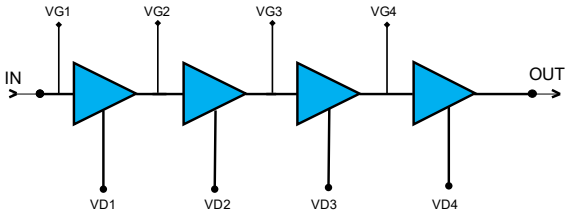
CHA4253a98F

17-24GHz Medium Power Amplifier

GaAs Monolithic Microwave IC

Description

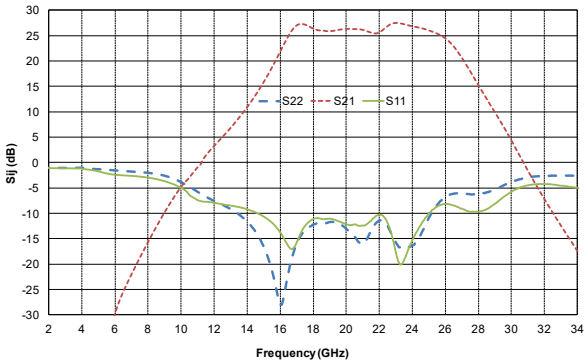
The CHA4253a98F is a four stage monolithic Medium Power Amplifier.
It is designed for a wide range of applications, from Point To Point Radio and K band to other commercial communication systems.
The circuit is manufactured with a pHEMT process, 0.15µm gate length.
It is available in chip form.



Main Features

- Broadband performances: 17-24GHz
- 24.5dBm Pout for 1dB gain compression
- 26dB gain
- 32dBm OTOI
- DC bias: Vd= 4.0V, Id= 230mA
- Chip size 2.61x1.66x0.07mm

S-parameters



Main Electrical Characteristics

Tamb.= +25°C

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	17.0		24.0	GHz
Gain	Linear Gain		26		dB
P-1dB	Output Power @1dB comp.		24.5		dBm
OTOI	3rd order Intercept point		32		dBm

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Specifications

Tamb.= +25°C, Vd = +4.0V

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	17.0		24.0	GHz
Gain	Linear Gain		26		dB
ΔG	Gain variation in temperature		-0.04		dB/°C
OTOI	3rd order Intercept point		32		dBm
P_{-1dB}	Output power @ 1dB compression		24.5		dBm
Psat	Saturated Output Power		25		dBm
RLin	Input Return Loss		12		dB
RLout	Output Return Loss		13		dB
NF	Noise figure		7.5		dB
Id	Quiescent Drain current		230		mA
Vg	Gate voltage		-0.7		V

These values are representative of test fixture measurements.

“Power ON” sequence

1. Ground the device
2. Bias MPA gate voltage at Vg low enough (Typically: Vg ≈ -2V)
3. Apply Vds bias voltage (Typically: Vd = 4V)
4. Increase slowly Vgs up to quiescent bias drain current Idq
5. Apply RF signal

“Power OFF” sequence

1. Turn off RF signal
2. Bias MPA gate voltage at Vg low enough (Typically: Vg ≈ -2V)
3. Turn Vds bias voltage to 0V
4. Turn Vgs bias voltage to 0V

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Absolute Maximum Ratings (1)

Tamb.= +25°C

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage	6V	V
Id	Drain bias quiescent current	370	mA
Vg	Gate bias voltage	-2 to +0.4	V
Vdg	External drain-gate excursion	12	V
Pin	Maximum input power	10	dBm
Tj	Junction temperature (2)	175	°C
Ta	Operating temperature range	-40 to +95	°C
Tstg	Storage temperature range	-55 to +150	°C

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

(2) See “Thermal device performance” for junction to ground Thermal Resistance

Recommended Operating Range 3, 4

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage	3.3 to 4	V
Id	Drain bias current	180 to 230	mA
Vg	Gate bias voltage	-1 to 0	V
Pin	Maximum peak input power overdrive	5	dBm

(3) Electrical performances are defined for specified test conditions

(4) Electrical performances are not guaranteed over all recommended operating conditions

Temperature Range

Ta	Operating temperature range	-40 to +95	°C
Tstg	Storage temperature range	-55 to +150	°C

Typical Bias Conditions

Tamb.= +25°C

Pad N°	Parameter	Values	Unit
VG1	DC Gate voltage 1st stage	-0.7	V
VG2	DC Gate voltage 2nd stage	-0.7	V
VG3	DC Gate voltage 3rd stage	-0.7	V
VG4	DC Gate voltage 4th stage	-0.7	V
VD1	DC Drain voltage 1st stage	4.0	V
VD2	DC Drain voltage 2nd stage	4.0	V
VD3	DC Drain voltage 3rd stage	4.0	V
VD4	DC Drain voltage 4th stage	4.0	V

