Modelling and PSpice® Analysis of GX4201 Video Crosspoint Switch

by J. Ian Ridpath, Senior Applications Engineer, Video/Broadcast Products

APPLICATION NOTE

INTRODUCTION

In order to assist the video design engineer in using Gennum's GX4201 video crosspoint, an AC equivalent circuit has been created. A PSpice® netlist of the circuit has been generated and is available on floppy disk.

The equivalent circuit is for AC steady state and transient analysis only. Noise and distortion or DC characteristics cannot be predicted with this model. The data accurately predicts the input and output impedances and transfer characteristics of the devices up to 500 MHz with load capacitances ranging from 10 pF to 100 pF.

INPUT/OUTPUT CONSIDERATIONS

The signal source for the network is specified as a voltage generator and a source impedance. This source impedance is 25 Ω or the equivalent output impedance of an amplifier driving the input. Figure 1 shows this set up.

The output must be loaded with a capacitance which represents the expected load capacitance seen by the device. This capacitance varies with the total number of inputs. For example, a 16x1 multiplexer using 16 devices, (15 of which are OFF at any one time), has an equivalent output bus capacitance of approximately 22 pF (17 pF from the 15 OFF devices and about 5 pF stray capacitance).

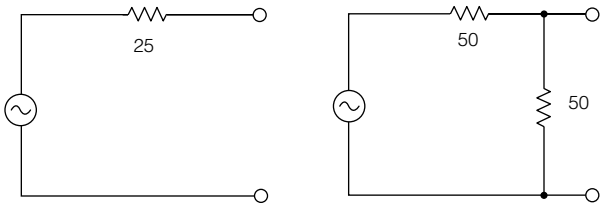

Fig. 1

Figure 2 shows the equivalent circuit for the GX4201.

The signal source and its associated resistances are applied between nodes (1) and (0) (input and ground) and the load capacitance is connected between nodes (16) and (0) (output and ground).

The following netlist itemizes all the components within the network. The user specifies the input signal and output load parameters. Component designations in the netlist refer to those shown in Figure 2.

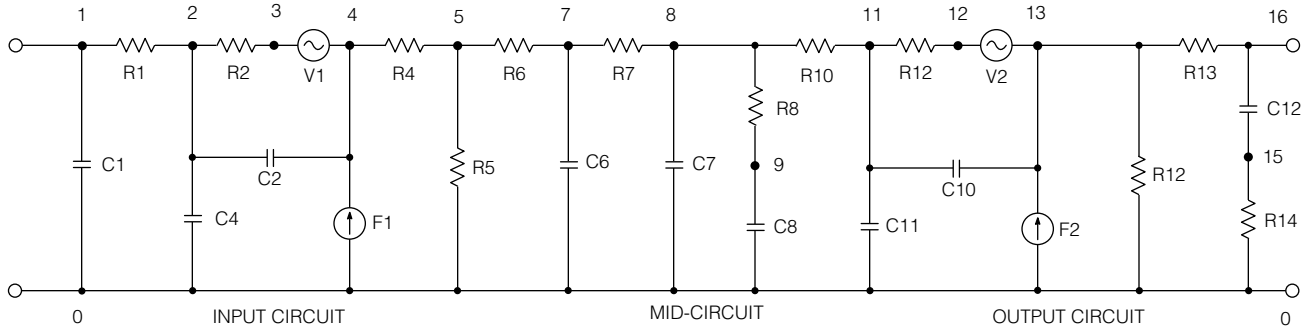

Fig. 2

Parameter Netlist for GX4201 FILE: MODL4201.CIR

INPUT				MID-CIRCUIT				OUTPUT			
C1	1	0	1.1P	R6	5	7	22.5	R10	8	11	50
R1	1	2	200	C6	7	0	0.2P	R11	11	12	700
R2	2	3	3000	R7	7	8	22.5	C11	11	0	0.08P
C2	2	4	8.5P	C7	8	0	0.2P	C10	11	13	34P
C4	2	0	0.02P	R8	8	9	12K	V2	12	13	DC 0
V1	3	4	DC 0	C8	9	0	1.8P	R13	13	16	2.5
F1	0	4	V1 130					F2	0	13	V2 132
R4	4	5	10					R12	13	0	11.3K
R5	5	0	41.1K					R14	15	0	20
								C12	15	16	1.5P

Figure 3 shows how the signal source and load capacitance are connected to the model.

