

DC-40GHz ATTENUATOR

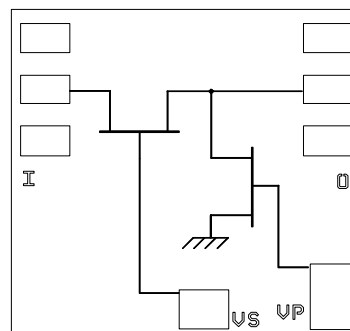
GaAs Monolithic Microwave IC

Description

The CHT3091a99F is a variable DC-40GHz attenuator designed for a wide range of applications, from military to commercial communication systems. The chip backside is both RF and DC grounds. This helps simplify the assembly process.

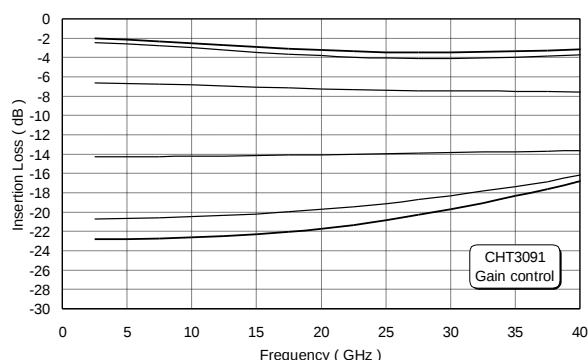
The circuit is manufactured with a MESFET process, 0.7μm gate length, via holes through the substrate, air bridges and electron beam gate lithography.

It is available in chip form.



Main Features

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



Main Electrical Characteristics

T_{amb} = +25°C

Symbol	Parameter	Min	Typ	Max	Unit
Fin	Input frequency range	DC		40	GHz
Min Att.	Minimum attenuation S ₂₁ (V _S =0V; V _P =-5V)		3		dB
Max Att.	Maximum attenuation S ₂₁ (V _S =-5V; V _P =0V)		20		dB
VSWR _{in}	Input VSWR (any attenuation)			2:1	
VSWR _{out}	Output VSWR (any attenuation)			2:1	
P _{in} 1dB	Input 1dB compression point.(any attenuation from 1 to 40GHz)	15			dBm

Electrical Characteristics

$T_{amb.} = +25^{\circ}\text{C}$

Symbol	Parameter	Min	Typ	Max	Unit
F_{in}	Input frequency range	DC		40	GHz
Min Att.	Minimum attenuation $ S_{21} $ ($V_S=0V; V_P=-5V$)				
	DC-10GHz		2.2		dB
	DC-20GHz		3		dB
	DC-40GHz		3.5	4	dB
Max Att.	Maximum attenuation $ S_{21} $ ($V_S=-5V; V_P=0V$)				
	DC-10GHz		23		dB
	DC-20GHz		21		dB
	DC-40GHz		17	15	dB
$VSWR_{in}$	Input VSWR (any attenuation)			2:1	
$VSWR_{out}$	Output VSWR (any attenuation)			2:1	
P_{in1dB}	Input 1dB comp. point.(any attenuation, $F > 1\text{GHz}$)	15			dBm

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

A bonding wire of typically 0.1 to 0.15nH will improve the matching at the accesses.

Absolute Maximum Ratings ⁽¹⁾

$T_{amb.} = +25^{\circ}\text{C}$

Symbol	Parameter	Values	Unit
V_P	V_P control voltage	-6V	V
V_S	V_S control voltage	-6V	V
P_{in}	RF input power	20	dBm
T_a	Operating temperature range	-40 to +85	$^{\circ}\text{C}$
T_{stg}	Storage temperature range	-55 to +150	$^{\circ}\text{C}$

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

⁽²⁾ Duration < 1s.