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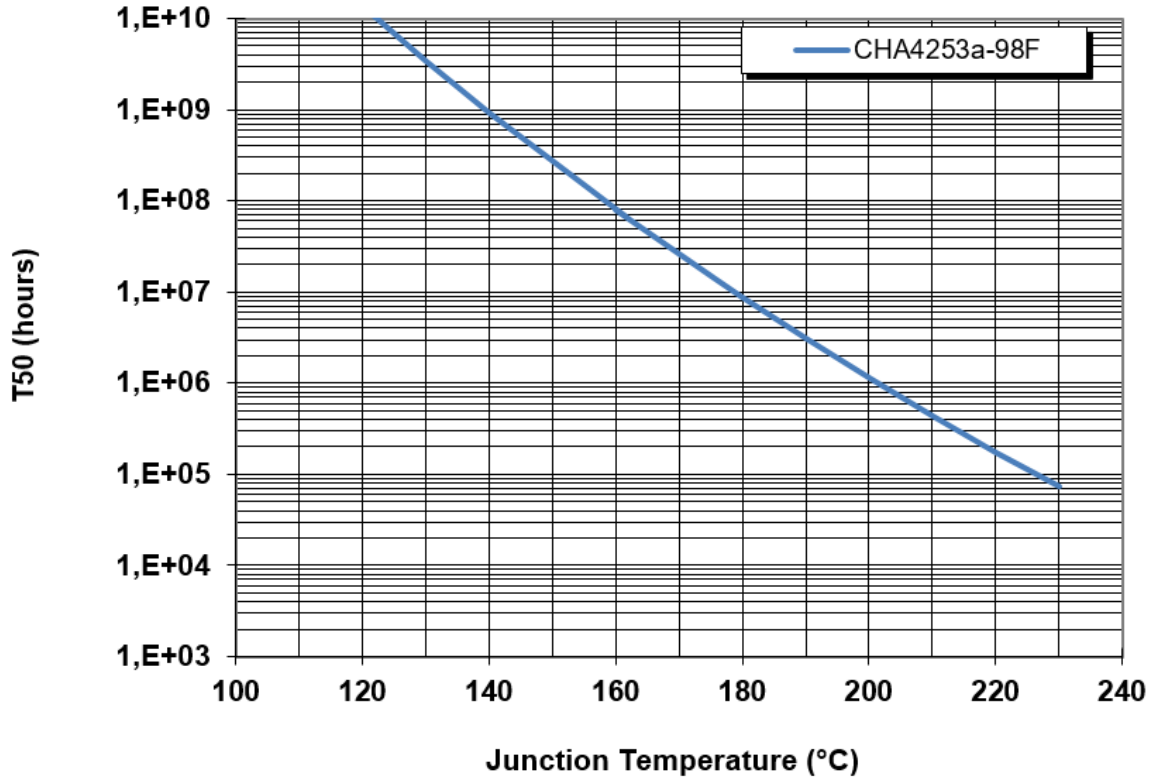
Device thermal performance

All the figures given in this section are obtained assuming that the bare die is only cooled down by conduction (no convection mode considered).
The temperature is monitored at the die back-side interface (Tb).
The system maximum temperature must be adjusted in order to guarantee that Tjunction remains below the maximum value specified in the Absolute Maximum Ratings table.
So, the system PCB must be designed to comply with this requirement.

Chip backside temperature	Biasing and operational conditions	Tjunction (°C)	R_{TH} junction to Ground (°C/W)	T50 (hours)
Tb=+85°C	Vd=4V/ Id=445mA Pdiss = 1.45W Pin # 2 dBm Pout=24 dBm (OP1dB)	159	50.9	9E+7
Tb=+95°C	Vd=4V/ Id=445mA Pdiss = 1.45W Pin # 2 dBm Pout=24 dBm (OP1dB)	171	52.2	2E+7



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Typical test fixture Sij parameters

Tamb.= +25°C, Vd = +4.0V, Id = 230mA

Freq (GHz)	S11 (dB)	PhS11 (°)	S12 (dB)	PhS12 (°)	S21 (dB)	PhS21 (°)	S22 (dB)	PhS22 (°)
2.0	-1.07	51.8	-66.97	-33.1	-64.70	-34.8	-1.07	51.8
3.0	-1.11	-11.8	-64.40	-90.1	-62.75	-92.3	-1.09	-12.7
4.0	-1.15	-77.7	-67.40	-143.8	-70.76	90.0	-1.05	-79.3
5.0	-1.73	-146.3	-68.84	168.0	-60.37	-70.1	-1.34	-148.9
6.0	-2.39	146.1	-83.79	110.7	-29.73	162.8	-1.58	137.4
7.0	-2.61	78.1	-81.63	148.6	-21.97	7.9	-1.81	60.9
8.0	-2.95	9.2	-76.04	-52.5	-15.62	-117.4	-2.05	-17.7
9.0	-3.65	-61.9	-61.40	-134.8	-9.79	124.9	-2.63	-99.4
10.0	-4.96	-141.5	-53.62	147.8	-4.76	7.9	-3.89	173.6
11.0	-7.40	-124.7	-52.69	88.9	-0.90	-82.3	-5.79	81.1
12.0	-7.90	87.3	-49.84	1.0	3.30	157.8	-7.57	-10.6
13.0	-8.47	3.9	-52.16	-59.4	6.86	53.8	-9.16	-94.2
14.0	-9.19	-70.3	-53.98	-99.4	10.94	-46.6	-11.64	-169.4
15.0	-10.63	-139.6	-54.98	-134.9	15.87	-148.3	-16.51	124.2
16.0	-13.72	154.0	-54.40	-171.1	21.86	100.7	-27.84	121.1
17.0	-15.71	132.2	-54.45	147.9	27.04	-36.2	-15.95	127.3
18.0	-11.14	67.4	-54.88	114.7	26.41	-172.5	-12.19	58.3
19.0	-11.04	5.5	-55.21	90.3	25.90	74.9	-11.70	1.6
20.0	-12.17	-39.1	-52.71	54.1	26.36	-37.7	-13.05	-50.1
21.0	-12.37	-68.8	-49.81	20.1	26.15	-151.6	-16.02	-67.7
22.0	-10.23	-108.8	-48.17	-46.8	25.65	104.7	-11.46	-98.3
23.0	-17.62	-163.2	-53.25	-93.9	27.52	-11.7	-15.70	-146.3
24.0	-15.32	-131.2	-52.07	-105.3	26.88	-133.2	-16.27	-145.8
25.0	-9.99	-168.9	-51.79	-141.5	26.06	105.7	-10.91	-160.9
26.0	-8.17	126.0	-49.56	-153.4	24.49	-20.5	-6.82	136.4
27.0	-9.05	45.7	-44.13	166.0	20.66	-148.9	-6.10	52.1
28.0	-9.66	-30.2	-40.51	105.0	15.31	94.2	-6.26	-32.5
29.0	-8.13	-97.8	-38.79	31.6	9.93	-14.0	-5.33	-103.9
30.0	-5.76	-162.0	-41.01	-35.6	4.38	-119.1	-3.89	-166.5
31.0	-4.47	137.5	-44.25	-93.3	-1.54	142.4	-2.98	137.8
32.0	-4.20	78.5	-49.31	-139.5	-7.18	49.5	-2.63	84.9
33.0	-4.54	17.2	-56.22	-165.7	-12.39	-40.7	-2.62	29.5
34.0	-4.94	-45.9	-59.42	-136.5	-17.40	-128.1	-2.57	-28.3
35.0	-5.75	-109.1	-51.36	-101.8	-22.45	149.4	-2.48	-86.5
36.0	-7.06	-172.4	-39.82	-150.9	-28.69	75.1	-2.41	-144.8
37.0	-9.37	126.4	-33.50	114.3	-33.02	34.4	-2.31	161.4
38.0	-15.98	61.3	-35.77	32.6	-36.77	-39.2	-2.17	111.6
39.0	-17.26	175.7	-38.75	-21.1	-49.02	-92.9	-2.27	60.8
40.0	-7.28	106.7	-40.00	-49.6	-44.29	-16.7	-2.56	9.7

