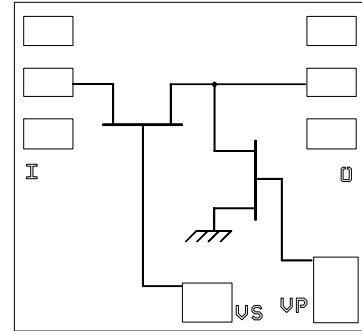


DC-40GHz ATTENUATOR

GaAs Monolithic Microwave IC

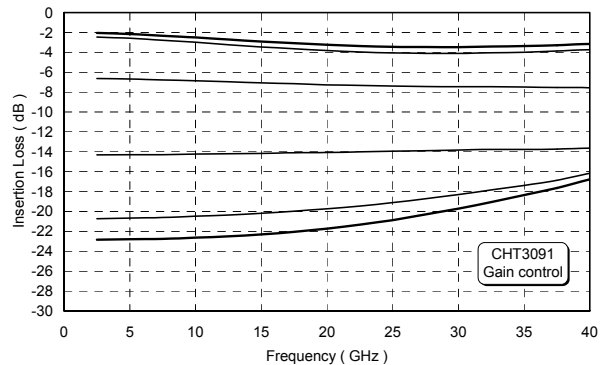
Description

The CHT3091a is a variable DC-40GHz attenuator designed for a wide range of applications, from military to commercial communication systems. The backside of the chip is both RF and DC grounds. This helps simplify the assembly process. The circuit is manufactured with a MESFET process, 0.7 μ m gate length, via holes through the substrate and air bridges. It is supplied in chip form.



Main Features

- Broadband performances: DC-40GHz
- 15dBm minimum input 1dB compression point (any attenuation)
- DC bias : -5V<VS<0V ; -5V<VP<0V
- Chip size: 0.91 x 0.86 x 0.10 mm



Main Characteristics

Tamb. = 25°C

| Symbol | Parameter | Min | Typ | Max | Unit |
|----------|---|-----|-----|------|------|
| Fin | Input frequency range | DC | | 40 | GHz |
| Min Att. | Minimum attenuation S21 (VS=0V;VP=-5V) | | 3 | | dB |
| Max Att. | Maximum attenuation S21 (VS=-5V;VP=0V) | | 20 | | dB |
| VSWRin | Input VSWR (any attenuation) | | | 2.:1 | |
| VSWRout | Output VSWR (any attenuation) | | | 2.:1 | |
| Pin1dB | Input 1dB compression point.(any attenuation) | 15 | | | dBm |

ESD Protection: Electrostatic discharge sensitive device. Observe handling precautions!

Electrical Characteristics (1)

Tamb = +25°C

| Symbol | Parameter | Min | Typ | Max | Unit |
|----------|--|-----|-----|-----|----------------|
| Fin | Input frequency range | DC | | 40 | GHz |
| Min Att. | Minimum attenuation S21 (VS=0V;VP=-5V) DC-10GHz DC-20GHz DC-40GHz | | 2.2 | | dB dB dB |
| | | | 3 | 4 | |
| | | | 3.5 | | |
| Max Att. | Maximum attenuation S21 (VS=-5V;VP=0V) DC-10GHz DC-20GHz DC-40GHz | | 23 | | dB dB dB |
| | | | 21 | 15 | |
| | | | 17 | | |
| VSWRin | Input VSWR (any attenuation) | | | 2:1 | |
| VSWRout | Output VSWR (any attenuation) | | | 2:1 | |
| Pin1dB | Input 1dB compression point.(any attenuation) | 15 | | | dBm |

(1) These values are representative of on-wafer measurements that are made without bonding wires at the RF ports.

Absolute Maximum Ratings

Tamb. = 25°C (1)

| Symbol | Parameter | Values | Unit |
|--------|-----------------------------|-------------|------|
| VP | VP control voltage | -6V | V |
| VS | VS control voltage | -6V | V |
| Pin | RF input power | 20 | dBm |
| Ta | Operating temperature range | -40 to +85 | °C |
| Tstg | Storage temperature range | -55 to +155 | °C |

(1) Operation of this device above anyone of these parameters may cause permanent damage.

