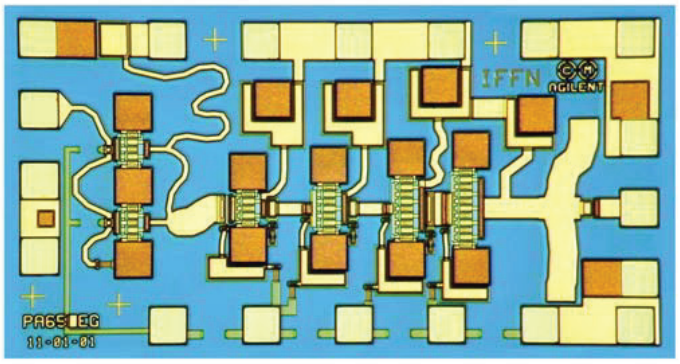
Keysight 1GG6-8070

40–68 GHz Medium Power Amplifier

TC956

Data Sheet



Features

- Frequency range:
  30–70 GHz usable range
- Small signal gain: 18.8 dB
- P–1 dB: 14 dBm
- P–3 dB: 17.6 dBm
- Return loss:
  - 10 dB input
  - 10 dB output

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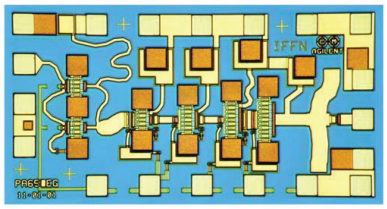
Description

The TC956 is a high–gain, medium–power mm–wave amplifier. It can be used as part of a banded solution to achieve respectable mm–wave power. Input and output ports are matched to 50 Ω.

The amplifier is biased with a single positive drain supply (V_{DD}) and a single negative gate supply (V_{G1}).



Chip size:
1440 x 780 µm (56.7 x 30.7 mils)
Chip size tolerance:
±10 µm (±0.4 mils)
Chip thickness:
62.5 ± 15 µm (2.5 ± 0.6 mils)
Pad dimensions:
80 x 80 µm (3.2 x 3.2 mils)

TC956

Absolute Maximum Ratings[1]

Symbol	Parameters/conditions	Minimum	Maximum	Units
$V_{D1,2-5}$	Drain supply voltage		3.25	Volts
I_{DD}	Total drain current		350	mA
$V_{G1,2-3,4,5}$	Gate voltage	–2.5	0.6	Volts
P_{DC}	DC power dissipation		1.2	Watts
P_{in}	CW input power		10	dBm
T_A	Backside ambient temperature	–55	75	°C
T_{ch}	Operating channel temperature[2]		160	°C
T_{case}	Operating case temperature	–55		°C
T_{stg}	Storage temperature	–65	165	°C

1. Operation in excess of any one of these conditions may result in permanent damage to this device. T_A = 25 °C except for T_{ch}, T_{stg}, and T_{max}.
2. Refer to DC specifications/physical properties table for derating information.

DC Specifications/Physical Properties[1]

Symbol	Parameters/conditions	Minimum	Typical	Maximum	Units
V_{DD}	Drain supply operating voltage	2	3	3	Volts
I_{DD}	Drain supply operating current (V_{DD} = 3.0 V, V_{GG} = –0.1 V)		330		mA
V_{GG}	Gate supply operating voltage (V_{DD} = 3.0 V, I_{DD} = 330 mA)	–0.6	–0.1	0.5	Volts
V_P	Gate supply pinch–off voltage (V_{DD} = 3.0 V, $I_{DD} \leq$ 17 mA)		–1.2		Volts
θ_{ch-bs}	Thermal resistance (channel to backside at T_{ch} = 160 °C)			85	°C/Watt
T_{ch}	Channel temperature[2] (T_A = 75 °C, MTTF > 10^6 hours, V_{DD} = 3.0 V, I_{DD} = 330 mA)		160		°C

1. Measured in wafer form with T_{chuck} = 25 °C unless otherwise noted.
2. Derate MTTF by a factor of 2 for every 8 °C above T_{ch}.

RF Specifications[1]

		Minimum	Typical	Maximum	Units
BW	Guaranteed bandwidth	40		68	GHz
Gain	Small signal gain	17	18		dB
Flatness	Small signal gain flatness		±1.3		dB
RL_{in}	Input return loss	8	10		dB
RL_{out}	Output return loss	8	10		dB
Isolation	Reverse isolation		40		dB
$P_{-1\ dB}$	Output power at 1 dB gain compression	13[2]	14		dBm
P_{sat}	Saturated output power	16[2]	17.6		dBm
NF	Noise figure		10		dB

1. Measured on wafer with T_{chuck} = 25 °C. Numbers given are minimum across the 40–67 band unless otherwise noted.
2. On–wafer gain and power measurements at 68 GHz have a measurement uncertainty of 1.5 dB. The number shown does not include guardband.