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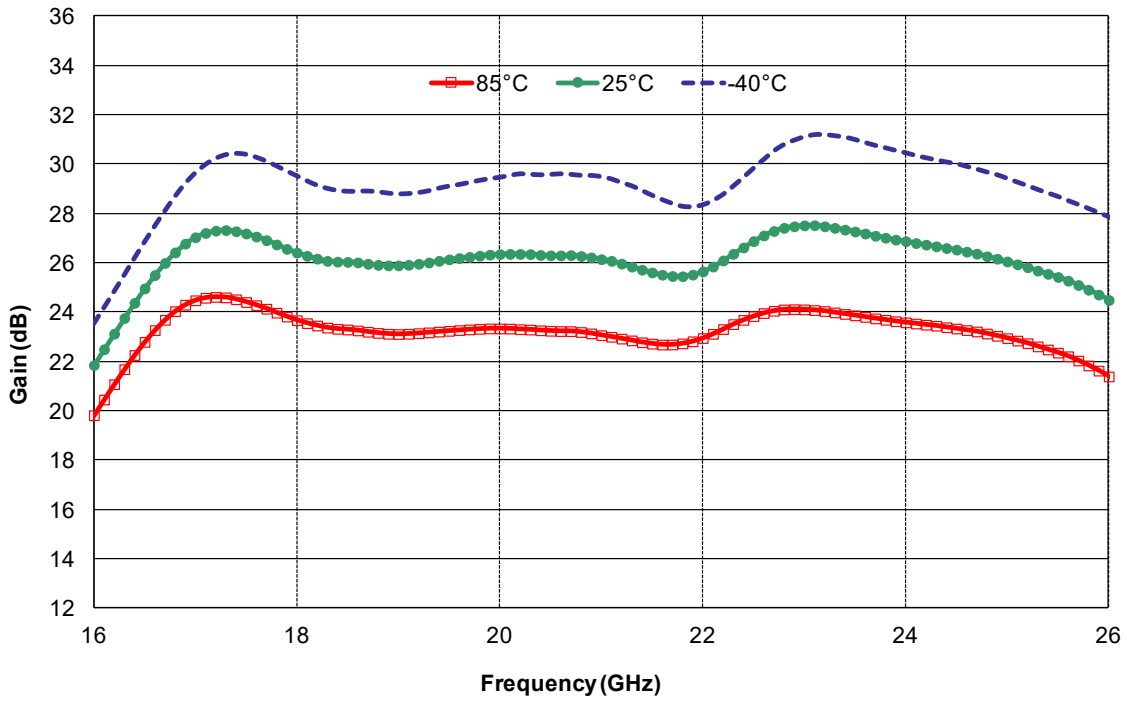
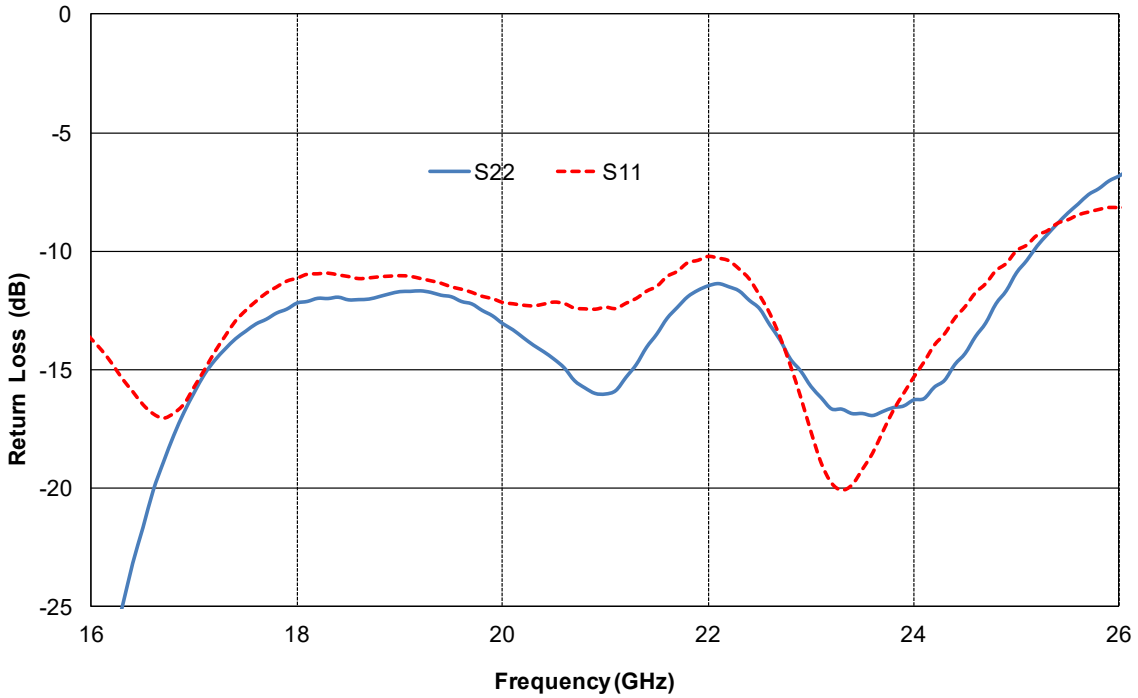
Typical Test Fixture Measurements