Typical on-wafer Sij parameters

T_{amb.} = +25°C, V_P = 0V, V_S = -5V

Freq (GHz)	S11 (dB)	PhS11 (°)	S12 (dB)	PhS12 (°)	S21 (dB)	PhS21 (°)	S22 (dB)	PhS22 (°)
1.0	-25.3	-7	-22.4	-2	-22.4	-2	-24.3	-5
3.0	-24.6	-18	-22.4	-6	-22.3	-6	-24.3	-18
4.0	-24.4	-23	-22.4	-7	-22.4	-8	-24.1	-24
5.0	-24.2	-29	-22.4	-9	-22.3	-9	-23.8	-30
6.0	-23.9	-34	-22.3	-11	-22.3	-11	-23.5	-36
7.0	-23.6	-39	-22.3	-13	-22.3	-13	-23.3	-40
8.0	-23.2	-43	-22.3	-14	-22.2	-15	-22.9	-44
9.0	-22.9	-48	-22.2	-16	-22.2	-17	-22.7	-50
10.0	-22.6	-52	-22.2	-18	-22.1	-19	-22.3	-54
11.0	-22.2	-56	-22.1	-20	-22.1	-20	-21.8	-56
12.0	-21.9	-59	-22.1	-22	-22.0	-22	-21.6	-61
13.0	-21.6	-62	-22.0	-23	-21.9	-24	-21.3	-63
14.0	-21.3	-65	-21.9	-25	-21.9	-26	-20.7	-67
15.0	-21.0	-68	-21.8	-27	-21.8	-28	-20.6	-69
16.0	-20.7	-70	-21.7	-29	-21.7	-30	-20.3	-71
17.0	-20.4	-73	-21.6	-30	-21.5	-32	-19.9	-75
18.0	-20.2	-75	-21.5	-32	-21.5	-33	-19.7	-76
19.0	-19.8	-77	-21.3	-34	-21.3	-35	-19.3	-79
20.0	-19.7	-79	-21.1	-36	-21.1	-37	-19.0	-80
21.0	-19.3	-81	-21.0	-38	-20.9	-40	-18.6	-82
22.0	-19.2	-83	-20.8	-40	-20.8	-42	-18.4	-83
23.0	-19.0	-84	-20.6	-43	-20.6	-44	-18.2	-84
24.0	-18.7	-85	-20.4	-45	-20.4	-46	-17.9	-88
25.0	-18.6	-86	-20.1	-47	-20.2	-48	-17.8	-88
26.0	-18.3	-87	-19.9	-50	-20.0	-51	-17.0	-90
27.0	-18.2	-89	-19.6	-52	-19.8	-53	-17.1	-93
28.0	-17.9	-89	-19.5	-54	-19.5	-56	-16.7	-92
29.0	-17.8	-89	-19.3	-57	-19.2	-59	-16.6	-93
30.0	-17.7	-90	-19.0	-60	-19.0	-62	-16.8	-92
31.0	-17.4	-91	-18.7	-63	-18.7	-65	-16.1	-92
32.0	-17.2	-91	-18.5	-66	-18.5	-68	-16.2	-97
33.0	-16.9	-90	-18.1	-70	-18.2	-71	-16.0	-96
34.0	-16.7	-90	-17.9	-73	-17.9	-75	-15.2	-99
35.0	-16.3	-91	-17.6	-76	-17.7	-77	-14.9	-101
36.0	-16.0	-90	-17.3	-80	-17.3	-81	-14.6	-94
37.0	-15.8	-91	-17.1	-84	-17.1	-85	-14.6	-99
38.0	-15.4	-91	-16.8	-88	-16.8	-90	-15.5	-104
39.0	-15.0	-90	-16.6	-92	-16.7	-93	-13.4	-102
40.0	-14.7	-90	-16.3	-95	-16.4	-98	-13.7	-105