Typical Result

Chip Typical Response (On wafer Sij):

Tamb = +25°C Vp=0V Vs=-5V

| Frequency | MS11 | PS11 | MS12 | PS12 | MS21 | PS21 | MS22 | PS22 |
|-----------|------------|------------|------------|------------|------------|------------|------------|------------|
| | <i>mod</i> | <i>pha</i> | <i>mod</i> | <i>pha</i> | <i>mod</i> | <i>pha</i> | <i>mod</i> | <i>pha</i> |
| GHz | dB | deg | dB | deg | dB | deg | dB | deg |
| 1.000 | -2,53E+01 | -7,45E+00 | -2,24E+01 | -1,90E+00 | -2,24E+01 | -2,14E+00 | -2,43E+01 | -5,46E+00 |
| 2.000 | -2,47E+01 | -1,19E+01 | -2,24E+01 | -3,81E+00 | -2,23E+01 | -3,70E+00 | -2,45E+01 | -1,20E+01 |
| 3.000 | -2,46E+01 | -1,80E+01 | -2,24E+01 | -5,50E+00 | -2,23E+01 | -5,54E+00 | -2,43E+01 | -1,80E+01 |
| 4.000 | -2,44E+01 | -2,33E+01 | -2,24E+01 | -7,42E+00 | -2,24E+01 | -7,55E+00 | -2,41E+01 | -2,43E+01 |
| 5.000 | -2,42E+01 | -2,90E+01 | -2,24E+01 | -9,20E+00 | -2,23E+01 | -9,27E+00 | -2,38E+01 | -2,97E+01 |
| 6.000 | -2,39E+01 | -3,43E+01 | -2,23E+01 | -1,12E+01 | -2,23E+01 | -1,13E+01 | -2,35E+01 | -3,56E+01 |
| 7.000 | -2,36E+01 | -3,92E+01 | -2,23E+01 | -1,29E+01 | -2,23E+01 | -1,31E+01 | -2,33E+01 | -4,04E+01 |
| 8.000 | -2,32E+01 | -4,32E+01 | -2,23E+01 | -1,43E+01 | -2,22E+01 | -1,46E+01 | -2,29E+01 | -4,43E+01 |
| 9.000 | -2,29E+01 | -4,77E+01 | -2,22E+01 | -1,63E+01 | -2,22E+01 | -1,68E+01 | -2,27E+01 | -4,96E+01 |
| 10.000 | -2,26E+01 | -5,20E+01 | -2,22E+01 | -1,81E+01 | -2,21E+01 | -1,88E+01 | -2,23E+01 | -5,38E+01 |
| 11.000 | -2,22E+01 | -5,56E+01 | -2,21E+01 | -2,01E+01 | -2,21E+01 | -2,04E+01 | -2,18E+01 | -5,64E+01 |
| 12.000 | -2,19E+01 | -5,90E+01 | -2,21E+01 | -2,17E+01 | -2,20E+01 | -2,24E+01 | -2,16E+01 | -6,05E+01 |
| 13.000 | -2,16E+01 | -6,18E+01 | -2,20E+01 | -2,34E+01 | -2,19E+01 | -2,42E+01 | -2,13E+01 | -6,32E+01 |
| 14.000 | -2,13E+01 | -6,51E+01 | -2,19E+01 | -2,52E+01 | -2,19E+01 | -2,60E+01 | -2,07E+01 | -6,69E+01 |
| 15.000 | -2,10E+01 | -6,81E+01 | -2,18E+01 | -2,70E+01 | -2,18E+01 | -2,78E+01 | -2,06E+01 | -6,91E+01 |
| 16.000 | -2,07E+01 | -6,99E+01 | -2,17E+01 | -2,88E+01 | -2,17E+01 | -2,97E+01 | -2,03E+01 | -7,09E+01 |
| 17.000 | -2,04E+01 | -7,28E+01 | -2,16E+01 | -3,04E+01 | -2,15E+01 | -3,15E+01 | -1,99E+01 | -7,48E+01 |
| 18.000 | -2,02E+01 | -7,49E+01 | -2,15E+01 | -3,23E+01 | -2,15E+01 | -3,32E+01 | -1,97E+01 | -7,64E+01 |