Tamb.= +25°C, Vd = +4.0V, Id = 230mA
These values are representative of test fixture measurements.

Linear Gain versus Frequency in Temperature



Return losses versus Frequency



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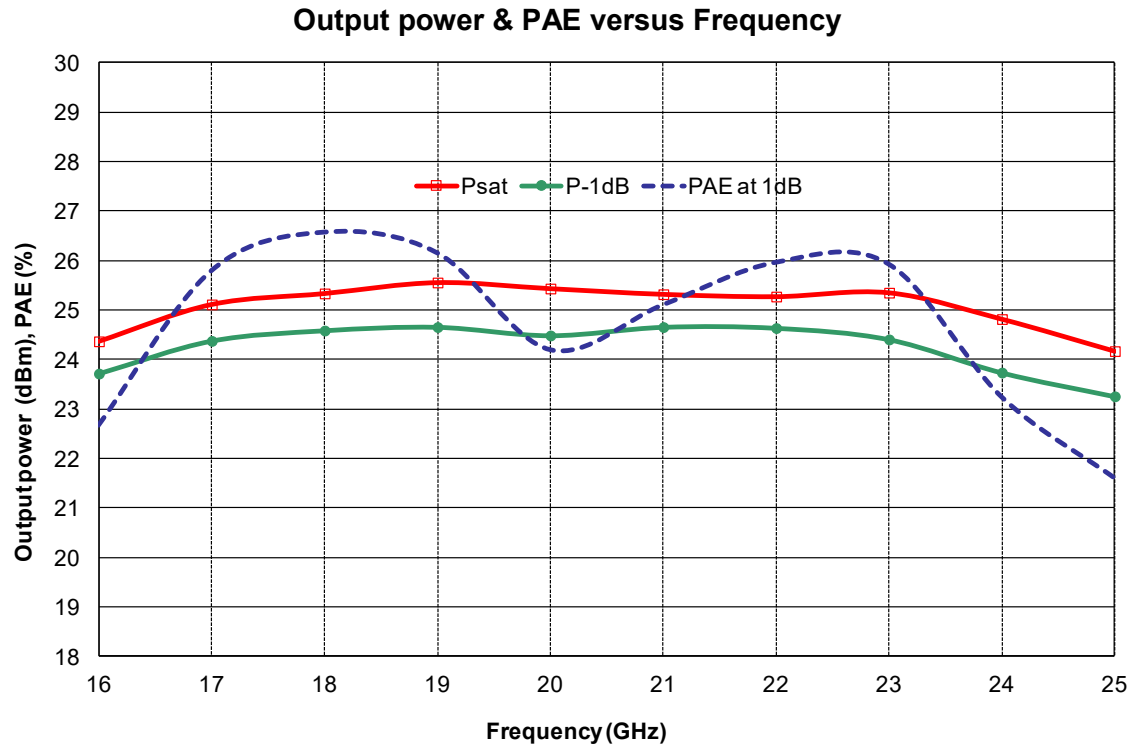
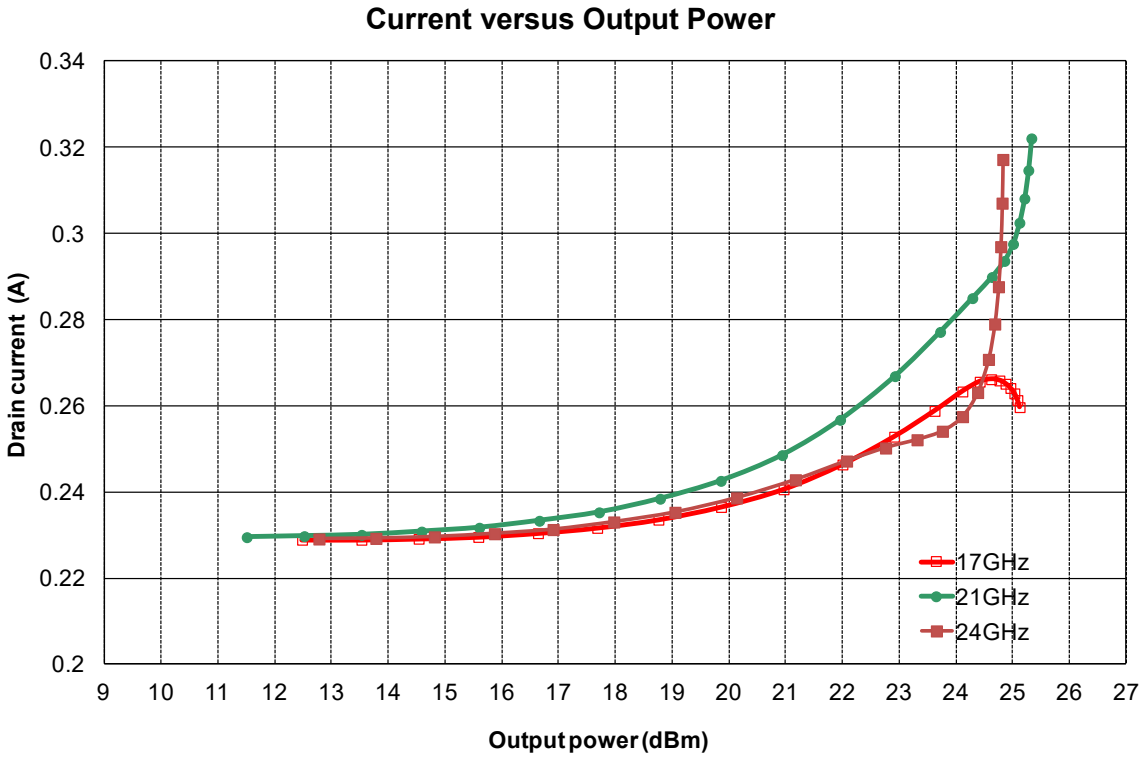
Typical Board Measurements