Applications

The TC956 amplifier offers high gain and power to mm frequencies. It can be used in mm–wave products with high power requirements, or in conjunction with a TC958 or TC906 in a banded design.

Biasing and Operation

The recommended bias conditions are to connect the drains to a shared 3 V supply and connect all gate pads to a shared, adjustable negative voltage. The gate voltage is adjusted for total drain supply current of 330 mA. Drain pains 2–4 are internally connected; either multiple bonds or a single bond is acceptable. Positive gate voltage can generate drain currents as high as 700 mA, so be sure that the bonds have sufficient capacity. Likewise, all gates can be controlled with a single bond wire attached to V_{G4}. The RF input matching circuity gives a 50 Ω DC and RF path to ground. A DC blocking capacitor should be used in the RF input transmission line. Any DC voltage applied to the RF input must be maintained below 1 V; DC voltage on the RF output can range from –7 V to +13 V.

No ground wires are needed since ground connections are made with plated through–holes to the backside of the device.

Reliability limits assume long–term operation into a 50 Ω match, with short–term excursions to an open circuit. Reliability will be degraded with long–term operation into an open circuit.

Assembly Techniques

For most applications, we recommend solder die attach. Reliability goals are modeled using solder attach to an infinite heat sink at 85 °C ambient. Epoxy attach requires 69 °C ambient. It is recommended that the RF input and output connectors be made using 500 lines per inch, or equivalent gold wire mesh. The RF connections should be kept as short as possible to minimize inductance. The DC bias supply wires can be 0.7 mil diameter gold.

MMIC ESD precautions, handling considerations, and die attach and bonding methods are critical factors in successful GaAs MMIC performance and reliability.

Additional References

Keysight Technologies, Inc. application note, *GaAs MMIC ESD, Die Attach and Bonding Guidelines* - Application Note (5991-3498EN) provides additional information on these subjects.