| 19.000 | -1,98E+01 | -7,70E+01 | -2,13E+01 | -3,43E+01 | -2,13E+01 | -3,51E+01 | -1,93E+01 | -7,85E+01 |
| 20.000 | -1,97E+01 | -7,93E+01 | -2,11E+01 | -3,59E+01 | -2,11E+01 | -3,72E+01 | -1,90E+01 | -8,02E+01 |
| 21.000 | -1,93E+01 | -8,08E+01 | -2,10E+01 | -3,84E+01 | -2,09E+01 | -3,96E+01 | -1,86E+01 | -8,19E+01 |
| 22.000 | -1,92E+01 | -8,26E+01 | -2,08E+01 | -4,03E+01 | -2,08E+01 | -4,20E+01 | -1,84E+01 | -8,31E+01 |
| 23.000 | -1,90E+01 | -8,35E+01 | -2,06E+01 | -4,28E+01 | -2,06E+01 | -4,38E+01 | -1,82E+01 | -8,43E+01 |
| 24.000 | -1,87E+01 | -8,54E+01 | -2,04E+01 | -4,49E+01 | -2,04E+01 | -4,59E+01 | -1,79E+01 | -8,81E+01 |
| 25.000 | -1,86E+01 | -8,60E+01 | -2,01E+01 | -4,70E+01 | -2,02E+01 | -4,81E+01 | -1,78E+01 | -8,83E+01 |
| 26.000 | -1,83E+01 | -8,71E+01 | -1,99E+01 | -4,95E+01 | -2,00E+01 | -5,09E+01 | -1,70E+01 | -8,99E+01 |
| 27.000 | -1,82E+01 | -8,86E+01 | -1,96E+01 | -5,21E+01 | -1,98E+01 | -5,31E+01 | -1,71E+01 | -9,26E+01 |
| 28.000 | -1,79E+01 | -8,90E+01 | -1,95E+01 | -5,44E+01 | -1,95E+01 | -5,62E+01 | -1,67E+01 | -9,15E+01 |
| 29.000 | -1,78E+01 | -8,92E+01 | -1,93E+01 | -5,74E+01 | -1,92E+01 | -5,85E+01 | -1,66E+01 | -9,34E+01 |
| 30.000 | -1,77E+01 | -9,00E+01 | -1,90E+01 | -6,03E+01 | -1,90E+01 | -6,17E+01 | -1,68E+01 | -9,20E+01 |
| 31.000 | -1,74E+01 | -9,07E+01 | -1,87E+01 | -6,32E+01 | -1,87E+01 | -6,47E+01 | -1,61E+01 | -9,23E+01 |
| 32.000 | -1,72E+01 | -9,05E+01 | -1,85E+01 | -6,59E+01 | -1,85E+01 | -6,77E+01 | -1,62E+01 | -9,71E+01 |
| 33.000 | -1,69E+01 | -9,02E+01 | -1,81E+01 | -6,98E+01 | -1,82E+01 | -7,11E+01 | -1,60E+01 | -9,57E+01 |
| 34.000 | -1,67E+01 | -8,99E+01 | -1,79E+01 | -7,31E+01 | -1,79E+01 | -7,45E+01 | -1,52E+01 | -9,89E+01 |
| 35.000 | -1,63E+01 | -9,09E+01 | -1,76E+01 | -7,62E+01 | -1,77E+01 | -7,72E+01 | -1,49E+01 | -1,01E+02 |
| 36.000 | -1,60E+01 | -8,99E+01 | -1,73E+01 | -8,02E+01 | -1,73E+01 | -8,13E+01 | -1,46E+01 | -9,37E+01 |
| 37.000 | -1,58E+01 | -9,11E+01 | -1,71E+01 | -8,40E+01 | -1,71E+01 | -8,51E+01 | -1,46E+01 | -9,89E+01 |
| 38.000 | -1,54E+01 | -9,10E+01 | -1,68E+01 | -8,81E+01 | -1,68E+01 | -8,99E+01 | -1,55E+01 | -1,04E+02 |
| 39.000 | -1,50E+01 | -9,00E+01 | -1,66E+01 | -9,15E+01 | -1,67E+01 | -9,32E+01 | -1,34E+01 | -1,02E+02 |
| 40.000 | -1,47E+01 | -9,03E+01 | -1,63E+01 | -9,53E+01 | -1,64E+01 | -9,77E+01 | -1,37E+01 | -1,05E+02 |