Tamb.= +25°C, Vd = +4.0V, Id = 230mA





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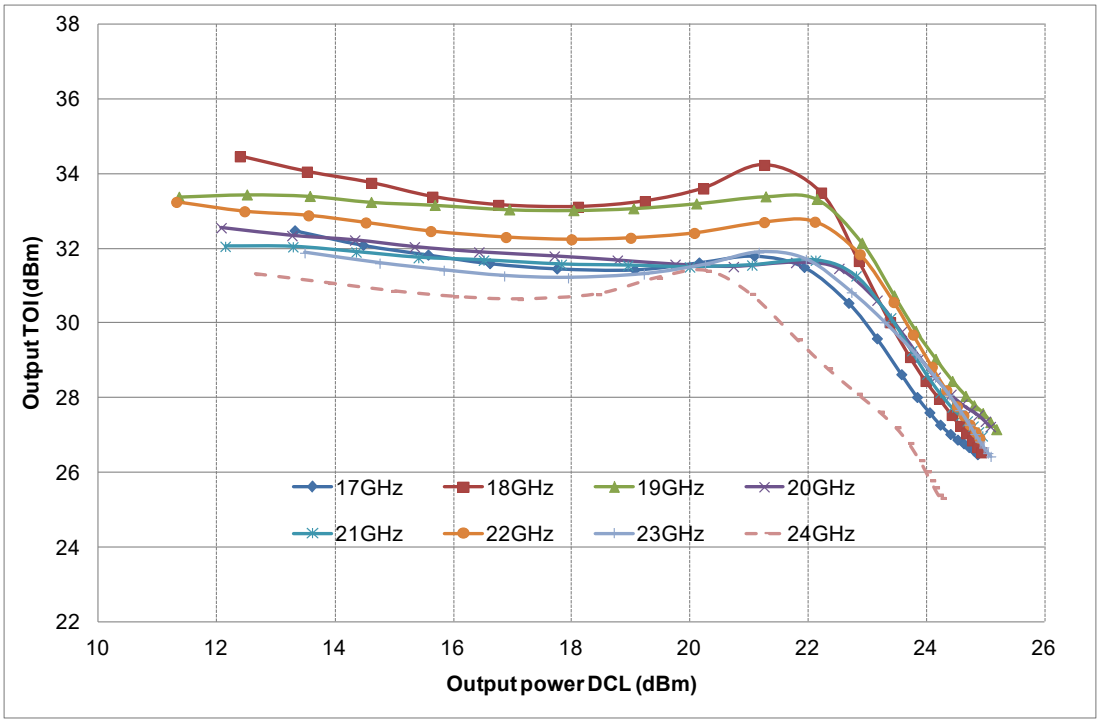
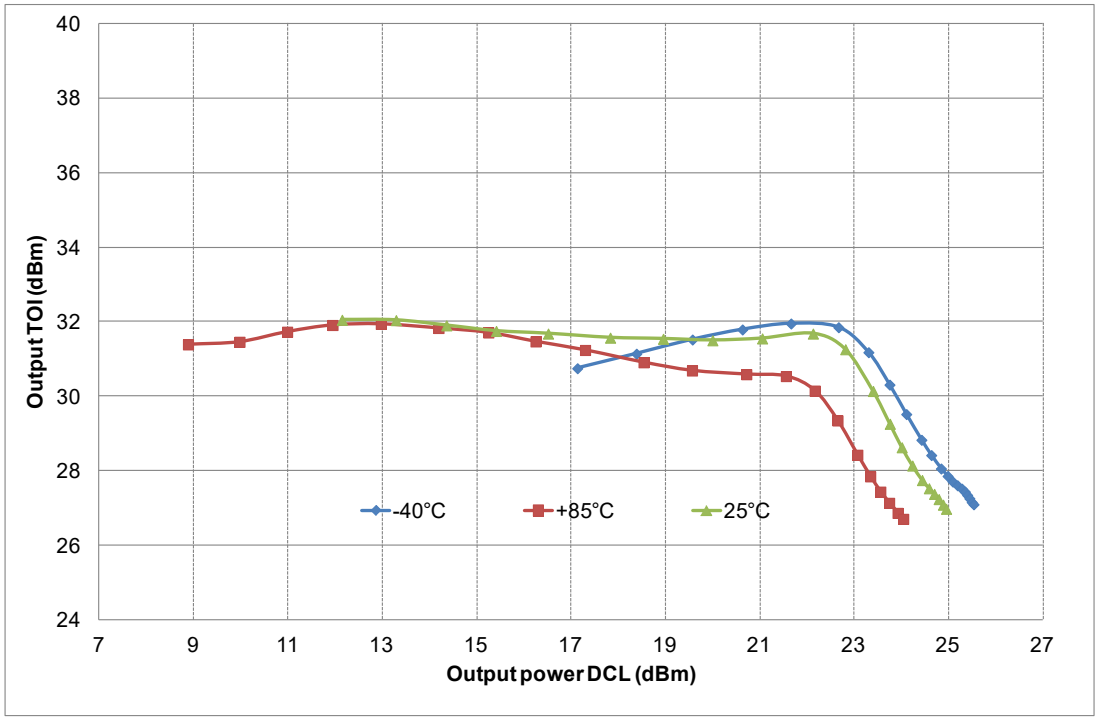
Typical Board Measurements

