component Name	Description
va_mc_MAN-2_19930601	Mini-Circuits MAN-2, 0.5-1000 MHz, Po1dBC=8dBm, NF=6dB, Model features SP, 1dBC, IP3
va_mc_TO-0812LN_19930601	Mini-Circuits TO-0812LN, 800-1200 MHz, Po1dBC=8dBm, NF=1.6dB, Model features SP, 1dBC, IP3
va_mc_TO-1217LN_19930601	Mini-Circuits TO-1217LN, 1200-1700 MHz, Po1dBC=10dBm, NF=1.6dB, Model features SP, 1dBC, IP3
va_mc_TO-1724LN_19930601	Mini-Circuits TO-1724LN, 1700-2400 MHz, Po1dBC=10dBm, NF=1.6dB, Model features SP, 1dBC, IP3
va_mc_ZEL-0812LN_19930601	Mini-Circuits ZEL-0812LN, 800-1200 MHz, Po1dBC=8dBm, NF=1.5dB, Model features SP, 1dBC, IP3
va_mc_ZEL-1217LN_19930601	Mini-Circuits ZEL-1217LN, 1200-1700 MHz, Po1dBC=10dBm, NF=1.5dB, Model features SP, 1dBC, IP3
va_mc_ZEL-1724LN_19930601	Mini-Circuits ZEL-1724LN, 1700-2400 MHz, Po1dBC=10dBm, NF=1.5dB, Model features SP, 1dBC, IP3
va_mc_ZFL-1000GH_19930601	Mini-Circuits ZFL-1000GH, 10-1200 MHz, Po1dBC=13dBm, NF=15dB, Model features SP, 1dBC, IP3
va_mc_ZFL-1000G_19930601	Mini-Circuits ZFL-1000G, 10-1000 MHz, Po1dBC=3dBm, NF=12dB, Model features SP, 1dBC, IP3
va_mc_ZFL-1000H_19930601	Mini-Circuits ZFL-1000H, 10-1000 MHz, Po1dBC=20dBm, NF=5dB, Model features SP, 1dBC, IP3
va_mc_ZFL-1000LN_19930601	Mini-Circuits ZFL-1000LN, 0.1-1000 MHz, Po1dBC=3dBm, NF=2.9dB, Model features SP, 1dBC, IP3
va_mc_ZFL-1000VH_19930601	Mini-Circuits ZFL-1000VH, 10-1000 MHz, Po1dBC=26dBm, NF=4.5dB, Model features SP, 1dBC, IP3
va_mc_ZFL-1000_19930601	Mini-Circuits ZFL-1000, 0.1-1000 MHz, Po1dBC=4.5dBm, NF=6dB, Model features SP, 1dBC, IP3
va_mc_ZFL-11AD_19930601	Mini-Circuits ZFL-11AD, 2-2000 MHz, Po1dBC=-2.75dBm, NF=6.5dB, Model features SP, 1dBC, IP3
va_mc_ZFL-1HAD_19930601	Mini-Circuits ZFL-1HAD, 10-500 MHz, Po1dBC=20dBm, NF=7.5dB, Model features SP, 1dBC, IP3
va_mc_ZFL-2000_19930601	Mini-Circuits ZFL-2000, 10-2000 MHz, Po1dBC=16dBm, NF=7dB, Model features SP, 1dBC, IP3
va_mc_ZFL-2AD_19930601	Mini-Circuits ZFL-2AD, 2-1000 MHz, Po1dBC=-2dBm, NF=6.5dB, Model features SP, 1dBC, IP3
va_mc_ZFL-500HLN_19930601	Mini-Circuits ZFL-500HLN, 10-500 MHz, Po1dBC=16dBm, NF=3.8dB, Model features SP, 1dBC, IP3

**Table 2-2. Mini-Circuits Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
va_mc_ZFL-500LN_19930601	Mini-Circuits ZFL-500LN, 0.1-500 MHz, Po1dBC=5dBm, NF=2.9dB, Model features SP, 1dBC, IP3
va_mc_ZFL-500_19930601	Mini-Circuits ZFL-500, 0.05-500 MHz, Po1dBC=4.5dBm, NF=5.3dB, Model features SP, 1dBC, IP3
va_mc_ZFL-750_19930601	Mini-Circuits ZFL-750, 0.2-750 MHz, Po1dBC=4.5dBm, NF=6dB, Model features SP, 1dBC, IP3
va_mc_ZHL-0812HLN_19930601	Mini-Circuits ZHL-0812HLN, 800-1200 MHz, Po1dBC=26dBm, NF=1.5dB, Model features SP, 1dBC, IP3
va_mc_ZHL-1-2W_19930601	Mini-Circuits ZHL-1-2W, 5-500 MHz, Po1dBC=33dBm, NF=12dB, Model features SP, 1dBC, IP3
va_mc_ZHL-1-50P3_19930601	Mini-Circuits ZHL-1-50P3, 50-500 MHz, Po1dBC=27dBm, NF=7dB, Model features SP, 1dBC, IP3
va_mc_ZHL-1000-3w_19930601	Mini-Circuits ZHL-1000-3W, 500-1000 MHz, Po1dBC=35dBm, NF=9dB, Model features SP, 1dBC, IP3
va_mc_ZHL-1042J_19930601	Mini-Circuits ZHL-1042J, 10-4200 MHz, Po1dBC=20dBm, NF=4.5dB, Model features SP, 1dBC, IP3
va_mc_ZHL-1217HLN_19930601	Mini-Circuits ZHL-1217HLN, 1200-1700 MHz, Po1dBC=26dBm, NF=1.5dB, Model features SP, 1dBC, IP3
va_mc_ZHL-1724HLN_19930601	Mini-Circuits ZHL-1724HLN, 1700-2400 MHz, Po1dBC=26dBm, NF=1.5dB, Model features SP, 1dBC, IP3
va_mc_ZHL-1A_19930601	Mini-Circuits ZHL-1A, 2-500 MHz, Po1dBC=28dBm, NF=11dB, Model features SP, 1dBC, IP3
va_mc_ZHL-1HLD_19930601	Mini-Circuits ZHL-1HLD, 225-400 MHz, Po1dBC=27dBm, NF=2.5dB, Model features SP, 1dBC, IP3
va_mc_ZHL-2-12_19930601	Mini-Circuits ZHL-2-12, 10-1200 MHz, Po1dBC=29dBm, NF=10dB, Model features SP, 1dBC, IP3
va_mc_ZHL-2-50P3_19930601	Mini-Circuits ZHL-2-50P3, 50-1000 MHz, Po1dBC=25dBm, NF=8dB, Model features SP, 1dBC, IP3
va_mc_ZHL-2-8_19930601	Mini-Circuits ZHL-2-8, 10-1000 MHz, Po1dBC=29dBm, NF=10dB, Model features SP, 1dBC, IP3
va_mc_ZHL-2_19930601	Mini-Circuits ZHL-2, 10-1000 MHz, Po1dBC=29dBm, NF=9dB, Model features SP, 1dBC, IP3
va_mc_ZHL-32A_19930601	Mini-Circuits ZHL-32A, 0.05-130 MHz, Po1dBC=29dBm, NF=10dB, Model features SP, 1dBC, IP3
va_mc_ZHL-3A_19930601	Mini-Circuits ZHL-3A, 0.4-150 MHz, Po1dBC=29.5dBm, NF=11dB, Model features SP, 1dBC, IP3

Table 2-2. Mini-Circuits Amplifiers (continued)

Component Name	Description
va_mc_ZHL-4240W_19930601	Mini-Circuits ZHL-4240W, 10-4200 MHz, Po1dBC=28dBm, NF=8dB, Model features SP, 1dBC, IP3
va_mc_ZHL-4240_19930601	Mini-Circuits ZHL-4240, 700-4200 MHz, Po1dBC=28dBm, NF=4dB, Model features SP, 1dBC, IP3
va_mc_ZHL-42W_19930601	Mini-Circuits ZHL-42W, 10-4200 MHz, Po1dBC=28dBm, NF=8dB, Model features SP, 1dBC, IP3
va_mc_ZHL-42_19930601	Mini-Circuits ZHL-42, 700-4200 MHz, Po1dBC=28dBm, NF=10dB, Model features SP, 1dBC, IP3
va_mc_ZHL-5W-1_19930601	Mini-Circuits ZHL-5W-1, 1-500 MHz, Po1dBC=37dBm, NF=8dB, Model features SP, 1dBC, IP3
va_mc_ZHL-6A_19930601	Mini-Circuits ZHL-6A, 0.0025-500 MHz, Po1dBC=23dBm, NF=7.5dB, Model features SP, 1dBC, IP3
va_mc_ZHL-7-2W_19930601	Mini-Circuits ZHL-7-2W, 600-800 MHz, Po1dBC=33dBm, NF=12dB, Model features SP, 1dBC, IP3
va_mc_ZHL-900-10W_19930601	Mini-Circuits ZHL-900-10W, 480-900 MHz, Po1dBC=38dBm, NF=10dB, Model features SP, 1dBC, IP3

# NEC Amplifiers

For modeling specifications, see “[Schematic Design](#)” on page 2-1.

The NEC Amplifiers include 18 components, representing individual parts. The naming convention for these components is *va\_nec\_<part number>*.

Several components refer to the same NEC part number in different test circuits. The affected component names employ an additional suffix to indicate the test circuit name associated with the corresponding model. An example of one such component is *va\_nec\_UPC1658C-1*, which employs a model characterized using test circuit 1.

Table 2-3. NEC Amplifiers

Component Name	Description
<i>va_nec_UPC1653A_19930601</i>	NEC UPC1653A, 0.1-2.0 GHz, NF=5.5dB, Model features SP
<i>va_nec_UPC1654P_19930601</i>	NEC UPC1654P, 0.1-2.0 GHz, NF=5.5dB, Model features SP
<i>va_nec_UPC1656C_19930601</i>	NEC UPC1656C, 0.05-1.0 GHz, Po1dBC=10dBm, NF=5.5dB, Model features SP, 1dBC
<i>va_nec_UPC1658C_1_19930601</i>	NEC UPC1658C, 0.01-1.5 GHz, test circuit 1, Po1dBC=10dBm, NF=2dB, Model features SP, 1dBC
<i>va_nec_UPC1658C_2_19930601</i>	NEC UPC1658C, 0.01-1.5 GHz, test circuit 2, Po1dBC=10dBm, NF=2dB, Model features SP, 1dBC
<i>va_nec_UPC1658C_3_19930601</i>	NEC UPC1658C, 0.01-1.5 GHz, test circuit 3, Po1dBC=10dBm, NF=2dB, Model features SP, 1dBC
<i>va_nec_UPC1659P_19930601</i>	NEC UPC1659P, 0.05-2.55 GHz, Po1dBC=3dBm, NF=6.5dB, Model features SP, 1dBC
<i>va_nec_UPC1675B_19930601</i>	NEC UPC1675B, 0.1-2.6 GHz, Po1dBC=2.5dBm, NF=5.5dB, Model features SP, 1dBC
<i>va_nec_UPC1675P_19930601</i>	NEC UPC1675P, 0.1-2.0 GHz, NF=5.5dB, Model features SP
<i>va_nec_UPC1676B_19930601</i>	NEC UPC1676B, 0.05-2.4 GHz, NF=4.5dB, Model features SP
<i>va_nec_UPC1676P_19930601</i>	NEC UPC1676P, 0.05-2.4 GHz, NF=4.5dB, Model features SP
<i>va_nec_UPC1677B_19930601</i>	NEC UPC1677B, 0.05-5.0 GHz, Po1dBC=18dBm, NF=6dB, Model features SP, 1dBC
<i>va_nec_UPC1677C_19930601</i>	NEC UPC1677C, 0.1-3.0 GHz, NF=6dB, Model features SP
<i>va_nec_UPC1677P_19930601</i>	NEC UPC1677P, 0.1-3.0 GHz, Po1dBC=18dBm, NF=6dB, Model features SP, 1dBC
<i>va_nec_UPC1678B_19930601</i>	NEC UPC1678B, 0.1-2.0 GHz, NF=6dB, Model features SP

Table 2-3. NEC Amplifiers (continued)

Component Name	Description
va_nec_UPC1678P_19930601	NEC UPC1678P, 0.1-3.0 GHz, Po1dBC=17.5dBm, NF=6dB, Model features SP, 1dBC
va_nec_UPG100B_19930601	NEC UPG100B, 0.1-5.0 GHz, Po1dBC=6dBm, NF=2.7dB, Model features SP, 1dBC
va_nec_UPG101B_19930601	NEC UPG101B, 0.05-5.0 GHz, Po1dBC=18dBm, NF=5dB, Model features SP, 1dBC

# Q-bit Amplifiers

For modeling specifications, see “[Schematic Design](#)” on page 2-1.

The Q-bit Amplifiers include 178 components, representing individual parts. The naming convention for these components is *va\_qb\_<part number>*.

Table 2-4. Q-Bit Amplifiers

Component Name	Description
va_qb_QB-101_19930601	Q-bit QB-101, 2.0-70.0 MHz, Po1dBC=31.00dBm, NF=4.5dB, Model features SP, NP, 1dBC, IP3
va_qb_QB-102_19930601	Q-bit QB-102, 2-32 Mhz, Po1dBC=28dBm, NF=6.2dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-105_19930601	Q-bit QB-105, 2-32 Mhz, Po1dBC=37dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-188-2_19930601	Q-bit QB-188-2, 0.5-100.0 MHz, Po1dBC=27.00dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-188_19930601	Q-bit QB-188, 0.5-100.0 MHz, Po1dBC=21.00dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-189_19930601	Q-bit QB-189, 0.5-500.0 MHz, Po1dBC=25.00dBm, NF=7.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-192_19930601	Q-bit QB-192, 806.0-824.0 MHz, Po1dBC=27.00dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-193_19930601	Q-bit QB-193, 806.0-824.0 MHz, Po1dBC=27.00dBm, NF=2.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-196_19930601	Q-bit QB-196, 896.0-901.0 MHz, Po1dBC=27.00dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-197_19930601	Q-bit QB-197, 896.0-901.0 MHz, Po1dBC=27.00dBm, NF=2.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-201_19930601	Q-bit QB-201, 800-1000 Mhz, Po1dBC=30dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-210_19930601	Q-bit QB-210, 10.0-200.0 MHz, Po1dBC=23.00dBm, NF=10.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-255_19930601	Q-bit QB-255, 800-900 Mhz, Po1dBC=24dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-258_19930601	Q-bit QB-258, 10.0-250.0 MHz, Po1dBC=15.00dBm, NF=2.4dB, Model features SP, NF, 1dBC, IP3

Table 2-4. Q-Bit Amplifiers (continued)

Component Name	Description
va_qb_QB-262_19930601	Q-bit QB-262, 10.0-500.0 MHz, Po1dB=27.00dBm, NF=7.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-300_19930601	Q-bit QB-300, 1.0-300.0 MHz, Po1dB=22.00dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-304_19930601	Q-bit QB-304, 800-900 Mhz, Po1dB=24dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-442_19930601	Q-bit QB-442, 10-400 Mhz, Po1dB=32dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-500-2_19930601	Q-bit QB-500-2, 2.0-500.0 MHz, Po1dB=22.00dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-500_19930601	Q-bit QB-500, 2.0-500.0 MHz, Po1dB=19.00dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-512-2_19930601	Q-bit QB-512-2, 2.0-500.0 MHz, Po1dB=22.00dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-538_19930601	Q-bit QB-538, 2.0-500.0 MHz, Po1dB=22.00dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-717_19930601	Q-bit QB-717, 5-200 Mhz, Po1dB=22dBm, NF=3.6dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-7205_19930601	Q-bit QB-7205, 2.0-30.0 MHz, Po1dB=27.00dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-7223_19930601	Q-bit QB-7223, 2-32 Mhz, Po1dB=34.0dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-728B_19930601	Q-bit QB-728B, 300-900 Mhz, Po1dB=30dBm, NF=10.5 dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-744_19930601	Q-bit QB-744, 2.0-200.0 MHz, Po1dB=30.00dBm, NF=7.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-749_19930601	Q-bit QB-749, 50.0-1000.0 MHz, Po1dB=7.00dBm, NF=3.7dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-760_19930601	Q-bit QB-760, 10.0-500.0 MHz, Po1dB=8.00dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-761_19930601	Q-bit QB-761, 806.0-870.0 MHz, Po1dB=18.00dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-808_19930601	Q-bit QB-808, 2-600 Mhz, Po1dB=22dBm, NF=7.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-815_19930601	Q-bit QB-815, 10-1000 Mhz, Po1dB=14dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3



**Table 2-4. Q-Bit Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
va_qb_QB-820_19930601	Q-bit QB-820, 50.0-850.0 MHz, Po1dBC=14.00dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QB-824_19930601	Q-bit QB-824, 50-850 Mhz, Po1dBC=8dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-101_19930601	Q-bit QBH-101, 25.0-450.0 MHz, Po1dBC=7.00dBm, NF=2.4dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-102_19930601	Q-bit QBH-102, 5.0-500.0 MHz, Po1dBC=21.00dBm, NF=7.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-103_19930601	Q-bit QBH-103, 10.0-90.0 MHz, Po1dBC=22.00dBm, NF=6.8dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-104_19930601	Q-bit QBH-104, 5.0-500.0 MHz, Po1dBC=10.50dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-105_19930601	Q-bit QBH-105, 5.0-300.0 MHz, Po1dBC=8.00dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-106_19930601	Q-bit QBH-106, 10.0-500.0 MHz, Po1dBC=1.00dBm, NF=2.4dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-107_19930601	Q-bit QBH-107, 5.0-550.0 MHz, Po1dBC=0.00dBm, NF=2.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-108_19930601	Q-bit QBH-108, 5.0-300.0 MHz, Po1dBC=20.00dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-109_19930601	Q-bit QBH-109, 10.0-500.0 MHz, Po1dBC=12.00dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-110_19930601	Q-bit QBH-110, 10.0-500.0 MHz, Po1dBC=9.00dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-114_19930601	Q-bit QBH-114, 10.0-400.0 MHz, Po1dBC=7.00dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-115_19930601	Q-bit QBH-115, 10.0-500.0 MHz, Po1dBC=26.00dBm, NF=7.8dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-116_19930601	Q-bit QBH-116, 5.0-400.0 MHz, Po1dBC=16.00dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-117_19930601	Q-bit QBH-117, 5.0-100.0 MHz, Po1dBC=4.50dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-118_19930601	Q-bit QBH-118, 3.0-100.0 MHz, Po1dBC=13.00dBm, NF=1.9dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-119_19930601	Q-bit QBH-119, 5.0-500.0 MHz, Po1dBC=12.00dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3

Table 2-4. Q-Bit Amplifiers (continued)

Component Name	Description
va_qb_QBH-120_19930601	Q-bit QBH-120, 5.0-500.0 MHz, Po1dBC=2.00dBm, NF=2.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-1216_19930601	Q-bit QBH-1216, 230.0-570.0 MHz, Po1dBC=20.00dBm, NF=8.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-121_19930601	Q-bit QBH-121, 10.0-500.0 MHz, Po1dBC=12.00dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-1229_19930601	Q-bit QBH-1229, 100.0-500.0 MHz, Po1dBC=15.00dBm, NF=3.3dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-122_19930601	Q-bit QBH-122, 10.0-500.0 MHz, Po1dBC=20.00dBm, NF=4.2dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-1230_19930601	Q-bit QBH-1230, 318.0-358.0 MHz, Po1dBC=14.50dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-1234_19930601	Q-bit QBH-1234, 100.0-500.0 MHz, Po1dBC=0.00dBm, NF=0.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-123_19930601	Q-bit QBH-123, 5.0-800.0 MHz, Po1dBC=7.00dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-124_19930601	Q-bit QBH-124, 10.0-90.0 MHz, Po1dBC=17.00dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-125_19930601	Q-bit QBH-125, 20.0-100.0 MHz, Po1dBC=23.00dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-126_19930601	Q-bit QBH-126, 5.0-500.0 MHz, Po1dBC=16.00dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-1274_19930601	Q-bit QBH-1274, 10-100 Mhz, Po1dBC=24dBm, NF=4dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-127_19930601	Q-bit QBH-127, 10.0-500.0 MHz, Po1dBC=15.00dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-128_19930601	Q-bit QBH-128, 20.0-1200.0 MHz, Po1dBC=13.00dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-130_19930601	Q-bit QBH-130, 10.0-100.0 MHz, Po1dBC=15.50dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-131_19930601	Q-bit QBH-131, 5.0-1300.0 MHz, Po1dBC=7.00dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-132_19930601	Q-bit QBH-132, 15.0-700.0 MHz, Po1dBC=16.00dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-133_19930601	Q-bit QBH-133, 10.0-500.0 MHz, Po1dBC=16.00dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3

Table 2-4. Q-Bit Amplifiers (continued)

Component Name	Description
va_qb_QBH-134_19930601	Q-bit QBH-134, 5.0-500.0 MHz, Po1dBc=7.00dBm, NF=2.5dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-135_19930601	Q-bit QBH-135, 3.0-350.0 MHz, Po1dBc=1.00dBm, NF=2.1dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-136_19930601	Q-bit QBH-136, 10.0-200.0 MHz, Po1dBc=21.00dBm, NF=4.0dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-137_19930601	Q-bit QBH-137, 10.0-200.0 MHz, Po1dBc=21.00dBm, NF=3.5dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-138_19930601	Q-bit QBH-138, 5.0-150.0 MHz, Po1dBc=21.00dBm, NF=3.2dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-139_19930601	Q-bit QBH-139, 5.0-100.0 MHz, Po1dBc=12.00dBm, NF=2.6dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-141_19930601	Q-bit QBH-141, 10.0-300.0 MHz, Po1dBc=7.50dBm, NF=2.9dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-142_19930601	Q-bit QBH-142, 10.0-140.0 MHz, Po1dBc=7.00dBm, NF=2.3dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-145_19930601	Q-bit QBH-145, 10.0-150.0 MHz, Po1dBc=19.00dBm, NF=5.8dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-146_19930601	Q-bit QBH-146, 20.0-1100.0 MHz, Po1dBc=6.00dBm, NF=2.9dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-147_19930601	Q-bit QBH-147, 20.0-1100.0 MHz, Po1dBc=10.00dBm, NF=3.5dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-149_19930601	Q-bit QBH-149, 10.0-150.0 MHz, Po1dBc=17.50dBm, NF=2.8dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-150_19930601	Q-bit QBH-150, 10.0-300.0 MHz, Po1dBc=18.00dBm, NF=3.5dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-152_19930601	Q-bit QBH-152, 10.0-300.0 MHz, Po1dBc=18.00dBm, NF=3.5dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-153_19930601	Q-bit QBH-153, 10.0-700.0 MHz, Po1dBc=25.00dBm, NF=9.5dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-154_19930601	Q-bit QBH-154, 200.0-1200.0 MHz, Po1dBc=8.00dBm, NF=2.6dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-155_19930601	Q-bit QBH-155, 5.0-300.0 MHz, Po1dBc=22.00dBm, NF=5.8dB, Model features SP, NF, 1dBc, IP3
va_qb_QBH-157_19930601	Q-bit QBH-157, 5.0-500.0 MHz, Po1dBc=22.00dBm, NF=7.2dB, Model features SP, NF, 1dBc, IP3

Table 2-4. Q-Bit Amplifiers (continued)

Component Name	Description
va_qb_QBH-160_19930601	Q-bit QBH-160, 20.0-1200.0 MHz, Po1dBC=17.00dBm, NF=8.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-164_19930601	Q-bit QBH-164, 20.0-1300.0 MHz, Po1dBC=14.50dBm, NF=8.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-167_19930601	Q-bit QBH-167, 10.0-500.0 MHz, Po1dBC=26.00dBm, NF=7.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-169_19930601	Q-bit QBH-169, 10.0-1000.0 MHz, Po1dBC=20.00dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-171_19930601	Q-bit QBH-171, 10.0-150.0 MHz, Po1dBC=27.00dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-172_19930601	Q-bit QBH-172, 1.0-100.0 MHz, Po1dBC=16.00dBm, NF=3.3dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-174_19930601	Q-bit QBH-174, 20-1200 Mhz, Po1dBC=5dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-175_19930601	Q-bit QBH-175, 20.0-500.0 MHz, Po1dBC=15.00dBm, NF=3.3dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-176_19930601	Q-bit QBH-176, 5.0-1100.0 MHz, Po1dBC=18.00dBm, NF=7.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-178_19930601	Q-bit QBH-178, 20.0-700.0 MHz, Po1dBC=5.50dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-179_19930601	Q-bit QBH-179, 5.0-200.0 MHz, Po1dBC=9.00dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-180_19930601	Q-bit QBH-180, 5.0-150.0 MHz, Po1dBC=18.00dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-181_19930601	Q-bit QBH-181, 10.0-200.0 MHz, Po1dBC=16.00dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-182_19930601	Q-bit QBH-182, 10.0-500.0 MHz, Po1dBC=25.00dBm, NF=8.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-183_19930601	Q-bit QBH-183, 5.0-1100.0 MHz, Po1dBC=16.00dBm, NF=5.8dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-184_19930601	Q-bit QBH-184, 5.0-1000.0 MHz, Po1dBC=10.00dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-186_19930601	Q-bit QBH-186, 10.0-600.0 MHz, Po1dBC=21.00dBm, NF=7.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-187_19930601	Q-bit QBH-187, 10.0-500.0 MHz, Po1dBC=11.00dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3

Table 2-4. Q-Bit Amplifiers (continued)

Component Name	Description
va_qb_QBH-189_19930601	Q-bit QBH-189, 5.0-2000.0 MHz, Po1dBC=16.00dBm, NF=7.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-191_19930601	Q-bit QBH-191, 5.0-500.0 MHz, Po1dBC=16.50dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-196_19930601	Q-bit QBH-196, 20.0-700.0 MHz, Po1dBC=15.00dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-198_19930601	Q-bit QBH-198, 5.0-450.0 MHz, Po1dBC=12.00dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-199_19930601	Q-bit QBH-199, 5.0-200.0 MHz, Po1dBC=7.00dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-228_19930601	Q-bit QBH-228, 5.0-100.0 MHz, Po1dBC=27.00dBm, NF=4.7dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-229_19930601	Q-bit QBH-229, 5.0-200.0 MHz, Po1dBC=27.00dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-302_19930601	Q-bit QBH-302, 10.0-450.0 MHz, Po1dBC=17.00dBm, NF=4.3dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-304_19930601	Q-bit QBH-304, 5.0-200.0 MHz, Po1dBC=8.50dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-4002_19930601	Q-bit QBH-4002, 200.0-3000.0 MHz, Po1dBC=12.00dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-4005_19930601	Q-bit QBH-4005, 1200-1600 Mhz, Po1dBC=5dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-4007_19930601	Q-bit QBH-4007, 50.0-2000.0 MHz, Po1dBC=28.00dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-4008_19930601	Q-bit QBH-4008, 1100-2500 Mhz, Po1dBC=28dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-804_19930601	Q-bit QBH-804, 10.0-100.0 MHz, Po1dBC=24.00dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-810_19930601	Q-bit QBH-810, 10.0-200.0 MHz, Po1dBC=22.00dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-811_19930601	Q-bit QBH-811, 200.0-1200.0 MHz, Po1dBC=8.00dBm, NF=2.6dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-812_19930601	Q-bit QBH-812, 50.0-500.0 MHz, Po1dBC=15.00dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-813_19930601	Q-bit QBH-813, 10.0-600.0 MHz, Po1dBC=15.00dBm, NF=3.3dB, Model features SP, NF, 1dBC, IP3

Table 2-4. Q-Bit Amplifiers (continued)

Component Name	Description
va_qb_QBH-814_19930601	Q-bit QBH-814, 10.0-1000.0 MHz, Po1dBC=24.50dBm, NF=9.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-816_19930601	Q-bit QBH-816, 10.0-2000.0 MHz, Po1dBC=21.00dBm, NF=8.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-817_19930601	Q-bit QBH-817, 10.0-1500.0 MHz, Po1dBC=20.00dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-818_19930601	Q-bit QBH-818, 10.0-400.0 MHz, Po1dBC=14.50dBm, NF=2.9dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-819_19930601	Q-bit QBH-819, 2.0-1000.0 MHz, Po1dBC=18.00dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-821_19930601	Q-bit QBH-821, 10.0-1000.0 MHz, Po1dBC=9.00dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-822_19930601	Q-bit QBH-822, 10.0-2000.0 MHz, Po1dBC=11.00dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-823_19930601	Q-bit QBH-823, 10.0-2000.0 MHz, Po1dBC=8.00dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-824_19930601	Q-bit QBH-824, 10.0-2000.0 MHz, Po1dBC=12.00dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-825_19930601	Q-bit QBH-825, 10.0-1200.0 MHz, Po1dBC=18.50dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-826_19930601	Q-bit QBH-826, 10.0-450.0 MHz, Po1dBC=20.00dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-827_19930601	Q-bit QBH-827, 10.0-1000.0 MHz, Po1dBC=27.00dBm, NF=8.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-828_19930601	Q-bit QBH-828, 10.0-1000.0 MHz, Po1dBC=19.50dBm, NF=4.8dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-830_19930601	Q-bit QBH-830, 10.0-1300.0 MHz, Po1dBC=2.00dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-831_19930601	Q-bit QBH-831, 10-1300 Mhz, Po1dBC=2dBm, NF=4dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-834_19930601	Q-bit QBH-834, 10.0-100.0 MHz, Po1dBC=27.00dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-835_19930601	Q-bit QBH-835, 10.0-500.0 MHz, Po1dBC=24.50dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-838_19930601	Q-bit QBH-838, 50.0-500.0 MHz, Po1dBC=1.00dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3

**Table 2-4. Q-Bit Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
va_qb_QBH-840_19930601	Q-bit QBH-840, 10.0-400.0 MHz, Po1dBC=20.00dBm, NF=5.8dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-841_19930601	Q-bit QBH-841, 5.0-100.0 MHz, Po1dBC=4.50dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-842_19930601	Q-bit QBH-842, 10.0-250.0 MHz, Po1dBC=27.00dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-843_19930601	Q-bit QBH-843, 5-100 Mhz, Po1dBC=30dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-844_19930601	Q-bit QBH-844, 10.0-400.0 MHz, Po1dBC=19.00dBm, NF=3.7dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-845_19930601	Q-bit QBH-845, 3.0-100.0 MHz, Po1dBC=16.00dBm, NF=1.9dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-847_19930601	Q-bit QBH-847, 30.0-1000.0 MHz, Po1dBC=10.00dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-849_19930601	Q-bit QBH-849, 5.0-600.0 MHz, Po1dBC=12.00dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-853_19930601	Q-bit QBH-853, 100-300 Mhz, Po1dBC=21dBm, NF=1.8dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-854_19930601	Q-bit QBH-854, 10-100 Mhz, Po1dBC=24dBm, NF=4dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-857_19930601	Q-bit QBH-857, 10-200 Mhz, Po1dBC=11dBm, NF=2dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-866_19930601	Q-bit QBH-866, 10-1500 Mhz, Po1dBC=13.5dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-868_19930601	Q-bit QBH-868, 10.0-1500.0 MHz, Po1dBC=14.00dBm, NF=7.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-869_19930601	Q-bit QBH-869, 10.0-1000.0 MHz, Po1dBC=20.00dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-870_19930601	Q-bit QBH-870, 10.0-200.0 MHz, Po1dBC=20.00dBm, NF=2.9dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-887_19930601	Q-bit QBH-887, 10.0-100.0 MHz, Po1dBC=10.00dBm, NF=2.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBH-9234_19930601	Q-bit QBH-9234, 5-100 Mhz, Po1dBC=4.5dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-101_19930601	Q-bit QBS-101, 2-70 Mhz, Po1dBC=4.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3

Table 2-4. Q-Bit Amplifiers (continued)

Component Name	Description
va_qb_QBS-104_19930601	Q-bit QBS-104, 896.0-925.0 MHz, Po1dBC=26.00dBm, NF=2.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-108_19930601	Q-bit QBS-108, 824.0-849.0 MHz, Po1dBC=25.00dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-110_19930601	Q-bit QBS-110, 806.0-849.0 MHz, Po1dBC=26.00dBm, NF=2.0dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-125_19930601	Q-bit QBS-125, 896-960 Mhz, Po1dBC=28dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-126-1_19930601	Q-bit QBS-126-1, 925-960 Mhz, Po1dBC=28dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-126-2_19930601	Q-bit QBS-126-2, 925.0-960.0 MHz, Po1dBC=28.00dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-127-2_19930601	Q-bit QBS-127-2, 940.0-956.0 MHz, Po1dBC=22.00dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-133_19930601	Q-bit QBS-133, 825.0-845.0 MHz, Po1dBC=19.00dBm, NF=1.3dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-135_19930601	Q-bit QBS-135, 824-849 Mhz, Po1dBC=24dBm, NF=1.3dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-136_19930601	Q-bit QBS-136, 824-849 Mhz, Po1dBC=25dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-137_19930601	Q-bit QBS-137, 824-849 Mhz, Po1dBC=15dBm, NF=1.3dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-141-1_19930601	Q-bit QBS-141-1, 824-849 Mhz, Po1dBC=28dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-141-2_19930601	Q-bit QBS-141-2, 824-849 Mhz, Po1dBC=28dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-142-1_19930601	Q-bit QBS-142-1, 824-849 Mhz, Po1dBC=22dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-142-2_19930601	Q-bit QBS-142-2, 824-849 Mhz, Po1dBC=22dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-146-1_19930601	Q-bit QBS-146-1, 870-915 Mhz, Po1dBC=28dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-146-2_19930601	Q-bit QBS-146-2, 870-915 Mhz, Po1dBC=28dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-147-1_19930601	Q-bit QBS-147-1, 870-915 Mhz, Po1dBC=22dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3



**Table 2-4. Q-Bit Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
va_qb_QBS-147-2_19930601	Q-bit QBS-147-2, 870-915 Mhz, Po1dBC=22dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
va_qb_QBS-158_19930601	Q-bit QBS-158, 800-960 Mhz, Po1dBC=33dBm, NF=2.5dB, Model features SP, NF, 1dBC, IP3

## TriQuint Amplifiers

For modeling specifications, see “[Schematic Design](#)” on page 2-1.