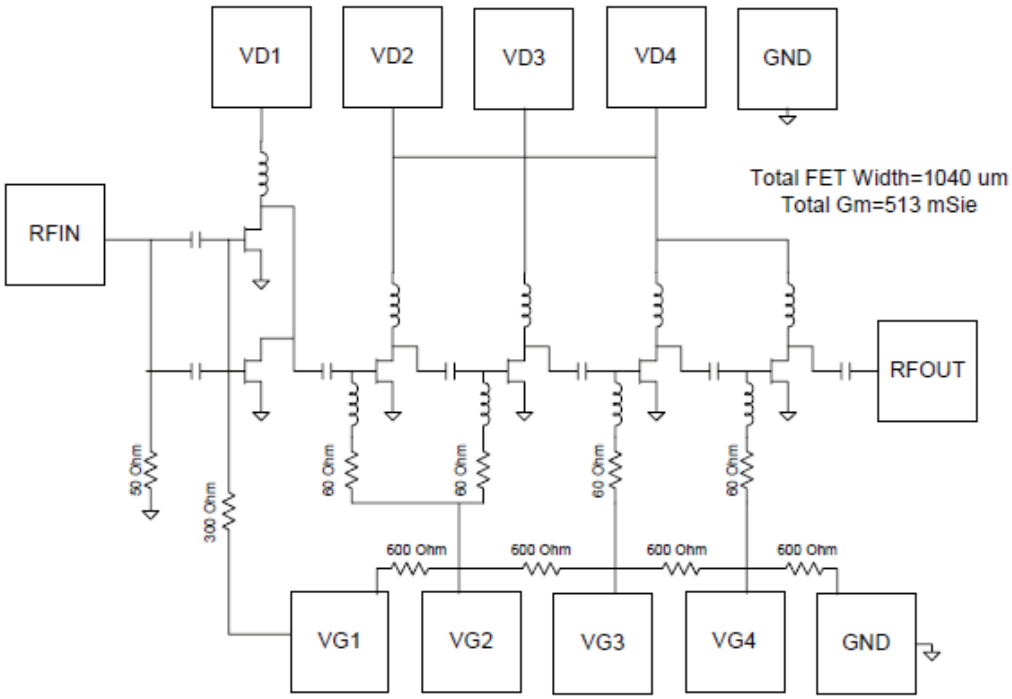


Figure 1. 1GG6-8070 schematic

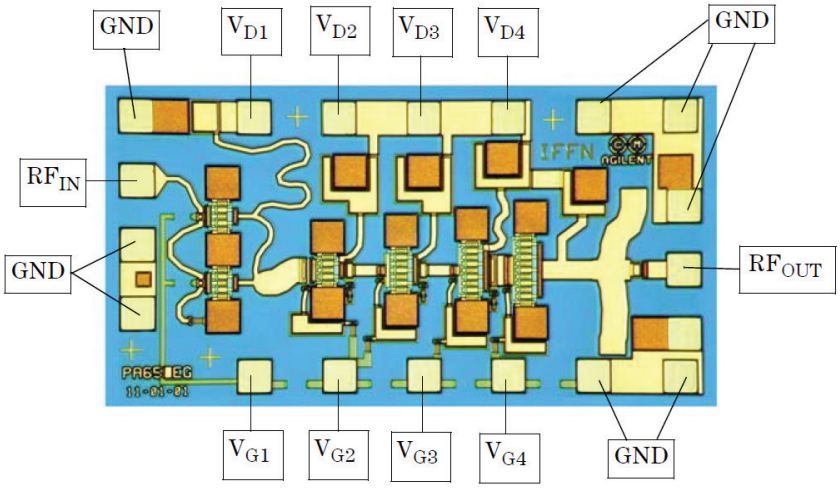


Figure 2. 1GG6-8070 pad locations

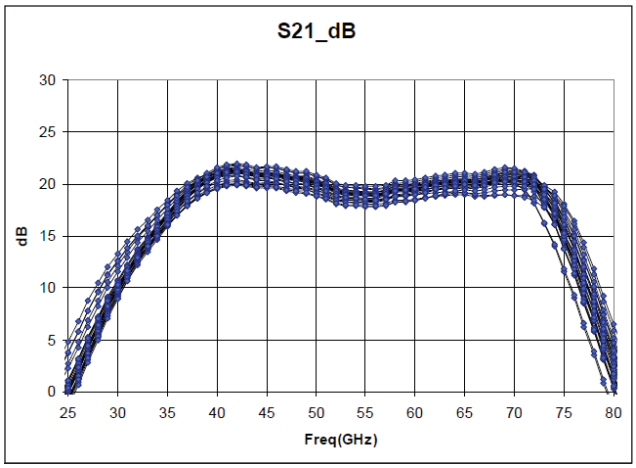


Figure 3. 1GG6-8070 gain

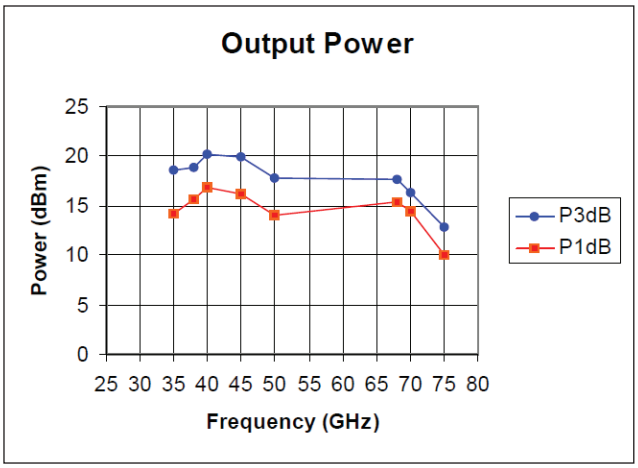


Figure 4. 1GG6-8070 output power

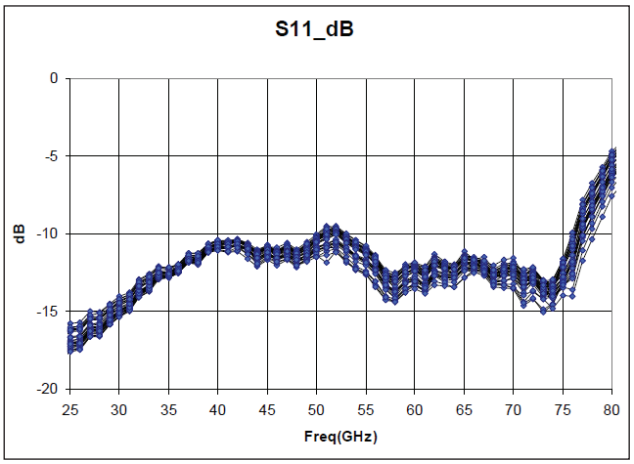


Figure 5. 1GG6-8070 input loss

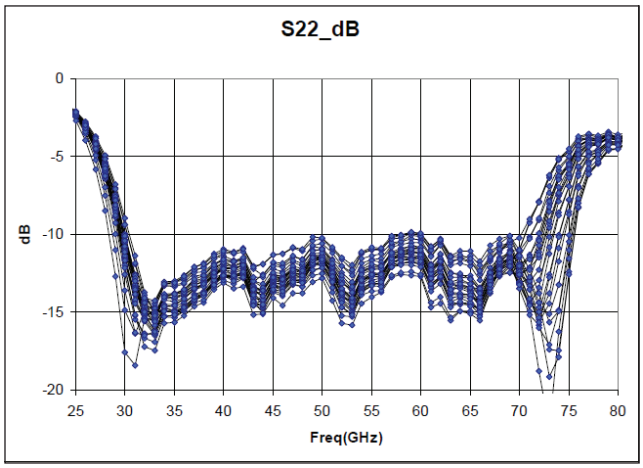


Figure 6. 1GG6-8070 output loss

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In this data sheet the term typical refers to the 50th percentile performance. For additional information and support email: mmic_helpline@keysight.com.

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