Tamb = +25°C Vp=-5V Vs=0V

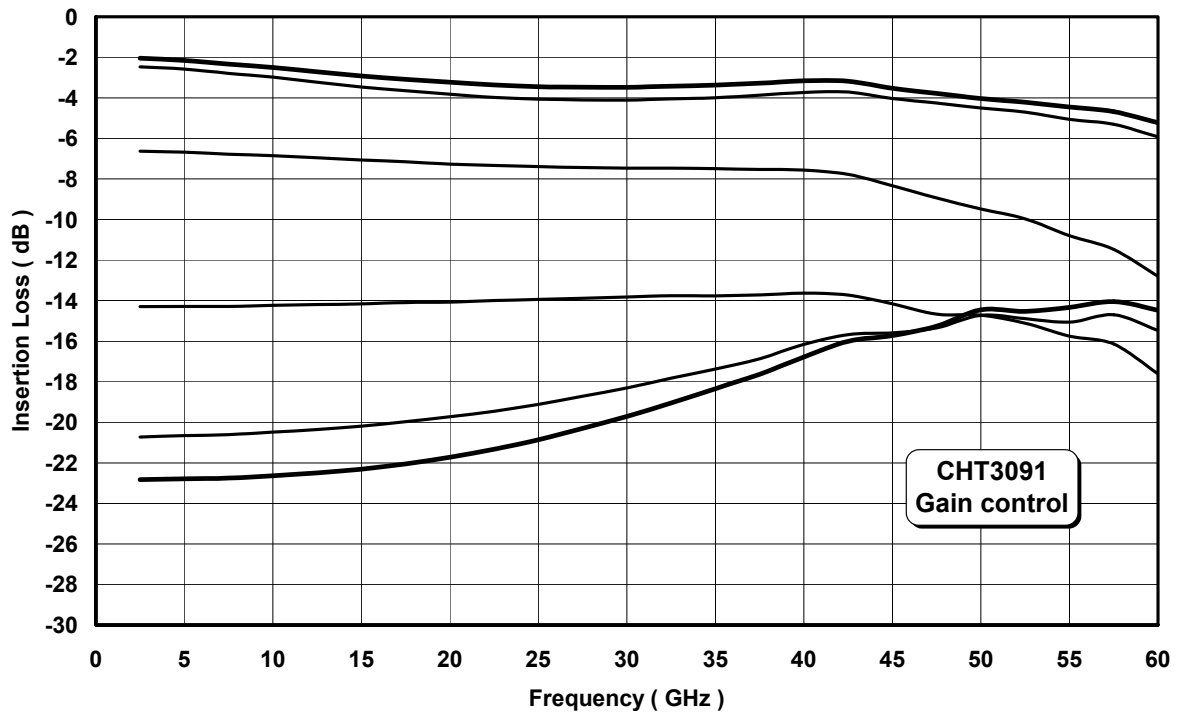
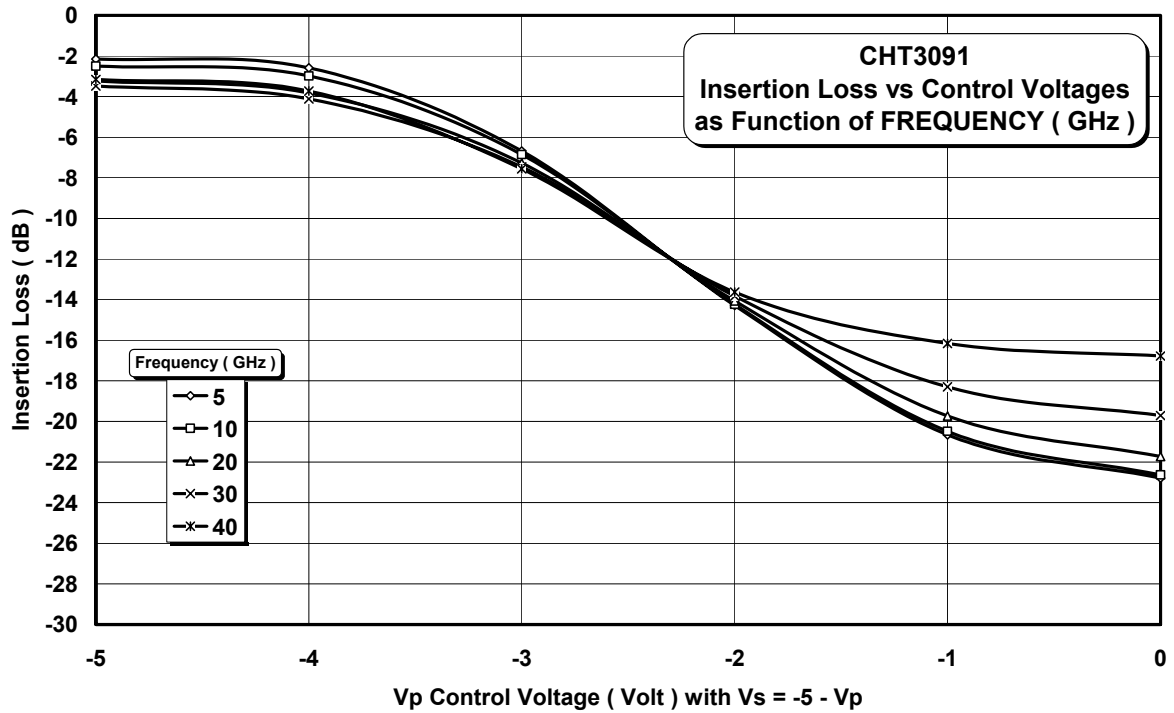
| Frequency | MS11 | PS11 | MS12 | PS12 | MS21 | PS21 | MS22 | PS22 |
|-----------|------------|------------|------------|------------|------------|------------|------------|------------|
| | <i>mod</i> | <i>pha</i> | <i>mod</i> | <i>pha</i> | <i>mod</i> | <i>pha</i> | <i>mod</i> | <i>pha</i> |
| | dB | deg | dB | deg | dB | deg | dB | deg |
| 1.000 | -1,68E+01 | -1,62E+01 | -2,09E+00 | -5,63E+00 | -1,91E+00 | -5,65E+00 | -1,61E+01 | -1,48E+01 |
| 2.000 | -1,59E+01 | -2,74E+01 | -1,92E+00 | -1,10E+01 | -1,88E+00 | -1,08E+01 | -1,59E+01 | -2,75E+01 |
| 3.000 | -1,57E+01 | -3,97E+01 | -1,98E+00 | -1,61E+01 | -1,94E+00 | -1,61E+01 | -1,55E+01 | -3,99E+01 |
| 4.000 | -1,54E+01 | -5,27E+01 | -2,07E+00 | -2,15E+01 | -2,03E+00 | -2,15E+01 | -1,52E+01 | -5,27E+01 |
| 5.000 | -1,50E+01 | -6,26E+01 | -2,13E+00 | -2,65E+01 | -2,09E+00 | -2,66E+01 | -1,48E+01 | -6,32E+01 |
| 6.000 | -1,44E+01 | -7,38E+01 | -2,20E+00 | -3,19E+01 | -2,17E+00 | -3,20E+01 | -1,42E+01 | -7,42E+01 |
| 7.000 | -1,41E+01 | -8,31E+01 | -2,30E+00 | -3,67E+01 | -2,26E+00 | -3,70E+01 | -1,39E+01 | -8,28E+01 |
| 8.000 | -1,37E+01 | -8,94E+01 | -2,34E+00 | -4,12E+01 | -2,29E+00 | -4,16E+01 | -1,35E+01 | -8,91E+01 |
| 9.000 | -1,30E+01 | -9,89E+01 | -2,41E+00 | -4,69E+01 | -2,40E+00 | -4,73E+01 | -1,28E+01 | -9,87E+01 |
| 10.000 | -1,28E+01 | -1,07E+02 | -2,53E+00 | -5,18E+01 | -2,49E+00 | -5,24E+01 | -1,24E+01 | -1,07E+02 |