Tamb.= +25°C, Vd = +4.0V, Id = 230mA

Output TOI versus Output Power DCL & Frequency



Output TOI versus Output Power DCL in Temperature at 21GHz



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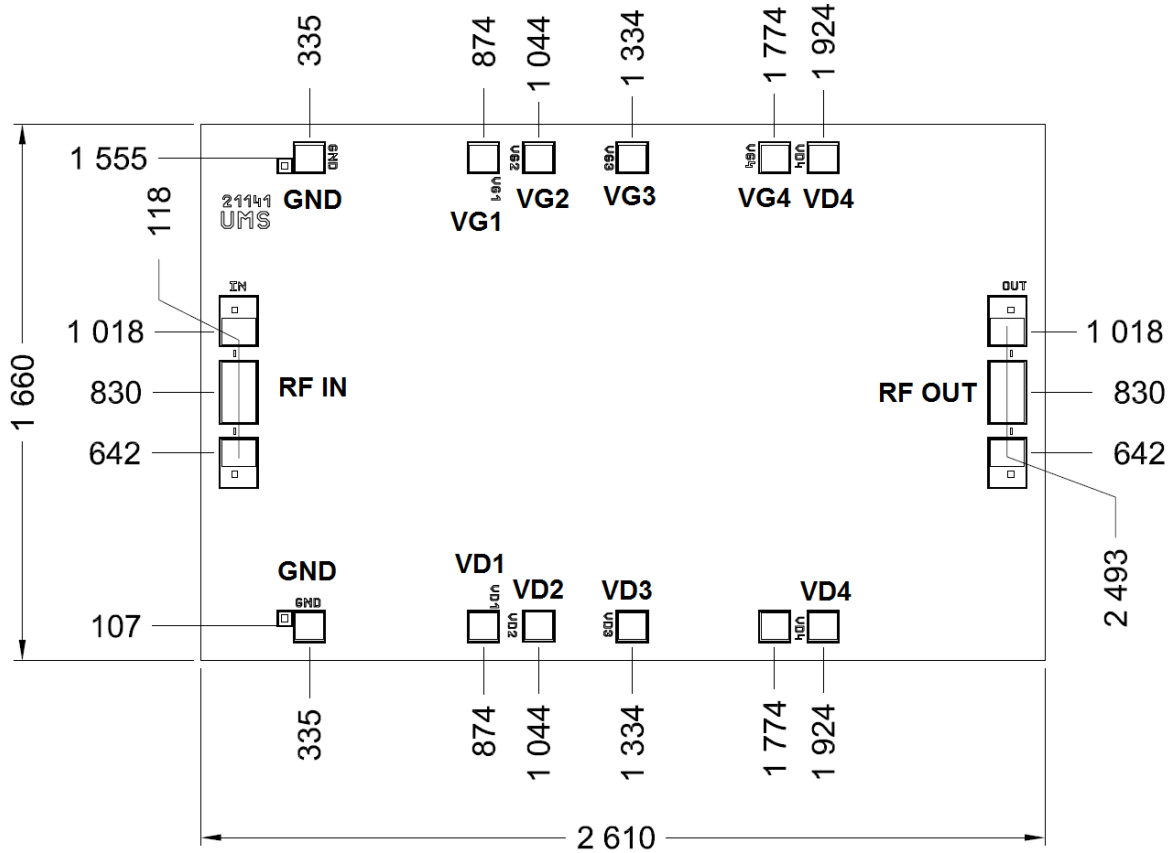
Mechanical data