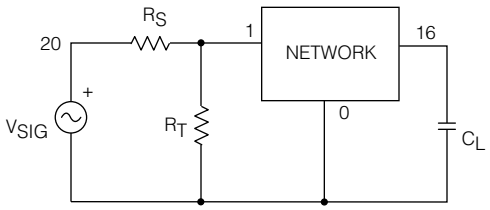

Fig. 3

The load capacitance between nodes (16) and (0) is specified as :

C_L 16 0 ---P (NOTE 10 pF < CL < 100 pF)

and the input AC source between nodes (1) and (0) is specified as:

V_{SIG} 20 0 AC <amplitude> <phase>
R_S 20 1 50
R_T 1 0 50
(if $R_S = R_T$, then <amplitude> = 2, <phase> =0)

Note that node (20) is the junction of the generator and its internal source resistance R_S.

The following PSpice® commands are used in this file.

- OPTIONS LIMPTS = 20000,NOMOD,NOPAGE
- AC DEC 50 1MEG 500 MEG
- PROBE
- END

These allow for the printing in tabular form of the output voltage in dB and phase in degrees versus frequency from 1 to 500 MHz. The •PROBE statement will allow for the graphical representation of the output data using PSpice® PROBE.

Figure 4 and 5 show typical performance curves which compare favourably with measured results. The spread in results can be predicted by looking at the GAIN SPREAD curves on the associated device DATA SHEETS.

This PSpice® design 'tool' can be used to determine the value of the series compensating resistor required to flatten the overall frequency response of a multiplexer system. (See Application Note No.510-39, FREQUENCY PEAKING COMPENSATION OF THE GX414 AND GX424, available from Gennum Corporation).

The application engineers in the Video and Broadcast Products Group at Gennum Corporation will assist in answering any questions or providing any additional engineering information.

A floppy disk with the netlist file is available from the above source.

PSpice® Probe Output Graphs of GX4201

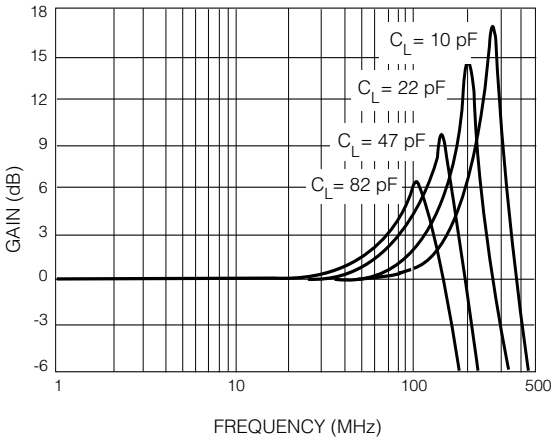

Fig. 4 Gain vs Frequency

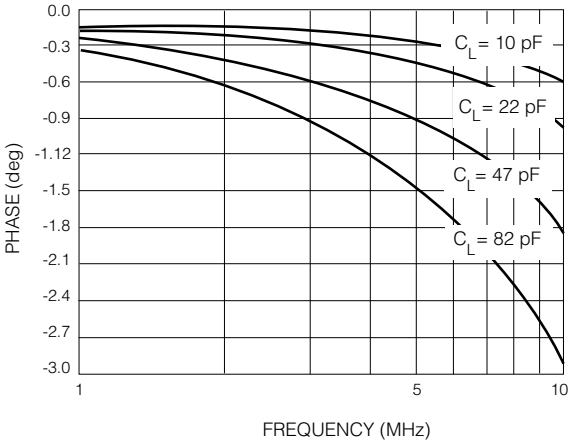

Fig. 5 Phase vs Frequency

Gennum Corp. assumes no responsibility for the use of any circuits described herein and makes no representation that they are free from patent infringement.
©1992 Gennum Corporation.