| 11.000 | -1,25E+01 | -1,14E+02 | -2,62E+00 | -5,65E+01 | -2,61E+00 | -5,69E+01 | -1,22E+01 | -1,13E+02 |
| 12.000 | -1,23E+01 | -1,21E+02 | -2,72E+00 | -6,13E+01 | -2,69E+00 | -6,20E+01 | -1,19E+01 | -1,20E+02 |
| 13.000 | -1,22E+01 | -1,27E+02 | -2,82E+00 | -6,60E+01 | -2,80E+00 | -6,66E+01 | -1,17E+01 | -1,26E+02 |
| 14.000 | -1,20E+01 | -1,34E+02 | -2,91E+00 | -7,06E+01 | -2,88E+00 | -7,14E+01 | -1,15E+01 | -1,32E+02 |
| 15.000 | -1,19E+01 | -1,40E+02 | -3,00E+00 | -7,52E+01 | -2,99E+00 | -7,61E+01 | -1,14E+01 | -1,37E+02 |
| 16.000 | -1,19E+01 | -1,45E+02 | -3,07E+00 | -7,98E+01 | -3,09E+00 | -8,06E+01 | -1,14E+01 | -1,43E+02 |
| 17.000 | -1,18E+01 | -1,50E+02 | -3,14E+00 | -8,44E+01 | -3,13E+00 | -8,52E+01 | -1,12E+01 | -1,48E+02 |
| 18.000 | -1,18E+01 | -1,56E+02 | -3,22E+00 | -8,89E+01 | -3,22E+00 | -8,97E+01 | -1,13E+01 | -1,53E+02 |
| 19.000 | -1,19E+01 | -1,61E+02 | -3,29E+00 | -9,35E+01 | -3,28E+00 | -9,45E+01 | -1,13E+01 | -1,58E+02 |
| 20.000 | -1,20E+01 | -1,66E+02 | -3,31E+00 | -9,78E+01 | -3,31E+00 | -9,88E+01 | -1,14E+01 | -1,62E+02 |
| 21.000 | -1,20E+01 | -1,71E+02 | -3,35E+00 | -1,03E+02 | -3,34E+00 | -1,04E+02 | -1,14E+01 | -1,66E+02 |
| 22.000 | -1,22E+01 | -1,77E+02 | -3,41E+00 | -1,07E+02 | -3,41E+00 | -1,08E+02 | -1,16E+01 | -1,72E+02 |
| 23.000 | -1,25E+01 | 1,78E+02 | -3,41E+00 | -1,12E+02 | -3,43E+00 | -1,13E+02 | -1,19E+01 | -1,76E+02 |
| 24.000 | -1,28E+01 | 1,73E+02 | -3,43E+00 | -1,16E+02 | -3,47E+00 | -1,18E+02 | -1,19E+01 | 1,80E+02 |
| 25.000 | -1,32E+01 | 1,68E+02 | -3,46E+00 | -1,21E+02 | -3,51E+00 | -1,22E+02 | -1,22E+01 | 1,75E+02 |