The TriQuint Amplifiers include a single component, representing an individual amplifier. The naming convention for this component is *va\_tqs\_<part number>*.

Table 2-5. TriQuint Amplifiers

Component Name	Description
va_tqs_TQ9111D_19930601	TriQuint TQ9111D, 1.0-8.0 GHz, Po1dBC=18dBm, NF=5dB, Model features SP, 1dBC, IP3

# Watkins-Johnson Amplifiers

For modeling specifications, see “[Schematic Design](#)” on page 2-1.

The Watkins-Johnson Amplifiers includes 150 components, representing individual parts. The naming convention for these components is *va\_wj\_<part number>*.

Several components refer to the same Watkins-Johnson part number at different operating conditions (*Vcc*). The affected component names employ an additional suffix to indicate the *Vcc* operating voltage associated with the corresponding model. An example of such an component is *va\_wj\_A70-3\_12V*, which employs a model characterized using *Vcc=12V*.

Table 2-6. Watkins-Johnson Amplifiers

Component Name	Description
va_wj_A11_19930601	Watkins-Johnson A11, 5-1000 MHz, Po1dBC=-2.0dBm, NF=3.1dB, Model features SP, NF, 1dBC, IP3
va_wj_A12_19930601	Watkins-Johnson A12, 10-1000 MHz, Po1dBC=8.0dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3
va_wj_A16-2_19930601	Watkins-Johnson A16-2, 10-1200 MHz, Po1dBC=6.0dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A17_19930601	Watkins-Johnson A17, 10-1000 MHz, Po1dBC=15.3dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A18-1_19930601	Watkins-Johnson A18-1, 10-1000 MHz, Po1dBC=16.0dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
va_wj_A180_19930601	Watkins-Johnson A180, 10-500 MHz, Po1dBC=18dBm, NF=3.4dB, Model features SP, NF, 1dBC, IP3
va_wj_A181_19930601	Watkins-Johnson A181, 10-250 MHz, Po1dBC=22dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
va_wj_A18_19930601	Watkins-Johnson A18, 5-800 MHz, Po1dBC=13.5dBm, NF=3.8dB, Model features SP, 1dBC, IP3
va_wj_A19-1_19930601	Watkins-Johnson A19-1, 10-1000 MHz, Po1dBC=22.5dBm, NF=6.0dB, Model features SP, 1dBC, IP3
va_wj_A19_19930601	Watkins-Johnson A19, 10-1000 MHz, Po1dBC=21.0dBm, NF=9.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A1_19930601	Watkins-Johnson A1, 5-500 MHz, Po1dBC=-1.0dBm, NF=2.4dB, Model features SP, NF, 1dBC, IP3
va_wj_A21-1_19930601	Watkins-Johnson A21-1, 10-1200 MHz, Po1dBC=-1.0dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3

Table 2-6. Watkins-Johnson Amplifiers (continued)

Component Name	Description
va_wj_A24_19930601	Watkins-Johnson A24, 5-1500 MHz, Po1dBC=8.0dBm, NF=4.2dB, Model features SP, NF, 1dBC, IP3
va_wj_A25-1_19930601	Watkins-Johnson A25-1, 2-1500 MHz, Po1dBC=9.0dBm, NF<3.8dB, Model features SP, NF, 1dBC, IP3
va_wj_A25_19930601	Watkins-Johnson A25, 5-1500 MHz, Po1dBC=9.0dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A26_19930601	Watkins-Johnson A26, 10-1500 MHz, Po1dBC=14dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A27_19930601	Watkins-Johnson A27, 10-1500 MHz, Po1dBC=15.5dBm, NF=7.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A28-2_19930601	Watkins-Johnson A28-2, 10-1500 MHz, Po1dBC=10.0dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A28_19930601	Watkins-Johnson A28, 5-1500 MHz, Po1dBC=15.0dBm, NF=6.0dB, Model features SP, 1dBC, IP3
va_wj_A29-1_19930601	Watkins-Johnson A29-1, 10-1500 MHz, Po1dBC=22.0dBm, NF=8.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A29_19930601	Watkins-Johnson A29, 10-1500 MHz, Po1dBC=22.0dBm, NF=9.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A31-1_19930601	Watkins-Johnson A31-1, 5-2000 MHz, Po1dBC=-4.0dBm, NF=3.5dB, Model features SP, 1dBC, IP3
va_wj_A32-1_19930601	Watkins-Johnson A32-1, 100-2000 MHz, Po1dBC=13.0dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A32_19930601	Watkins-Johnson A32, 100-2000 MHz, Po1dBC=21.0dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A33-1_19930601	Watkins-Johnson A33-1, 2-2400 MHz, Po1dBC=6.0dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A33_19930601	Watkins-Johnson A33, 10-2000 MHz, Po1dBC=3.0dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A34-1_19930601	Watkins-Johnson A34-1, 1.5-2.3 GHz, Po1dBC=8.0dBm, NF=5.7dB, Model features SP, NF, 1dBC, IP3
va_wj_A34_19930601	Watkins-Johnson A34, 100-2000 MHz, Po1dBC=7.0dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A35-1_19930601	Watkins-Johnson A35-1, 2-2400 MHz, Po1dBC=9.5dBm, NF=4.2dB, Model features SP, 1dBC, IP3
va_wj_A35_19930601	Watkins-Johnson A35, 10-2000 MHz, Po1dBC=9.0dBm, NF=5.0dB, Model features SP, 1dBC, IP3

**Table 2-6. Watkins-Johnson Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
va_wj_A36-1_19930601	Watkins-Johnson A36-1, 100-2300 MHz, Po1dBC=12.0dBm, NF=6.0dB, Model features SP, 1dBC, IP3
va_wj_A36-2_19930601	Watkins-Johnson A36-2, 100-2600 MHz, Po1dBC=12.0dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A36_19930601	Watkins-Johnson A36, 100-2000 MHz, Po1dBC=12.0dBm, NF=5.5dB, Model features SP, 1dBC, IP3
va_wj_A37_19930601	Watkins-Johnson A37, 10-2000 MHz, Po1dBC=15.5dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A38-1_19930601	Watkins-Johnson A38-1, 10-2000 MHz, Po1dBC=18.0dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A38_19930601	Watkins-Johnson A38, 10-2000 MHz, Po1dBC=18.0dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A39_19930601	Watkins-Johnson A39, 10-2000 MHz, Po1dBC=22.0dBm, NF<8.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A3_19930601	Watkins-Johnson A3, 5-500 MHz, Po1dBC=-1.0dBm, NF=3.3dB, Model features SP, NF, 1dBC, IP3
va_wj_A40_19930601	Watkins-Johnson A40, 500-4000 MHz, Po1dBC=15.0dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A41_19930601	Watkins-Johnson A41, 1-4 GHz, Po1dBC=12.0dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A43_19930601	Watkins-Johnson A43, 100-3200 MHz, Po1dBC=8.5dBm, NF=6.7dB, Model features SP, NF, 1dBC, IP3
va_wj_A45-1_19930601	Watkins-Johnson A45-1, 1-4 GHz, Po1dBC=13.0dBm, NF=4.1dB, Model features SP, NF, 1dBC, IP3
va_wj_A45_19930601	Watkins-Johnson A45, 1-4 GHz, Po1dBC=19.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A5-5_19930601	Watkins-Johnson A5-5, 5-500 MHz, Po1dBC=9.0dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A5-6_19930601	Watkins-Johnson A5-6, 5-600 MHz, Po1dBC=8.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A53_19930601	Watkins-Johnson A53, 10-500 MHz, Po1dBC=3.5dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A54_19930601	Watkins-Johnson A54, 5-400 MHz, Po1dBC=8.0dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A55_19930601	Watkins-Johnson A55, 10-500 MHz, Po1dBC=11.0dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3

Table 2-6. Watkins-Johnson Amplifiers (continued)

Component Name	Description
va_wj_A56_19930601	Watkins-Johnson A56, 5-400 MHz, Po1dBC=13.5dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A57_19930601	Watkins-Johnson A57, 10-500 MHz, Po1dBC=14.0dBm, NF=4.8dB, Model features SP, NF, 1dBC, IP3
va_wj_A58_19930601	Watkins-Johnson A58, 5-500 MHz, Po1dBC=19.0dBm, NF=4.8dB, Model features SP, NF, 1dBC, IP3
va_wj_A59-1_19930601	Watkins-Johnson A59-1, 10-700 MHz, Po1dBC=22.0dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A59_19930601	Watkins-Johnson A59, 5-500 MHz, Po1dBC=22.0dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A5_19930601	Watkins-Johnson A5, 5-500 MHz, Po1dBC=8.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A61-1_19930601	Watkins-Johnson A61-1, 2-6 GHz, Po1dBC=20.0dBm, NF=3.4dB, Model features SP, NF, 1dBC, IP3
va_wj_A61_19930601	Watkins-Johnson A61, 2-6 GHz, Po1dBC=12.5dBm, NF=3.2dB, Model features SP, NF, 1dBC, IP3
va_wj_A63_19930601	Watkins-Johnson A63, 5-1000 MHz, Po1dBC=4.0dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A64_19930601	Watkins-Johnson A64, 10-1200 MHz, Po1dBC=8.0dBm, NF=3.2dB, Model features SP, NF, 1dBC, IP3
va_wj_A65_19930601	Watkins-Johnson A65, 10-1000 MHz, Po1dBC=10.0dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A66-1_19930601	Watkins-Johnson A66-1, 10-1000 MHz, Po1dBC=15.0dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3
va_wj_A66-3_19930601	Watkins-Johnson A66-3, 10-1000 MHz, Po1dBC=3.0dBm, NF<3.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A66_19930601	Watkins-Johnson A66, 10-1200 MHz, Po1dBC=15.0dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A67-1_19930601	Watkins-Johnson A67-1, 10-600 MHz, Po1dBC=17.0dBm, NF<4.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A67_19930601	Watkins-Johnson A67, 10-800 MHz, Po1dBC=16.0dBm, NF<4.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A70-1_19930601	Watkins-Johnson A70-1, 10-250 MHz, Po1dBC=14.0dBm, NF=1.8dB, Model features SP, NF, 1dBC, IP3
va_wj_A70-2_19930601	Watkins-Johnson A70-2, 10-250 MHz, Po1dBC=19.0dBm, NF=2.2dB, Model features SP, NF, 1dBC, IP3

**Table 2-6. Watkins-Johnson Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
va_wj_A70-3_12V_19930601	Watkins-Johnson A70-3, Vcc=12V, 20-250 MHz, Po1dB=21.0dBm, NF=2.5dB, Model features SP, NF, 1dB, IP3
va_wj_A70-3_15V_19930601	Watkins-Johnson A70-3, Vcc=15V, 20-250 MHz, Po1dB=21.0dBm, NF=2.5dB, Model features SP, NF, 1dB, IP3
va_wj_A70_19930601	Watkins-Johnson A70, 10-250 MHz, Po1dB=8.5dBm, NF=1.8dB, Model features SP, NF, 1dB, IP3
va_wj_A71_19930601	Watkins-Johnson A71, 5-200 MHz, Po1dB=-2.5dBm, NF=2.1dB, Model features SP, NF, 1dB, IP3
va_wj_A72_5V_19930601	Watkins-Johnson A72, Vcc=5V, 5-500 MHz, Po1dB=12.5dBm, NF=4.0dB, Model features SP, NF, 1dB, IP3
va_wj_A72_8V_19930601	Watkins-Johnson A72, Vcc=8V, 5-500 MHz, Po1dB=16.5dBm, NF=4.0dB, Model features SP, NF, 1dB, IP3
va_wj_A73_19930601	Watkins-Johnson A73, 5-500 MHz, Po1dB=1.5dBm, NF=3.5dB, Model features SP, NF, 1dB, IP3
va_wj_A74-1_19930601	Watkins-Johnson A74-1, 5-250 MHz, Po1dB=8.5dBm, NF=4.5dB, Model features SP, NF, 1dB, IP3
va_wj_A74-2_19930601	Watkins-Johnson A74-2, 5-500 MHz, Po1dB=-1.0dBm, NF=3.8dB, Model features SP, NF, 1dB, IP3
va_wj_A74_19930601	Watkins-Johnson A74, 5-500 MHz, Po1dB=8.5dBm, NF=3.0dB, Model features SP, NF, 1dB, IP3
va_wj_A75-2_19930601	Watkins-Johnson A75-2, 5-250 MHz, Po1dB=8.0dBm, NF=4.2dB, Model features SP, NF, 1dB, IP3
va_wj_A75-3_19930601	Watkins-Johnson A75-3, 10-500 MHz, Po1dB=3.5dBm, NF=2.3dB, Model features SP, NF, 1dB, IP3
va_wj_A75_19930601	Watkins-Johnson A75, 5-500 MHz, Po1dB=9.0dBm, NF=2.6dB, Model features SP, NF, 1dB, IP3
va_wj_A76-1_19930601	Watkins-Johnson A76-1, 5-500 MHz, Po1dB=13dBm, NF=2.8dB, Model features SP, NF, 1dB, IP3
va_wj_A76_19930601	Watkins-Johnson A76, 5-500 MHz, Po1dB=15dBm, NF=4.7dB, Model features SP, NF, 1dB, IP3
va_wj_A77-1_19930601	Watkins-Johnson A77-1, 5-600 MHz, Po1dB=16.5dBm, NF=5dB, Model features SP, NF, 1dB, IP3
va_wj_A77_15V_19930601	Watkins-Johnson A77, Vcc=15V, 5-500 MHz, Po1dB=16.5dBm, NF=5.0dB, Model features SP, NF, 1dB, IP3
va_wj_A77_8V_19930601	Watkins-Johnson A77, Vcc=8V, 5-500 MHz, Po1dB=16.5dBm, NF=5.0dB, Model features SP, NF, 1dB, IP3

Table 2-6. Watkins-Johnson Amplifiers (continued)

Component Name	Description
va_wj_A78_19930601	Watkins-Johnson A78, 5-300 MHz, Po1dBC=19.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A79_19930601	Watkins-Johnson A79, 10-300 MHz, Po1dBC=22.0dBm, NF=5.2dB, Model features SP, NF, 1dBC, IP3
va_wj_A7_19930601	Watkins-Johnson A7, 5-500 MHz, Po1dBC=14.0dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A80-1_12V_19930601	Watkins-Johnson A80-1, Vcc=12V, 10-200 MHz, Po1dBC=16.0dBm, NF=2.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A80-1_15V_19930601	Watkins-Johnson A80-1, Vcc=15V, 10-200 MHz, Po1dBC=16.0dBm, NF=2.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A80_12V_19930601	Watkins-Johnson A80, Vcc=12V, 20-500 MHz, Po1dBC=14.3dBm, NF=2.3dB, Model features SP, NF, 1dBC, IP3
va_wj_A80_15V_19930601	Watkins-Johnson A80, Vcc=15V, 20-500 MHz, Po1dBC=14.3dBm, NF=2.3dB, Model features SP, NF, 1dBC, IP3
va_wj_A81-1_19930601	Watkins-Johnson A81-1, 20-250 MHz, Po1dBC=12.5dBm, NF=2.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A81-2_19930601	Watkins-Johnson A81-2, 20-500 MHz, Po1dBC=15dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A81-3_19930601	Watkins-Johnson A81-3, 20-500 MHz, Po1dBC=8dBm, NF=3.6dB, Model features SP, NF, 1dBC, IP3
va_wj_A81_12V_19930601	Watkins-Johnson A81, Vcc=12V, 20-250 MHz, Po1dBC=17.0dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A81_15V_19930601	Watkins-Johnson A81, Vcc=15V, 20-250 MHz, Po1dBC=17.0dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A82_12V_19930601	Watkins-Johnson A82, Vcc=12V, 20-250 MHz, Po1dBC=20.0dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A82_15V_19930601	Watkins-Johnson A82, Vcc=15V, 20-250 MHz, Po1dBC=20.0dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
va_wj_A83_19930601	Watkins-Johnson A83, 10-500 MHz, Po1dBC=-1dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
va_wj_A86-1_19930601	Watkins-Johnson A86-1, 10-200 MHz, Po1dBC=16dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3
va_wj_A86_19930601	Watkins-Johnson A86, 10-200 MHz, Po1dBC=9dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
va_wj_A87-1_19930601	Watkins-Johnson A87-1, 10-400 MHz, Po1dBC=17dBm, NF=3.6dB, Model features SP, NF, 1dBC, IP3



**Table 2-6. Watkins-Johnson Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
va_wj_A87-2_19930601	Watkins-Johnson A87-2, 10-300 MHz, Po1dBC=9.5dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
va_wj_A87_19930601	Watkins-Johnson A87, 5-400 MHz, Po1dBC=17.0dBm, NF=4.7dB, Model features SP, 1dBC, IP3
va_wj_A88-1_19930601	Watkins-Johnson A88-1, 5-300 MHz, Po1dBC=18.5dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
va_wj_A88_19930601	Watkins-Johnson A88, 5-500 MHz, Po1dBC=20.5dBm, NF=5.5dB, Model features SP, 1dBC, IP3
va_wj_A89_19930601	Watkins-Johnson A89, 100-800 MHz, Po1dBC=17.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_A9_19930601	Watkins-Johnson A9, 5-500 MHz, Po1dBC=22.0dBm, NF=8.0dB, Model features SP, NF, 1dBC, IP3
va_wj_EA2_19930601	Watkins-Johnson EA2, 5-400 MHz, Po1dBC=6.5dBm, NF=5.7dB, Model features SP, NF, 1dBC, IP3
va_wj_EA41_19930601	Watkins-Johnson EA41, 1000-4000 MHz, Po1dBC=12dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_wj_EA51_19930601	Watkins-Johnson EA51, 5-250 MHz, Po1dBC=-1.0dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
va_wj_EA53-2_19930601	Watkins-Johnson EA53-2, 5-500 MHz, Po1dBC=11dBm, NF=3.6dB, Model features SP, NF, 1dBC, IP3
va_wj_EA53_19930601	Watkins-Johnson EA53, 5-250 MHz, Po1dBC=4.5dBm, NF=2dB, Model features SP, NF, 1dBC, IP3
va_wj_EA54-2_19930601	Watkins-Johnson EA54-2, 5-500 MHz, Po1dBC=9.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_EA54-3_19930601	Watkins-Johnson EA54-3, 5-300 MHz, Po1dBC=9dBm, NF=2.7dB, Model features SP, NF, 1dBC, IP3
va_wj_EA54_19930601	Watkins-Johnson EA54, 10-250 MHz, Po1dBC=5dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
va_wj_EA5_19930601	Watkins-Johnson EA5, 5-400 MHz, Po1dBC=6.5dBm, NF=5.7dB, Model features SP, NF, 1dBC, IP3
va_wj_EA7_19930601	Watkins-Johnson EA7, 5-250 MHz, Po1dBC=16dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
va_wj_LA17_19930601	Watkins-Johnson LA17, 10-1000 MHz, Po1dBC=10dBm, NF=5.8dB, Model features SP, NF, 1dBC, IP3
va_wj_LA45-1_19930601	Watkins-Johnson LA45-1, 1000-4000 MHz, Po1dBC=17dBm, NF=7.5dB, Model features SP, NF, 1dBC, IP3

Table 2-6. Watkins-Johnson Amplifiers (continued)

Component Name	Description
va_wj_LA45_19930601	Watkins-Johnson LA45, 1000-4000 MHz, Po1dBC=14dBm, NF=8dB, Model features SP, NF, 1dBC, IP3
va_wj_LA7_19930601	Watkins-Johnson LA7, 50-500 MHz, Po1dBC=12dBm, NF=7dB, Model features SP, NF, 1dBC, IP3
va_wj_LA88_19930601	Watkins-Johnson LA88, 10-500 MHz, Po1dBC=17dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
va_wj_PA10_19930601	Watkins-Johnson PA10, 10-1000 MHz, Po1dBC=22.5dBm, NF=8.5dB, Model features SP, NF, 1dBC, IP3
va_wj_PA12-1_19930601	Watkins-Johnson PA12-1, 10-1200 MHz, Po1dBC=22dBm, NF=8.5dB, Model features SP, NF, 1dBC, IP3
va_wj_PA12_19930601	Watkins-Johnson PA12, 10-1200 MHz, Po1dBC=22.5dBm, NF=8.5dB, Model features SP, NF, 1dBC, IP3
va_wj_PA15_19930601	Watkins-Johnson PA15, 5-1000 MHz, Po1dBC=26.0dBm, NF=6.5dB, Model features SP, 1dBC, IP3
va_wj_PA2_19930601	Watkins-Johnson PA2, 10-300 MHz, Po1dBC=25dBm, NF=8dB, Model features SP, NF, 1dBC, IP3
va_wj_PA30_19930601	Watkins-Johnson PA30, 0.5-2.0 GHz, Po1dBC=25dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_wj_PA32_19930601	Watkins-Johnson PA32, 0.5-2.0 GHz, Po1dBC=28.5dBm, NF=10dB, Model features SP, NF, 1dBC, IP3
va_wj_PA38-2_19930601	Watkins-Johnson PA38-2, 200-2600 MHz, Po1dBC=23.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_PA38_19930601	Watkins-Johnson PA38, 200-2000 MHz, Po1dBC=23dBm, NF=4dB, Model features SP, NF, 1dBC, IP3
va_wj_PA3_19930601	Watkins-Johnson PA3, 5-500 MHz, Po1dBC=24.5dBm, NF=7.5dB, Model features SP, NF, 1dBC, IP3
va_wj_PA48_19930601	Watkins-Johnson PA48, 1-4 GHz, Po1dBC=24dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_wj_PA5_19930601	Watkins-Johnson PA5, 10-500 MHz, Po1dBC=25dBm, NF=8.5dB, Model features SP, NF, 1dBC, IP3
va_wj_PA6_19930601	Watkins-Johnson PA6, 10-500 MHz, Po1dBC=26.5dBm, NF=8.5dB, Model features SP, NF, 1dBC, IP3
va_wj_RA26_19930601	Watkins-Johnson RA26, 10-1500 MHz, Po1dBC=14.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_RA36_19930601	Watkins-Johnson RA36, 100-2000 MHz, Po1dBC=13dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3

**Table 2-6. Watkins-Johnson Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
va_wj_RA38_19930601	Watkins-Johnson RA38, 200-2000 MHz, Po1dBC=18.5dBm, NF=6.8dB, Model features SP, NF, 1dBC, IP3
va_wj_RA43_19930601	Watkins-Johnson RA43, 1000-4000 MHz, Po1dBC=12dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_RA46_19930601	Watkins-Johnson RA46, 1000-4000 MHz, Po1dBC=19dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_RA53_19930601	Watkins-Johnson RA53, 1000-5000 MHz, Po1dBC=11.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_RA62_19930601	Watkins-Johnson RA62, 2000-6000 MHz, Po1dBC=13dBm, NF=4dB, Model features SP, NF, 1dBC, IP3
va_wj_RA63-1_19930601	Watkins-Johnson RA63-1, 2000-6000 MHz, Po1dBC=16dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_wj_RA63_19930601	Watkins-Johnson RA63, 2000-6000 MHz, Po1dBC=13dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
va_wj_RA66_19930601	Watkins-Johnson RA66, 10-1000 MHz, Po1dBC=15.5dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
va_wj_RA69_19930601	Watkins-Johnson RA69, 10-1000 MHz, Po1dBC=23dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
va_wj_RA76_19930601	Watkins-Johnson RA76, 10-500 MHz, Po1dBC=15dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
va_wj_RA89-1_19930601	Watkins-Johnson RA89-1, 10-500 MHz, Po1dBC=21.5dBm, NF=3.2dB, Model features SP, NF, 1dBC, IP3
va_wj_RA89_19930601	Watkins-Johnson RA89, 5-500 MHz, Po1dBC=21.5dBm, NF=3.7dB, Model features SP, NF, 1dBC, IP3



# Chapter 3: Filters

## Schematic Design

This section describes the schematic design of the non-surface-mount system library filter components and describes the underlying model for each type of component.

Figure 3-1 shows how a system filter component appears when placed into the Schematic design window. The schematic symbol artwork is derived from the standard 2-port LPFB, HPFB and BPF symbols. The annotation consists of the component name, the default component ID prefix (in this case, S). No component parameters are displayed.

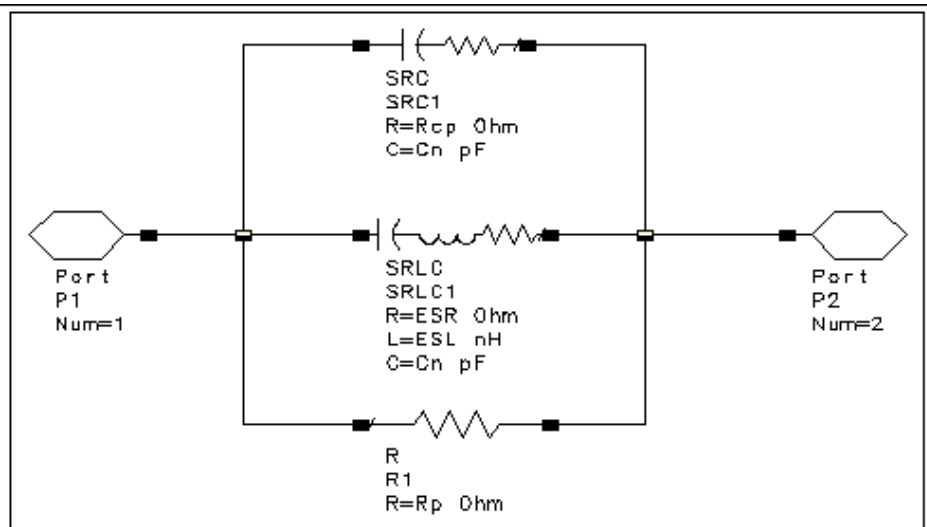
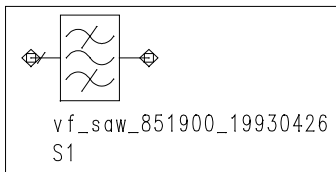


Figure 3-1. Filter Schematic Component Example



The *label* field appearing at the top of the component parameter dialog box contains the selected component label. The *description* field below the label field reads *Linear Model*.

The filter component represents a parametric subnetwork schematic design. An example of such a design subnetwork is shown in [Figure 3-2](#).

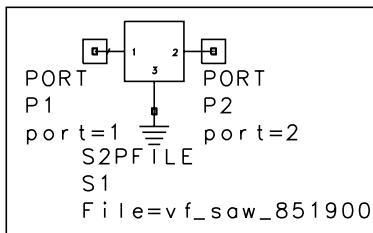


Figure 3-2. Filter Schematic Design Subnetwork Example

The subnetwork is comprised of a S2P file-based component. The S2P is simply an alias application of a standard 2-port file-based data component S2P. The standard component name of the S2P component is replaced by the selected filter library component name; for example, `vf_saw_851900_19930426`.

The S2P data file contains small-signal S-parameters. The file is installed in the same library group subdirectory as the associated component.

The filter library components are suitable for placement in any RF/Analog schematic.

## Data

The Filter library consists of linear models representing 146 filters from 3 manufacturers. The models were extracted from data provided by these manufacturers.

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**Note** The library itself is a binary file named *FilterLibrary.library* which can be found in *\$HPEESOF\_DIR/ComponentLibs/models*.

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The filter library groups available for selection from the Schematic window are:

- “Mini-Circuits Filters” on page 3-4
- “RF Monolithics Filters” on page 3-13
- “Sawtek Filters” on page 3-14

## Mini-Circuits Filters

For modeling specifications, see [“Schematic Design” on page 3-1](#).

The Mini-Circuits Filters include 51 components, representing individual parts. The naming convention for these components is *vf\_mc\_<part number>*.