Typical on-wafer Sij parameters

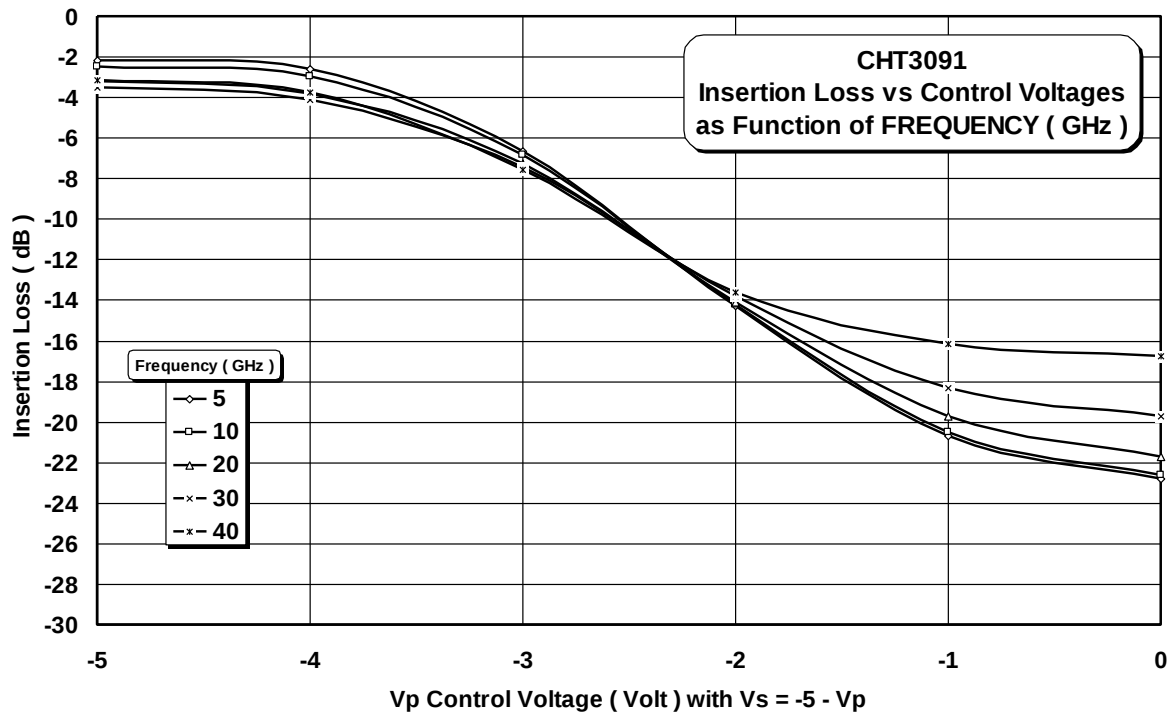
$T_{amb.} = +25^{\circ}\text{C}$, $V_P = -5\text{V}$, $V_S = 0\text{V}$