| 26.000 | -1,37E+01 | 1,62E+02 | -3,47E+00 | -1,26E+02 | -3,52E+00 | -1,27E+02 | -1,25E+01 | 1,72E+02 |
| 27.000 | -1,42E+01 | 1,56E+02 | -3,44E+00 | -1,31E+02 | -3,54E+00 | -1,32E+02 | -1,28E+01 | 1,67E+02 |
| 28.000 | -1,49E+01 | 1,51E+02 | -3,52E+00 | -1,36E+02 | -3,53E+00 | -1,37E+02 | -1,36E+01 | 1,64E+02 |
| 29.000 | -1,57E+01 | 1,45E+02 | -3,51E+00 | -1,40E+02 | -3,50E+00 | -1,42E+02 | -1,40E+01 | 1,60E+02 |
| 30.000 | -1,66E+01 | 1,41E+02 | -3,49E+00 | -1,46E+02 | -3,49E+00 | -1,47E+02 | -1,47E+01 | 1,53E+02 |
| 31.000 | -1,77E+01 | 1,34E+02 | -3,45E+00 | -1,51E+02 | -3,49E+00 | -1,52E+02 | -1,58E+01 | 1,50E+02 |
| 32.000 | -1,92E+01 | 1,29E+02 | -3,45E+00 | -1,56E+02 | -3,52E+00 | -1,57E+02 | -1,62E+01 | 1,48E+02 |
| 33.000 | -2,10E+01 | 1,22E+02 | -3,40E+00 | -1,61E+02 | -3,48E+00 | -1,63E+02 | -1,74E+01 | 1,43E+02 |
| 34.000 | -2,29E+01 | 1,11E+02 | -3,43E+00 | -1,67E+02 | -3,46E+00 | -1,68E+02 | -1,86E+01 | 1,49E+02 |
| 35.000 | -2,63E+01 | 1,01E+02 | -3,42E+00 | -1,72E+02 | -3,48E+00 | -1,74E+02 | -1,99E+01 | 1,51E+02 |
| 36.000 | -3,12E+01 | 7,94E+01 | -3,41E+00 | -1,78E+02 | -3,46E+00 | -1,79E+02 | -2,38E+01 | 1,51E+02 |
| 37.000 | -3,55E+01 | 2,69E+01 | -3,39E+00 | 1,77E+02 | -3,47E+00 | 1,75E+02 | -2,35E+01 | 1,58E+02 |
| 38.000 | -3,11E+01 | -3,53E+01 | -3,41E+00 | 1,70E+02 | -3,41E+00 | 1,68E+02 | -2,30E+01 | 1,49E+02 |
| 39.000 | -2,50E+01 | -6,00E+01 | -3,45E+00 | 1,64E+02 | -3,49E+00 | 1,63E+02 | -2,35E+01 | -1,63E+02 |
| 40.000 | -2,27E+01 | -7,35E+01 | -3,54E+00 | 1,58E+02 | -3,55E+00 | 1,57E+02 | -2,28E+01 | -1,64E+02 |