Table 3-1. Mini-Circuits Filters

Component Name	Description
vf_mc_SBLP-117_19930426	Mini-Circuits SBLP-117, Low Pass Filter DC-65MHz, Fco(3dB loss)=117MHz, Model features SP
vf_mc_SBLP-156_19930426	Mini-Circuits SBLP-156, Low Pass Filter DC-94MHz, Fco(3dB loss)=156MHz, Model features SP
vf_mc_SBLP-1870_19930426	Mini-Circuits SBLP-1870, Low Pass Filter DC-850MHz, Fco(3dB loss)=1870MHz, Model features SP
vf_mc_SBLP-200_19930426	Mini-Circuits SBLP-200, Low Pass Filter DC-120MHz, Fco(3dB loss)=200MHz, Model features SP
vf_mc_SBLP-300_19930426	Mini-Circuits SBLP-300, Low Pass Filter DC-180MHz, Fco(3dB loss)=300MHz, Model features SP
vf_mc_SBLP-39_19930426	Mini-Circuits SBLP-39, Low Pass Filter DC-23MHz, Fco(3dB loss)=39MHz, Model features SP
vf_mc_SBLP-467_19930426	Mini-Circuits SBLP-467, Low Pass Filter DC-280MHz, Fco(3dB loss)=467MHz, Model features SP
vf_mc_SBLP-933_19930426	Mini-Circuits SBLP-933, Low Pass Filter DC-560MHz, Fco(3dB loss)=933MHz, Model features SP
vf_mc_SHP-100_19930426	Mini-Circuits SHP-100, High Pass Filter 90-400MHz, Fco(3dB loss)=82MHz, Model features SP
vf_mc_SHP-1000_19930426	Mini-Circuits SHP-1000, High Pass Filter 1000-2200MHz, Fco(3dB loss)=900MHz, Model features SP
vf_mc_SHP-150_19930426	Mini-Circuits SHP-150, High Pass Filter 133-600MHz, Fco(3dB loss)=120MHz, Model features SP
vf_mc_SHP-175_19930426	Mini-Circuits SHP-175, High Pass Filter 160-800MHz, Fco(3dB loss)=140MHz, Model features SP
vf_mc_SHP-200_19930426	Mini-Circuits SHP-200, High Pass Filter 185-800MHz, Fco(3dB loss)=164MHz, Model features SP
vf_mc_SHP-25_19930426	Mini-Circuits SHP-25, High Pass Filter 27.5-200MHz, Fco(3dB loss)=25MHz, Model features SP



**Table 3-1. Mini-Circuits Filters (continued)**

<b>Component Name</b>	<b>Description</b>
vf_mc_SHP-250_19930426	Mini-Circuits SHP-250, High Pass Filter 225-1200MHz, Fco(3dB loss)=205MHz, Model features SP
vf_mc_SHP-300_19930426	Mini-Circuits SHP-300, High Pass Filter 290-1200MHz, Fco(3dB loss)=245MHz, Model features SP
vf_mc_SHP-400_19930426	Mini-Circuits SHP-400, High Pass Filter 395-1600MHz, Fco(3dB loss)=360MHz, Model features SP
vf_mc_SHP-50_19930426	Mini-Circuits SHP-50, High Pass Filter 41-200MHz, Fco(3dB loss)=37MHz, Model features SP
vf_mc_SHP-500_19930426	Mini-Circuits SHP-500, High Pass Filter 500-1600MHz, Fco(3dB loss)=454MHz, Model features SP
vf_mc_SHP-600_19930426	Mini-Circuits SHP-600, High Pass Filter 600-1600MHz, Fco(3dB loss)=545MHz, Model features SP
vf_mc_SHP-700_19930426	Mini-Circuits SHP-700, High Pass Filter 700-1800MHz, Fco(3dB loss)=640MHz, Model features SP
vf_mc_SHP-800_19930426	Mini-Circuits SHP-800, High Pass Filter 780-2000MHz, Fco(3dB loss)=710MHz, Model features SP
vf_mc_SHP-900_19930426	Mini-Circuits SHP-900, High Pass Filter 910-2100MHz, Fco(3dB loss)=820MHz, Model features SP
vf_mc_SIF-214_19930426	Mini-Circuits SIF-21.4, Band Pass Filter 18-25MHz, Fcenter=21.4MHz, Model features SP
vf_mc_SIF-30_19930426	Mini-Circuits SIF-30, Band Pass Filter 25-35MHz, Fcenter=30MHz, Model features SP
vf_mc_SIF-40_19930426	Mini-Circuits SIF-40, Band Pass Filter 35-49MHz, Fcenter=42MHz, Model features SP
vf_mc_SIF-50_19930426	Mini-Circuits SIF-50, Band Pass Filter 41-58MHz, Fcenter=50MHz, Model features SP
vf_mc_SIF-60_19930426	Mini-Circuits SIF-60, Band Pass Filter 50-70MHz, Fcenter=60MHz, Model features SP
vf_mc_SIF-70_19930426	Mini-Circuits SIF-70, Band Pass Filter 58-82MHz, Fcenter=70MHz, Model features SP
vf_mc_SLP-19_19930426	Mini-Circuits SLP-1.9, Low Pass Filter DC-1.9MHz, Fco(3dB loss)=2.2MHz, Model features SP
vf_mc_SLP-107_19930426	Mini-Circuits SLP-10.7, Low Pass Filter DC-11MHz, Fco(3dB loss)=14MHz, Model features SP
vf_mc_SLP-100_19930426	Mini-Circuits SLP-100, Low Pass Filter DC-98MHz, Fco(3dB loss)=108MHz, Model features SP

Table 3-1. Mini-Circuits Filters (continued)

Component Name	Description
vf_mc_SLP-1000_19930426	Mini-Circuits SLP-1000, Low Pass Filter DC-900MHz, Fco(3dB loss)=990MHz, Model features SP
vf_mc_SLP-1200_19930426	Mini-Circuits SLP-1200, Low Pass Filter DC-1000MHz, Fco(3dB loss)=1200MHz, Model features SP
vf_mc_SLP-15_19930426	Mini-Circuits SLP-15, Low Pass Filter DC-14MHz, Fco(3dB loss)=17MHz, Model features SP
vf_mc_SLP-150_19930426	Mini-Circuits SLP-150, Low Pass Filter DC-140MHz, Fco(3dB loss)=155MHz, Model features SP
vf_mc_SLP-200_19930426	Mini-Circuits SLP-200, Low Pass Filter DC-190MHz, Fco(3dB loss)=210MHz, Model features SP
vf_mc_SLP-214_19930426	Mini-Circuits SLP-21.4, Low Pass Filter DC-22MHz, Fco(3dB loss)=24.5MHz, Model features SP
vf_mc_SLP-250_19930426	Mini-Circuits SLP-250, Low Pass Filter DC-225MHz, Fco(3dB loss)=250MHz, Model features SP
vf_mc_SLP-30_19930426	Mini-Circuits SLP-30, Low Pass Filter DC-32MHz, Fco(3dB loss)=35MHz, Model features SP
vf_mc_SLP-300_19930426	Mini-Circuits SLP-300, Low Pass Filter DC-270MHz, Fco(3dB loss)=297MHz, Model features SP
vf_mc_SLP-450_19930426	Mini-Circuits SLP-450, Low Pass Filter DC-400MHz, Fco(3dB loss)=440MHz, Model features SP
vf_mc_SLP-5_19930426	Mini-Circuits SLP-5, Low Pass Filter DC-5MHz, Fco(3dB loss)=6MHz, Model features SP
vf_mc_SLP-50_19930426	Mini-Circuits SLP-50, Low Pass Filter DC-48MHz, Fco(3dB loss)=55MHz, Model features SP
vf_mc_SLP-550_19930426	Mini-Circuits SLP-550, Low Pass Filter DC-520MHz, Fco(3dB loss)=570MHz, Model features SP
vf_mc_SLP-600_19930426	Mini-Circuits SLP-600, Low Pass Filter DC-580MHz, Fco(3dB loss)=640MHz, Model features SP
vf_mc_SLP-70_19930426	Mini-Circuits SLP-70, Low Pass Filter DC-60MHz, Fco(3dB loss)=67MHz, Model features SP
vf_mc_SLP-750_19930426	Mini-Circuits SLP-750, Low Pass Filter DC-700MHz, Fco(3dB loss)=770MHz, Model features SP
vf_mc_SLP-800_19930426	Mini-Circuits SLP-800, Low Pass Filter DC-720MHz, Fco(3dB loss)=800MHz, Model features SP
vf_mc_SLP-850_19930426	Mini-Circuits SLP-850, Low Pass Filter DC-780MHz, Fco(3dB loss)=850MHz, Model features SP

**Table 3-1. Mini-Circuits Filters (continued)**

<b>Component Name</b>	<b>Description</b>
vf_mc_SLP-90_19930426	Mini-Circuits SLP-90, Low Pass Filter DC-81MHz, Fco(3dB loss)=90MHz, Model features SP
vf_rfm_SF1041_m_19930426	RF Monolithics SF1041, SAW Filter (Matched) Fc=71MHz, 3dB BW=0.3MHz, Loss=6.5dB, Model features SP
vf_rfm_SF1041_u_19930426	RF Monolithics SF1041, SAW Filter (Unmatched) Fc=71MHz, 3dB BW=0.3MHz, Loss=6.5dB, Model features SP
vf_saw_851475	Sawtek 851475, SAW Filter Fc=70MHz, 3dB BW=10.27MHz, Loss=24.5dB, Model features SP
vf_saw_851505_19930426	Sawtek 851505, SAW Filter Fc=70MHz, 3dB BW=8.10MHz, Loss=22.3dB, Model features SP
vf_saw_851539_19930426	Sawtek 851539, SAW Filter Fc=70MHz, 3dB BW=0.155MHz, Loss=22.0dB, Model features SP
vf_saw_851541_19930426	Sawtek 851541, SAW Filter Fc=70MHz, 3dB BW=0.18MHz, Loss=17.5dB, Model features SP
vf_saw_851542_19930426	Sawtek 851542, SAW Filter Fc=70MHz, 3dB BW=0.56MHz, Loss=21.6dB, Model features SP
vf_saw_851543_19930426	Sawtek 851543, SAW Filter Fc=70MHz, 3dB BW=0.82MHz, Loss=18.2dB, Model features SP
vf_saw_851544_19930426	Sawtek 851544, SAW Filter Fc=70MHz, 3dB BW=1.26MHz, Loss=21.5dB, Model features SP
vf_saw_851545_19930426	Sawtek 851545, SAW Filter Fc=70MHz, 3dB BW=1.68MHz, Loss=23.2dB, Model features SP
vf_saw_851546_19930426	Sawtek 851546, SAW Filter Fc=70MHz, 3dB BW=2.22MHz, Loss=24.3dB, Model features SP
vf_saw_851547_19930426	Sawtek 851547, SAW Filter Fc=70MHz, 3dB BW=2.60MHz, Loss=25.2dB, Model features SP
vf_saw_851548_19930426	Sawtek 851548, SAW Filter Fc=70MHz, 3dB BW=3.14MHz, Loss=24.5dB, Model features SP
vf_saw_851549_19930426	Sawtek 851549, SAW Filter Fc=70MHz, 3dB BW=3.62MHz, Loss=25.7dB, Model features SP
vf_saw_851550_19930426	Sawtek 851550, SAW Filter Fc=70MHz, 3dB BW=4.25MHz, Loss=22.5dB, Model features SP
vf_saw_851551_19930426	Sawtek 851551, SAW Filter Fc=70MHz, 3dB BW=4.73MHz, Loss=24.3dB, Model features SP

Table 3-1. Mini-Circuits Filters (continued)

Component Name	Description
vf_saw_851552_19930426	Sawtek 851552, SAW Filter Fc=70MHz, 3dB BW=5.27MHz, Loss=24.1dB, Model features SP
vf_saw_851553_19930426	Sawtek 851553, SAW Filter Fc=70MHz, 3dB BW=5.68MHz, Loss=23.0dB, Model features SP
vf_saw_851555_19930426	Sawtek 851555, SAW Filter Fc=70MHz, 3dB BW=6.72MHz, Loss=23.0dB, Model features SP
vf_saw_851556_19930426	Sawtek 851556, SAW Filter Fc=70MHz, 3dB BW=7.20MHz, Loss=20.5dB, Model features SP
vf_saw_851557_19930426	Sawtek 851557, SAW Filter Fc=70MHz, 3dB BW=8.23MHz, Loss=22.0dB, Model features SP
vf_saw_851558_19930426	Sawtek 851558, SAW Filter Fc=70MHz, 3dB BW=8.81MHz, Loss=22.7dB, Model features SP
vf_saw_851559_19930426	Sawtek 851559, SAW Filter Fc=70MHz, 3dB BW=9.26MHz, Loss=22.9dB, Model features SP
vf_saw_851560_19930426	Sawtek 851560, SAW Filter Fc=70MHz, 3dB BW=9.58MHz, Loss=24.0dB, Model features SP
vf_saw_851841_19930426	Sawtek 851841, SAW Filter Fc=70MHz, 3dB BW=11.47MHz, Loss=22.4dB, Model features SP
vf_saw_851842_19930426	Sawtek 851842, SAW Filter Fc=70MHz, 3dB BW=12.51MHz, Loss=23.5dB, Model features SP
vf_saw_851843_19930426	Sawtek 851843, SAW Filter Fc=70MHz, 3dB BW=13.79MHz, Loss=25.7dB, Model features SP
vf_saw_851844_19930426	Sawtek 851844, SAW Filter Fc=70MHz, 3dB BW=14.63MHz, Loss=24.6dB, Model features SP
vf_saw_851845_19930426	Sawtek 851845, SAW Filter Fc=70MHz, 3dB BW=15.63MHz, Loss=22.7dB, Model features SP
vf_saw_851846_19930426	Sawtek 851846, SAW Filter Fc=70MHz, 3dB BW=16.51MHz, Loss=24.2dB, Model features SP
vf_saw_851847_19930426	Sawtek 851847, SAW Filter Fc=70MHz, 3dB BW=18.84MHz, Loss=24.7dB, Model features SP
vf_saw_851848_19930426	Sawtek 851848, SAW Filter Fc=70MHz, 3dB BW=20.70MHz, Loss=25.2dB, Model features SP
vf_saw_851849_19930426	Sawtek 851849, SAW Filter Fc=70MHz, 3dB BW=22.60MHz, Loss=22.0dB, Model features SP
vf_saw_851850_19930426	Sawtek 851850, SAW Filter Fc=70MHz, 3dB BW=24.80MHz, Loss=22.8dB, Model features SP

**Table 3-1. Mini-Circuits Filters (continued)**

<b>Component Name</b>	<b>Description</b>
vf_saw_851851_19930426	Sawtek 851851, SAW Filter Fc=70MHz, 3dB BW=26.63MHz, Loss=24.3dB, Model features SP
vf_saw_851852_19930426	Sawtek 851852, SAW Filter Fc=70MHz, 3dB BW=28.74MHz, Loss=26.4dB, Model features SP
vf_saw_851853_19930426	Sawtek 851853, SAW Filter Fc=70MHz, 3dB BW=30.30MHz, Loss=22.0dB, Model features SP
vf_saw_851854_19930426	Sawtek 851854, SAW Filter Fc=70MHz, 3dB BW=32.50MHz, Loss=22.8dB, Model features SP
vf_saw_851855_19930426	Sawtek 851855, SAW Filter Fc=70MHz, 3dB BW=34.77MHz, Loss=23.3dB, Model features SP
vf_saw_851856_19930426	Sawtek 851856, SAW Filter Fc=70MHz, 3dB BW=36.89MHz, Loss=24.0dB, Model features SP
vf_saw_851857_19930426	Sawtek 851857, SAW Filter Fc=70MHz, 3dB BW=38.65MHz, Loss=24.8dB, Model features SP
vf_saw_851858_19930426	Sawtek 851858, SAW Filter Fc=70MHz, 3dB BW=40.40MHz, Loss=25.3dB, Model features SP
vf_saw_851900_19930426	Sawtek 851900, SAW Filter Fc=140MHz, 3dB BW=0.27MHz, Loss=23.2dB, Model features SP
vf_saw_851901_19930426	Sawtek 851901, SAW Filter Fc=140MHz, 3dB BW=0.56MHz, Loss=19.5dB, Model features SP
vf_saw_851902_19930426	Sawtek 851902, SAW Filter Fc=140MHz, 3dB BW=0.77MHz, Loss=20.7dB, Model features SP
vf_saw_851903_19930426	Sawtek 851903, SAW Filter Fc=140MHz, 3dB BW=1.04MHz, Loss=21.9dB, Model features SP
vf_saw_851904_19930426	Sawtek 851904, SAW Filter Fc=140MHz, 3dB BW=1.53MHz, Loss=22.8dB, Model features SP
vf_saw_851905_19930426	Sawtek 851905, SAW Filter Fc=140MHz, 3dB BW=2.07MHz, Loss=23.8dB, Model features SP
vf_saw_851906_19930426	Sawtek 851906, SAW Filter Fc=140MHz, 3dB BW=2.56MHz, Loss=25.6dB, Model features SP
vf_saw_851907_19930426	Sawtek 851907, SAW Filter Fc=140MHz, 3dB BW=3.06MHz, Loss=25.5dB, Model features SP
vf_saw_851909_19930426	Sawtek 851909, SAW Filter Fc=140MHz, 3dB BW=4.22MHz, Loss=23.3dB, Model features SP
vf_saw_851911_19930426	Sawtek 851911, SAW Filter Fc=140MHz, 3dB BW=5.30MHz, Loss=22.5dB, Model features SP

Table 3-1. Mini-Circuits Filters (continued)

Component Name	Description
vf_saw_851913_19930426	Sawtek 851913, SAW Filter Fc=140MHz, 3dB BW=6.30MHz, Loss=26.5dB, Model features SP
vf_saw_851917_19930426	Sawtek 851917, SAW Filter Fc=140MHz, 3dB BW=8.18MHz, Loss=23.6dB, Model features SP
vf_saw_851919_19930426	Sawtek 851919, SAW Filter Fc=140MHz, 3dB BW=9.35MHz, Loss=21.4dB, Model features SP
vf_saw_851921_19930426	Sawtek 851921, SAW Filter Fc=140MHz, 3dB BW=10.35MHz, Loss=22.0dB, Model features SP
vf_saw_851923_19930426	Sawtek 851923, SAW Filter Fc=140MHz, 3dB BW=12.20MHz, Loss=22.3dB, Model features SP
vf_saw_851925_19930426	Sawtek 851925, SAW Filter Fc=140MHz, 3dB BW=14.16MHz, Loss=22.0dB, Model features SP
vf_saw_851927_19930426	Sawtek 851927, SAW Filter Fc=140MHz, 3dB BW=16.19MHz, Loss=22.8dB, Model features SP
vf_saw_851929_19930426	Sawtek 851929, SAW Filter Fc=140MHz, 3dB BW=18.30MHz, Loss=22.0dB, Model features SP
vf_saw_851931_19930426	Sawtek 851931, SAW Filter Fc=140MHz, 3dB BW=20.40MHz, Loss=22.0dB, Model features SP
vf_saw_851933_19930426	Sawtek 851933, SAW Filter Fc=140MHz, 3dB BW=24.27MHz, Loss=24.7dB, Model features SP
vf_saw_851935_19930426	Sawtek 851935, SAW Filter Fc=140MHz, 3dB BW=28.35MHz, Loss=24.5dB, Model features SP
vf_saw_851937_19930426	Sawtek 851937, SAW Filter Fc=140MHz, 3dB BW=32.2MHz, Loss=24.6dB, Model features SP
vf_saw_851939_19930426	Sawtek 851939, SAW Filter Fc=140MHz, 3dB BW=36.60MHz, Loss=23.5dB, Model features SP
vf_saw_851941_19930426	Sawtek 851941, SAW Filter Fc=140MHz, 3dB BW=40.10MHz, Loss=23.6dB, Model features SP
vf_saw_851943_19930426	Sawtek 851943, SAW Filter Fc=140MHz, 3dB BW=44.50MHz, Loss=23.0dB, Model features SP
vf_saw_851945_19930426	Sawtek 851945, SAW Filter Fc=140MHz, 3dB BW=48.40MHz, Loss=26.5dB, Model features SP
vf_saw_851947_19930426	Sawtek 851947, SAW Filter Fc=140MHz, 3dB BW=56.50MHz, Loss=27.0dB, Model features SP
vf_saw_851948_19930426	Sawtek 851948, SAW Filter Fc=140MHz, 3dB BW=64.70MHz, Loss=29.5dB, Model features SP

**Table 3-1. Mini-Circuits Filters (continued)**

<b>Component Name</b>	<b>Description</b>
vf_saw_851949_19930426	Sawtek 851949, SAW Filter Fc=140MHz, 3dB BW=74.50MHz, Loss=25.0dB, Model features SP
vf_saw_854101_19930426	Sawtek 854101, SAW Filter Fc=140MHz, 3dB BW=81.70MHz, Loss=26.7dB, Model features SP
vf_saw_851950_19930426	Sawtek 851950, SAW Filter Fc=160MHz, 3dB BW=0.29MHz, Loss=23.2dB, Model features SP
vf_saw_851951_19930426	Sawtek 851951, SAW Filter Fc=160MHz, 3dB BW=0.55MHz, Loss=24.2dB, Model features SP
vf_saw_851952_19930426	Sawtek 851952, SAW Filter Fc=160MHz, 3dB BW=0.79MHz, Loss=24.8dB, Model features SP
vf_saw_851955_19930426	Sawtek 851955, SAW Filter Fc=160MHz, 3dB BW=2.03MHz, Loss=26.3dB, Model features SP
vf_saw_851957_19930426	Sawtek 851957, SAW Filter Fc=160MHz, 3dB BW=3.12MHz, Loss=22.5dB, Model features SP
vf_saw_851959_19930426	Sawtek 851959, SAW Filter Fc=160MHz, 3dB BW=4.11MHz, Loss=22.9dB, Model features SP
vf_saw_851961_19930426	Sawtek 851961, SAW Filter Fc=160MHz, 3dB BW=5.10MHz, Loss=22.8dB, Model features SP
vf_saw_851963_19930426	Sawtek 851963, SAW Filter Fc=160MHz, 3dB BW=6.16MHz, Loss=22.8dB, Model features SP
vf_saw_851965_19930426	Sawtek 851965, SAW Filter Fc=160MHz, 3dB BW=7.30MHz, Loss=25.2dB, Model features SP
vf_saw_851967_19930426	Sawtek 851967, SAW Filter Fc=160MHz, 3dB BW=8.37MHz, Loss=24.2dB, Model features SP
vf_saw_851969_19930426	Sawtek 851969, SAW Filter Fc=160MHz, 3dB BW=9.40MHz, Loss=24.0dB, Model features SP
vf_saw_851973_19930426	Sawtek 851973, SAW Filter Fc=160MHz, 3dB BW=12.4MHz, Loss=24.3dB, Model features SP
vf_saw_851975_19930426	Sawtek 851975, SAW Filter Fc=160MHz, 3dB BW=14.6MHz, Loss=23.4dB, Model features SP
vf_saw_851977_19930426	Sawtek 851977, SAW Filter Fc=160MHz, 3dB BW=16.6MHz, Loss=24.0dB, Model features SP
vf_saw_851979_19930426	Sawtek 851979, SAW Filter Fc=160MHz, 3dB BW=18.0MHz, Loss=25.5dB, Model features SP
vf_saw_851985_19930426	Sawtek 851985, SAW Filter Fc=160MHz, 3dB BW=28.0MHz, Loss=25.5dB, Model features SP

Table 3-1. Mini-Circuits Filters (continued)

Component Name	Description
vf_saw_851986_19930426	Sawtek 851986, SAW Filter Fc=160MHz, 3dB BW=31.4MHz, Loss=24.8dB, Model features SP
vf_saw_851987_19930426	Sawtek 851987, SAW Filter Fc=160MHz, 3dB BW=33.3MHz, Loss=24.7dB, Model features SP
vf_saw_851989_19930426	Sawtek 851989, SAW Filter Fc=160MHz, 3dB BW=36.8MHz, Loss=24.6dB, Model features SP
vf_saw_851991_19930426	Sawtek 851991, SAW Filter Fc=160MHz, 3dB BW=40.0MHz, Loss=26.5dB, Model features SP
vf_saw_854220_19930426	Sawtek 854220, SONET SAW Filter Fc=155.52+0.031MHz, 3dB BW=600+50KHz, Loss=17+1.5dB, Model features SP
vf_saw_854221_19930426	Sawtek 854221, SONET SAW Filter Fc=622.02+0.1MHz, 3dB BW=960+70KHz, Loss=18dB, Model features SP
vf_saw_854349_19930426	Sawtek 854349, SONET SAW Filter Fc=155.52+0.031MHz, 3dB BW=295+50KHz, Loss=16+1.5dB, Model features SP



# RF Monolithics Filters

For modeling specifications, see “[Schematic Design](#)” on page 3-1.

The RF Monolithics Filters include 2 components, representing individual parts. The naming convention for these components is *vf\_rfm\_<part number>*.

Table 3-2. RF Monolithics Filters

Component Name	Description
vf_rfm_SF1041_m_19930426	RF Monolithics SF1041, SAW Filter (Matched) Fc=71MHz, 3dB BW=0.3MHz, Loss=6.5dB, Model features SP
vf_rfm_SF1041_u_19930426	RF Monolithics SF1041, SAW Filter (Unmatched) Fc=71MHz, 3dB BW=0.3MHz, Loss=6.5dB, Model features SP

## Sawtek Filters

For modeling specifications, see “[Schematic Design](#)” on page 3-1.

The Sawtek Filters include 93 components, representing individual parts, listed in the order given in the *Sawtek Product Catalog*. The naming convention for these components is *vf\_saw\_<part number>*.

Table 3-3. Filters

Component Name	Description
vf_saw_851475	Sawtek 851475, SAW Filter Fc=70MHz, 3dB BW=10.27MHz, Loss=24.5dB, Model features SP
vf_saw_851505_19930426	Sawtek 851505, SAW Filter Fc=70MHz, 3dB BW=8.10MHz, Loss=22.3dB, Model features SP
vf_saw_851539_19930426	Sawtek 851539, SAW Filter Fc=70MHz, 3dB BW=0.155MHz, Loss=22.0dB, Model features SP
vf_saw_851541_19930426	Sawtek 851541, SAW Filter Fc=70MHz, 3dB BW=0.18MHz, Loss=17.5dB, Model features SP
vf_saw_851542_19930426	Sawtek 851542, SAW Filter Fc=70MHz, 3dB BW=0.56MHz, Loss=21.6dB, Model features SP
vf_saw_851543_19930426	Sawtek 851543, SAW Filter Fc=70MHz, 3dB BW=0.82MHz, Loss=18.2dB, Model features SP
vf_saw_851544_19930426	Sawtek 851544, SAW Filter Fc=70MHz, 3dB BW=1.26MHz, Loss=21.5dB, Model features SP
vf_saw_851545_19930426	Sawtek 851545, SAW Filter Fc=70MHz, 3dB BW=1.68MHz, Loss=23.2dB, Model features SP
vf_saw_851546_19930426	Sawtek 851546, SAW Filter Fc=70MHz, 3dB BW=2.22MHz, Loss=24.3dB, Model features SP
vf_saw_851547_19930426	Sawtek 851547, SAW Filter Fc=70MHz, 3dB BW=2.60MHz, Loss=25.2dB, Model features SP
vf_saw_851548_19930426	Sawtek 851548, SAW Filter Fc=70MHz, 3dB BW=3.14MHz, Loss=24.5dB, Model features SP
vf_saw_851549_19930426	Sawtek 851549, SAW Filter Fc=70MHz, 3dB BW=3.62MHz, Loss=25.7dB, Model features SP
vf_saw_851550_19930426	Sawtek 851550, SAW Filter Fc=70MHz, 3dB BW=4.25MHz, Loss=22.5dB, Model features SP
vf_saw_851551_19930426	Sawtek 851551, SAW Filter Fc=70MHz, 3dB BW=4.73MHz, Loss=24.3dB, Model features SP

**Table 3-3. Filters (continued)**

<b>Component Name</b>	<b>Description</b>
vf_saw_851552_19930426	Sawtek 851552, SAW Filter Fc=70MHz, 3dB BW=5.27MHz, Loss=24.1dB, Model features SP
vf_saw_851553_19930426	Sawtek 851553, SAW Filter Fc=70MHz, 3dB BW=5.68MHz, Loss=23.0dB, Model features SP
vf_saw_851555_19930426	Sawtek 851555, SAW Filter Fc=70MHz, 3dB BW=6.72MHz, Loss=23.0dB, Model features SP
vf_saw_851556_19930426	Sawtek 851556, SAW Filter Fc=70MHz, 3dB BW=7.20MHz, Loss=20.5dB, Model features SP
vf_saw_851557_19930426	Sawtek 851557, SAW Filter Fc=70MHz, 3dB BW=8.23MHz, Loss=22.0dB, Model features SP
vf_saw_851558_19930426	Sawtek 851558, SAW Filter Fc=70MHz, 3dB BW=8.81MHz, Loss=22.7dB, Model features SP
vf_saw_851559_19930426	Sawtek 851559, SAW Filter Fc=70MHz, 3dB BW=9.26MHz, Loss=22.9dB, Model features SP
vf_saw_851560_19930426	Sawtek 851560, SAW Filter Fc=70MHz, 3dB BW=9.58MHz, Loss=24.0dB, Model features SP
vf_saw_851841_19930426	Sawtek 851841, SAW Filter Fc=70MHz, 3dB BW=11.47MHz, Loss=22.4dB, Model features SP
vf_saw_851842_19930426	Sawtek 851842, SAW Filter Fc=70MHz, 3dB BW=12.51MHz, Loss=23.5dB, Model features SP
vf_saw_851843_19930426	Sawtek 851843, SAW Filter Fc=70MHz, 3dB BW=13.79MHz, Loss=25.7dB, Model features SP
vf_saw_851844_19930426	Sawtek 851844, SAW Filter Fc=70MHz, 3dB BW=14.63MHz, Loss=24.6dB, Model features SP
vf_saw_851845_19930426	Sawtek 851845, SAW Filter Fc=70MHz, 3dB BW=15.63MHz, Loss=22.7dB, Model features SP
vf_saw_851846_19930426	Sawtek 851846, SAW Filter Fc=70MHz, 3dB BW=16.51MHz, Loss=24.2dB, Model features SP
vf_saw_851847_19930426	Sawtek 851847, SAW Filter Fc=70MHz, 3dB BW=18.84MHz, Loss=24.7dB, Model features SP
vf_saw_851848_19930426	Sawtek 851848, SAW Filter Fc=70MHz, 3dB BW=20.70MHz, Loss=25.2dB, Model features SP
vf_saw_851849_19930426	Sawtek 851849, SAW Filter Fc=70MHz, 3dB BW=22.60MHz, Loss=22.0dB, Model features SP
vf_saw_851850_19930426	Sawtek 851850, SAW Filter Fc=70MHz, 3dB BW=24.80MHz, Loss=22.8dB, Model features SP

Table 3-3. Filters (continued)