Freq (GHz)	S11 (dB)	PhS11 (°)	S12 (dB)	PhS12 (°)	S21 (dB)	PhS21 (°)	S22 (dB)	PhS22 (°)
1.0	-16.8	-16	-2.1	-6	-1.9	-6	-16.1	-15
3.0	-15.7	-40	-2.0	-16	-1.9	-16	-15.5	-40
4.0	-15.4	-53	-2.1	-22	-2.0	-22	-15.2	-53
5.0	-15.0	-63	-2.1	-27	-2.1	-27	-14.8	-63
6.0	-14.4	-74	-2.2	-32	-2.2	-32	-14.2	-74
7.0	-14.1	-83	-2.3	-37	-2.3	-37	-13.9	-83
8.0	-13.7	-89	-2.3	-41	-2.3	-42	-13.5	-89
9.0	-13.0	-99	-2.4	-47	-2.4	-47	-12.8	-99
10.0	-12.8	-107	-2.5	-52	-2.5	-52	-12.4	-107
11.0	-12.5	-114	-2.6	-57	-2.6	-57	-12.2	-113
12.0	-12.3	-121	-2.7	-61	-2.7	-62	-11.9	-120
13.0	-12.2	-127	-2.8	-66	-2.8	-67	-11.7	-126
14.0	-12.0	-134	-2.9	-71	-2.9	-71	-11.5	-132
15.0	-11.9	-140	-3.0	-75	-3.0	-76	-11.4	-137
16.0	-11.9	-145	-3.1	-80	-3.1	-81	-11.4	-143
17.0	-11.8	-150	-3.1	-84	-3.1	-85	-11.2	-148
18.0	-11.8	-156	-3.2	-89	-3.2	-90	-11.3	-153
19.0	-11.9	-161	-3.3	-94	-3.3	-95	-11.3	-158
20.0	-12.0	-166	-3.3	-98	-3.3	-99	-11.4	-162
21.0	-12.0	-171	-3.4	-103	-3.3	-104	-11.4	-166
22.0	-12.2	-177	-3.4	-107	-3.4	-108	-11.6	-172
23.0	-12.5	178	-3.4	-112	-3.4	-113	-11.9	-176
24.0	-12.8	173	-3.4	-116	-3.5	-118	-11.9	180
25.0	-13.2	168	-3.5	-121	-3.5	-122	-12.2	175
26.0	-13.7	162	-3.5	-126	-3.5	-127	-12.5	172
27.0	-14.2	156	-3.4	-131	-3.5	-132	-12.8	167
28.0	-14.9	151	-3.5	-136	-3.5	-137	-13.6	164
29.0	-15.7	145	-3.5	-140	-3.5	-142	-14.0	160
30.0	-16.6	141	-3.5	-146	-3.5	-147	-14.7	153
31.0	-17.7	134	-3.5	-151	-3.5	-152	-15.8	150
32.0	-19.2	129	-3.5	-156	-3.5	-157	-16.2	148
33.0	-21.0	122	-3.4	-161	-3.5	-163	-17.4	143
34.0	-22.9	111	-3.4	-167	-3.5	-168	-18.6	149
35.0	-26.3	101	-3.4	-172	-3.5	-174	-19.9	151
36.0	-31.2	79	-3.4	-178	-3.5	-179	-23.8	151
37.0	-35.5	27	-3.4	177	-3.5	175	-23.5	158
38.0	-31.1	-35	-3.4	170	-3.4	168	-23.0	149
39.0	-25.0	-60	-3.5	164	-3.5	163	-23.5	-163
40.0	-22.7	-74	-3.5	158	-3.6	157	-22.8	-164