Chip thickness: 70µm.
Chip size: 2610x1660 ±35µm
All dimensions are in micrometers

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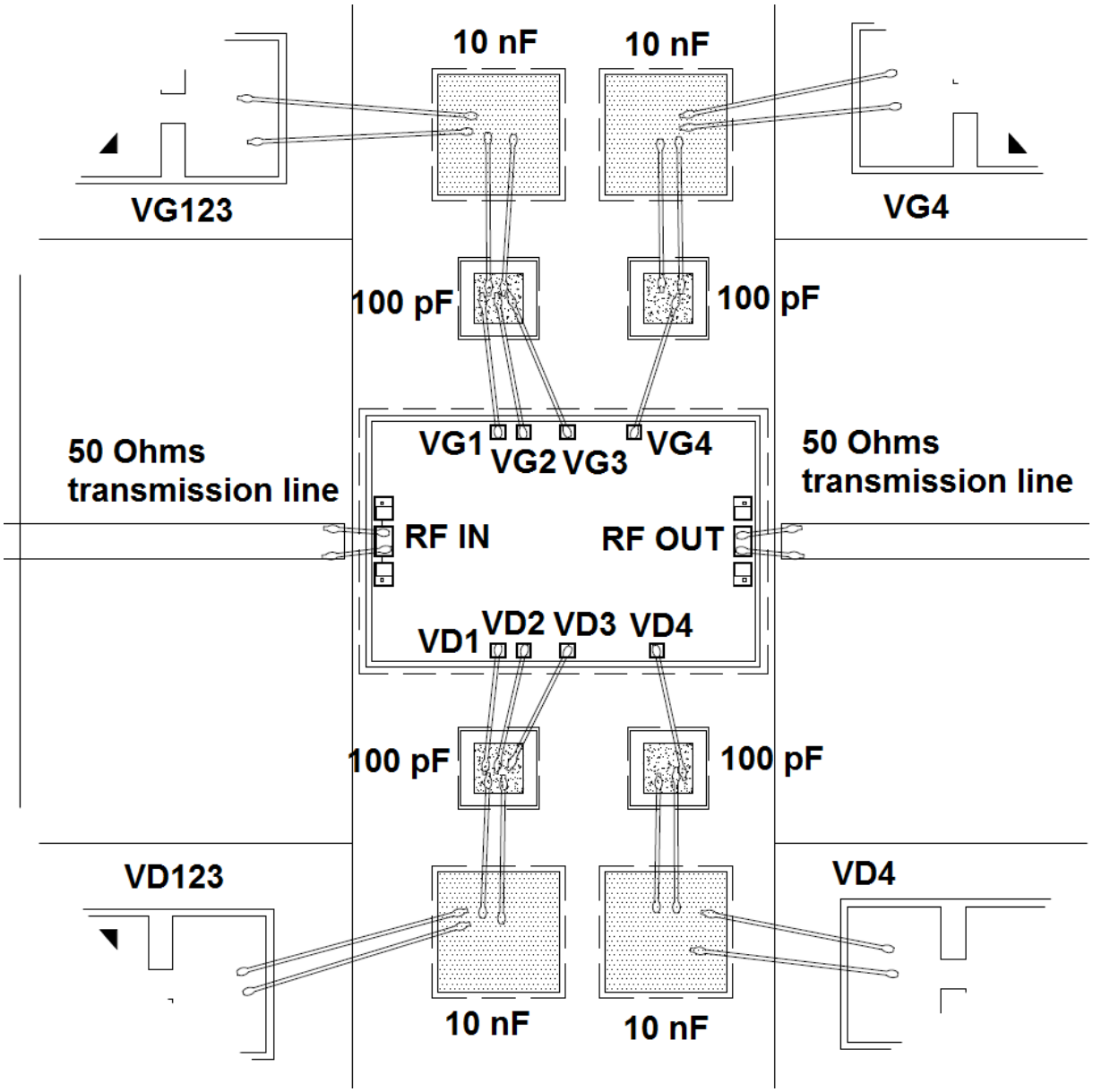
Recommended assembly plan