Component Name	Description
vf_saw_851851_19930426	Sawtek 851851, SAW Filter Fc=70MHz, 3dB BW=26.63MHz, Loss=24.3dB, Model features SP
vf_saw_851852_19930426	Sawtek 851852, SAW Filter Fc=70MHz, 3dB BW=28.74MHz, Loss=26.4dB, Model features SP
vf_saw_851853_19930426	Sawtek 851853, SAW Filter Fc=70MHz, 3dB BW=30.30MHz, Loss=22.0dB, Model features SP
vf_saw_851854_19930426	Sawtek 851854, SAW Filter Fc=70MHz, 3dB BW=32.50MHz, Loss=22.8dB, Model features SP
vf_saw_851855_19930426	Sawtek 851855, SAW Filter Fc=70MHz, 3dB BW=34.77MHz, Loss=23.3dB, Model features SP
vf_saw_851856_19930426	Sawtek 851856, SAW Filter Fc=70MHz, 3dB BW=36.89MHz, Loss=24.0dB, Model features SP
vf_saw_851857_19930426	Sawtek 851857, SAW Filter Fc=70MHz, 3dB BW=38.65MHz, Loss=24.8dB, Model features SP
vf_saw_851858_19930426	Sawtek 851858, SAW Filter Fc=70MHz, 3dB BW=40.40MHz, Loss=25.3dB, Model features SP
vf_saw_851900_19930426	Sawtek 851900, SAW Filter Fc=140MHz, 3dB BW=0.27MHz, Loss=23.2dB, Model features SP
vf_saw_851901_19930426	Sawtek 851901, SAW Filter Fc=140MHz, 3dB BW=0.56MHz, Loss=19.5dB, Model features SP
vf_saw_851902_19930426	Sawtek 851902, SAW Filter Fc=140MHz, 3dB BW=0.77MHz, Loss=20.7dB, Model features SP
vf_saw_851903_19930426	Sawtek 851903, SAW Filter Fc=140MHz, 3dB BW=1.04MHz, Loss=21.9dB, Model features SP
vf_saw_851904_19930426	Sawtek 851904, SAW Filter Fc=140MHz, 3dB BW=1.53MHz, Loss=22.8dB, Model features SP
vf_saw_851905_19930426	Sawtek 851905, SAW Filter Fc=140MHz, 3dB BW=2.07MHz, Loss=23.8dB, Model features SP
vf_saw_851906_19930426	Sawtek 851906, SAW Filter Fc=140MHz, 3dB BW=2.56MHz, Loss=25.6dB, Model features SP
vf_saw_851907_19930426	Sawtek 851907, SAW Filter Fc=140MHz, 3dB BW=3.06MHz, Loss=25.5dB, Model features SP
vf_saw_851909_19930426	Sawtek 851909, SAW Filter Fc=140MHz, 3dB BW=4.22MHz, Loss=23.3dB, Model features SP
vf_saw_851911_19930426	Sawtek 851911, SAW Filter Fc=140MHz, 3dB BW=5.30MHz, Loss=22.5dB, Model features SP

**Table 3-3. Filters (continued)**

<b>Component Name</b>	<b>Description</b>
vf_saw_851913_19930426	Sawtek 851913, SAW Filter Fc=140MHz, 3dB BW=6.30MHz, Loss=26.5dB, Model features SP
vf_saw_851917_19930426	Sawtek 851917, SAW Filter Fc=140MHz, 3dB BW=8.18MHz, Loss=23.6dB, Model features SP
vf_saw_851919_19930426	Sawtek 851919, SAW Filter Fc=140MHz, 3dB BW=9.35MHz, Loss=21.4dB, Model features SP
vf_saw_851921_19930426	Sawtek 851921, SAW Filter Fc=140MHz, 3dB BW=10.35MHz, Loss=22.0dB, Model features SP
vf_saw_851923_19930426	Sawtek 851923, SAW Filter Fc=140MHz, 3dB BW=12.20MHz, Loss=22.3dB, Model features SP
vf_saw_851925_19930426	Sawtek 851925, SAW Filter Fc=140MHz, 3dB BW=14.16MHz, Loss=22.0dB, Model features SP
vf_saw_851927_19930426	Sawtek 851927, SAW Filter Fc=140MHz, 3dB BW=16.19MHz, Loss=22.8dB, Model features SP
vf_saw_851929_19930426	Sawtek 851929, SAW Filter Fc=140MHz, 3dB BW=18.30MHz, Loss=22.0dB, Model features SP
vf_saw_851931_19930426	Sawtek 851931, SAW Filter Fc=140MHz, 3dB BW=20.40MHz, Loss=22.0dB, Model features SP
vf_saw_851933_19930426	Sawtek 851933, SAW Filter Fc=140MHz, 3dB BW=24.27MHz, Loss=24.7dB, Model features SP
vf_saw_851935_19930426	Sawtek 851935, SAW Filter Fc=140MHz, 3dB BW=28.35MHz, Loss=24.5dB, Model features SP
vf_saw_851937_19930426	Sawtek 851937, SAW Filter Fc=140MHz, 3dB BW=32.2MHz, Loss=24.6dB, Model features SP
vf_saw_851939_19930426	Sawtek 851939, SAW Filter Fc=140MHz, 3dB BW=36.60MHz, Loss=23.5dB, Model features SP
vf_saw_851941_19930426	Sawtek 851941, SAW Filter Fc=140MHz, 3dB BW=40.10MHz, Loss=23.6dB, Model features SP
vf_saw_851943_19930426	Sawtek 851943, SAW Filter Fc=140MHz, 3dB BW=44.50MHz, Loss=23.0dB, Model features SP
vf_saw_851945_19930426	Sawtek 851945, SAW Filter Fc=140MHz, 3dB BW=48.40MHz, Loss=26.5dB, Model features SP
vf_saw_851947_19930426	Sawtek 851947, SAW Filter Fc=140MHz, 3dB BW=56.50MHz, Loss=27.0dB, Model features SP
vf_saw_851948_19930426	Sawtek 851948, SAW Filter Fc=140MHz, 3dB BW=64.70MHz, Loss=29.5dB, Model features SP

Table 3-3. Filters (continued)

Component Name	Description
vf_saw_851949_19930426	Sawtek 851949, SAW Filter Fc=140MHz, 3dB BW=74.50MHz, Loss=25.0dB, Model features SP
vf_saw_854101_19930426	Sawtek 854101, SAW Filter Fc=140MHz, 3dB BW=81.70MHz, Loss=26.7dB, Model features SP
vf_saw_851950_19930426	Sawtek 851950, SAW Filter Fc=160MHz, 3dB BW=0.29MHz, Loss=23.2dB, Model features SP
vf_saw_851951_19930426	Sawtek 851951, SAW Filter Fc=160MHz, 3dB BW=0.55MHz, Loss=24.2dB, Model features SP
vf_saw_851952_19930426	Sawtek 851952, SAW Filter Fc=160MHz, 3dB BW=0.79MHz, Loss=24.8dB, Model features SP
vf_saw_851955_19930426	Sawtek 851955, SAW Filter Fc=160MHz, 3dB BW=2.03MHz, Loss=26.3dB, Model features SP
vf_saw_851957_19930426	Sawtek 851957, SAW Filter Fc=160MHz, 3dB BW=3.12MHz, Loss=22.5dB, Model features SP
vf_saw_851959_19930426	Sawtek 851959, SAW Filter Fc=160MHz, 3dB BW=4.11MHz, Loss=22.9dB, Model features SP
vf_saw_851961_19930426	Sawtek 851961, SAW Filter Fc=160MHz, 3dB BW=5.10MHz, Loss=22.8dB, Model features SP
vf_saw_851963_19930426	Sawtek 851963, SAW Filter Fc=160MHz, 3dB BW=6.16MHz, Loss=22.8dB, Model features SP
vf_saw_851965_19930426	Sawtek 851965, SAW Filter Fc=160MHz, 3dB BW=7.30MHz, Loss=25.2dB, Model features SP
vf_saw_851967_19930426	Sawtek 851967, SAW Filter Fc=160MHz, 3dB BW=8.37MHz, Loss=24.2dB, Model features SP
vf_saw_851969_19930426	Sawtek 851969, SAW Filter Fc=160MHz, 3dB BW=9.40MHz, Loss=24.0dB, Model features SP
vf_saw_851973_19930426	Sawtek 851973, SAW Filter Fc=160MHz, 3dB BW=12.4MHz, Loss=24.3dB, Model features SP
vf_saw_851975_19930426	Sawtek 851975, SAW Filter Fc=160MHz, 3dB BW=14.6MHz, Loss=23.4dB, Model features SP
vf_saw_851977_19930426	Sawtek 851977, SAW Filter Fc=160MHz, 3dB BW=16.6MHz, Loss=24.0dB, Model features SP
vf_saw_851979_19930426	Sawtek 851979, SAW Filter Fc=160MHz, 3dB BW=18.0MHz, Loss=25.5dB, Model features SP
vf_saw_851985_19930426	Sawtek 851985, SAW Filter Fc=160MHz, 3dB BW=28.0MHz, Loss=25.5dB, Model features SP

**Table 3-3. Filters (continued)**

<b>Component Name</b>	<b>Description</b>
vf_saw_851986_19930426	Sawtek 851986, SAW Filter Fc=160MHz, 3dB BW=31.4MHz, Loss=24.8dB, Model features SP
vf_saw_851987_19930426	Sawtek 851987, SAW Filter Fc=160MHz, 3dB BW=33.3MHz, Loss=24.7dB, Model features SP
vf_saw_851989_19930426	Sawtek 851989, SAW Filter Fc=160MHz, 3dB BW=36.8MHz, Loss=24.6dB, Model features SP
vf_saw_851991_19930426	Sawtek 851991, SAW Filter Fc=160MHz, 3dB BW=40.0MHz, Loss=26.5dB, Model features SP
vf_saw_854220_19930426	Sawtek 854220, SONET SAW Filter Fc=155.52+0.031MHz, 3dB BW=600+50KHz, Loss=17+1.5dB, Model features SP
vf_saw_854221_19930426	Sawtek 854221, SONET SAW Filter Fc=622.02+0.1MHz, 3dB BW=960+70KHz, Loss=18dB, Model features SP
vf_saw_854349_19930426	Sawtek 854349, SONET SAW Filter Fc=155.52+0.031MHz, 3dB BW=295+50KHz, Loss=16+1.5dB, Model features SP





# Chapter 4: Mixers

## Schematic Design

This section describes the schematic design of the non-surface-mount system library mixer components and describes the underlying model for each type of component.

Figure 4-1 shows how a mixer component appears when placed into the Schematic design window. The schematic symbol artwork is derived from the standard 2-port MIX symbol. The annotation consists of the component name, the default component ID prefix (in this case, S), and the component parameters.

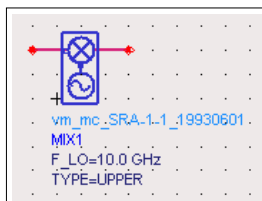


Figure 4-1. Mixer Schematic Component Example

Two component parameters are displayed:

- F\_LO denotes the local oscillator frequency in user frequency units and can be assigned to any real value; its default assignment is 100.0
- TYPE denotes the mixer type and is assigned to one of the enumerated constants  $r + l$ ,  $l - r$ , or  $r - l$ ; its default assignment is  $r + l$

These parameters are set in the component parameter dialog box. The *label* field appearing at the top of the component parameter dialog box contains the selected component label. The *description* field below the label field reads *Nonlinear Model*.

The mixer component represents a parametric subnetwork schematic design. An example of such a design subnetwork is shown in Figure 4-2.

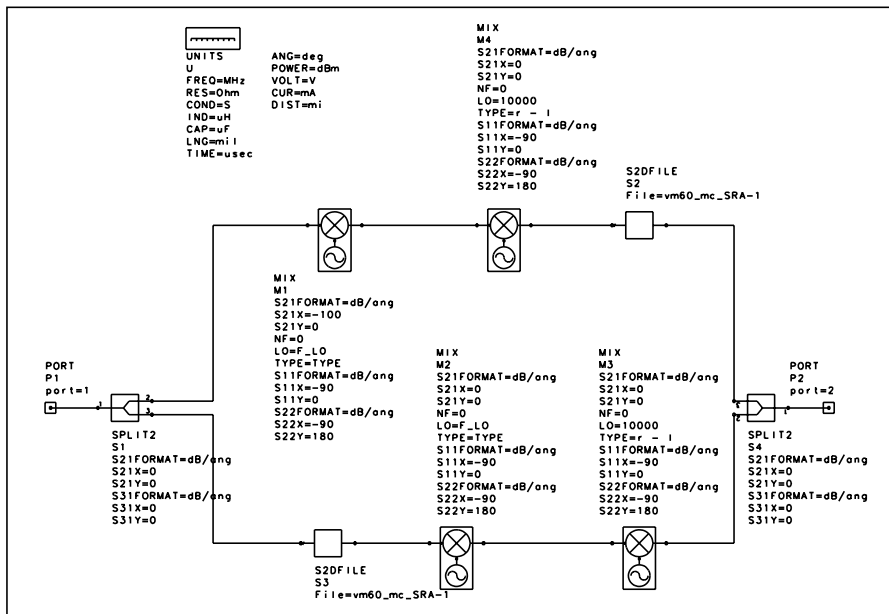


Figure 4-2. Mixer Schematic Design Subnetwork Example

The subnetwork is comprised of 2 RF branches, connected in parallel by SPLIT2 components. The lower branch, consisting of an S2D file-based component followed by 2 MIX components, is used to model the forward transmission and RF port reflection characteristics of the mixer. The second MIX component, with the ID M3, is placed to model the Spurious responses. The value of the parameter LO in M3 varies:

- If the parameter FREQ in the UNITS component is MHz, LO has a value 10,000
- If the parameter FREQ in the UNITS component is GHz, LO has a value 10

The upper branch consists of two MIX components followed by an S2D component and is used to model the IF port reflection characteristics of the mixer. The reverse transmission is set to 0. The MIX component M4 is similar to M3.

The same model data file is referenced by both S2D component placements. As a minimum, the file contains small-signal S-parameter data for the mixer, but this can be accompanied by noise data, gain compression characteristics and an intermodulation table (IMT), according to the amount of data that the manufacturer

has supplied. The model features attributable to the selected mixer component are summarized in the associated component label. The S2D file is physically located in the same directory as the subnetwork design file.

The formal parameters, F\_LO and TYPE, are used to define the MIX components when placed in the subnetwork. Local Oscillator power is not a parameter; the model data is characterized at a single LO power chosen by the manufacturer. This power is specified in the component label associated with the selected mixer component.

The mixer library components are suitable for placement in any RF/Analog schematic.

## Data

The Mixer Library consists of nonlinear models representing 142 mixers from 3 manufacturers. The models were extracted from data provided by these manufacturers.

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**Note** The library itself is a binary file named *MixerLibrary.library* which can be found in *\$HPEESOF\_DIR/ComponentLibs/models*.

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The mixer library groups available for selection from the Schematic window are:

- “Agilent Technologies Mixers” on page 4-4
- “Mini-Circuits Mixers” on page 4-5
- “Watkins-Johnson Mixers” on page 4-13

## Agilent Technologies Mixers

For modeling specifications, see [“Schematic Design” on page 4-1](#).

The Agilent Technologies Mixers include 2 components, representing individual parts. The naming convention for these components is *vm\_hp\_<part number>*.

Table 4-1. Agilent Technologies Mixers

Component Name	Description
vm_hp_IAM-81018_19930601	HP IAM-81018, RF 0.05-5, IF DC-1 GHz, Gain=8.5dB, NF=16dB, Po1dBC=-6dBm, Model features SP, NF, 1dBC, IP3
vm_hp_IAM-82018_19930601	HP IAM-82018, RF 0.05-5, IF DC-2 GHz, Gain=15dB, NF=16dB, Po1dBC=8dBm, Model features SP, NF, 1dBC, IP3

# Mini-Circuits Mixers

For modeling specifications, see [“Schematic Design” on page 4-1](#).

The Mini-Circuits Mixers include 127 components, representing individual mixers listed in the same order as in the manufacturer's catalog. The naming convention for these components is *vm\_mc\_<part number>*.

Table 4-2. Mini-Circuits Mixers

Component Name	Description
vm_mc_ASK-1_19930601	Mini-Circuits ASK-1, RF 1-600, IF DC-600 MHz, P_LO=7dBm, Loss=5.58dB, Model features SP, IMT
vm_mc_ASK-2_19930601	Mini-Circuits ASK-2, RF 1-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=6.79dB, Model features SP, IMT
vm_mc_CBL-1X_19930601	Mini-Circuits CBL-1X, RF 10-1000, IF 5-500 MHz, P_LO=7dBm, Loss=5.94dB, Model features SP, IMT
vm_mc_CBL-1_19930601	Mini-Circuits CBL-1, RF 1-500, IF DC-500 MHz, P_LO=7dBm, Loss=5.9dB, Model features SP, IMT
vm_mc_GRA-6H_19930601	Mini-Circuits GRA-6H, RF 0.01-50, IF DC-50 MHz, P_LO=17dBm, Loss=5.04dB, Model features SP, IMT
vm_mc_LMX-113_19930601	Mini-Circuits LMX-113, RF 5-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=5.72dB, Model features SP, IMT
vm_mc_LMX-123MH_19930601	Mini-Circuits LMX-123MH, RF 10-2500, IF 10-500 MHz, P_LO=13dBm, Loss=6.8dB, Model features SP, IMT
vm_mc_LMX-123_19930601	Mini-Circuits LMX-123, RF 10-3000, IF 10-1000 MHz, P_LO=10dBm, Loss=5.94dB, Model features SP, IMT
vm_mc_LMX-124_19930601	Mini-Circuits LMX-124, RF 0.5-500, IF DC-500 MHz, P_LO=7dBm, Loss=5.18dB, Model features SP, IMT
vm_mc_LMX-125MH_19930601	Mini-Circuits LMX-125MH, RF 0.5-500, IF 0.5-500 MHz, P_LO=13dBm, Loss=5.8dB, Model features SP, IMT
vm_mc_LMX-1481_19930601	Mini-Circuits LMX-1481, RF 3-1100, IF DC-1100 MHz, P_LO=10dBm, Loss=6.7dB, Model features SP, IMT
vm_mc_LMX-149_19930601	Mini-Circuits LMX-149, RF 10-1500, IF DC-1500 MHz, P_LO=7dBm, Loss=6.58dB, Model features SP, IMT
vm_mc_RAY-11_19930601	Mini-Circuits RAY-11, RF 100-2500, IF DC-500 MHz, P_LO=23dBm, Loss=6.23dB, Model features SP, IMT
vm_mc_RAY-1_19930601	Mini-Circuits RAY-1, RF 5-500, IF DC-500 MHz, P_LO=23dBm, Loss=6.57dB, Model features SP, IMT

Table 4-2. Mini-Circuits Mixers (continued)

Component Name	Description
vm_mc_RAY-2_19930601	Mini-Circuits RAY-2, RF 10-1000, IF DC-1000 MHz, P_LO=23dBm, Loss=6.89dB, Model features SP, IMT
vm_mc_RAY-3_19930601	Mini-Circuits RAY-3, RF 0.07-200, IF DC-200 MHz, P_LO=23dBm, Loss=5.53dB, Model features SP, IMT
vm_mc_RAY-6_19930601	Mini-Circuits RAY-6, RF 0.03-50, IF DC-50 MHz, P_LO=23dBm, Loss=5.36dB, Model features SP, IMT
vm_mc_ROK-186MH_19930601	Mini-Circuits ROK-186MH, RF 5-2500, IF 10-1000 MHz, P_LO=13dBm, Loss=6.57dB, Model features SP, IMT
vm_mc_SAM-1_19930601	Mini-Circuits SAM-1, RF 1-600, IF DC-600 MHz, P_LO=7dBm, Loss=5.67dB, Model features SP, IMT
vm_mc_SAM-2_19930601	Mini-Circuits SAM-2, RF 1-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=5.68dB, Model features SP, IMT
vm_mc_SAM-3_19930601	Mini-Circuits SAM-3, RF 0.1-500, IF DC-500 MHz, P_LO=7dBm, Loss=5.04dB, Model features SP, IMT
vm_mc_SAM-4_19930601	Mini-Circuits SAM-4, RF 5-1250, IF 0.5-1000 MHz, P_LO=7dBm, Loss=5.98dB, Model features SP, IMT
vm_mc_SAM-5_19930601	Mini-Circuits SAM-5, RF 5-1500, IF 0.5-1000 MHz, P_LO=7dBm, Loss=5.81dB, Model features SP, IMT
vm_mc_SAY-11_19930601	Mini-Circuits SAY-11, RF 10-2400, IF 5-1000 MHz, P_LO=23dBm, Loss=7.4dB, Model features SP, IMT
vm_mc_SAY-1_19930601	Mini-Circuits SAY-1, RF 0.1-500, IF 0.01-500 MHz, P_LO=23dBm, Loss=4.85dB, Model features SP, IMT
vm_mc_SAY-2_19930601	Mini-Circuits SAY-2, RF 0.1-1000, IF 0.01-500 MHz, P_LO=23dBm, Loss=5.4dB, Model features SP, IMT
vm_mc_SBL-1-1LH_19930601	Mini-Circuits SBL-1-1LH, RF 0.2-400, IF DC-400 MHz, P_LO=10dBm, Loss=5.2dB, Model features SP, IMT
vm_mc_SBL-11LH_19930601	Mini-Circuits SBL-11LH, RF 5-2000, IF 10-600 MHz, P_LO=10dBm, Loss=7dB, Model features SP, IMT
vm_mc_SBL-11_19930601	Mini-Circuits SBL-11, RF 5-2000, IF 10-600 MHz, P_LO=7dBm, Loss=7.08dB, Model features SP, IMT
vm_mc_SBL-1H_19930601	Mini-Circuits SBL-1H, RF 1-500, IF DC-500 MHz, P_LO=17dBm, Loss=5.6dB, Model features SP, IMT
vm_mc_SBL-1LH_19930601	Mini-Circuits SBL-1LH, RF 2-500, IF DC-500 MHz, P_LO=10dBm, Loss=5.8dB, Model features SP, IMT
vm_mc_SBL-1MH_19930601	Mini-Circuits SBL-1MH, RF 1-500, IF DC-500 MHz, P_LO=13dBm, Loss=5.73dB, Model features SP, IMT

**Table 4-2. Mini-Circuits Mixers (continued)**

<b>Component Name</b>	<b>Description</b>
vm_mc_SBL-1XH_19930601	Mini-Circuits SBL-1XH, RF 10-1000, IF 5-500 MHz, P_LO=17dBm, Loss=6dB, Model features SP, IMT
vm_mc_SBL-1XLH_19930601	Mini-Circuits SBL-1XLH, RF 10-1000, IF 5-500 MHz, P_LO=10dBm, Loss=6dB, Model features SP, IMT
vm_mc_SBL-1X_19930601	Mini-Circuits SBL-1X, RF 10-1000, IF 5-500 MHz, P_LO=7dBm, Loss=5.88dB, Model features SP, IMT
vm_mc_SBL-1ZMH_19930601	Mini-Circuits SBL-1ZMH, RF 2-1100, IF DC-500 MHz, P_LO=13dBm, Loss=6.63dB, Model features SP, IMT
vm_mc_SBL-1Z_19930601	Mini-Circuits SBL-1Z, RF 10-1000, IF DC-500 MHz, P_LO=7dBm, Loss=6.27dB, Model features SP, IMT
vm_mc_SBL-1_19930601	Mini-Circuits SBL-1, RF 1-500, IF DC-500 MHz, P_LO=7dBm, Loss=5.6dB, Model features SP, IMT
vm_mc_SBL-2LH_19930601	Mini-Circuits SBL-2LH, RF 5-1000, IF DC-1000 MHz, P_LO=10dBm, Loss=5.9dB, Model features SP, IMT
vm_mc_SBL-3LH_19930601	Mini-Circuits SBL-3LH, RF 0.07-250, IF DC-250 MHz, P_LO=10dBm, Loss=4.9dB, Model features SP, IMT
vm_mc_SIMA-5H_19930601	Mini-Circuits SIMA-5H, RF 2-1500, IF DC-1000 MHz, P_LO=17dBm, Loss=6.83dB, Model features SP, IMT
vm_mc_SIMA-5MH_19930601	Mini-Circuits SIMA-5MH, RF 2-1500, IF DC-1000 MHz, P_LO=13dBm, Loss=7.11dB, Model features SP, IMT
vm_mc_SIMA-5_19930601	Mini-Circuits SIMA-5, RF 2-1500, IF DC-1000 MHz, P_LO=7dBm, Loss=7.01dB, Model features SP, IMT
vm_mc_SRA-1-1_19930601	Mini-Circuits SRA-1-1, RF 0.1-500, IF DC-500 MHz, P_LO=7dBm, Loss=4.81dB, Model features SP, IMT
vm_mc_SRA-11H_19930601	Mini-Circuits SRA-11H, RF 10-3000, IF 10-1000 MHz, P_LO=17dBm, Loss=6.83dB, Model features SP, IMT
vm_mc_SRA-11_19930601	Mini-Circuits SRA-11, RF 5-2000, IF 10-600 MHz, P_LO=7dBm, Loss=6.72dB, Model features SP, IMT
vm_mc_SRA-12_19930601	Mini-Circuits SRA-12, RF 800-1250, IF 50-90 MHz, P_LO=7dBm, Loss=6.21dB, Model features SP, IMT
vm_mc_SRA-173H_19930601	Mini-Circuits SRA-173H, RF 5-1200, IF DC-1200 MHz, P_LO=17dBm, Loss=5.38dB, Model features SP, IMT
vm_mc_SRA-1H_19930601	Mini-Circuits SRA-1H, RF 0.5-500, IF DC-500 MHz, P_LO=17dBm, Loss=6.01dB, Model features SP, IMT
vm_mc_SRA-1WH_19930601	Mini-Circuits SRA-1WH, RF 1-750, IF DC-750 MHz, P_LO=17dBm, Loss=6.01dB, Model features SP, IMT

Table 4-2. Mini-Circuits Mixers (continued)

Component Name	Description
vm_mc_SRA-1W_19930601	Mini-Circuits SRA-1W, RF 1-750, IF DC-750 MHz, P_LO=7dBm, Loss=5.8dB, Model features SP, IMT
vm_mc_SRA-1_19930601	Mini-Circuits SRA-1, RF 0.5-500, IF DC-500 MHz, P_LO=7dBm, Loss=5.11dB, Model features SP, IMT
vm_mc_SRA-2000_19930601	Mini-Circuits SRA-2000, RF 100-2000, IF DC-600 MHz, P_LO=7dBm, Loss=6.69dB, Model features SP, IMT
vm_mc_SRA-2010MH_19930601	Mini-Circuits SRA-2010MH, RF 10-2000, IF DC-600 MHz, P_LO=13dBm, Loss=7.5dB, Model features SP, IMT
vm_mc_SRA-215_19930601	Mini-Circuits SRA-215, RF 0.05-1500, IF 0.05-500 MHz, P_LO=10dBm, Loss=5.2dB, Model features SP, IMT
vm_mc_SRA-220_19930601	Mini-Circuits SRA-220, RF 0.05-2000, IF 0.05-500 MHz, P_LO=10dBm, Loss=5.59dB, Model features SP, IMT
vm_mc_SRA-2CM_19930601	Mini-Circuits SRA-2CM, RF 5-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=5.27dB, Model features SP, IMT
vm_mc_SRA-2CR_19930601	Mini-Circuits SRA-2CR, RF 10-1000, IF 5-500 MHz, P_LO=10dBm, Loss=5.68dB, Model features SP, IMT
vm_mc_SRA-2H_19930601	Mini-Circuits SRA-2H, RF 2-1000, IF DC-1000 MHz, P_LO=17dBm, Loss=6.34dB, Model features SP, IMT
vm_mc_SRA-2_19930601	Mini-Circuits SRA-2, RF 1-1000, IF 0.5-500 MHz, P_LO=7dBm, Loss=5.66dB, Model features SP, IMT
vm_mc_SRA-3H_19930601	Mini-Circuits SRA-3H, RF 0.05-200, IF DC-200 MHz, P_LO=17dBm, Loss=5.18dB, Model features SP, IMT
vm_mc_SRA-3MH_19930601	Mini-Circuits SRA-3MH, RF 0.025-200, IF DC-200 MHz, P_LO=13dBm, Loss=4.77dB, Model features SP, IMT
vm_mc_SRA-3_19930601	Mini-Circuits SRA-3, RF 0.025-200, IF DC-200 MHz, P_LO=7dBm, Loss=4.61dB, Model features SP, IMT
vm_mc_SRA-4_19930601	Mini-Circuits SRA-4, RF 5-1250, IF 0.5-500 MHz, P_LO=7dBm, Loss=5.71dB, Model features SP, IMT
vm_mc_SRA-5_19930601	Mini-Circuits SRA-5, RF 5-1500, IF 10-600 MHz, P_LO=7dBm, Loss=6.69dB, Model features SP, IMT
vm_mc_SRA-6H_19930601	Mini-Circuits SRA-6H, RF 0.01-50, IF DC-50 MHz, P_LO=17dBm, Loss=4.97dB, Model features SP, IMT
vm_mc_SRA-6_19930601	Mini-Circuits SRA-6, RF 0.003-100, IF DC-100 MHz, P_LO=7dBm, Loss=4.58dB, Model features SP, IMT
vm_mc_SRA-8_19930601	Mini-Circuits SRA-8, RF 0.0005-10, IF DC-10 MHz, P_LO=7dBm, Loss=5.69dB, Model features SP, IMT



**Table 4-2. Mini-Circuits Mixers (continued)**

<b>Component Name</b>	<b>Description</b>
vm_mc_TAK-1WH_19930601	Mini-Circuits TAK-1WH, RF 5-750, IF DC-750 MHz, P_LO=17dBm, Loss=5.71dB, Model features SP, IMT
vm_mc_TAK-3H_19930601	Mini-Circuits TAK-3H, RF 0.05-300, IF DC-300 MHz, P_LO=17dBm, Loss=4.82dB, Model features SP, IMT
vm_mc_TAK-5R_19930601	Mini-Circuits TAK-5R, RF 0.05-200, IF DC-200 MHz, P_LO=7dBm, Loss=4.65dB, Model features SP, IMT
vm_mc_TAK-5_19930601	Mini-Circuits TAK-5, RF 0.01-250, IF DC-250 MHz, P_LO=7dBm, Loss=4.65dB, Model features SP, IMT
vm_mc_TAK-6R_19930601	Mini-Circuits TAK-6R, RF 0.5-600, IF DC-600 MHz, P_LO=7dBm, Loss=5.4dB, Model features SP, IMT
vm_mc_TAK-6_19930601	Mini-Circuits TAK-6, RF 0.5-600, IF DC-600 MHz, P_LO=7dBm, Loss=5.58dB, Model features SP, IMT
vm_mc_TAK-7_19930601	Mini-Circuits TAK-7, RF 2-1000, IF 5-500 MHz, P_LO=7dBm, Loss=5.86dB, Model features SP, IMT
vm_mc_TFM-11_19930601	Mini-Circuits TFM-11, RF 1-2000, IF 5-600 MHz, P_LO=7dBm, Loss=7.16dB, Model features SP, IMT
vm_mc_TFM-12MH_19930601	Mini-Circuits TFM-12MH, RF 0.5-2000, IF 0.2-600 MHz, P_LO=13dBm, Loss=6.99dB, Model features SP, IMT
vm_mc_TFM-12_19930601	Mini-Circuits TFM-12, RF 800-1250, IF 50-90 MHz, P_LO=7dBm, Loss=5.71dB, Model features SP, IMT
vm_mc_TFM-150_19930601	Mini-Circuits TFM-150, RF 10-2000, IF DC-1000 MHz, P_LO=10dBm, Loss=6.19dB, Model features SP, IMT
vm_mc_TFM-15_19930601	Mini-Circuits TFM-15, RF 10-3000, IF 10-800 MHz, P_LO=10dBm, Loss=6.75dB, Model features SP, IMT
vm_mc_TFM-1H_19930601	Mini-Circuits TFM-1H, RF 2-500, IF DC-500 MHz, P_LO=17dBm, Loss=6.14dB, Model features SP, IMT
vm_mc_TFM-1MH_19930601	Mini-Circuits TFM-1MH, RF 2-500, IF DC-500 MHz, P_LO=13dBm, Loss=5.8dB, Model features SP, IMT
vm_mc_TFM-2400_19930601	Mini-Circuits TFM-2400, RF 750-2400, IF DC-400 MHz, P_LO=7dBm, Loss=6.65dB, Model features SP, IMT
vm_mc_TFM-2H_19930601	Mini-Circuits TFM-2H, RF 5-1000, IF DC-1000 MHz, P_LO=17dBm, Loss=6.12dB, Model features SP, IMT
vm_mc_TFM-2LH_19930601	Mini-Circuits TFM-2LH, RF 2-1000, IF DC-1000 MHz, P_LO=10dBm, Loss=5.7dB, Model features SP, IMT
vm_mc_TFM-2_19930601	Mini-Circuits TFM-2, RF 1-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=5.74dB, Model features SP, IMT