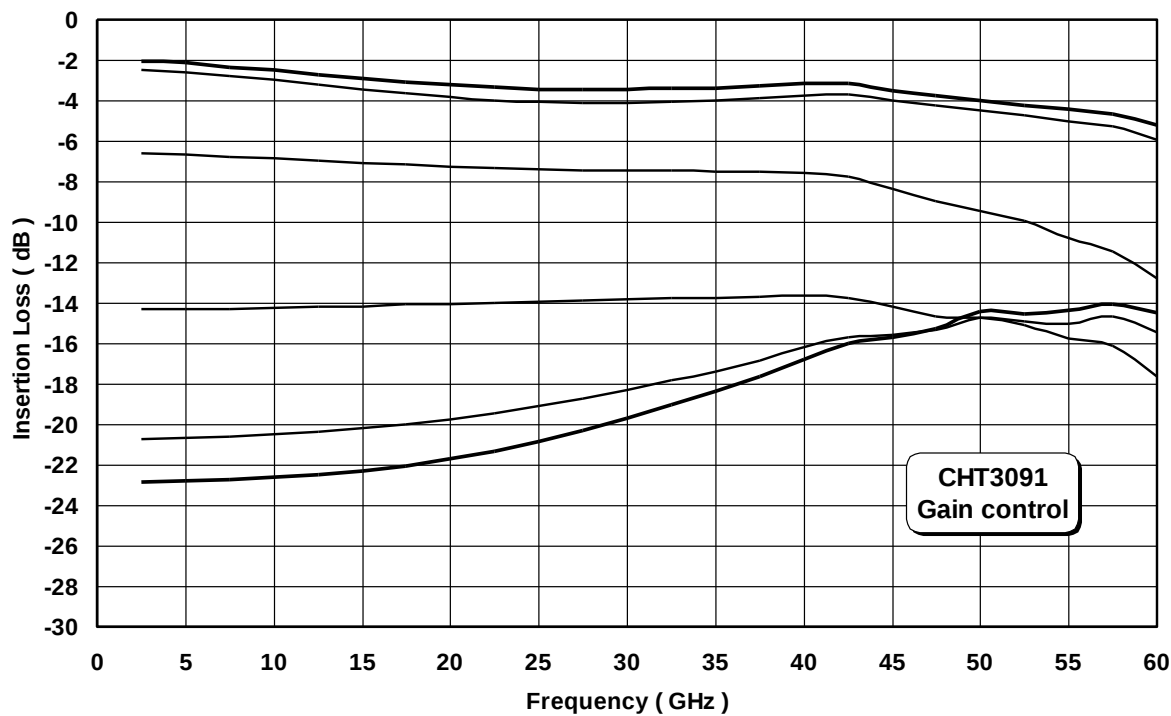
Typical on wafer Measurements

 $T_{amb.} = +25^{\circ}\text{C}$, $V_P = 0\text{V}$ to -5V & $V_S = -5\text{V}$ to 0V

Insertion Loss versus Control Voltage (and per Frequency)