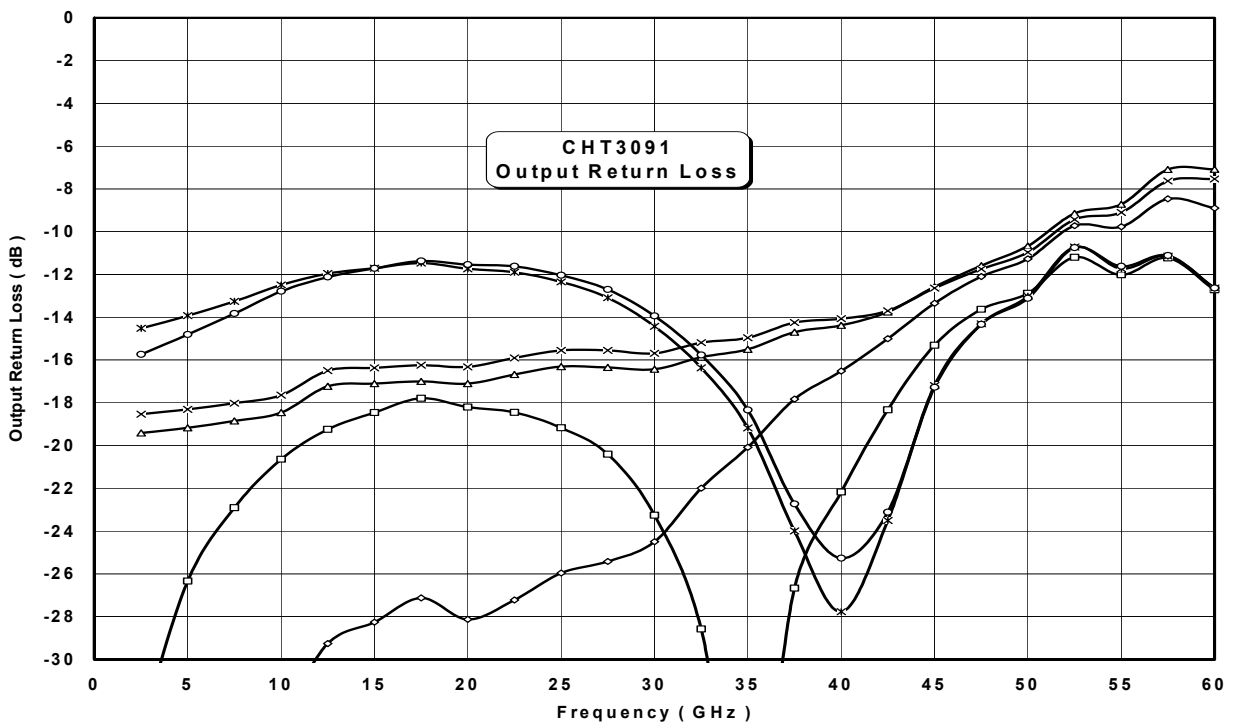
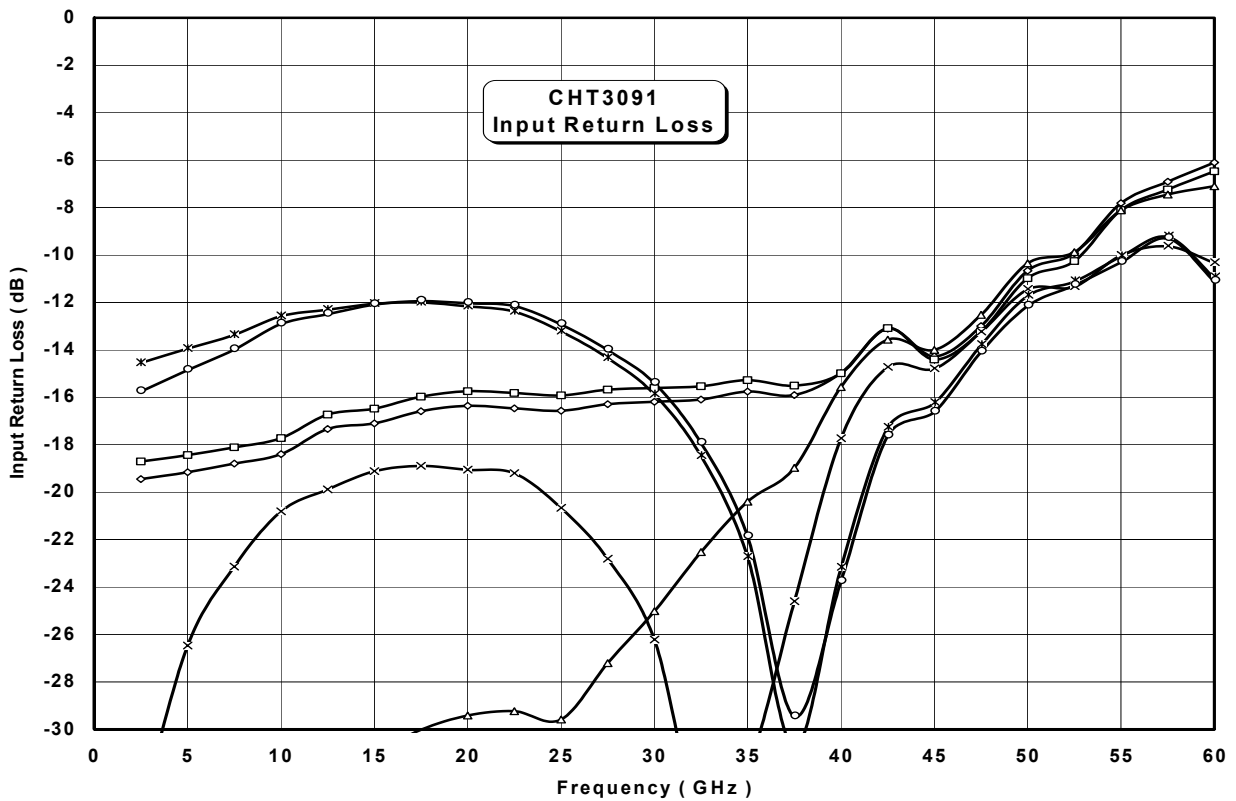
Typical Results