Table 4-2. Mini-Circuits Mixers (continued)

Component Name	Description
vm_mc_TFM-3H_19930601	Mini-Circuits TFM-3H, RF 0.1-250, IF DC-250 MHz, P_LO=17dBm, Loss=4.58dB, Model features SP, IMT
vm_mc_TFM-3MH_19930601	Mini-Circuits TFM-3MH, RF 1-250, IF DC-250 MHz, P_LO=13dBm, Loss=4.79dB, Model features SP, IMT
vm_mc_TFM-3_19930601	Mini-Circuits TFM-3, RF 0.04-400, IF DC-400 MHz, P_LO=7dBm, Loss=4.7dB, Model features SP, IMT
vm_mc_TFM-4H_19930601	Mini-Circuits TFM-4H, RF 5-1200, IF DC-1200 MHz, P_LO=17dBm, Loss=5.24dB, Model features SP, IMT
vm_mc_TFM-4_19930601	Mini-Circuits TFM-4, RF 5-1250, IF DC-1250 MHz, P_LO=7dBm, Loss=6.47dB, Model features SP, IMT
vm_mc_TFM-5_19930601	Mini-Circuits TFM-5, RF 5-1500, IF DC-1000 MHz, P_LO=7dBm, Loss=6.33dB, Model features SP, IMT
vm_mc_TSM-1_19930601	Mini-Circuits TSM-1, RF 1-600, IF DC-600 MHz, P_LO=7dBm, Loss=5.71dB, Model features SP, IMT
vm_mc_TSM-3_19930601	Mini-Circuits TSM-3, RF 0.1-500, IF DC-500 MHz, P_LO=7dBm, Loss=4.75dB, Model features SP, IMT
vm_mc_TSM-5_19930601	Mini-Circuits TSM-5, RF 5-1500, IF DC-1000 MHz, P_LO=7dBm, Loss=6.16dB, Model features SP, IMT
vm_mc_TUF-11AH_19930601	Mini-Circuits TUF-11AH, RF 1400-1900, IF 40-500 MHz, P_LO=17dBm, Loss=7.3dB, Model features SP, IMT
vm_mc_TUF-11ALH_19930601	Mini-Circuits TUF-11ALH, RF 1400-1900, IF 40-500 MHz, P_LO=10dBm, Loss=7dB, Model features SP, IMT
vm_mc_TUF-11A_19930601	Mini-Circuits TUF-11A, RF 1400-1900, IF 40-500 MHz, P_LO=7dBm, Loss=6.8dB, Model features SP, IMT
vm_mc_TUF-1LH_19930601	Mini-Circuits TUF-1LH, RF 2-600, IF DC-600 MHz, P_LO=10dBm, Loss=6dB, Model features SP, IMT
vm_mc_TUF-1_19930601	Mini-Circuits TUF-1, RF 2-600, IF DC-600 MHz, P_LO=7dBm, Loss=5.85dB, Model features SP, IMT
vm_mc_TUF-2MH_19930601	Mini-Circuits TUF-2MH, RF 50-1000, IF DC-1000 MHz, P_LO=13dBm, Loss=6dB, Model features SP, IMT
vm_mc_TUF-2_19930601	Mini-Circuits TUF-2, RF 50-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=5.85dB, Model features SP, IMT
vm_mc_TUF-3LH_19930601	Mini-Circuits TUF-3LH, RF 0.15-400, IF DC-400 MHz, P_LO=10dBm, Loss=4.8dB, Model features SP, IMT
vm_mc_TUF-3_19930601	Mini-Circuits TUF-3, RF 0.15-400, IF DC-400 MHz, P_LO=7dBm, Loss=4.7dB, Model features SP, IMT

**Table 4-2. Mini-Circuits Mixers (continued)**

<b>Component Name</b>	<b>Description</b>
vm_mc_TUF-5H_19930601	Mini-Circuits TUF-5H, RF 20-1500, IF DC-1000 MHz, P_LO=17dBm, Loss=7.5dB, Model features SP, IMT
vm_mc_TUF-5LH_19930601	Mini-Circuits TUF-5LH, RF 20-1500, IF DC-1000 MHz, P_LO=10dBm, Loss=6.9dB, Model features SP, IMT
vm_mc_TUF-5MH_19930601	Mini-Circuits TUF-5MH, RF 20-1500, IF DC-1000 MHz, P_LO=13dBm, Loss=7dB, Model features SP, IMT
vm_mc_TUF-5_19930601	Mini-Circuits TUF-5, RF 20-1500, IF DC-1000 MHz, P_LO=7dBm, Loss=5.7dB, Model features SP, IMT
vm_mc_TUF-860H_19930601	Mini-Circuits TUF-860H, RF 800-1050, IF DC-250 MHz, P_LO=17dBm, Loss=6.8dB, Model features SP, IMT
vm_mc_TUF-860LH_19930601	Mini-Circuits TUF-860LH, RF 800-1050, IF DC-250 MHz, P_LO=10dBm, Loss=6.3dB, Model features SP, IMT
vm_mc_TUF-860MH_19930601	Mini-Circuits TUF-860MH, RF 800-1050, IF DC-250 MHz, P_LO=13dBm, Loss=6.8dB, Model features SP, IMT
vm_mc_TUF-860_19930601	Mini-Circuits TUF-860, RF 800-1050, IF DC-250 MHz, P_LO=7dBm, Loss=5.6dB, Model features SP, IMT
vm_mc_UNCL-L1H_19930601	Mini-Circuits UNCL-L1H, RF 10-500, IF DC-500 MHz, P_LO=6dBm, Loss=5.73dB, Model features SP, IMT
vm_mc_UNCL-L1_19930601	Mini-Circuits UNCL-L1, RF 10-500, IF DC-500 MHz, P_LO=-4dBm, Loss=5.73dB, Model features SP, IMT
vm_mc_UNCL-R1H_19930601	Mini-Circuits UNCL-R1H, RF 10-500, IF DC-500 MHz, P_LO=17dBm, Loss=6.32dB, Model features SP, IMT
vm_mc_UNCL-R1_19930601	Mini-Circuits UNCL-R1, RF 10-500, IF DC-500 MHz, P_LO=7dBm, Loss=5.53dB, Model features SP, IMT
vm_mc_UNCL-X1MH_19930601	Mini-Circuits UNCL-X1MH, RF 1-500, IF 10-500 MHz, P_LO=13dBm, Loss=2.41dB, Model features SP, IMT
vm_mc_UNCL-X1_19930601	Mini-Circuits UNCL-X1, RF 1-500, IF 10-500 MHz, P_LO=7dBm, Loss=1.57dB, Model features SP, IMT
vm_mc_VAY-1_19930601	Mini-Circuits VAY-1, RF 0.5-500, IF 0.02-500 MHz, P_LO=23dBm, Loss=5.79dB, Model features SP, IMT
vm_mc_ZEM-2B_19930601	Mini-Circuits ZEM-2B, RF 10-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=5.74dB, Model features SP, IMT
vm_mc_ZEM-4300MH_19930601	Mini-Circuits ZEM-4300MH, RF 300-4300, IF DC-1000 MHz, P_LO=13dBm, Loss=6.42dB, Model features SP, IMT
vm_mc_ZFM-1H_19930601	Mini-Circuits ZFM-1H, RF 2-500, IF DC-500 MHz, P_LO=17dBm, Loss=6.14dB, Model features SP, IMT

Table 4-2. Mini-Circuits Mixers (continued)

Component Name	Description
vm_mc_ZFM-1W_19930601	Mini-Circuits ZFM-1W, RF 10-750, IF DC-750 MHz, P_LO=7dBm, Loss=5.42dB, Model features SP, IMT
vm_mc_ZFM-42MH_19930601	Mini-Circuits ZFM-42MH, RF 10-4200, IF 10-1000 MHz, P_LO=13dBm, Loss=7.46dB, Model features SP, IMT
vm_mc_ZLW-1SH_19930601	Mini-Circuits ZLW-1SH, RF 2-500, IF DC-500 MHz, P_LO=17dBm, Loss=5.93dB, Model features SP, IMT
vm_mc_ZLW-1WSH_19930601	Mini-Circuits ZLW-1WSH, RF 5-750, IF DC-750 MHz, P_LO=17dBm, Loss=5.83dB, Model features SP, IMT
vm_mc_ZP-10514_19930601	Mini-Circuits ZP-10514, RF 0.2-500, IF DC-500 MHz, P_LO=7dBm, Loss=5.18dB, Model features SP, IMT

# Watkins-Johnson Mixers

For modeling specifications, see “[Schematic Design](#)” on page 4-1.

The Watkins-Johnson Mixers include 13 components, representing individual parts. The naming convention for these components is *vm\_wj\_<part number>*.

Table 4-3. Watkins-Johnson Mixers

Component Name	Description
vm_wj_M1J_19930601	Watkins-Johnson M1J, RF 300-2000, IF DC-1000 MHz, P_LO=7dBm, Loss=8dB, Model features SP, 1dBC, IMT
vm_wj_M2A_19930601	Watkins-Johnson M2A, RF 10-1500, IF DC-800 MHz, P_LO=7dBm, Loss=7.5dB, Model features SP, 1dBC, IMT
vm_wj_M2E_19930601	Watkins-Johnson M2E, RF 10-1000, IF DC-600 MHz, P_LO=20dBm, Loss=8.5dB, Model features SP, 1dBC, IMT
vm_wj_M4T_19930601	Watkins-Johnson M4T, RF 1-3400, IF 1-2000 MHz, P_LO=10dBm, Loss=8dB, Model features SP, 1dBC, IMT
vm_wj_M50_19930601	Watkins-Johnson M50, RF 2-26, IF 1-15 GHz, P_LO=10dBm, Loss=8dB, Model features SP, 1dBC, IMT
vm_wj_M52_19930601	Watkins-Johnson M52, RF 2-24, IF 0.1-5 GHz, P_LO=10dBm, Loss=8.5dB, Model features SP, 1dBC, IMT
vm_wj_M79H_19930601	Watkins-Johnson M79H, RF 7-18, IF DC-3 GHz, P_LO=20dBm, Loss=7.5dB, Model features SP, 1dBC, IMT
vm_wj_M85_19930601	Watkins-Johnson M85, RF 2-18, IF DC-1 GHz, P_LO=7dBm, Loss=8dB, Model features SP, 1dBC, IMT
vm_wj_M88_19930601	Watkins-Johnson M88, RF 2-18, IF 1-8 GHz, P_LO=13dBm, Loss=8dB, Model features SP, 1dBC, IMT
vm_wj_M89_19930601	Watkins-Johnson M89, RF 2-18, IF 1-8 GHz, P_LO=10dBm, Loss=8dB, Model features SP, 1dBC, IMT
vm_wj_M9E_19930601	Watkins-Johnson M9E, RF 1-400, IF DC-400 MHz, P_LO=27dBm, Loss=7dB, Model features SP, 1dBC, IMT
vm_wj_MF4020_19930601	Watkins-Johnson MF4020, RF 10-1100, IF 10-300 MHz, P_LO=20dBm, Po1dBC=25dBm, NF=10dB, Model features SP, NF, 1dBC, IP3, IMT
vm_wj_MF4027_19930601	Watkins-Johnson MF4027, RF 10-1000, IF 10-300 MHz, P_LO=27dBm, Po1dBC=30dBm, NF=10dB, Model features SP, NF, 1dBC, IP3, IMT



# Chapter 5: Power Dividers

## Schematic Design

This section describes the schematic design of the non-surface-mount system library power divider components and describes the underlying model for each type of component.

Figure 5-1 shows how a power divider component appears when placed into the Schematic design window. The schematic symbol artwork is derived from the standard 3-port SPLIT2 symbol. The annotation consists of the component name, the default component ID prefix (in this case, S). No component parameters are displayed.

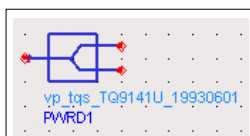


Figure 5-1. Power Divider Schematic Component Example

The *label* field appearing at the top of the component parameter dialog box the selected component label. The *description* field below the label field reads Nonlinear Model.

The power divider component represents a parametric subnetwork schematic design. An example of such a design subnetwork is shown in Figure 5-2. We use the component shown in this figure internally.

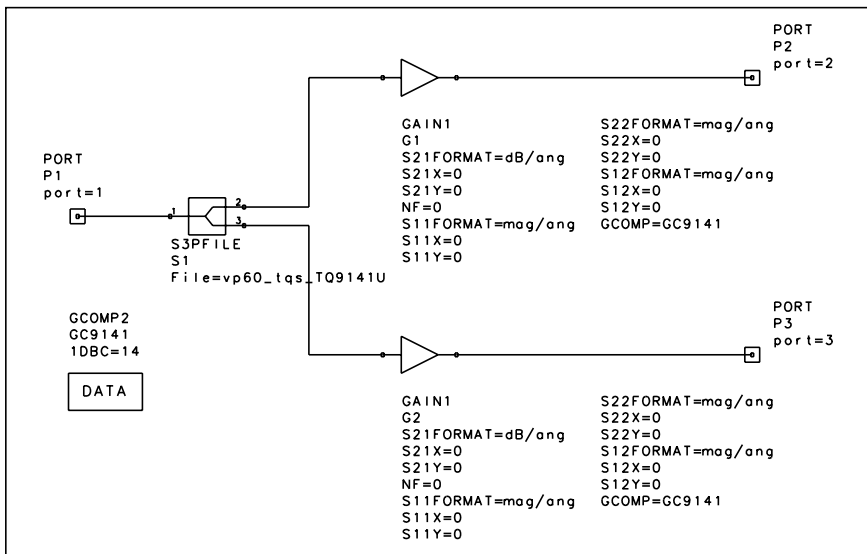


Figure 5-2. Power Divider Schematic Design Subnetwork Example

The subnetwork is comprised of a S3P data component, followed by a GAIN1 component at each of the two output ports. The data file characterizes the small-signal S-parameters of the power divider and is physically located in the same directory as the subnetwork design file. The GCOMP data associated with each GAIN1 component is used to model the gain compression characteristics of the power divider. The subnetwork has no formal parameters.

The power divider library components are suitable for placement in any RF/Analog schematic.

## Data

The Power Divider Library consists of nonlinear models representing 2 dividers from a single manufacturer. The models were extracted from data provided by the manufacturer.



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**Note** The library itself is a binary file named *PowerDividerLibrary.library* which can be found in *\$HPEESOF\_DIR/ComponentLibs/models*.

---

The power divider library group available for selection from the Schematic window is:

- [“TriQuint Power Dividers” on page 5-4](#)

## TriQuint Power Dividers

For modeling specifications, see “[Schematic Design](#)” on page 5-1.

The TriQuint Power Dividers include 2 components, representing individual power dividers. The naming convention for these components is *vp\_tqs\_<part number>*.

Table 5-1. TriQuint Power Dividers

Component Name	Description
vp_tqs_TQ9141D_19930601	PWRD
vp_tqs_TQ9141U_19930601	PWRD

# Chapter 6: Switches

## Schematic Design

This section describes the schematic design of the non-surface-mount system library switch components and describes the underlying model for each type of component.

Figure 6-1 shows how a switch component appears when placed into the Schematic design window. The schematic symbol artwork is derived from the standard 2-port 2PORT symbol. The annotation consists of the component name and the default component ID prefix (in this case, S), and the component parameters.

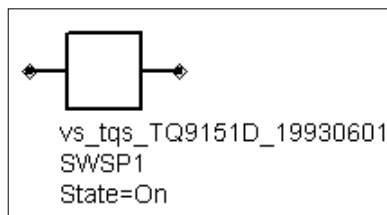


Figure 6-1. Switch Schematic Component Example

Two component parameters are displayed:

- STATE denotes the state of the switch, and is assigned to one of the enumerated constants On or Off; its default assignment is On.
- TEMP, denotes the temperature of the switch, a standard convention for linear components in Omnisys; its default assignment is TEMP=\*

These parameters are set in the component parameter dialog box. The *label* field appearing at the top of the component parameter dialog box the selected component label. The *description* field below the label field reads *Linear Model*.

The Switch component represents a parametric subnetwork schematic design. An example of such a design subnetwork is shown in Figure 6-2.

The subnetwork is comprised of a S2D file-based component. The S2D model data file is indexed by an MDIFLIST variable with keyword Switch and value equal to the subnetwork parameter STATE. The file small-signal S-parameter data for both On and Off states. The S2D file is physically located in the same directory as the subnetwork design file.

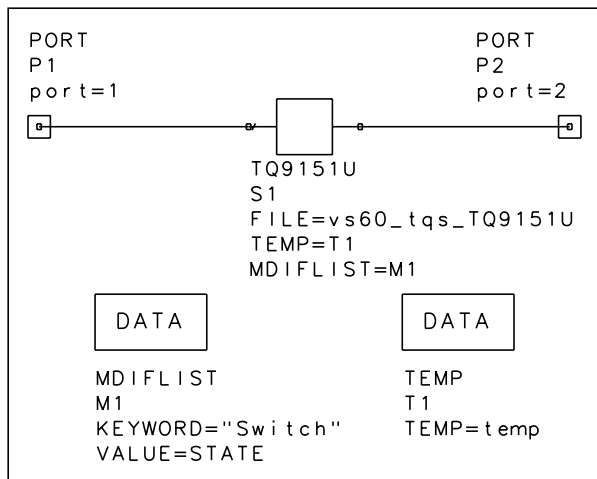


Figure 6-2. Switch Schematic Design Subnetwork Example

The switch library components are suitable for placement in any RF/Analog schematic.

## Data

The Switch library consists of S2D models representing 2 switches from a single manufacturer. The models were extracted from data provided by the manufacturer.

---

**Note** The library itself is a binary file named *SwitchLibrary.library* which can be found in *\$HPEESOF\_DIR/ComponentLibs/models*.

---

The switch library group available for selection from the Schematic window is:

- [“TriQuint Switches” on page 6-3](#)

# TriQuint Switches

For modeling specifications, see [“Schematic Design” on page 6-1](#).

The TriQuint Switches include 2 components, representing individual parts. The naming convention for these components is *vs\_tqs\_<part number>*.

Table 6-1. TriQuint Switches

Name	Description
vs_tqs_TQ9151D_19930601	SWSP
vs_tqs_TQ9151U_19930601	SWSP



# Chapter 7: SMT Amplifiers

The SMT Amplifier Library consists of amplifiers representing 112 surface mount amplifiers from 5 manufacturers. The models were extracted from data provided by these manufacturers.

The SMT amplifier library groups available for selection from the Schematic and Layout windows are:

- [“Agilent Technologies SMT Amplifiers” on page 7-4](#)
- [“NEC SMT Amplifiers” on page 7-6](#)
- [“Q-bit SMT Amplifiers” on page 7-8](#)
- [“TriQuint SMT Amplifiers” on page 7-12](#)
- [“Watkins-Johnson SMT Amplifiers” on page 7-13](#)

## Schematic Design

This section describes the schematic design of the SMT amplifier library components and specifies the simulation model that is incorporated in the design.

Figure 7-1 shows how an SMT amplifier component appears when placed into the Schematic design window. The schematic symbol artwork is derived from the standard 2-port GAIN1 symbol. The annotation consists of the component name and the default component ID prefix (in this case, S). No component parameters are displayed.

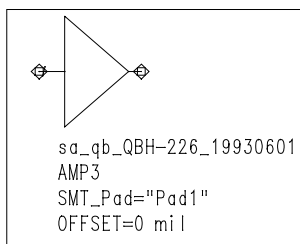


Figure 7-1. SMT Amplifier Schematic Component Example

Two parameters, SMTPAD and OFFSET, are listed in the component parameter dialog box. These parameters are suppressed from the schematic display and are used for layout artwork generation only. The *label* field appearing at the top of the component parameter dialog box contains the selected component label. The *description* field below the label field reads *Nonlinear Model*.

---

**Note** Some components with package artwork of type SOT143 have two SMTPAD parameters: the first one is for pin 1 and the second one for the other pins.

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The SMT amplifier component is simply an alias application of the standard S2D file-based data component. No schematic design subnetwork is associated with the component. The standard component name S2D is replaced by the selected SMT amplifier Library component name; for example, sa\_qb\_QBH-226\_19930601.

The S2D data file small-signal S-parameters, gain compression characteristics and, in some cases, noise figure or noise parameter data. The file is installed in the same library group subdirectory as the associated component.



**The SMT amplifier library components are suitable for placement in any RF/Analog schematic.**

# Agilent Technologies SMT Amplifiers

For modeling specifications, see [“Schematic Design” on page 7-2](#).

The Agilent Technologies SMT Amplifiers include 22 components, representing individual parts. The naming convention for these components is *sa\_hp\_<part number>*.

Table 7-1. Agilent Technologies SMT Amplifiers

Component Name	Description
sa_hp_INA-02186_19930601	Agilent INA-02186, 86 package, 0.01-4 GHz, Po1dBC=11dBm, NF=2.0dB, Model features SP, 1dBC, IP3
sa_hp_INA-10386_19930601	Agilent INA-10386, 86 package, 0.05-4 GHz, Po1dBC=11dBm, NF=3.6dB, Model features SP, NF, 1dBC, IP3
sa_hp_MGA-86576_19930601	Agilent MGA-86576, 76 package, 0.5-10 GHz, Po1dBC=6.3, NF=1.6dB, Model features SP, NF, 1dBC, IP3
sa_hp_MSA-0186_19930601	Agilent MSA-0186, 86 package, 0.1-5 GHz, Po1dBC=1.5dBm, NF=5.4dB, Model features SP, NF, 1dBC, IP3
sa_hp_MSA-0286_19930601	Agilent MSA-0286, 86 package, 0.1-5 GHz, Po1dBC=4.5dBm, NF=6.4dB, Model features SP, NP, 1dBC, IP3
sa_hp_MSA-0311_19930601	Agilent MSA-0311, SOT143 package, 0.1-6 GHz, Po1dBC=9dBm, NF=6dB, Model features SP, NP, 1dBC, IP3
sa_hp_MSA-0386_19930601	Agilent MSA-0386, 86 package, 0.1-5 GHz, Po1dBC=10dBm, NF=6dB, Model features SP, NP, 1dBC, IP3
sa_hp_MSA-0486_19930601	Agilent MSA-0486, 86 package, 0.1-5 GHz, Po1dBC=12.5dBm, NF=7dB, Model features SP, NP, 1dBC, IP3
sa_hp_MSA-0505_19930601	Agilent MSA-0505, 05 package, 0.05-3 GHz, Po1dBC=18dBm, NF=N/A, Model features SP, 1dBC, IP3
sa_hp_MSA-0611_19930601	Agilent MSA-0611, SOT143 package, 0.1-4 GHz, Po1dBC=1dBm, NF=3.2dB, Model features SP, NP, 1dBC, IP3
sa_hp_MSA-0686_19930601	Agilent MSA-0686, 86 package, 0.1-5 GHz, Po1dBC=2dBm, NF=3.1dB, Model features SP, NP, 1dBC, IP3
sa_hp_MSA-0711_19930601	Agilent MSA-0711, SOT143 package, 0.1-4 GHz, Po1dBC=5.5dBm, NF=5dB, Model features SP, NP, 1dBC, IP3
sa_hp_MSA-0786_19930601	Agilent MSA-0786, 86 package, 0.1-5 GHz, Po1dBC=5.5dBm, NF=5.2dB, Model features SP, NP, 1dBC, IP3
sa_hp_MSA-0886_19930601	Agilent MSA-0886, 86 package, 0.1-6 GHz, Po1dBC=12.5dBm, NF=3.1dB, Model features SP, NP, 1dBC, IP3

**Table 7-1. Agilent Technologies SMT Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
sa_hp_MSA-0900_19930601	Agilent MSA-0900, 86 package, 0.02-7 GHz, Po1dB=11.5dBm, NF=6.0dB, Model features SP, 1dB, IP3
sa_hp_MSA-0986_19930601	Agilent MSA-0986, 86 package, 0.02-6 GHz, Po1dB=10.5dBm, NF=6.1dB, Model features SP, NP, 1dB, IP3
sa_hp_MSA-1105_19930601	Agilent MSA-1105, 05 package, 0.0005-3 GHz, Po1dB=17.5dBm, NF=4.4dB, Model features SP, NP, 1dB, IP3
sa_hp_MSA-2011_19930601	Agilent MSA-2011, SOT143 package, 0.1-6 GHz, Po1dB=9.0dBm, NF=4.3dB, Model features SP, 1dB, IP3
sa_hp_MSA-2086_19930601	Agilent MSA-2086, 86 package, 0.1-6 GHz, Po1dB=9.0dBm, NF=3.7dB, Model features SP, 1dB, IP3
sa_hp_MSA-2111_19930601	Agilent MSA-2111, SOT143 package, 0.1-4 GHz, Po1dB=10.0dBm, NF=3.3dB, Model features SP, 1dB, IP3
sa_hp_MSA-3111_19930601	Agilent MSA-3111, SOT143 package, 0.1-6 GHz, Po1dB=9.0dBm, NF=3.5dB, Model features SP, 1dB, IP3
sa_hp_MSA-3186_19930601	Agilent MSA-3186, 86 package, 0.1-6 GHz, Po1dB=9.0dBm, NF=3.5dB, Model features SP, 1dB, IP3

## NEC SMT Amplifiers

For modeling specifications, see “[Schematic Design](#)” on page 7-2.

The NEC SMT Amplifiers include 25 components, representing individual parts. The naming convention for these components is *sa\_nec\_<part number>*.

Table 7-2. NEC SMT Amplifiers

Component Name	Description
sa_nec_UPC1659G_19930601	NEC UPC1659G, G08 package, 0.1-2.1 GHz, Po1dBC=0dBm, NF=N/A, Model features SP, 1dBC
sa_nec_UPC1675G_19930601	NEC UPC1675G, 39 package, 0.1-2.6 GHz, Po1dBC=2dBm, NF=N/A, Model features SP, 1dBC
sa_nec_UPC1676G_19930601	NEC UPC1676G, 39 package, 0.1-2.4 GHz, NF=4.5dB, Model features SP
sa_nec_UPC1678G_19930601	NEC UPC1678G, G08 package, 0.05-2.5 GHz, Po1dBC=12dBm, NF=N/A, Model features SP, 1dBC
sa_nec_UPC1688G_1_19930601	NEC UPC1688G_1, 39 package, 0.05-2.00 GHz, NF=4dB, Model features SP
sa_nec_UPC1688G_2_19930601	NEC UPC1688G_2, 39 package, 0.05-2.00 GHz, NF=4dB, Model features SP
sa_nec_UPC1688G_3_19930601	NEC UPC1688G_3, 39 package, 0.05-2.00 GHz, NF=4dB, Model features SP
sa_nec_UPC2708T_19930601	NEC UPC2708T, T06 package, 0.1-3.0 GHz, NF=6.5dB, Model features SP
sa_nec_UPC2709T_19930601	NEC UPC2709T, T06 package, 0.1-2.5 GHz, NF=5dB, Model features SP
sa_nec_UPC2710T_19930601	NEC UPC2710T, T06 package, 0.1-1.5 GHz, NF=3.5dB, Model features SP
sa_nec_UPC2711T_19930601	NEC UPC2711T, T06 package, 0.1-3.5 GHz, NF=5dB, Model features SP
sa_nec_UPC2712T_19930601	NEC UPC2712T, T06 package, 0.1-3.0 GHz, NF=4.5dB, Model features SP
sa_nec_UPC2713T_19930601	NEC UPC2713T, T06 package, 0.1-2.0 GHz, NF=3.2dB, Model features SP
sa_nec_UPC2714T_19930601	NEC UPC2714T, T06 package, 0.1-2.5 GHz, NF=5dB, Model features SP

**Table 7-2. NEC SMT Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
sa_nec_UPC2715T_19930601	NEC UPC2715T, T06 package, 0.1-2.0 GHz, NF=5dB, Model features SP
sa_nec_UPC2723T_1_19930601	NEC UPC2723T_1, T06 package, 0.1-4.0 GHz, Po1dBC=-3dBm,NF=11dB, Model features SP, 1dBC
sa_nec_UPC2723T_2_19930601	NEC UPC2723T_2, T06 package, 0.1-4.0 GHz, Po1dBC=-3dBm,NF=11dB, Model features SP, 1dBC
sa_nec_UPC2745T_1_19930601	NEC UPC2745T_1, T06 package, 0.1-3.0 GHz, NF=6dB, Model features SP
sa_nec_UPC2745T_2_19930601	NEC UPC2745T_2, T06 package, 0.1-3.0 GHz, NF=8dB, Model features SP
sa_nec_UPC2746T_1_19930601	NEC UPC2746T_1, T06 package, 0.1-3.0 GHz, NF=5dB, Model features SP
sa_nec_UPC2746T_2_19930601	NEC UPC2746T_2, T06 package, 0.1-2.0 GHz, NF=4dB, Model features SP
sa_nec_UPC2747T_1_19930601	NEC UPC2747T_1, T06 package, 0.1-2.0 GHz, NF=5.5dB, Model features SP
sa_nec_UPC2747T_2_19930601	NEC UPC2747T_2, T06 package, 0.1-2.0 GHz, NF=3.3dB, Model features SP
sa_nec_UPC2748T_1_19930601	NEC UPC2748T_1, T06 package, 0.1-2.0 GHz, NF=5.3dB, Model features SP
sa_nec_UPC2748T_2_19930601	NEC UPC2748T_2, T06 package, 0.1-2.0 GHz, NF=2.8dB, Model features SP

## Q-bit SMT Amplifiers

For modeling specifications, see “[Schematic Design](#)” on page 7-2.

The Q-bit SMT Amplifiers include 51 components, representing individual parts. The naming convention for these components is *sa\_qb\_<part number>*.