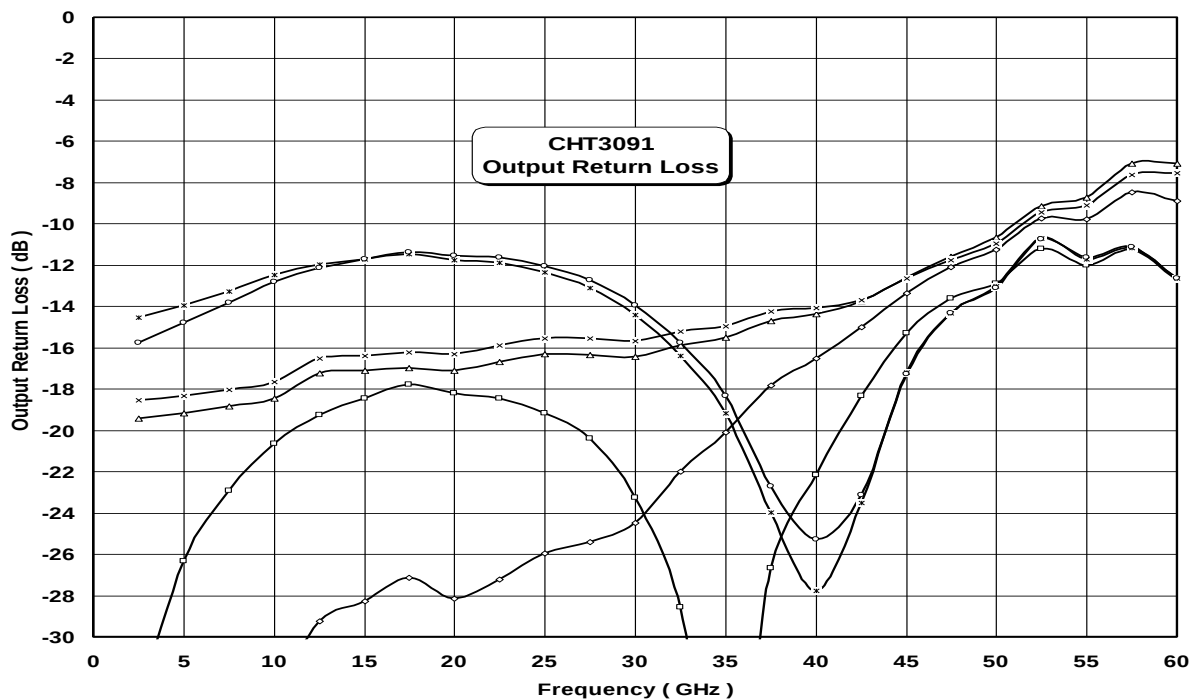
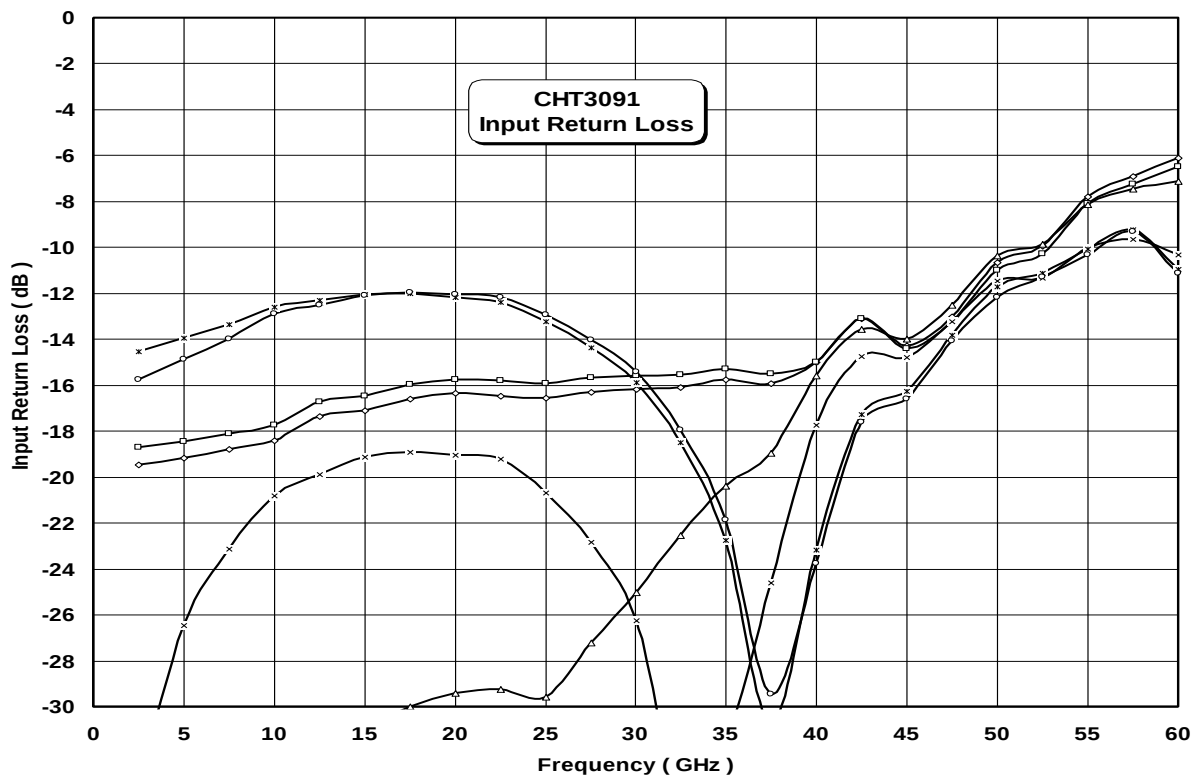