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

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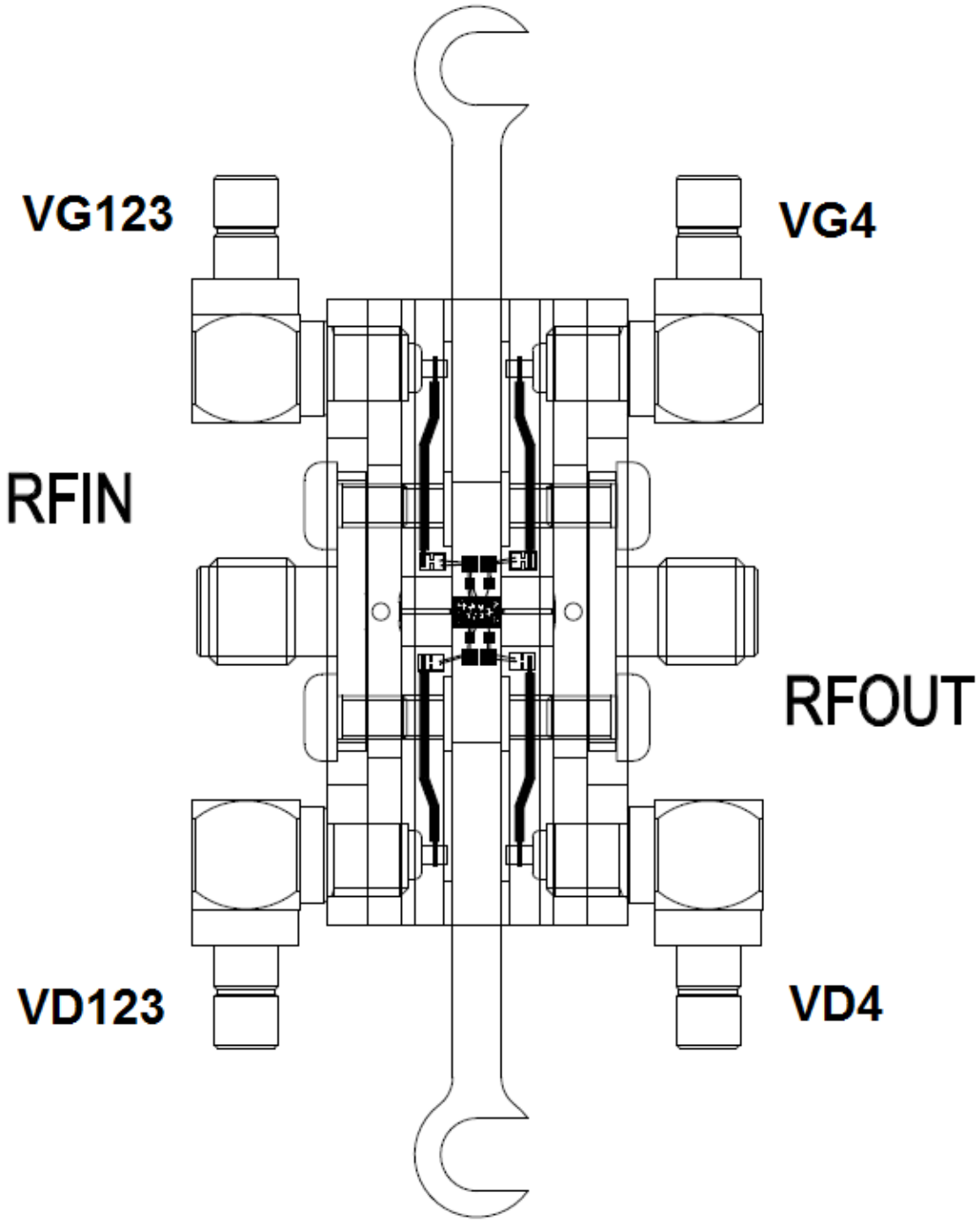
Evaluation test fixture



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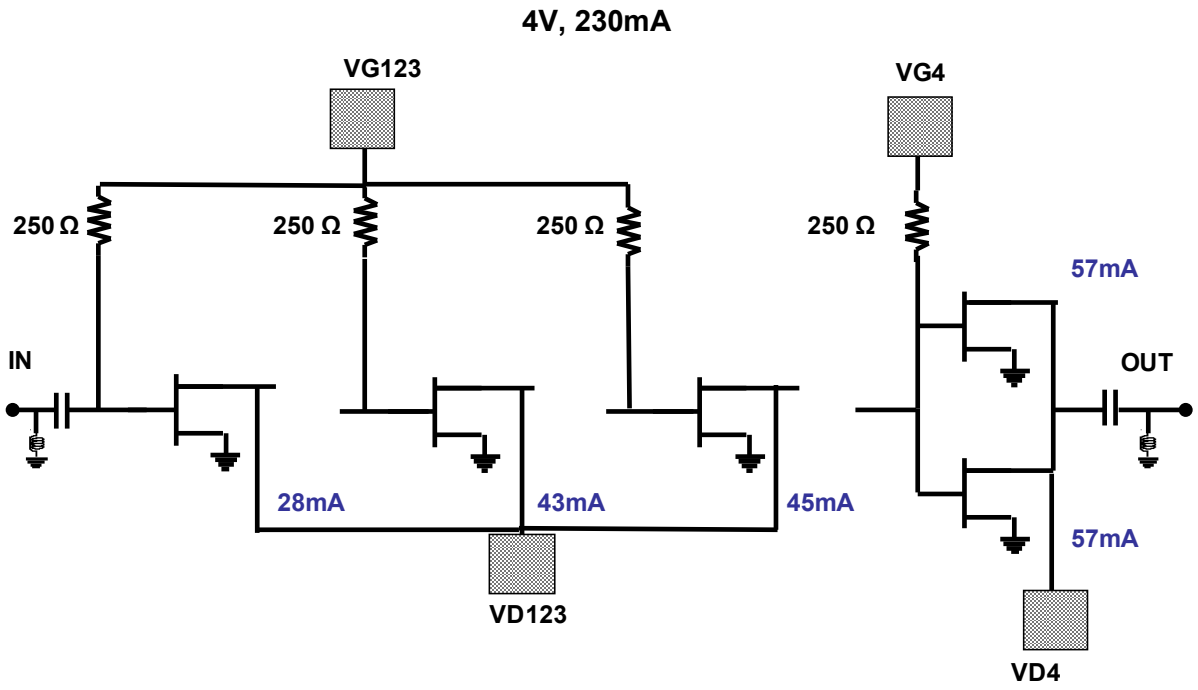
DC Schematic



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Notes

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Recommended reflow process assembly

Refer to the application note AN0001 available at https://www.ums-rf.com for die attach.

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:	CHA4253a98F/00

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