Table 7-3. Q-Bit SMT Amplifiers

Component Name	Description
sa_qb_QBH-204_19930601	Q-bit QBH-204, FPACK_625 package, 5-700 MHz, Po1dBC=22dBm, NF=7dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-208_19930601	Q-bit QBH-208, FPACK_625 package, 10-450 MHz, Po1dBC=18dBm, NF=3.7dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-210_19930601	Q-bit QBH-210, FPACK_625 package, 5-500 MHz, Po1dBC=9dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-213_19930601	Q-bit QBH-213, FPACK_625 package, 20-1100 MHz, Po1dBC=10dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-214_19930601	Q-bit QBH-214, FPACK_625 package, 5-200 MHz, Po1dBC=25dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-215_19930601	Q-bit QBH-215, FPACK_625 package, 10-500 MHz, Po1dBC=26dBm, NF=7.8dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-217_19930601	Q-bit QBH-217, FPACK_625 package, 33-49 MHz, Po1dBC=4.5dBm, NF=1.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-223_19930601	Q-bit QBH-223, FPACK_625 package, 30-300 MHz, Po1dBC=21dBm, NF=6.3dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-224_19930601	Q-bit QBH-224, FPACK_625 package, 5-100 MHz, Po1dBC=16dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-225_19930601	Q-bit QBH-225, FPACK_625 package, 10-100 MHz, Po1dBC=22dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-226_19930601	Q-bit QBH-226, FPACK_625 package, 5-500Mhz, Po1dBC=16dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-231_19930601	Q-bit QBH-231, FPACK_625 package, 100-700 MHz, Po1dBC=16dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-233_19930601	Q-bit QBH-233, FPACK_625 package, 5-500 MHz, Po1dBC=15dBm, NF=4.2dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-236_19930601	Q-bit QBH-236, FPACK_625 package, 10-200 MHz, Po1dBC=21dBm, NF=4dB, Model features SP, NF, 1dBC, IP3

Table 7-3. Q-Bit SMT Amplifiers (continued)

Component Name	Description
sa_qb_QBH-237_19930601	Q-bit QBH-237, FPACK_625 package, 10-200 MHz, Po1dBC=20dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-238_19930601	Q-bit QBH-238, FPACK_625 package, 5-150 MHz, Po1dBC=21dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-244_19930601	Q-bit QBH-244, FPACK_625 package, 10-300 MHz, Po1dBC=7.5dBm, NF=2.9dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-247_19930601	Q-bit QBH-247, FPACK_625 package, 10-200 Mhz, Po1dBC=22dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-250_19930601	Q-bit QBH-250, FPACK_625 package, 10-300 MHz, Po1dBC=18dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-254_19930601	Q-bit QBH-254, FPACK_625 package, 400-800 MHz, Po1dBC=8dBm, NF=2.6dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-261_19930601	Q-bit QBH-261, FPACK_625 package, 10-150 Mhz, Po1dBC=27.0dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-265_19930601	Q-bit QBH-265, FPACK_625 package, 5-300 Mhz, Po1dBC=22dBm, NF=5.8dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-277_19930601	Q-bit QBH-277, FPACK_625 package, 10-300 MHz, Po1dBC=12dBm, NF=2.6dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-279_19930601	Q-bit QBH-279, FPACK_625 package, 5-200 MHz, Po1dBC=9dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-280_19930601	Q-bit QBH-280, FPACK_625 package, 5-150 MHz, Po1dBC=19dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-281_19930601	Q-bit QBH-281, FPACK_625 package, 10-200 MHz, Po1dBC=16dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-284_19930601	Q-bit QBH-284, FPACK_625 package, 10-100 MHz, Po1dBC=24dBm, NF=4dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-287_19930601	Q-bit QBH-287, FPACK_625 package, 10-1500 MHz, Po1dBC=20dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5119_19930601	Q-bit QBH-5119, FPACK_450 package, 10-500 MHz, Po1dBC=12dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5122_19930601	Q-bit QBH-5122, FPACK_450 package, 10-500 MHz, Po1dBC=20dBm, NF=4.2dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5128_19930601	Q-bit QBH-5128, FPACK_450 package, 20-1200 Mhz, Po1dBC=13dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5130_19930601	Q-bit QBH-5130, FPACK_450 package, 10-100 MHz, Po1dBC=15.5dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3

Table 7-3. Q-Bit SMT Amplifiers (continued)

Component Name	Description
sa_qb_QBH-5134_19930601	Q-bit QBH-5134, FPACK_450 package, 5-500 Mhz, Po1dBC=7dBm, NF=2.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5146_19930601	Q-bit QBH-5146, FPACK_450 package, 20-1100 MHz, Po1dBC=5dBm, NF=3.1dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5147_19930601	Q-bit QBH-5147, FPACK_450 package, 20-1100 MHz, Po1dBC=9dBm, NF=3.7dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5169_19930601	Q-bit QBH-5169, FPACK_450 package, 10-1000 MHz, Po1dBC=20dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5237_19930601	Q-bit QBH-5237, FPACK_450 package, 10-200 MHz, Po1dBC=22dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5255_19930601	Q-bit QBH-5255, FPACK_450 package, 5-250 MHz, Po1dBC=22dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5271_19930601	Q-bit QBH-5271, FPACK_450 package, 10-150 MHz, Po1dBC=26dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5284_19930601	Q-bit QBH-5284, FPACK_450 package, 10-100 Mhz, Po1dBC=22dBm, NF=4dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5407_19930601	Q-bit QBH-5407, FPACK_625 package, 50-2000 Mhz, Po1dBC=27dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5616_19930601	Q-bit QBH-5616, FPACK_450 package, 135-185 Mhz, Po1dBC=20dBm, NF=5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5647_19930601	Q-bit QBH-5647, FPACK_450 package, 50-2000 Mhz, Po1dBC=27dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5804_19930601	Q-bit QBH-5804, FPACK_450 package, 10-100 Mhz, Po1dBC=24dBm, NF=4dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5811_19930601	Q-bit QBH-5811, FPACK_450 package, 200-1200 MHz, Po1dBC=8dBm, NF=2.6dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5817_19930601	Q-bit QBH-5817, FPACK_450 package, 10-1500 Mhz, Po1dBC=20dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5819_19930601	Q-bit QBH-5819, FPACK_450 package, 2-1000 Mhz, Po1dBC=18dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5824_19930601	Q-bit QBH-5824, FPACK_450 package, 10-2000 MHz, Po1dBC=12dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5847_19930601	Q-bit QBH-5847, FPACK_450 package, 30-1000 Mhz, Po1dBC=10dBm, NF=4.8dB, Model features SP, NF, 1dBC, IP3



Table 7-3. Q-Bit SMT Amplifiers (continued)

Component Name	Description
sa_qb_QBH-5857_19930601	Q-bit QBH-5857, FPACK_450 package, 10-200 Mhz, Po1dBC=11dBm, NF=2dB, Model features SP, NF, 1dBC, IP3
sa_qb_QBH-5870_19930601	Q-bit QBH-5870, FPACK_450 package, 10-200 Mhz, Po1dBC=20dBm, NF=2.9dB, Model features SP, NF, 1dBC, IP3

## TriQuint SMT Amplifiers

For modeling specifications, see [“Schematic Design” on page 7-2](#).

The TriQuint SMT Amplifiers include a single component, representing an individual amplifier. The naming convention for this component is *sa\_tqs\_<part number>*.

Table 7-4. TriQuint SMT Amplifiers

Component Name	Description
sa_tqs_9111U_19930601	TriQuint 9111U, MICRO_S package, 0.5-10.5 GHz, Po1dBC=18dBm, NF=5dB, Model features SP, 1dBC, IP3

# Watkins-Johnson SMT Amplifiers

For modeling specifications, see “[Schematic Design](#)” on page 7-2.

The Watkins-Johnson SMT Amplifiers include 140 components, representing individual parts. The naming convention for these components is *sa\_wj\_<part number>*.

Several components refer to the same Watkins-Johnson part number at different operating conditions (*Vcc*). The affected component names employ an additional suffix to indicate the *Vcc* operating voltage associated with the corresponding model. For example, *sa\_wj\_SMA70-3\_12V*, employs a model characterized using *Vcc* = 12V.

Table 7-5. Watkins-Johnson SMT Amplifiers

Component Name	Description
sa_wj_SMA11_19930601	Watkins-Johnson SMA11, FPACK_450 package, 5-1000 MHz, Po1dBC=-2.0dBm, NF=3.1dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA12_19930601	Watkins-Johnson SMA12, FPACK_450 package, 10-1000 MHz, Po1dBC=8.0dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA16-2_19930601	Watkins-Johnson SMA16-2, FPACK_450 package, 10-1200 MHz, Po1dBC=6.0dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA17_19930601	Watkins-Johnson SMA17, FPACK_450 package, 10-1000 MHz, Po1dBC=15.3dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA18-1_19930601	Watkins-Johnson SMA18-1, FPACK_450 package, 10-1000 MHz, Po1dBC=16.0dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA180_19930601	Watkins-Johnson SMA180, FPACK_450 package, 10-500 MHz, Po1dBC=18dBm, NF=3.4dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA181_19930601	Watkins-Johnson SMA181, FPACK_450 package, 10-250 MHz, Po1dBC=22dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA18_19930601	Watkins-Johnson SMA18, FPACK_450 package, 5-800 MHz, Po1dBC=13.5dBm, NF=3.8dB, Model features SP, 1dBC, IP3
sa_wj_SMA19-1_19930601	Watkins-Johnson SMA19-1, FPACK_450 package, 10-1000 MHz, Po1dBC=22.5dBm, NF=6.0dB, Model features SP, 1dBC, IP3
sa_wj_SMA19_19930601	Watkins-Johnson SMA19, FPACK_450 package, 10-1000 MHz, Po1dBC=21.0dBm, NF=9.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA1_19930601	Watkins-Johnson SMA1, FPACK_450 package, 5-500 MHz, Po1dBC=-1.0dBm, NF=2.4dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA21-1_19930601	Watkins-Johnson SMA21-1, FPACK_450package, 10-1200 MHz, Po1dBC=-1.0dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3

Table 7-5. Watkins-Johnson SMT Amplifiers (continued)

Component Name	Description
sa_wj_SMA24_19930601	Watkins-Johnson SMA24, FPACK_450 package, 5-1500 MHz, Po1dBC=8.0dBm, NF=4.2dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA25-1_19930601	Watkins-Johnson SMA25-1, FPACK_450 package, 2-1500 MHz, Po1dBC=9.0dBm, NF<3.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA25_19930601	Watkins-Johnson SMA25, FPACK_450 package, 5-1500 MHz, Po1dBC=9.0dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA26_19930601	Watkins-Johnson SMA26, FPACK_450 package, 10-1500 MHz, Po1dBC=14dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA27_19930601	Watkins-Johnson SMA27, FPACK_450 package, 10-1500 MHz, Po1dBC=15.5dBm, NF=7.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA28-2_19930601	Watkins-Johnson SMA28-2, FPACK_450 package, 10-1500 MHz, Po1dBC=10dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA28_19930601	Watkins-Johnson SMA28, FPACK_450package, 5-1500 MHz, Po1dBC=15.0dBm, NF=6.0dB, Model features SP, 1dBC, IP3
sa_wj_SMA29-1_19930601	Watkins-Johnson SMA29-1, FPACK_450 package, 10-1500 MHz, Po1dBC=22.0dBm, NF=8.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA29_19930601	Watkins-Johnson SMA29, FPACK_450 package, 10-1500 MHz, Po1dBC=22.0dBm, NF=9.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA31-1_19930601	Watkins-Johnson SMA31-1, FPACK_450package, 5-2000 MHz, Po1dBC=-4.0dBm, NF=3.5dB, Model features SP, 1dBC, IP3
sa_wj_SMA32-1_19930601	Watkins-Johnson SMA32-1, FPACK_450 package, 100-2000 MHz, Po1dBC=13.0dBm, NF=3.0dB, Model features SP, 1dBC, IP3
sa_wj_SMA32_19930601	Watkins-Johnson SMA32, FPACK_450 package, 100-2000 MHz, Po1dBC=21.0dBm, NF=3.5dB, Model features SP, 1dBC, IP3
sa_wj_SMA33-1_19930601	Watkins-Johnson SMA33-1, FPACK_450 package, 2-2400 MHz, Po1dBC=6.0dBm, NF=4.0dB, Model features SP, 1dBC, IP3
sa_wj_SMA33_19930601	Watkins-Johnson SMA33, FPACK_450 package, 10-2000 MHz, Po1dBC=3.0dBm, NF=4.5dB, Model features SP, 1dBC, IP3
sa_wj_SMA34-1_19930601	Watkins-Johnson SMA34-1, FPACK_450 package, 1.5-2.3 GHz, Po1dBC=8.0dBm, NF=5.7dB, Model features SP, 1dBC, IP3
sa_wj_SMA34_19930601	Watkins-Johnson SMA34, FPACK_450 package, 100-2000 MHz, Po1dBC=7.0dBm, NF=5.5dB, Model features SP, 1dBC, IP3
sa_wj_SMA35-1_19930601	Watkins-Johnson SMA35-1, FPACK_450 package, 2-2400 MHz, Po1dBC=9.5dBm, NF=4.2dB, Model features SP, 1dBC, IP3
sa_wj_SMA35_19930601	Watkins-Johnson SMA35, FPACK_450 package, 10-2000 MHz, Po1dBC=9.0dBm, NF=5.0dB, Model features SP, 1dBC, IP3

**Table 7-5. Watkins-Johnson SMT Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
sa_wj_SMA36-1_19930601	Watkins-Johnson SMA36-1, FPACK_450 package, 100-2300 MHz, Po1dBC=12.0dBm, NF=6.0dB, Model features SP, 1dBC, IP3
sa_wj_SMA36-2_19930601	Watkins-Johnson SMA36-2, FPACK_450 package, 100-2600 MHz, Po1dBC=12.0dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA36_19930601	Watkins-Johnson SMA36, FPACK_450 package, 100-2000 MHz, Po1dBC=12.0dBm, NF=5.5dB, Model features SP, 1dBC, IP3
sa_wj_SMA37_19930601	Watkins-Johnson SMA37, FPACK_450 package, 10-2000 MHz, Po1dBC=15.5dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA38-1_19930601	Watkins-Johnson SMA38-1, FPACK_450 package, 10-2000 MHz, Po1dBC=18.0dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA38_19930601	Watkins-Johnson SMA38, FPACK_450 package, 10-2000 MHz, Po1dBC=18.0dBm, NF=6.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA39_19930601	Watkins-Johnson SMA39, FPACK_450 package, 10-2000 MHz, Po1dBC=22.0dBm, NF<8.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA3_19930601	Watkins-Johnson SMA3, FPACK_450 package, 5-500 MHz, Po1dBC=-1.0dBm, NF=3.3dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA40_19930601	Watkins-Johnson SMA40, FPACK_450 package, 500-4000 MHz, Po1dBC=15.0dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA41_19930601	Watkins-Johnson SMA41, FPACK_450 package, 1-4 GHz, Po1dBC=12.0dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA43_19930601	Watkins-Johnson SMA43, FPACK_450 package, 100-3200 MHz, Po1dBC=8.5dBm, NF=6.7dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA45-1_19930601	Watkins-Johnson SMA45-1, FPACK_450 package, 1-4 GHz, Po1dBC=13.0dBm, NF=4.1dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA45_19930601	Watkins-Johnson SMA45, FPACK_450 package, 1-4 GHz, Po1dBC=19.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA5-5_19930601	Watkins-Johnson SMA5-5, FPACK_450 package, 5-500 MHz, Po1dBC=9.0dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA5-6_19930601	Watkins-Johnson SMA5-6, FPACK_450 package, 5-600 MHz, Po1dBC=8.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA53_19930601	Watkins-Johnson SMA53, FPACK_450 package, 10-500 MHz, Po1dBC=3.5dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA54_19930601	Watkins-Johnson SMA54, FPACK_450 package, 5-400 MHz, Po1dBC=8.0dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA55_19930601	Watkins-Johnson SMA55, FPACK_450 package, 10-500 MHz, Po1dBC=11.0dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3

Table 7-5. Watkins-Johnson SMT Amplifiers (continued)

Component Name	Description
sa_wj_SMA56_19930601	Watkins-Johnson SMA56, FPACK_450 package, 5-400 MHz, Po1dBC=13.5dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA57_19930601	Watkins-Johnson SMA57, FPACK_450 package, 10-500 MHz, Po1dBC=14.0dBm, NF=4.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA58_19930601	Watkins-Johnson SMA58, FPACK_450 package, 5-500 MHz, Po1dBC=19.0dBm, NF=4.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA59-1_19930601	Watkins-Johnson SMA59-1, FPACK_450 package, 10-700 MHz, Po1dBC=22.0dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA59_19930601	Watkins-Johnson SMA59, FPACK_450 package, 5-500 MHz, Po1dBC=22.0dBm, NF=5.5dB, Model features SP, 1dBC, IP3
sa_wj_SMA5_19930601	Watkins-Johnson SMA5, FPACK_450 package, 5-500 MHz, Po1dBC=8.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA61-1_19930601	Watkins-Johnson SMA61-1, FPACK_450 package, 2-6 GHz, Po1dBC=20.0dBm, NF=3.4dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA61_19930601	Watkins-Johnson SMA61, FPACK_450 package, 2-6 GHz, Po1dBC=12.5dBm, NF=3.2dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA63_19930601	Watkins-Johnson SMA63, FPACK_450 package, 5-1000 MHz, Po1dBC=4.0dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA64_19930601	Watkins-Johnson SMA64, FPACK_450 package, 10-1200 MHz, Po1dBC=8.0dBm, NF=3.2dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA65_19930601	Watkins-Johnson SMA65, FPACK_450 package, 10-1000 MHz, Po1dBC=10.0dBm, NF=6.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA66-1_19930601	Watkins-Johnson SMA66-1, FPACK_450 package, 10-1000 MHz, Po1dBC=15.0dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA66-3_19930601	Watkins-Johnson SMA66-3, FPACK_450 package, 10-1000 MHz, Po1dBC=3.0dBm, NF<3.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA66_19930601	Watkins-Johnson SMA66, FPACK_450 package, 10-1200 MHz, Po1dBC=15.0dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA67-1_19930601	Watkins-Johnson SMA67-1, FPACK_450 package, 10-600 MHz, Po1dBC=17.0dBm, NF<4.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA67_19930601	Watkins-Johnson SMA67, FPACK_450 package, 10-800 MHz, Po1dBC=16.0dBm, NF<4.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA70-1_19930601	Watkins-Johnson SMA70-1, FPACK_450 package, 10-250 MHz, Po1dBC=14.0dBm, NF=1.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA70-2_19930601	Watkins-Johnson SMA70-2, FPACK_450 package, 10-250 MHz, Po1dBC=19.0dBm, NF=2.2dB, Model features SP, NF, 1dBC, IP3

**Table 7-5. Watkins-Johnson SMT Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
sa_wj_SMA70-3_12V_19930601	Watkins-Johnson SMA70-3, FPACK_450package, Vcc=12V,20-250 MHz, Po1dBC=21.0dBm, NF=2.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA70-3_15V_19930601	Watkins-Johnson SMA70-3, FPACK_450 package, Vcc=15V,20-250 MHz, Po1dBC=21.0dBm, NF=2.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA70_19930601	Watkins-Johnson SMA70, FPACK_450 package, 10-250 MHz, Po1dBC=8.5dBm, NF=1.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA71_19930601	Watkins-Johnson SMA71, FPACK_450 package, 5-200 MHz, Po1dBC=-2.5dBm, NF=2.1dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA72_5V_19930601	Watkins-Johnson SMA72, FPACK_450 package, Vcc=5V, 5-500 MHz, Po1dBC=12.5dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA72_8V_19930601	Watkins-Johnson SMA72, FPACK_450 package, Vcc=8V, 5-500 MHz, Po1dBC=16.5dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA73_19930601	Watkins-Johnson SMA73, FPACK_450 package, 5-500 MHz, Po1dBC=1.5dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA74-1_19930601	Watkins-Johnson SMA74-1, FPACK_450 package, 5-250 MHz, Po1dBC=8.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA74-2_19930601	Watkins-Johnson SMA74-2, FPACK_450 package, 5-500 MHz, Po1dBC=-1.0dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA74_19930601	Watkins-Johnson SMA74, FPACK_450 package, 5-500 MHz, Po1dBC=8.5dBm, NF=3.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA75-2_19930601	Watkins-Johnson SMA75-2, FPACK_450 package, 5-250 MHz, Po1dBC=8.0dBm, NF=4.2dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA75-3_19930601	Watkins-Johnson SMA75-3, FPACK_450 package, 10-500 MHz, Po1dBC=3.5dBm, NF=2.3dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA75_19930601	Watkins-Johnson SMA75, FPACK_450 package, 5-500 MHz, Po1dBC=9.0dBm, NF=2.6dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA76-1_19930601	Watkins-Johnson SMA76-1, FPACK_450 package, 5-500 MHz, Po1dBC=13dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA76_19930601	Watkins-Johnson SMA76, FPACK_450 package, 5-500 MHz, Po1dBC=15dBm, NF=4.7dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA77-1_19930601	Watkins-Johnson SMA77-1, FPACK_450 package, 5-600 MHz, Po1dBC=16.5dBm, NF=5dB, Model features SP, NF, 1dBC, IP3

Table 7-5. Watkins-Johnson SMT Amplifiers (continued)

Component Name	Description
sa_wj_SMA77_15V_19930601	Watkins-Johnson SMA77, FPACK_450 package, Vcc=15V, 5-500 MHz, Po1dBC=16.5dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA77_8V_19930601	Watkins-Johnson SMA77, FPACK_450 package, Vcc=8V, 5-500 MHz, Po1dBC=16.5dBm, NF=5.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA78_19930601	Watkins-Johnson SMA78, FPACK_450 package, 5-300 MHz, Po1dBC=19.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA79_19930601	Watkins-Johnson SMA79, FPACK_450 package, 10-300 MHz, Po1dBC=22.0dBm, NF=5.2dB, Model features SP, 1dBC, IP3
sa_wj_SMA7_19930601	Watkins-Johnson SMA7, FPACK_450 package, 5-500 MHz, Po1dBC=14.0dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA80-1_12V_19930601	Watkins-Johnson SMA80-1, FPACK_450 package, Vcc=12V,10-200 MHz, Po1dBC=16.0dBm, NF=2.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA80-1_15V_19930601	Watkins-Johnson SMA80-1, FPACK_450 package, Vcc=15V,10-200 MHz, Po1dBC=16.0dBm, NF=2.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA80_12V_19930601	Watkins-Johnson SMA80, FPACK_450 package, Vcc=12V,20-500 MHz, Po1dBC=14.3dBm, NF=2.3dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA80_15V_19930601	Watkins-Johnson SMA80, FPACK_450 package, Vcc=15V,20-500 MHz, Po1dBC=14.3dBm, NF=2.3dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA81-1_19930601	Watkins-Johnson SMA81-1, FPACK_450 package, 20-250 MHz, Po1dBC=12.5dBm, NF=2.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA81-2_19930601	Watkins-Johnson SMA81-2, FPACK_450 package, 20-500 MHz, Po1dBC=15dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA81-3_19930601	Watkins-Johnson SMA81-3, FPACK_450 package, 20-500 MHz, Po1dBC=8dBm, NF=3.6dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA81_12V_19930601	Watkins-Johnson SMA81, FPACK_450 package, Vcc=12V,20-250 MHz, Po1dBC=17.0dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA81_15V_19930601	Watkins-Johnson SMA81, FPACK_450 package, Vcc=15V,20-250 MHz, Po1dBC=17.0dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3



**Table 7-5. Watkins-Johnson SMT Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
sa_wj_SMA82_12V_19930601	Watkins-Johnson SMA82, FPACK_450 package, Vcc=12V,20-250 MHz, Po1dBC=20.0dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA82_15V_19930601	Watkins-Johnson SMA82, FPACK_450 package, Vcc=15V,20-250 MHz, Po1dBC=20.0dBm, NF=4.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA83_19930601	Watkins-Johnson SMA83, FPACK_450 package, 10-500 MHz, Po1dBC=-1dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA86-1_19930601	Watkins-Johnson SMA86-1, FPACK_450 package, 10-200 MHz, Po1dBC=16dBm, NF=2.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA86_19930601	Watkins-Johnson SMA86, FPACK_450 package, 10-200 MHz, Po1dBC=9dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA87-1_19930601	Watkins-Johnson SMA87-1, FPACK_450 package, 10-400 MHz, Po1dBC=17dBm, NF=3.6dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA87-2_19930601	Watkins-Johnson SMA87-2, FPACK_450 package, 10-300 MHz, Po1dBC=9.5dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA87_19930601	Watkins-Johnson SMA87, FPACK_450 package, 5-400 MHz, Po1dBC=17.0dBm, NF=4.7dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA88-1_19930601	Watkins-Johnson SMA88-1, FPACK_450 package, 5-300 MHz, Po1dBC=18.5dBm, NF=3.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA88_19930601	Watkins-Johnson SMA88, FPACK_450 package, 5-500 MHz, Po1dBC=20.5dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA89_19930601	Watkins-Johnson SMA89, FPACK_450 package, 100-800 MHz, Po1dBC=17.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMA9_19930601	Watkins-Johnson SMA9, FPACK_450 package, 5-500 MHz, Po1dBC=22.0dBm, NF=8.0dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMLA17_19930601	Watkins-Johnson SMLA17, FPACK_450 package, 10-1000 MHz, Po1dBC=10dBm, NF=5.8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMLA45-1_19930601	Watkins-Johnson SMLA45-1, FPACK_450 package, 1000-4000 MHz, Po1dBC=17dBm, NF=7.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMLA45_19930601	Watkins-Johnson SMLA45, FPACK_450 package, 1000-4000 MHz, Po1dBC=14dBm, NF=8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMLA7_19930601	Watkins-Johnson SMLA7, FPACK_450 package, 50-500 MHz, Po1dBC=12dBm, NF=7dB, Model features SP, NF, 1dBC, IP3

Table 7-5. Watkins-Johnson SMT Amplifiers (continued)

Component Name	Description
sa_wj_SMLA88_19930601	Watkins-Johnson SMLA88, FPACK_450 package, 10-500 MHz, Po1dBC=17dBm, NF=6dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMPA10_19930601	Watkins-Johnson SMPA10, FPACK_450 package, 10-1000 MHz, Po1dBC=22.5dBm, NF=8.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMPA12-1_19930601	Watkins-Johnson SMPA12-1, FPACK_450 package, 10-1200 MHz, Po1dBC=22dBm, NF=8.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMPA12_19930601	Watkins-Johnson SMPA12, FPACK_450 package, 10-1200 MHz, Po1dBC=22.5dBm, NF=8.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMPA15_19930601	Watkins-Johnson SMPA15, FPACK_450 package, 5-1000 MHz, Po1dBC=26.0dBm, NF=6.5dB, Model features SP, 1dBC, IP3
sa_wj_SMPA2_19930601	Watkins-Johnson SMPA2, FPACK_450 package, 10-300 MHz, Po1dBC=25dBm, NF=8dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMPA30_19930601	Watkins-Johnson SMPA30, FPACK_450 package, 0.5-2.0 GHz, Po1dBC=25dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMPA32_19930601	Watkins-Johnson SMPA32, FPACK_450 package, 0.5-2.0 GHz, Po1dBC=28.5dBm, NF=10dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMPA38-2_19930601	Watkins-Johnson SMPA38-2, FPACK_450 package, 200-2600 MHz, Po1dBC=23.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMPA38_19930601	Watkins-Johnson SMPA38, FPACK_450 package, 200-2000 MHz, Po1dBC=23dBm, NF=4dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMPA3_19930601	Watkins-Johnson SMPA3, FPACK_450 package, 5-500 MHz, Po1dBC=24.5dBm, NF=7.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMPA48_19930601	Watkins-Johnson SMPA48, FPACK_450 package, 1-4 GHz, Po1dBC=24dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMPA5_19930601	Watkins-Johnson SMPA5, FPACK_450 package, 10-500 MHz, Po1dBC=25dBm, NF=8.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMPA6_19930601	Watkins-Johnson SMPA6, FPACK_450 package, 10-500 MHz, Po1dBC=26.5dBm, NF=8.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA26_19930601	Watkins-Johnson SMRA26, FPACK_450 package, 10-1500 MHz, Po1dBC=14.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA36_19930601	Watkins-Johnson SMRA36, FPACK_450 package, 100-2000 MHz, Po1dBC=13dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA38_19930601	Watkins-Johnson SMRA38, FPACK_450 package, 200-2000 MHz, Po1dBC=18.5dBm, NF=6.8dB, Model features SP, NF, 1dBC, IP3

**Table 7-5. Watkins-Johnson SMT Amplifiers (continued)**

<b>Component Name</b>	<b>Description</b>
sa_wj_SMRA43_19930601	Watkins-Johnson SMRA43, FPACK_450 package, 1000-4000 MHz, Po1dBC=12dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA46_19930601	Watkins-Johnson SMRA46, FPACK_450 package, 1000-4000 MHz, Po1dBC=19dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA53_19930601	Watkins-Johnson SMRA53, FPACK_450 package, 1000-5000 MHz, Po1dBC=11.5dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA62_19930601	Watkins-Johnson SMRA62, FPACK_450 package, 2000-6000 MHz, Po1dBC=13dBm, NF=4dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA63-1_19930601	Watkins-Johnson SMRA63-1, FPACK_450 package, 2000-6000 MHz, Po1dBC=16dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA63_19930601	Watkins-Johnson SMRA63, FPACK_450 package, 2000-6000 MHz, Po1dBC=13dBm, NF=5.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA66_19930601	Watkins-Johnson SMRA66, FPACK_450 package, 10-1000 MHz, Po1dBC=15.5dBm, NF=3.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA69_19930601	Watkins-Johnson SMRA69, FPACK_450 package, 10-1000 MHz, Po1dBC=23dBm, NF=4.5dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA76_19930601	Watkins-Johnson SMRA76, FPACK_450 package, 10-500 MHz, Po1dBC=15dBm, NF=3dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA89-1_19930601	Watkins-Johnson SMRA89-1, FPACK_450 package, 10-500 MHz, Po1dBC=21.5dBm, NF=3.2dB, Model features SP, NF, 1dBC, IP3
sa_wj_SMRA89_19930601	Watkins-Johnson SMRA89, FPACK_450 package, 5-500 MHz, Po1dBC=21.5dBm, NF=3.7dB, Model features SP, NF, 1dBC, IP3



# Chapter 8: SMT Crystals

The SMT Crystal Library consists of 439 discrete-value linear models representing 2 manufacturers. The models were extracted from data provided by these manufacturers.

---

**Note** The library itself is a binary file named *SMT\_CrystalLibrary.library* which can be found in *\$HPPEESOF\_DIR/ComponentLibs/models*.

---

The SMT crystal library groups available for selection from the Schematic and Layout windows are:

- “Statek CX-1-SM Series SMT Crystals” on page 8-5
- “Statek CX-1HG-SM Series SMT Crystals” on page 8-6
- “Statek CX-3V-SM Series SMT Crystals” on page 8-7
- “Statek CX-4V-SM Series SMT Crystals” on page 8-9
- “TeleQuartz Group CS4 Series SMT Crystals” on page 8-10
- “TeleQuartz Group CS10 Series SMT Crystals” on page 8-17
- “TeleQuartz Group CS12 Series SMT Crystals” on page 8-24
- “TeleQuartz Group CS20 Series SMT Crystals” on page 8-39

## Schematic Design

This section describes the schematic design of the SMT crystal library components and specifies the simulation models that are incorporated in the design.