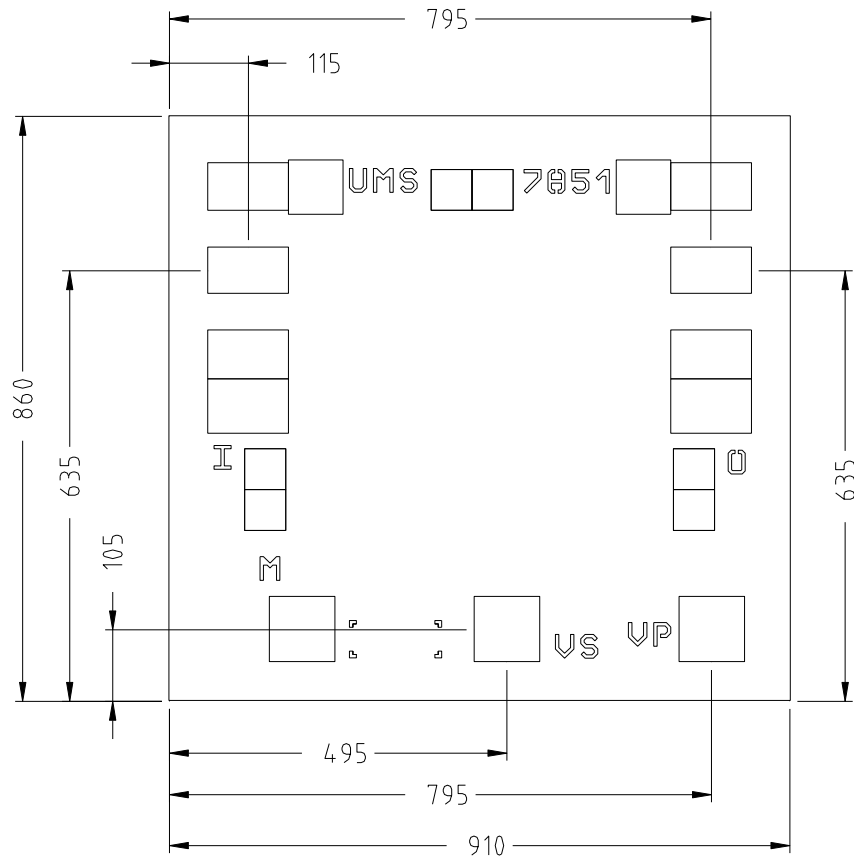
Insertion Loss versus Frequency (and Control Voltage)



Typical on wafer Measurements

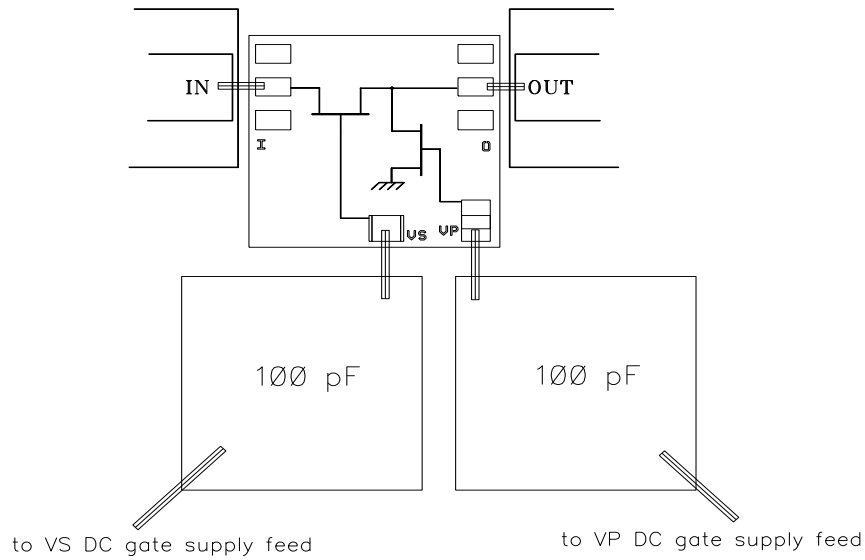
$T_{amb.} = +25^{\circ}\text{C}$, $V_P = 0\text{V}$ to -5V & $V_S = -5\text{V}$ to 0V



Mechanical data

Chip thickness: 100μm.
 Chip size: 860x910 ±35μm
 All dimensions are in micrometers

Recommended assembly plan



25µm wedge bonding is preferred

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

Notes

Recommended ESD management

Refer to the application note AN0020 available at <https://www.ums-rf.com> for ESD sensitivity and handling recommendations for the UMS products.

Recommended environmental management

UMS products are compliant with the regulation in particular with the directives RoHS N°2011/65 and REACH N°1907/2006. More environmental data are available in the application note AN0019 also available at <https://www.ums-rf.com>.

Ordering Information

Chip form:

CHT3091a99F/00

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