Chip Typical Response (On wafer Sij):

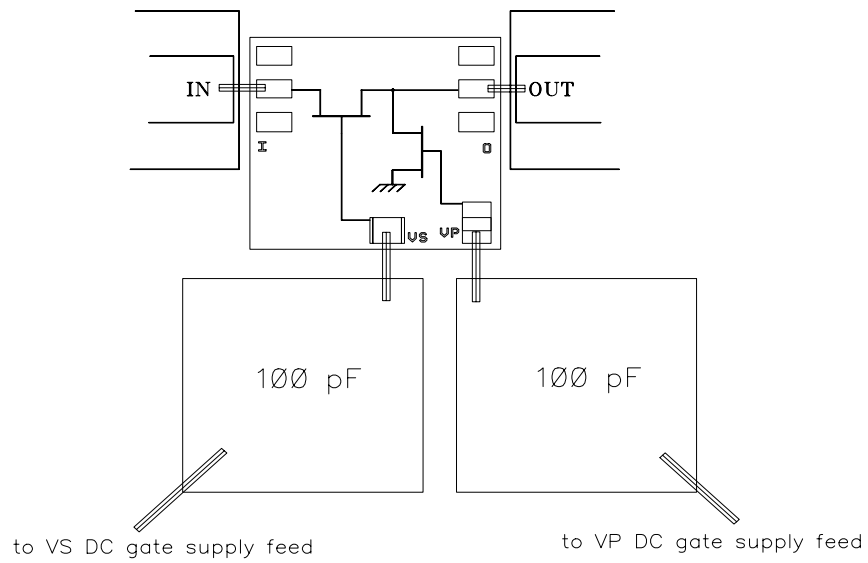
Tamb = +25°C

Vp = 0V to -5V & Vs = -5V to 0V

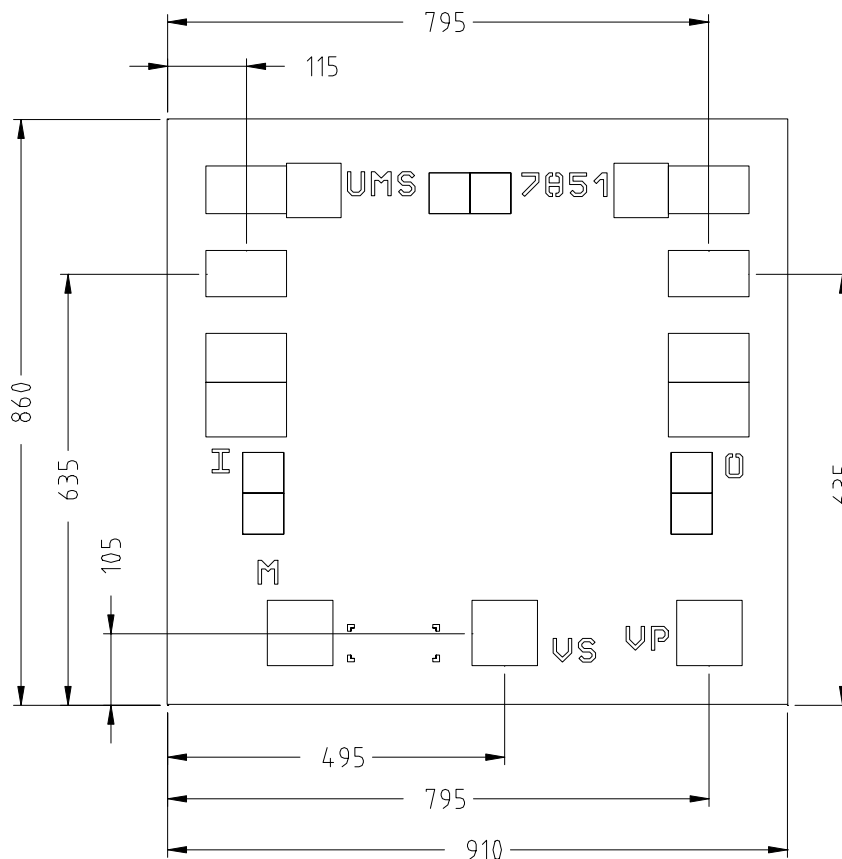




Chip Assembly and Mechanical Data



Note : Supply feed might be capacitively bypassed. 25µm diameter gold wire is to be preferred.



UNITS : µm
Tol : ±35µm

Bonding pad positions.

(Chip thickness: 100µm. All dimensions are in micrometers)

Ordering Information

Chip form: CHT3091a99F/00

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