Figure 8-1 shows how an SMT crystal component appears when placed into the Schematic design window. The schematic symbol artwork is derived from the standard 2-port XTAL1 symbol. The annotation consists of the Component Name, the default component ID prefix (in this case, XTL), and the component parameter, Fres.

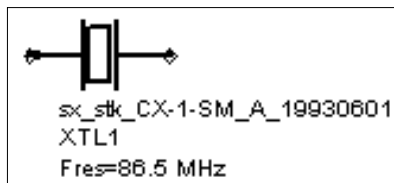


Figure 8-1. SMT Crystal Schematic Component Example

---

**Note** Fres is in units of frequency. Therefore, you should confirm that the correct unit is applied.

---

Each crystal library component represents a single model from a single manufacturer. In the component Parameters dialog box, the Value Type option button for the Fres parameter contains options for *Real*, *Variable*, *Unconstrained Opt*, *Constrained Opt*, *Uniform Yield*, *xxppm*, *Uniform YldOpt*, *xxppm*, where:

*xx* stands for the parts per million probability distribution of frequency

---

**Important** The *Variable* assignment of Fres should be within the range described in the component Parameters dialog box.

---

This tolerance is converted to % tolerance within the AEL. For example, the CSL\_J095\_02\_H\_19930601 component Fres parameter has the Value Type options:

Real

Variable

---

Constrained Opt/Yld

Uniform Yld, 100ppm

Uniform Yld/Opt, 100ppm

Two additional parameters, SMTPAD and OFFSET, are contained in the component parameter dialog box. These parameters are suppressed from the schematic display and are used for layout artwork generation only. The *label* field appearing at the top of the component parameter dialog box contains the selected component label. The *description* field below the label field reads *Linear Passive Model*.

The SMT crystal component represents a parametric subnetwork schematic design. An example of such a design subnetwork is shown in [Figure 8-2](#).

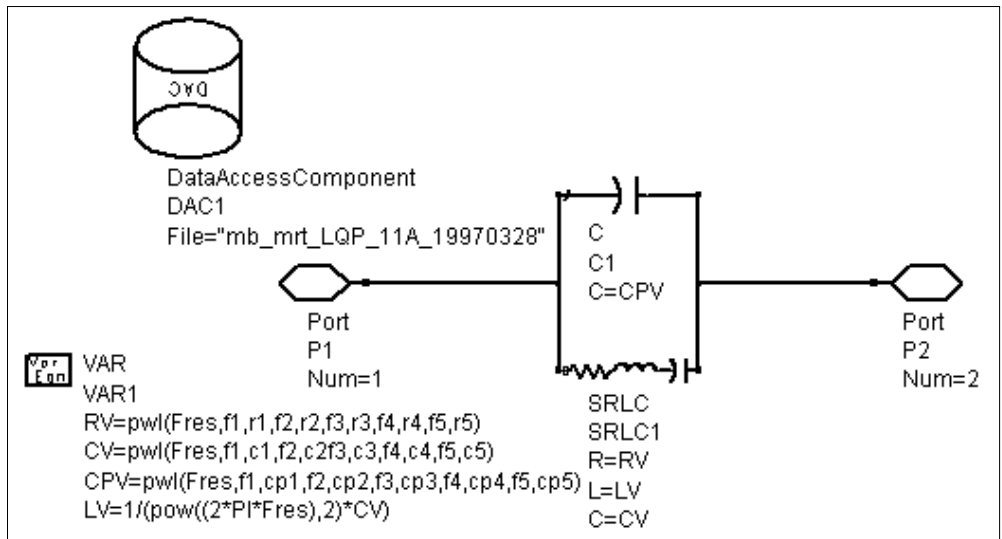


Figure 8-2. SMT Crystal Schematic Design Subnetwork Example

The subnetwork is comprised of a SRLC component and a parallel CAP component. The parameters describing SRLC and CAP are dependent on the resonant frequency of the crystal. The variation of RV, CV, and CPV with frequency are represented by piecewise linear curves in the design file. LV is calculated as the inductance that combined with CV causes resonance at Fres. The single formal parameter of the subnetwork, Fres, serves as an argument to the piecewise linear function used in the design file.

The SMT crystal library design subnetworks are designed for placement in RF/Analog schematics.



# Statek CX-1-SM Series SMT Crystals

For modeling specifications, see “Schematic Design” on page 8-2.

The Statek CX-1-SM Series SMT Crystals are third overtone mode AT crystals. The frequency range covered by these crystals is 50 MHz to 125 MHz.

The Statek CX-1-SM Series SMT Crystals include 3 components, representing 3 resonant frequency tolerances. The naming convention for these components is *sx\_stk\_CX-1-SM\_<resonant frequency tolerance>*

where:

resonant frequency tolerance = A ( $\pm 0.01\%$ ), B ( $\pm 0.1\%$ ), or C ( $\pm 1.0\%$ )

case dimensions (length  $\times$  width) are: 335 mil  $\times$  160 mil

---

**Note** The SMT pad component in the layout drawing does not completely cover the T-shaped solder lead. You can add an additional SMT pad component to compensate for this extra notch.

---

Table 8-1. Statek CX-1-SM Series SMT Crystals

Name	Description
sx_stk_CX-1-SM_A_19930601	Statek Group CX-1-SM Series, Freq (48 - 125) MHz, Tolerance +/-100 ppm
sx_stk_CX-1-SM_B_19930601	Statek Group CX-1-SM Series, Freq (48 - 125) MHz, Tolerance +/-1000 ppm
sx_stk_CX-1-SM_C_19930601	Statek Group CX-1-SM Series, Freq (48 - 125) MHz, Tolerance +/-10000 ppm

## Statek CX-1HG-SM Series SMT Crystals

For modeling specifications, see “[Schematic Design](#)” on page 8-2.

The Statek CX-1HG-SM Series SMT Crystals are fundamental mode AT crystals used in Pierce oscillators. The frequency range covered by these crystals is 8 MHz to 40 MHz.

The Statek CX-1HG-SM Series SMT Crystals include 3 components, representing 3 resonant frequency tolerances. The naming convention for these components is *sx\_stk\_CX-1HG-SM\_<resonant frequency tolerance>*

where:

resonant frequency tolerance = A ( $\pm 0.01\%$ ), B ( $\pm 0.1\%$ ), or C ( $\pm 1.0\%$ )

case dimensions (length  $\times$  width) are: 335 mil  $\times$  160 mil

---

**Note** The SMT pad component in the layout drawing does not completely cover the T-shaped solder lead. You can add an additional SMT pad component to compensate for this extra notch.

---

Table 8-2. Statek CX-1HG-SM Series SMT Crystals

Name	Description
sx_stk_CX-1HG-SM_A_19930601	Statek Group CX-1HG-SM Series, Freq (8 - 50) MHz, Tolerance +/-100 ppm
sx_stk_CX-1HG-SM_B_19930601	Statek Group CX-1HG-SM Series, Freq (8 - 50) MHz, Tolerance +/-1000 ppm
sx_stk_CX-1HG-SM_C_19930601	Statek Group CX-1HG-SM Series, Freq (8 - 50) MHz, Tolerance +/-10000 ppm

# Statek CX-3V-SM Series SMT Crystals

For modeling specifications, see “Schematic Design” on page 8-2.

The Statek CX-3V-SM Series SMT Crystals are used in Pierce oscillators.

The Statek CX-3V-SM Series SMT Crystals include 15 components, representing 3 resonant frequency tolerances at 5 frequency ranges. The naming convention for these components is *sx\_stk\_CX-3V-SM\_<resonant frequency tolerance>\_<frequency range designator>*

where the resonant frequency tolerance is listed in Table 8-3.

Table 8-3. Resonant Frequency Tolerance

Calibration Code	Frequency: KHz				
	18 - 74.9	75 - 169	170 - 249	250 - 540	860 - 1350
A	+/-0.003%	+/-0.005%	+/-0.01%	+/-0.01%	+/-0.05%
B	+/-0.01%	+/-0.01%	+/-0.02%	+/-0.05%	+/-0.1%
C	+/-0.1%	+/-0.1%	+/-0.2%	+/-0.5%	+/-1.0%

frequency range designator = A (18 - 74.9 KHz), B (75 - 169 KHz), C (170 - 249 KHz), D (250 - 540 KHz), and E (860 - 1350 KHz)

case dimensions (length × width) are: 285 mil × 118 mil

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**Note** The SMT pad component in the layout drawing does not completely cover the T-shaped solder lead. You can add an additional SMT pad component to compensate for this extra notch.

---

Table 8-4. Statek CX-3V-SM Series SMT Crystals

Name	Description
sx_stk_CX-3V-SM_A_A_19930601	Statek Group CX-3V-SM Series, Freq (18 - 74.9) kHz, Tolerance +/-30 ppm
sx_stk_CX-3V-SM_A_B_19930601	Statek Group CX-3V-SM Series, Freq (75 - 169) kHz, Tolerance +/-50 ppm

Table 8-4. Statek CX-3V-SM Series SMT Crystals (continued)

Name	Description
sx_stk_CX-3V-SM_A_C_19930601	Statek Group CX-3V-SM Series, Freq (170 - 249) kHz, Tolerance +/-100 ppm
sx_stk_CX-3V-SM_A_D_19930601	Statek Group CX-3V-SM Series, Freq (250 - 540) kHz, Tolerance +/-100 ppm
sx_stk_CX-3V-SM_A_E_19930601	Statek Group CX-3V-SM Series, Freq (860 - 1350) kHz, Tolerance +/-500 ppm
sx_stk_CX-3V-SM_B_A_19930601	Statek Group CX-3V-SM Series, Freq (18 - 74.9) kHz, Tolerance +/-100 ppm
sx_stk_CX-3V-SM_B_B_19930601	Statek Group CX-3V-SM Series, Freq (75 - 169) kHz, Tolerance +/-100 ppm
sx_stk_CX-3V-SM_B_C_19930601	Statek Group CX-3V-SM Series, Freq (170 - 249) kHz, Tolerance +/-200 ppm
sx_stk_CX-3V-SM_B_D_19930601	Statek Group CX-3V-SM Series, Freq (250 - 540) kHz, Tolerance +/-500 ppm
sx_stk_CX-3V-SM_B_E_19930601	Statek Group CX-3V-SM Series, Freq (860 - 1350) kHz, Tolerance +/-1000 ppm
sx_stk_CX-3V-SM_C_A_19930601	Statek Group CX-3V-SM Series, Freq (18 - 74.9) kHz, Tolerance +/-1000 ppm
sx_stk_CX-3V-SM_C_B_19930601	Statek Group CX-3V-SM Series, Freq (75 - 169) kHz, Tolerance +/-1000 ppm
sx_stk_CX-3V-SM_C_C_19930601	Statek Group CX-3V-SM Series, Freq (170 - 249) kHz, Tolerance +/-2000 ppm
sx_stk_CX-3V-SM_C_D_19930601	Statek Group CX-3V-SM Series, Freq (250 - 540) kHz, Tolerance +/-5000 ppm
sx_stk_CX-3V-SM_C_E_19930601	Statek Group CX-3V-SM Series, Freq (860 - 1350) kHz, Tolerance +/-10000 ppm

# Statek CX-4V-SM Series SMT Crystals

For modeling specifications, see “[Schematic Design](#)” on page 8-2.

The Statek CX-4V-SM Series SMT Crystal is used as a one-second time base on potable terminals. The resonant frequency of this crystal is 32.768 KHz.

The Statek CX-4V-SM Series SMT Crystals include 3 components, representing 3 resonant frequency tolerances. The naming convention for these components is *sx\_stk\_CX-4V-SM\_<resonant frequency tolerance>*

where:

resonant frequency tolerance = A ( $\pm 0.003\%$ ), B ( $\pm 0.01\%$ ), or C ( $\pm 0.1\%$ )

case dimensions (length  $\times$  width) are:

210 mil  $\times$  85 mil

The model for the Statek CX-4V-SM Series SMT Crystals is different from the model given in the section “[Schematic Design](#)” on page 8-2 in that the resonant frequency is not a user-definable parameter but instead is fixed at 32.768 KHz.

---

**Note** The SMT pad component in the layout drawing does not completely cover the T-shaped solder lead. You can add an additional SMT pad component to compensate for this extra notch.

---

Table 8-5. Statek CX-4V-SM Series SMT Crystals

Name	Description
sx_stk_CX-4V-SM_A_19930601	Statek Group CX-4V-SM Series, Frequency Selection Range of 32.768 kHz, Tolerance +/-30 ppm
sx_stk_CX-4V-SM_B_19930601	Statek Group CX-4V-SM Series, Frequency Selection Range of 32.768 kHz, Tolerance +/-100 ppm
sx_stk_CX-4V-SM_C_19930601	Statek Group CX-4V-SM Series, Frequency Selection Range of 32.768 kHz, Tolerance +/-1000 ppm

## TeleQuartz Group CS4 Series SMT Crystals

For modeling specifications, see “[Schematic Design](#)” on page 8-2.

The TeleQuartz Group CS4 crystals are used for wireless communications applications.

The TeleQuartz Group CS4 Series SMT Crystals include 100 components, representing 4 types, 4 overtone numbers, 5 resonant frequency tolerances, and 12 frequency ranges. The naming convention for these components is  $sx\_tqz\_CS4\_<type><overtone\ number>\_<resonant\ frequency\ tolerance>\_<frequency\ range\ designator>$

where:

type = TQ7, TQ8, TQ9, and TQ27

overtone number = 1 (fundamental), 3 (third overtone), 5 (fifth overtone), or 7 (seventh overtone)

resonant frequency tolerance code =

01 ( $\pm 100\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

02 ( $\pm 50\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

03 ( $\pm 20\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

05 ( $\pm 10\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

07 ( $\pm 5\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

frequency range designator code =

A (3.5 - 17.5 MHz), B (5 - 17.5 MHz), C (6 - 17.5 MHz), D (10 - 17.5 MHz), E (8 - 45 MHz), F (10 - 45 MHz), G (30 - 90 MHz), H (90.001 - 150 MHz), J (150.001 - 210 MHz), K (10 - 23 MHz), M (11 - 23 MHz), N (20 - 45 MHz)

case dimensions (length  $\times$  width  $\times$  can height) are

TQ7: 12.75 mm  $\times$  8.0 mm  $\times$  8.8 mm

TQ8: 12.75 mm  $\times$  8.0 mm  $\times$  8.0 mm

TQ9: 12.75 mm  $\times$  8.0 mm  $\times$  6.0 mm

TQ27: 12.75 mm × 8.0 mm × 5.1 mm

Table 8-6. TeleQuartz Group CS4 Series SMT Crystals

Name	Description
sx_tqz_CS4_TQ271_01_M_19930601	Telequartz Crystal CS4 Series, Freq (11 - 23) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ271_01_N_19930601	Telequartz Crystal CS4 Series, Freq (20 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ271_02_M_19930601	Telequartz Crystal CS4 Series, Freq (11 - 23) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ271_02_N_19930601	Telequartz Crystal CS4 Series, Freq (20 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ271_03_M_19930601	Telequartz Crystal CS4 Series, Freq (11 - 23) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ271_03_N_19930601	Telequartz Crystal CS4 Series, Freq (20 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ271_05_M_19930601	Telequartz Crystal CS4 Series, Freq (11 - 23) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ271_05_N_19930601	Telequartz Crystal CS4 Series, Freq (20 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ271_07_M_19930601	Telequartz Crystal CS4 Series, Freq (11 - 23) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ271_07_N_19930601	Telequartz Crystal CS4 Series, Freq (20 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ273_01_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ273_02_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ273_03_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ273_05_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ273_07_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ275_01_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm

Table 8-6. TeleQuartz Group CS4 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS4_TQ275_02_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ275_03_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ275_05_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ275_07_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ277_01_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ277_02_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ277_03_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ277_05_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ277_07_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ71_01_A_19930601	Telequartz Crystal CS4 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ71_01_E_19930601	Telequartz Crystal CS4 Series, Freq (8 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ71_02_A_19930601	Telequartz Crystal CS4 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ71_02_E_19930601	Telequartz Crystal CS4 Series, Freq (8 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ71_03_A_19930601	Telequartz Crystal CS4 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ71_03_E_19930601	Telequartz Crystal CS4 Series, Freq (8 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ71_05_A_19930601	Telequartz Crystal CS4 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ71_05_E_19930601	Telequartz Crystal CS4 Series, Freq (8 - 45) MHz, Tolerance +/-10 ppm



**Table 8-6. TeleQuartz Group CS4 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS4_TQ71_07_A_19930601	Telequartz Crystal CS4 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ71_07_E_19930601	Telequartz Crystal CS4 Series, Freq (8 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ73_01_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ73_02_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ73_03_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ73_05_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ73_07_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ75_01_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ75_02_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ75_03_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ75_05_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ75_07_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ77_01_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ77_02_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ77_03_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ77_05_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ77_07_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm

Table 8-6. TeleQuartz Group CS4 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS4_TQ81_01_A_19930601	Telequartz Crystal CS4 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ81_01_E_19930601	Telequartz Crystal CS4 Series, Freq (8 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ81_02_A_19930601	Telequartz Crystal CS4 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ81_02_E_19930601	Telequartz Crystal CS4 Series, Freq (8 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ81_03_A_19930601	Telequartz Crystal CS4 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ81_03_E_19930601	Telequartz Crystal CS4 Series, Freq (8 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ81_05_A_19930601	Telequartz Crystal CS4 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ81_05_E_19930601	Telequartz Crystal CS4 Series, Freq (8 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ81_07_A_19930601	Telequartz Crystal CS4 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ81_07_E_19930601	Telequartz Crystal CS4 Series, Freq (8 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ83_01_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ83_02_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ83_03_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ83_05_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ83_07_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ85_01_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ85_02_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm

**Table 8-6. TeleQuartz Group CS4 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS4_TQ85_03_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ85_05_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ85_07_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ87_01_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ87_02_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ87_03_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ87_05_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ87_07_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ91_01_K_19930601	Telequartz Crystal CS4 Series, Freq (10 - 23) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ91_02_K_19930601	Telequartz Crystal CS4 Series, Freq (10 - 23) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ91_03_K_19930601	Telequartz Crystal CS4 Series, Freq (10 - 23) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ91_05_K_19930601	Telequartz Crystal CS4 Series, Freq (10 - 23) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ91_07_K_19930601	Telequartz Crystal CS4 Series, Freq (10 - 23) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ93_01_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ93_02_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ93_03_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ93_05_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm

Table 8-6. TeleQuartz Group CS4 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS4_TQ93_07_G_19930601	Telequartz Crystal CS4 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ95_01_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ95_02_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ95_03_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ95_05_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ95_07_H_19930601	Telequartz Crystal CS4 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS4_TQ97_01_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS4_TQ97_02_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS4_TQ97_03_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS4_TQ97_05_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS4_TQ97_07_J_19930601	Telequartz Crystal CS4 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm

# TeleQuartz Group CS10 Series SMT Crystals

For modeling specifications, see “[Schematic Design](#)” on page 8-2.

The TeleQuartz Group CS10 crystals are used for wireless communications applications.

The TeleQuartz Group CS10 Series SMT Crystals include 100 components, representing 4 types, 4 overtone numbers, 5 resonant frequency tolerances, and 12 frequency ranges. The naming convention for these components is *sx\_tqz\_CS10\_<type><overtone number>\_<resonant frequency tolerance>\_<frequency range designator>*

where:

the type = TQ7, TQ8, TQ9, and TQ27

overtone number = 1 (fundamental), 3 (third overtone), 5 (fifth overtone), or 7 (seventh overtone)

resonant frequency tolerance code =

01 ( $\pm 100\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

02 ( $\pm 50\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

03 ( $\pm 20\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

05 ( $\pm 10\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

07 ( $\pm 5\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

frequency range designator code =

A (3.5 - 17.5 MHz), B (5 - 17.5 MHz), C (6 - 17.5 MHz), D (10 - 17.5 MHz), E (8 - 45 MHz), F (10 - 45 MHz), G (30 - 90 MHz), H (90.001 - 150 MHz), J (150.001 - 210 MHz), K (10 - 23 MHz), M (11 - 23 MHz), N (20 - 45 MHz)

case dimensions (length  $\times$  width  $\times$  can height) are

TQ7: 12.75 mm  $\times$  8.0 mm  $\times$  8.8 mm

TQ8: 12.75 mm  $\times$  8.0 mm  $\times$  8.0 mm

TQ9: 12.75 mm  $\times$  8.0 mm  $\times$  6.0 mm

TQ27: 12.75 mm  $\times$  8.0 mm  $\times$  5.1 mm

Table 8-7. TeleQuartz Group CS10 Series SMT Crystals

Name	Description
sx_tqz_CS10_TQ271_01_M_19930601	Telequartz Crystal CS10 Series, Freq (11 - 23) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ271_01_N_19930601	Telequartz Crystal CS10 Series, Freq (20 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ271_02_M_19930601	Telequartz Crystal CS10 Series, Freq (11 - 23) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ271_02_N_19930601	Telequartz Crystal CS10 Series, Freq (20 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ271_03_M_19930601	Telequartz Crystal CS10 Series, Freq (11 - 23) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ271_03_N_19930601	Telequartz Crystal CS10 Series, Freq (20 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ271_05_M_19930601	Telequartz Crystal CS10 Series, Freq (11 - 23) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ271_05_N_19930601	Telequartz Crystal CS10 Series, Freq (20 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ271_07_M_19930601	Telequartz Crystal CS10 Series, Freq (11 - 23) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ271_07_N_19930601	Telequartz Crystal CS10 Series, Freq (20 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ273_01_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ273_02_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ273_03_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ273_05_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ273_07_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ275_01_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm

**Table 8-7. TeleQuartz Group CS10 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS10_TQ275_02_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ275_03_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ275_05_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ275_07_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ277_01_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ277_02_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ277_03_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ277_05_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ277_07_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ71_01_A_19930601	Telequartz Crystal CS10 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ71_01_E_19930601	Telequartz Crystal CS10 Series, Freq (8 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ71_02_A_19930601	Telequartz Crystal CS10 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ71_02_E_19930601	Telequartz Crystal CS10 Series, Freq (8 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ71_03_A_19930601	Telequartz Crystal CS10 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ71_03_E_19930601	Telequartz Crystal CS10 Series, Freq (8 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ71_05_A_19930601	Telequartz Crystal CS10 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ71_05_E_19930601	Telequartz Crystal CS10 Series, Freq (8 - 45) MHz, Tolerance +/-10 ppm

Table 8-7. TeleQuartz Group CS10 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS10_TQ71_07_A_19930601	Telequartz Crystal CS10 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ71_07_E_19930601	Telequartz Crystal CS10 Series, Freq (8 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ73_01_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ73_02_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ73_03_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ73_05_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ73_07_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ75_01_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ75_02_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ75_03_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ75_05_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ75_07_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ77_01_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ77_02_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ77_03_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ77_05_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ77_07_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm



**Table 8-7. TeleQuartz Group CS10 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS10_TQ81_01_A_19930601	Telequartz Crystal CS10 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ81_01_E_19930601	Telequartz Crystal CS10 Series, Freq (8 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ81_02_A_19930601	Telequartz Crystal CS10 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ81_02_E_19930601	Telequartz Crystal CS10 Series, Freq (8 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ81_03_A_19930601	Telequartz Crystal CS10 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ81_03_E_19930601	Telequartz Crystal CS10 Series, Freq (8 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ81_05_A_19930601	Telequartz Crystal CS10 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ81_05_E_19930601	Telequartz Crystal CS10 Series, Freq (8 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ81_07_A_19930601	Telequartz Crystal CS10 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ81_07_E_19930601	Telequartz Crystal CS10 Series, Freq (8 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ83_01_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ83_02_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ83_03_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ83_05_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ83_07_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ85_01_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ85_02_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm

Table 8-7. TeleQuartz Group CS10 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS10_TQ85_03_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ85_05_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ85_07_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ87_01_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ87_02_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ87_03_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ87_05_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ87_07_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ91_01_K_19930601	Telequartz Crystal CS10 Series, Freq (10 - 23) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ91_02_K_19930601	Telequartz Crystal CS10 Series, Freq (10 - 23) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ91_03_K_19930601	Telequartz Crystal CS10 Series, Freq (10 - 23) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ91_05_K_19930601	Telequartz Crystal CS10 Series, Freq (10 - 23) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ91_07_K_19930601	Telequartz Crystal CS10 Series, Freq (10 - 23) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ93_01_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ93_02_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ93_03_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ93_05_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm

**Table 8-7. TeleQuartz Group CS10 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS10_TQ93_07_G_19930601	Telequartz Crystal CS10 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ95_01_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ95_02_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ95_03_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ95_05_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ95_07_H_19930601	Telequartz Crystal CS10 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS10_TQ97_01_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS10_TQ97_02_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS10_TQ97_03_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS10_TQ97_05_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS10_TQ97_07_J_19930601	Telequartz Crystal CS10 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm

## TeleQuartz Group CS12 Series SMT Crystals

For modeling specifications, see [“Schematic Design” on page 8-2](#).

The TeleQuartz Group CS12 crystals are used for wireless communications applications.

The TeleQuartz Group CS12 Series SMT Crystals include 100 components, representing 4 types, 4 overtone numbers, 5 resonant frequency tolerances, and 12 frequency ranges. The naming convention for these components is *sx\_tqz\_CS12\_<type><overtone number>\_<resonant frequency tolerance>\_<frequency range designator>*

where:

type = TQ7, TQ8, TQ9, and TQ27

overtone number = 1 (fundamental), 3 (third overtone), 5 (fifth overtone), or 7 (seventh overtone)

resonant frequency tolerance code =

01 ( $\pm 100\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

02 ( $\pm 50\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

03 ( $\pm 20\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

05 ( $\pm 10\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

07 ( $\pm 5\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

frequency range designator code =

A (3.5 - 17.5 MHz), B (5 - 17.5 MHz), C (6 - 17.5 MHz), D (10 - 17.5 MHz), E (8 - 45 MHz), F (10 - 45 MHz), G (30 - 90 MHz), H (90.001 - 150 MHz), J (150.001 - 210 MHz), K (10 - 23 MHz), M (11 - 23 MHz), N (20 - 45 MHz)

The case dimensions (length  $\times$  width  $\times$  can height) are

TQ7: 8.0 mm  $\times$  6.8 mm  $\times$  8.8 mm

TQ8: 8.0 mm  $\times$  6.8 mm  $\times$  8.0 mm

TQ9: 8.0 mm  $\times$  6.8 mm  $\times$  6.0 mm

TQ27: 8.0 mm × 6.8 mm × 5.1 mm

Table 8-8. TeleQuartz Group CS12 Series SMT Crystals

Name	Description
sx_tqz_CS12_TQ271_01_M_19930601	Telequartz Crystal CS12 Series, Freq (11 - 23) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ271_01_N_19930601	Telequartz Crystal CS12 Series, Freq (20 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ271_02_M_19930601	Telequartz Crystal CS12 Series, Freq (11 - 23) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ271_02_N_19930601	Telequartz Crystal CS12 Series, Freq (20 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ271_03_M_19930601	Telequartz Crystal CS12 Series, Freq (11 - 23) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ271_03_N_19930601	Telequartz Crystal CS12 Series, Freq (20 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ271_05_M_19930601	Telequartz Crystal CS12 Series, Freq (11 - 23) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ271_05_N_19930601	Telequartz Crystal CS12 Series, Freq (20 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ271_07_M_19930601	Telequartz Crystal CS12 Series, Freq (11 - 23) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ271_07_N_19930601	Telequartz Crystal CS12 Series, Freq (20 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ273_01_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ273_02_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ273_03_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ273_05_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ273_07_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ275_01_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm

Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS12_TQ275_02_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ275_03_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ275_05_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ275_07_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ277_01_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ277_02_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ277_03_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ277_05_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ277_07_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ71_01_A_19930601	Telequartz Crystal CS12 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ71_01_E_19930601	Telequartz Crystal CS12 Series, Freq (8 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ71_02_A_19930601	Telequartz Crystal CS12 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ71_02_E_19930601	Telequartz Crystal CS12 Series, Freq (8 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ71_03_A_19930601	Telequartz Crystal CS12 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ71_03_E_19930601	Telequartz Crystal CS12 Series, Freq (8 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ71_05_A_19930601	Telequartz Crystal CS12 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ71_05_E_19930601	Telequartz Crystal CS12 Series, Freq (8 - 45) MHz, Tolerance +/-10 ppm

**Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS12_TQ71_07_A_19930601	Telequartz Crystal CS12 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ71_07_E_19930601	Telequartz Crystal CS12 Series, Freq (8 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ73_01_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ73_02_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ73_03_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ73_05_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ73_07_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ75_01_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ75_02_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ75_03_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ75_05_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ75_07_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ77_01_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ77_02_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ77_03_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ77_05_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ77_07_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm

Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS12_TQ81_01_A_19930601	Telequartz Crystal CS12 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ81_01_E_19930601	Telequartz Crystal CS12 Series, Freq (8 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ81_02_A_19930601	Telequartz Crystal CS12 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ81_02_E_19930601	Telequartz Crystal CS12 Series, Freq (8 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ81_03_A_19930601	Telequartz Crystal CS12 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ81_03_E_19930601	Telequartz Crystal CS12 Series, Freq (8 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ81_05_A_19930601	Telequartz Crystal CS12 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ81_05_E_19930601	Telequartz Crystal CS12 Series, Freq (8 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ81_07_A_19930601	Telequartz Crystal CS12 Series, Frequency Selection Range of 3.5 - 17.5 MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ81_07_E_19930601	Telequartz Crystal CS12 Series, Freq (8 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ83_01_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ83_02_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ83_03_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ83_05_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ83_07_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ85_01_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ85_02_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm



**Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS12_TQ85_03_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ85_05_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ85_07_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ87_01_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ87_02_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ87_03_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ87_05_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ87_07_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ91_01_K_19930601	Telequartz Crystal CS12 Series, Freq (10 - 23) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ91_02_K_19930601	Telequartz Crystal CS12 Series, Freq (10 - 23) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ91_03_K_19930601	Telequartz Crystal CS12 Series, Freq (10 - 23) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ91_05_K_19930601	Telequartz Crystal CS12 Series, Freq (10 - 23) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ91_07_K_19930601	Telequartz Crystal CS12 Series, Freq (10 - 23) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ93_01_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ93_02_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ93_03_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ93_05_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm

Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS12_TQ93_07_G_19930601	Telequartz Crystal CS12 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ95_01_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ95_02_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ95_03_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ95_05_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ95_07_H_19930601	Telequartz Crystal CS12 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS12_TQ97_01_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS12_TQ97_02_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS12_TQ97_03_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS12_TQ97_05_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS12_TQ97_07_J_19930601	Telequartz Crystal CS12 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2311_01_A_19930601	Telequartz Crystal CS20 Series, Freq (4 - 8) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2311_01_K_19930601	Telequartz Crystal CS20 Series, Freq (8 - 23) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2311_01_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2311_02_A_19930601	Telequartz Crystal CS20 Series, Freq (4 - 8) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2311_02_K_19930601	Telequartz Crystal CS20 Series, Freq (8 - 23) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2311_02_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-50 ppm

**Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)**

Name	Description
sx_tqz_CS20_TQ2311_03_A_19930601	Telequartz Crystal CS20 Series, Freq (4 - 8) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2311_03_K_19930601	Telequartz Crystal CS20 Series, Freq (8 - 23) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2311_03_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2311_05_A_19930601	Telequartz Crystal CS20 Series, Freq (4 - 8) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2311_05_K_19930601	Telequartz Crystal CS20 Series, Freq (8 - 23) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2311_05_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2311_07_A_19930601	Telequartz Crystal CS20 Series, Freq (4 - 8) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2311_07_K_19930601	Telequartz Crystal CS20 Series, Freq (8 - 23) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2311_07_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2313_01_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2313_02_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2313_03_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2313_05_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2313_07_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2315_01_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2315_02_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2315_03_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm

Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS20_TQ2315_05_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2315_07_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2317_01_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2317_02_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2317_03_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2317_05_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2317_07_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2411_01_L_19930601	Telequartz Crystal CS20 Series, Freq (11 - 23) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2411_01_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2411_02_L_19930601	Telequartz Crystal CS20 Series, Freq (11 - 23) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2411_02_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2411_03_L_19930601	Telequartz Crystal CS20 Series, Freq (11 - 23) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2411_03_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2411_05_L_19930601	Telequartz Crystal CS20 Series, Freq (11 - 23) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2411_05_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2411_07_L_19930601	Telequartz Crystal CS20 Series, Freq (11 - 23) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2411_07_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-5 ppm

**Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS20_TQ2413_01_S_19930601	Telequartz Crystal CS20 Series, Freq (40 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2413_02_S_19930601	Telequartz Crystal CS20 Series, Freq (40 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2413_03_S_19930601	Telequartz Crystal CS20 Series, Freq (40 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2413_05_S_19930601	Telequartz Crystal CS20 Series, Freq (40 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2413_07_S_19930601	Telequartz Crystal CS20 Series, Freq (40 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2415_01_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2415_02_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2415_03_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2415_05_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2415_07_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2417_01_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2417_02_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2417_03_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2417_05_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2417_07_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ31_01_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ31_01_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-100 ppm

Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS20_TQ31_02_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ31_02_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ31_03_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ31_03_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ31_05_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ31_05_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ31_07_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ31_07_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ33_01_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ33_02_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ33_03_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ33_05_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ33_07_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ35_01_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ35_02_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ35_03_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ35_05_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm

**Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS20_TQ35_07_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ37_01_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ37_02_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ37_03_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ37_05_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ37_07_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ41_01_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ41_01_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ41_02_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ41_02_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ41_03_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ41_03_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ41_05_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ41_05_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ41_07_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ41_07_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ43_01_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm

Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS20_TQ43_02_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ43_03_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ43_05_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ43_07_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ45_01_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ45_02_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ45_03_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ45_05_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ45_07_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ47_01_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ47_02_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ47_03_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ47_05_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ47_07_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ61_01_H_19930601	Telequartz Crystal CS20 Series, Freq (5 - 17) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ61_01_Q_19930601	Telequartz Crystal CS20 Series, Frequency Selection Range of 6.5 - 45 MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ61_02_H_19930601	Telequartz Crystal CS20 Series, Freq (5 - 17) MHz, Tolerance +/-50 ppm



**Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS20_TQ61_02_Q_19930601	Telequartz Crystal CS20 Series, Frequency Selection Range of 6.5 - 45 MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ61_03_H_19930601	Telequartz Crystal CS20 Series, Freq (5 - 17) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ61_03_Q_19930601	Telequartz Crystal CS20 Series, Frequency Selection Range of 6.5 - 45 MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ61_05_H_19930601	Telequartz Crystal CS20 Series, Freq (5 - 17) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ61_05_Q_19930601	Telequartz Crystal CS20 Series, Frequency Selection Range of 6.5 - 45 MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ61_07_H_19930601	Telequartz Crystal CS20 Series, Freq (5 - 17) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ61_07_Q_19930601	Telequartz Crystal CS20 Series, Frequency Selection Range of 6.5 - 45 MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ63_01_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ63_02_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ63_03_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ63_05_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ63_07_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ65_01_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ65_02_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ65_03_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ65_05_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ65_07_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm

Table 8-8. TeleQuartz Group CS12 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS20_TQ67_01_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ67_02_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ67_03_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ67_05_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ67_07_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm

# TeleQuartz Group CS20 Series SMT Crystals

For modeling specifications, see “[Schematic Design](#)” on page 8-2.

The TeleQuartz Group CS20 crystals are used for wireless communications applications.

The TeleQuartz Group CS20 Series SMT Crystals include 130 components, representing 3 types, 4 overtone numbers, 5 resonant frequency tolerances, and 19 frequency ranges. The naming convention for these components is *sx\_tqz\_CS20\_<type><overtone number>\_<resonant frequency tolerance>\_<frequency range designator>*

where:

type = TQ3, TQ4, TQ6, TQ23, and TQ24

overtone number = 1 (fundamental), 3 (third overtone), 5 (fifth overtone), or 7 (seventh overtone)

resonant frequency tolerance code =

01 ( $\pm 100\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

02 ( $\pm 50\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

03 ( $\pm 20\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

05 ( $\pm 10\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

07 ( $\pm 5\text{ppm } \Delta f/f @ 23^\circ\text{C}$ )

frequency range designator code =

A (4 - 8 MHz), B (4.3 - 8 MHz), C (6 - 8 MHz), D (2 - 11.5 MHz), E (2.3 - 11.5 MHz), F (4.3 - 11.5 MHz), G (6 - 11.5 MHz), H (5 - 17 MHz), J (6 - 17 MHz), K (8 - 23 MHz), L (11 - 23 MHz), M (4 - 45 MHz), N (4.3 - 45 MHz), P (6 - 45 MHz), Q (6.5 - 45 MHz), R (20 - 45 MHz), S (40 - 90 MHz for type TQ24), S (30 - 90 MHz for all other types), T (90.001 - 150 MHz), or V (150.001 - 210 MHz)

case dimensions (length  $\times$  width  $\times$  can height) are

TQ3: 18.0 mm  $\times$  11.0 mm  $\times$  13.5 mm

TQ4: 18.0 mm  $\times$  11.0 mm  $\times$  11.4 mm

TQ6: 18.0 mm  $\times$  11.0 mm  $\times$  9.7 mm

TQ23: 18.0 mm  $\times$  11.0 mm  $\times$  6.6 mm

TQ24: 18.0 mm × 11.0 mm × 5.1 mm

Table 8-9. TeleQuartz Group CS20 Series SMT Crystals

Name	Description
sx_tqz_CS20_TQ2311_01_A_19930601	Telequartz Crystal CS20 Series, Freq (4 - 8) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2311_01_K_19930601	Telequartz Crystal CS20 Series, Freq (8 - 23) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2311_01_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2311_02_A_19930601	Telequartz Crystal CS20 Series, Freq (4 - 8) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2311_02_K_19930601	Telequartz Crystal CS20 Series, Freq (8 - 23) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2311_02_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2311_03_A_19930601	Telequartz Crystal CS20 Series, Freq (4 - 8) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2311_03_K_19930601	Telequartz Crystal CS20 Series, Freq (8 - 23) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2311_03_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2311_05_A_19930601	Telequartz Crystal CS20 Series, Freq (4 - 8) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2311_05_K_19930601	Telequartz Crystal CS20 Series, Freq (8 - 23) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2311_05_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2311_07_A_19930601	Telequartz Crystal CS20 Series, Freq (4 - 8) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2311_07_K_19930601	Telequartz Crystal CS20 Series, Freq (8 - 23) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2311_07_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2313_01_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm

**Table 8-9. TeleQuartz Group CS20 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS20_TQ2313_02_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2313_03_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2313_05_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2313_07_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2315_01_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2315_02_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2315_03_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2315_05_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2315_07_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2317_01_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2317_02_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2317_03_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2317_05_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2317_07_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2411_01_L_19930601	Telequartz Crystal CS20 Series, Freq (11 - 23) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2411_01_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2411_02_L_19930601	Telequartz Crystal CS20 Series, Freq (11 - 23) MHz, Tolerance +/-50 ppm

Table 8-9. TeleQuartz Group CS20 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS20_TQ2411_02_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2411_03_L_19930601	Telequartz Crystal CS20 Series, Freq (11 - 23) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2411_03_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2411_05_L_19930601	Telequartz Crystal CS20 Series, Freq (11 - 23) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2411_05_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2411_07_L_19930601	Telequartz Crystal CS20 Series, Freq (11 - 23) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2411_07_R_19930601	Telequartz Crystal CS20 Series, Freq (20 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2413_01_S_19930601	Telequartz Crystal CS20 Series, Freq (40 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2413_02_S_19930601	Telequartz Crystal CS20 Series, Freq (40 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2413_03_S_19930601	Telequartz Crystal CS20 Series, Freq (40 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2413_05_S_19930601	Telequartz Crystal CS20 Series, Freq (40 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2413_07_S_19930601	Telequartz Crystal CS20 Series, Freq (40 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ2415_01_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2415_02_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2415_03_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2415_05_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2415_07_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm

**Table 8-9. TeleQuartz Group CS20 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS20_TQ2417_01_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ2417_02_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ2417_03_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ2417_05_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ2417_07_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ31_01_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ31_01_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ31_02_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ31_02_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ31_03_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ31_03_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ31_05_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ31_05_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ31_07_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ31_07_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ33_01_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ33_02_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm

Table 8-9. TeleQuartz Group CS20 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS20_TQ33_03_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ33_05_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ33_07_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ35_01_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ35_02_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ35_03_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ35_05_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ35_07_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ37_01_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ37_02_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ37_03_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ37_05_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ37_07_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ41_01_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ41_01_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ41_02_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ41_02_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-50 ppm



**Table 8-9. TeleQuartz Group CS20 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS20_TQ41_03_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ41_03_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ41_05_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ41_05_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ41_07_D_19930601	Telequartz Crystal CS20 Series, Freq (2 - 11.5) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ41_07_M_19930601	Telequartz Crystal CS20 Series, Freq (4 - 45) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ43_01_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ43_02_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ43_03_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ43_05_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ43_07_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ45_01_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ45_02_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ45_03_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ45_05_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ45_07_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ47_01_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm

Table 8-9. TeleQuartz Group CS20 Series SMT Crystals (continued)

Name	Description
sx_tqz_CS20_TQ47_02_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ47_03_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ47_05_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ47_07_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ61_01_H_19930601	Telequartz Crystal CS20 Series, Freq (5 - 17) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ61_01_Q_19930601	Telequartz Crystal CS20 Series, Frequency Selection Range of 6.5 - 45 MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ61_02_H_19930601	Telequartz Crystal CS20 Series, Freq (5 - 17) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ61_02_Q_19930601	Telequartz Crystal CS20 Series, Frequency Selection Range of 6.5 - 45 MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ61_03_H_19930601	Telequartz Crystal CS20 Series, Freq (5 - 17) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ61_03_Q_19930601	Telequartz Crystal CS20 Series, Frequency Selection Range of 6.5 - 45 MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ61_05_H_19930601	Telequartz Crystal CS20 Series, Freq (5 - 17) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ61_05_Q_19930601	Telequartz Crystal CS20 Series, Frequency Selection Range of 6.5 - 45 MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ61_07_H_19930601	Telequartz Crystal CS20 Series, Freq (5 - 17) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ61_07_Q_19930601	Telequartz Crystal CS20 Series, Frequency Selection Range of 6.5 - 45 MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ63_01_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ63_02_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ63_03_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-20 ppm

**Table 8-9. TeleQuartz Group CS20 Series SMT Crystals (continued)**

<b>Name</b>	<b>Description</b>
sx_tqz_CS20_TQ63_05_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ63_07_S_19930601	Telequartz Crystal CS20 Series, Freq (30 - 90) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ65_01_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ65_02_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ65_03_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ65_05_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ65_07_T_19930601	Telequartz Crystal CS20 Series, Freq (90 - 150) MHz, Tolerance +/-5 ppm
sx_tqz_CS20_TQ67_01_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-100 ppm
sx_tqz_CS20_TQ67_02_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-50 ppm
sx_tqz_CS20_TQ67_03_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-20 ppm
sx_tqz_CS20_TQ67_05_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-10 ppm
sx_tqz_CS20_TQ67_07_V_19930601	Telequartz Crystal CS20 Series, Freq (150 - 210) MHz, Tolerance +/-5 ppm



# Chapter 9: SMT Filters

The SMT Filter Library consists of linear models representing 16 surface mount filters from a single manufacturer. The models were extracted from data provided by this manufacturer.

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**Note** The library itself is a binary file named *SMT\_FilterLibrary.library* which can be found in *\$HPEESOF\_DIR/ComponentLibs/models*.

---

The SMT filter library group available for selection from the Schematic and Layout windows is:

- “AVX/Kyocera SMT Filters” on page 9-1

## AVX/Kyocera SMT Filters

### Schematic Design

This section describes the schematic design of the SMT filter library components and specifies the simulation models that are incorporated in the design.

Figure 9-1 shows how an SMT filter component appears when placed into the Schematic design window. The schematic symbol artwork is derived from the standard 2-port BPFB symbol. The annotation consists of the component name, the default component ID prefix (in this case, S). No component parameters are displayed.

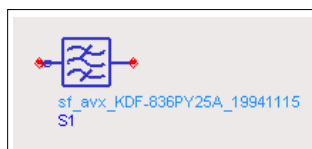


Figure 9-1. SMT Filter Schematic Instance Example

Two additional parameters, *SMTPAD* and *OFFSET* are contained in the component parameter dialog box. In some components, 3 parameters (*SMTPAD1*, *SMTPAD2* and *OFFSET*) are contained. These parameters are suppressed from the schematic

display and are used for layout artwork generation only. The *label* field appearing at the top of the component parameter dialog box contains the selected component label. The *description* field below the label field reads *Linear Model*.

The SMT filter component represents a parametric subnetwork schematic design. An example of such a design subnetwork is shown in [Figure 9-2](#).

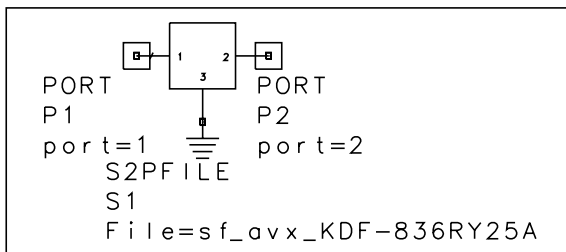


Figure 9-2. SMT Filter Schematic Design Subnetwork Example

The subnetwork is comprised of a S2P file-based component. The S2PFILE is simply an alias application of a standard 2-port file-based data component S2P. The standard component name of the S2P element is replaced by the selected filter library component name; for example, `sf_avx_KDF-836RY25A_19941115`.

The S2P data file contains small-signal S-parameters. The file is installed in the same library group subdirectory as the associated component.

The SMT filter library components are suitable for placement in any RF/Analog schematic.

## Data

The AVX/Kyocera SMT Filters include 16 components, representing individual parts, from a single manufacturer.

Table 9-1. AVX/Kyocera SMT Filters

Name	Description
sf_avx_KDF-836PY25A_19941115	AVX/Kyocera KDF-836PY25A, Dielectric Filter Fc=836.5MHz, 3dB BW=12.5MHz, Loss=2.5dB, E-AMPS, Model features SP
sf_avx_KDF-881PY25A_19941115	AVX/Kyocera KDF-881PY25A, Dielectric Filter Fc=881.5MHz, 3dB BW=12.5MHz, Loss=2.5dB, E-AMPS, Model features SP

**Table 9-1. AVX/Kyocera SMT Filters**

<b>Name</b>	<b>Description</b>
sf_avx_KDF-902PY25A_19941115	AVX/Kyocera KDF-902PY25A, Dielectric Filter Fc=902.5MHz, 3dB BW=12.5MHz, Loss=2.5dB, E-AMPS, Model features SP
sf_avx_KDF-915PY26A_19941115	AVX/Kyocera KDF-915PY26A, Dielectric Filter Fc=915.0MHz, 3dB BW=13.0MHz, Loss=2.5dB, SST Digital Cordless, Model features SP
sf_avx_KDF-947PY25A_19941115	AVX/Kyocera KDF-947PY25A, Dielectric Filter Fc=947.5MHz, 3dB BW=12.5MHz, Loss=2.5dB, NMT900, Model features SP
sf_avx_KDF-836RY25A_19941115	AVX/Kyocera KDF-836RY25A, Dielectric Filter Fc=836.5MHz, 3dB BW=12.5MHz, Loss=3.0dB, E-AMPS, Model features SP
sf_avx_KDF-881RY25A_19941115	AVX/Kyocera KDF-881RY25A, Dielectric Filter Fc=881.5MHz, 3dB BW=12.5MHz, Loss=3.0dB, E-AMPS, Model features SP
sf_avx_KDF-888RY33A_19941115	AVX/Kyocera KDF-888RY33A, Dielectric Filter Fc=888.5MHz, 3dB BW=16.5MHz, Loss=3.0dB, E-TACS, Model features SP
sf_avx_KDF-902RY25A_19941115	AVX/Kyocera KDF-902RY25A, Dielectric Filter Fc=902.5MHz, 3dB BW=12.5MHz, Loss=3.0dB, E-AMPS, Model features SP
sf_avx_KDF-915RY26A_19941115	AVX/Kyocera KDF-915RY26A, Dielectric Filter Fc=915.0MHz, 3dB BW=13.0MHz, Loss=3.0dB, SST Digital Cordless, Model features SP
sf_avx_KDF-933RY33A_19941115	AVX/Kyocera KDF-933RY33A, Dielectric Filter Fc=933.0MHz, 3dB BW=16.5MHz, Loss=3.0dB, E-TACS , Model features SP
sf_avx_KDF-947RY25A_19941115	AVX/Kyocera KDF-947RY25A, Dielectric Filter Fc=947.5MHz, 3dB BW=12.5MHz, Loss=3.0dB, NMT900, Model features SP
sf_avx_PBFS450P30K_19941115	AVX/Kyocera PBFS450P30K, Dielectric Filter Fc=450.0KHz, 6dB BW=15.0KHz, Loss=7.0dB, Model features SP
sf_avx_PBFS455P30K_19941115	AVX/Kyocera PBFS455P30K, Dielectric Filter Fc=455.0KHz, 6dB BW=15.0KHz, Loss=7.0dB, Model features SP
sf_avx_PBFC450P30K_19941115	AVX/Kyocera PBFC450P30K, Dielectric Filter Fc=450.0KHz, 6dB BW=15.0KHz, Loss=7.0dB, Model features SP
sf_avx_PBFC455P30K_19941115	AVX/Kyocera PBFC455P30K, Dielectric Filter Fc=455.0KHz, 6dB BW=15.0KHz, Loss=7.0dB, Model features SP





# Chapter 10: SMT Mixers

The SMT Mixer Library consists of nonlinear models representing 57 mixers from a single manufacturer. The models were extracted from data provided by this manufacturer.

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**Note** The library itself is a binary file named *SMT\_MixerLibrary.library* which can be found in *\$HPPEESOF\_DIR/ComponentLibs/models*.

---

The SMT mixer library group available for selection from the Schematic and Layout windows is:

- [“Mini-Circuits Mixers” on page 10-1](#)

## Mini-Circuits Mixers

The Mini-Circuits Mixers include 127 components, representing individual mixers listed in the same order as in the manufacturer's catalog. The naming convention for these components is *sm\_mc\_<part number>*.

Table 10-1. Mini-Circuits Mixers

Name	Description
sm_mc_LRMS-11A_19930601	Mini-Circuits LRMS-11A, QQQ_130 package, RF 1500-1900, IF 40-400 MHz, P_LO=7dBm, Loss=9dB, Model features SP, IMT
sm_mc_LRMS-1H_19930601	Mini-Circuits LRMS-1H, QQQ_130 package, RF 2-500, IF DC-500 MHz, P_LO=17dBm, Loss=7dB, Model features SP, IMT
sm_mc_LRMS-1WH_19930601	Mini-Circuits LRMS-1WH, QQQ_130 package, RF 5-750, IF DC-750 MHz, P_LO=17dBm, Loss=8.5dB, Model features SP, IMT
sm_mc_LRMS-1W_19930601	Mini-Circuits LRMS-1W, QQQ_130 package, RF 2-750, IF DC-750 MHz, P_LO=7dBm, Loss=7.5dB, Model features SP, IMT
sm_mc_LRMS-1_19930601	Mini-Circuits LRMS-1, QQQ_130 package, RF 0.5-500, IF DC-500 MHz, P_LO=7dBm, Loss=7dB, Model features SP, IMT

Table 10-1. Mini-Circuits Mixers (continued)

Name	Description
sm_mc_LRMS-2D_19930601	Mini-Circuits LRMS-2D, QQQ_130 package, RF 5-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=8dB, Model features SP, IMT
sm_mc_LRMS-2H_19930601	Mini-Circuits LRMS-2H, QQQ_130 package, RF 5-1000, IF DC-900 MHz, P_LO=17dBm, Loss=8.5dB, Model features SP, IMT
sm_mc_LRMS-2L_19930601	Mini-Circuits LRMS-2L, QQQ_130 package, RF 800-1000, IF DC-200 MHz, P_LO=3dBm, Loss=8.4dB, Model features SP, IMT
sm_mc_LRMS-2UH_19930601	Mini-Circuits LRMS-2UH, QQQ_130 package, RF 10-1000, IF 10-750 MHz, P_LO=17dBm, Loss=8.5dB, Model features SP, IMT
sm_mc_LRMS-2U_19930601	Mini-Circuits LRMS-2U, QQQ_130 package, RF 10-1000, IF 10-750 MHz, P_LO=7dBm, Loss=8dB, Model features SP, IMT
sm_mc_LRMS-2_19930601	Mini-Circuits LRMS-2, QQQ_130 package, RF 5-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=8dB, Model features SP, IMT
sm_mc_LRMS-5H_19930601	Mini-Circuits LRMS-5H, QQQ_130 package, RF 10-1500, IF DC-900 MHz, P_LO=17dBm, Loss=8dB, Model features SP, IMT
sm_mc_LRMS-5LH_19930601	Mini-Circuits LRMS-5LH, QQQ_130 package, RF 10-1500, IF DC-900 MHz, P_LO=10dBm, Loss=8dB, Model features SP, IMT
sm_mc_LRMS-5L_19930601	Mini-Circuits LRMS-5L, QQQ_130 package, RF 400-1400, IF DC-800 MHz, P_LO=3dBm, Loss=9.8dB, Model features SP, IMT
sm_mc_LRMS-5_19930601	Mini-Circuits LRMS-5, QQQ_130 package, RF 5-1500, IF DC-1000 MHz, P_LO=7dBm, Loss=7.5dB, Model features SP, IMT
sm_mc_LRMS-860_19930601	Mini-Circuits LRMS-860, QQQ_130 package, RF 800-1050, IF DC-250 MHz, P_LO=7dBm, Loss=7.5dB, Model features SP, IMT
sm_mc_RMS-11A_19930601	Mini-Circuits RMS-11A, TT_100 package, RF 1500-1900, IF 40-400 MHz, P_LO=7dBm, Loss=9dB, Model features SP, IMT

**Table 10-1. Mini-Circuits Mixers (continued)**

<b>Name</b>	<b>Description</b>
sm_mc_RMS-1H_19930601	Mini-Circuits RMS-1H, TT_100 package, RF 2-500, IF DC-500 MHz, P_LO=17dBm, Loss=7dB, Model features SP, IMT
sm_mc_RMS-1WH_19930601	Mini-Circuits RMS-1WH, TT_100 package, RF 5-750, IF DC-750 MHz, P_LO=17dBm, Loss=8.5dB, Model features SP, IMT
sm_mc_RMS-1W_19930601	Mini-Circuits RMS-1W, TT_100 package, RF 2-750, IF DC-750 MHz, P_LO=7dBm, Loss=7.5dB, Model features SP, IMT
sm_mc_RMS-1_19930601	Mini-Circuits RMS-1, TT_100 package, RF 0.5-500, IF DC-500 MHz, P_LO=7dBm, Loss=7dB, Model features SP, IMT
sm_mc_RMS-2D_19930601	Mini-Circuits RMS-2D, TT_100 package, RF 5-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=8dB, Model features SP, IMT
sm_mc_RMS-2H_19930601	Mini-Circuits RMS-2H, TT_100 package, RF 5-1000, IF DC-900 MHz, P_LO=17dBm, Loss=8.5dB, Model features SP, IMT
sm_mc_RMS-2L_19930601	Mini-Circuits RMS-2L, TT_146 package, RF 800-1000, IF DC-200 MHz, P_LO=3dBm, Loss=8.4dB, Model features SP, IMT
sm_mc_RMS-2UH_19930601	Mini-Circuits RMS-2UH, TT_100 package, RF 10-1000, IF 10-750 MHz, P_LO=17dBm, Loss=8.5dB, Model features SP, IMT
sm_mc_RMS-2U_19930601	Mini-Circuits RMS-2U, TT_100 package, RF 10-1000, IF 10-750 MHz, P_LO=7dBm, Loss=8dB, Model features SP, IMT
sm_mc_RMS-2_19930601	Mini-Circuits RMS-2, TT_100 package, RF 5-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=8dB, Model features SP, IMT
sm_mc_RMS-5H_19930601	Mini-Circuits RMS-5H, TT_100 package, RF 10-1500, IF DC-900 MHz, P_LO=17dBm, Loss=8dB, Model features SP, IMT
sm_mc_RMS-5LH_19930601	Mini-Circuits RMS-5LH, TT_100 package, RF 10-1500, IF DC-900 MHz, P_LO=10dBm, Loss=8dB, Model features SP, IMT

Table 10-1. Mini-Circuits Mixers (continued)

Name	Description
sm_mc_RMS-5L_19930601	Mini-Circuits RMS-5L, TT_146 package, RF 400-1400, IF DC-800 MHz, P_LO=3dBm, Loss=9.8dB, Model features SP, IMT
sm_mc_RMS-5_19930601	Mini-Circuits RMS-5, TT_100 package, RF 5-1500, IF DC-1000 MHz, P_LO=7dBm, Loss=7.5dB, Model features SP, IMT
sm_mc_RMS-860_19930601	Mini-Circuits RMS-860, TT_100 package, RF 800-1050, IF DC-250 MHz, P_LO=7dBm, Loss=7.5dB, Model features SP, IMT
sm_mc_SCM-2500_19930601	Mini-Circuits SCM-2500, YY_101b package, RF 500-2500, IF DC-500 MHz, P_LO=7dBm, Loss=6.9dB, Model features SP, IMT
sm_mc_SCM-5_19930601	Mini-Circuits SCM-5, YY_101b package, RF 1250-1800, IF DC-500 MHz, P_LO=7dBm, Loss=8dB, Model features SP, IMT
sm_mc_SYM-11H_19930601	Mini-Circuits SYM-11H, TTT_167 package, RF 50-2000, IF 50-1950 MHz, P_LO=17dBm, Loss=7.5dB, Model features SP, IMT
sm_mc_SYM-11LH_19930601	Mini-Circuits SYM-11LH, TTT_167 package, RF 1-2000, IF 10-600 MHz, P_LO=10dBm, Loss=8.3dB, Model features SP, IMT
sm_mc_SYM-11MH_19930601	Mini-Circuits SYM-11MH, TTT_167 package, RF 50-2000, IF 50-1000 MHz, P_LO=13dBm, Loss=8dB, Model features SP, IMT
sm_mc_SYM-11_19930601	Mini-Circuits SYM-11, TTT_167 package, RF 1-2500, IF 10-600 MHz, P_LO=7dBm, Loss=9dB, Model features SP, IMT
sm_mc_SYM-2_19930601	Mini-Circuits SYM-2, TTT_166 package, RF 2-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=7.2dB, Model features SP, IMT
sm_mc_SYM-860_19930601	Mini-Circuits SYM-860, TTT_166 package, RF 800-1050, IF DC-250 MHz, P_LO=7dBm, Loss=7dB, Model features SP, IMT
sm_mc_TUF-11AHSM_19930601	Mini-Circuits TUF-11AHSM, NNN_150 package, RF 1400-1900, IF 40-500 MHz, P_LO=17dBm, Loss=9dB, Model features SP, IMT

**Table 10-1. Mini-Circuits Mixers (continued)**

Name	Description
sm_mc_TUF-11ALHSM_19930601	Mini-Circuits TUF-11ALHSM, NNN_150 package, RF 1400-1900, IF 40-500 MHz, P_LO=10dBm, Loss=8.6dB, Model features SP, IMT
sm_mc_TUF-11ASM_19930601	Mini-Circuits TUF-11ASM, NNN_150 package, RF 1400-1900, IF 40-500 MHz, P_LO=7dBm, Loss=8.6dB, Model features SP, IMT
sm_mc_TUF-1LHSM_19930601	Mini-Circuits TUF-1LHSM, NNN_150 package, RF 2-600, IF DC-600 MHz, P_LO=10dBm, Loss=7dB, Model features SP, IMT
sm_mc_TUF-1SM_19930601	Mini-Circuits TUF-1SM, NNN_150 package, RF 2-600, IF DC-600 MHz, P_LO=7dBm, Loss=7dB, Model features SP, IMT
sm_mc_TUF-2MHSM_19930601	Mini-Circuits TUF-2MHSM, NNN_150 package, RF 50-1000, IF DC-1000 MHz, P_LO=13dBm, Loss=7.5dB, Model features SP, IMT
sm_mc_TUF-2SM_19930601	Mini-Circuits TUF-2SM, NNN_150 package, RF 50-1000, IF DC-1000 MHz, P_LO=7dBm, Loss=7.5dB, Model features SP, IMT
sm_mc_TUF-3LHSM_19930601	Mini-Circuits TUF-3LHSM, NNN_150 package, RF 0.15-400, IF DC-400 MHz, P_LO=10dBm, Loss=7dB, Model features SP, IMT
sm_mc_TUF-3SM_19930601	Mini-Circuits TUF-3SM, NNN_150 package, RF 0.15-400, IF DC-400 MHz, P_LO=7dBm, Loss=7dB, Model features SP, IMT
sm_mc_TUF-5HSM_19930601	Mini-Circuits TUF-5HSM, NNN_150 package, RF 20-1500, IF DC-1000 MHz, P_LO=17dBm, Loss=8.5dB, Model features SP, IMT
sm_mc_TUF-5LHSM_19930601	Mini-Circuits TUF-5LHSM, NNN_150 package, RF 20-1500, IF DC-1000 MHz, P_LO=10dBm, Loss=8.5dB, Model features SP, IMT
sm_mc_TUF-5MHSM_19930601	Mini-Circuits TUF-5MHSM, NNN_150 package, RF 20-1500, IF DC-1000 MHz, P_LO=13dBm, Loss=8.5dB, Model features SP, IMT
sm_mc_TUF-5SM_19930601	Mini-Circuits TUF-5SM, NNN_150 package, RF 20-1500, IF DC-1000 MHz, P_LO=7dBm, Loss=9dB, Model features SP, IMT

Table 10-1. Mini-Circuits Mixers (continued)

Name	Description
sm_mc_TUF-860HSM_19930601	Mini-Circuits TUF-860HSM, NNN_150 package, RF 800-1050, IF DC-250 MHz, P_LO=17dBm, Loss=8.3dB, Model features SP, IMT
sm_mc_TUF-860LHSM_19930601	Mini-Circuits TUF-860LHSM, NNN_150 package, RF 800-1050, IF DC-250 MHz, P_LO=10dBm, Loss=7.9dB, Model features SP, IMT
sm_mc_TUF-860MHSM_19930601	Mini-Circuits TUF-860MHSM, NNN_150 package, RF 800-1050, IF DC-250 MHz, P_LO=13dBm, Loss=8.3dB, Model features SP, IMT
sm_mc_TUF-860SM_19930601	Mini-Circuits TUF-860SM, NNN_150 package, RF 800-1050, IF DC-250 MHz, P_LO=7dBm, Loss=7.75dB, Model features SP, IMT

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