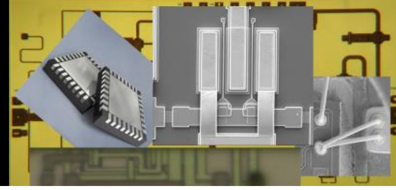
TMC162D
DC-20 GHz Distributed Low Noise Amplifier



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Product Features

- RF frequency: DC to 20 GHz
- Linear Gain: 19 dB
- Noise Figure: 2.5 dB
- Die Size: X=3.22 mm, Y=1.55 mm, Z=0.1mm
- DC Power: 8 VDC, 160 mA

Application

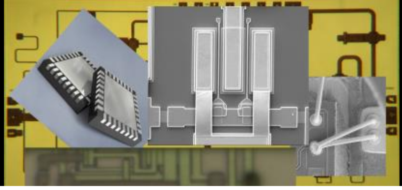
- Point-to-Point Radios and VSATs
- Test instrumentation
- Fiber Optics
- Military, EW and Space

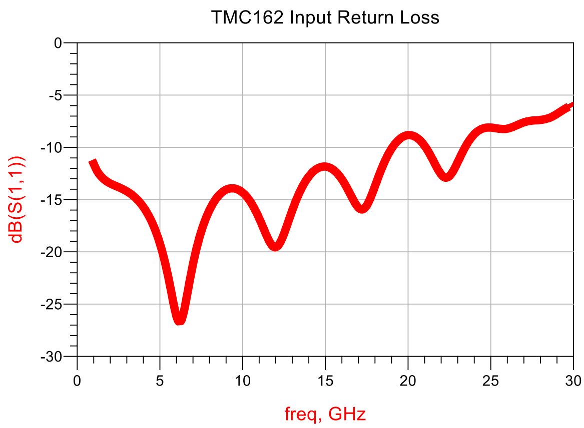
Product Description

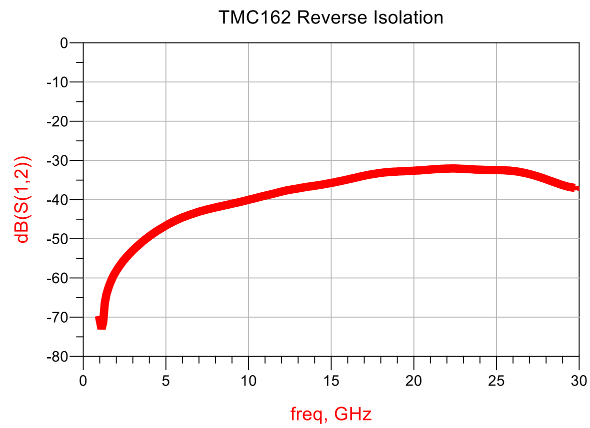
The TMC162D GaAs PHEMT Distributed amplifier is a broadband low noise and high linearity device, designed for use in Radios, Test instrumentation, Military, OC192 LN/MZ Modulator Driver, EW and Space applications. The TMC162D is a 50 Ω matched design providing 2.5dB of noise figure, 19dB of gain and 31dBm of OIP3 and eliminates the need for RF port matching. The typical bias for TMC162D is 8V and 160mA but it can be biased to as low as 5V and 125mA with excellent performance. Both bond pad and backside metallization are Au-based that is compatible with ribbon and wedge bonding and high conductivity epoxy and eutectic die attach methods. The packaged version is available as TMC162 in a 20 lead 5x5 QFN.

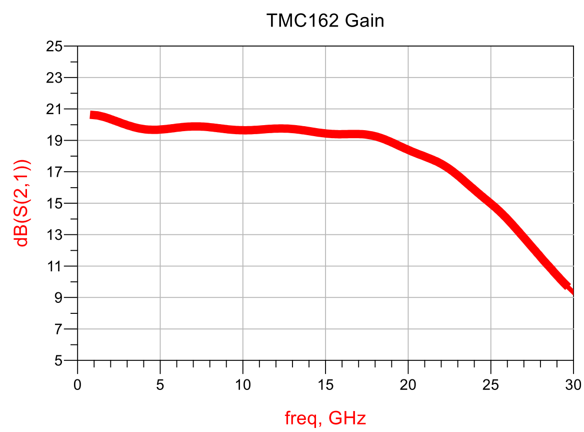
Electrical Performance : **VDD = 8 V, VG1 = -0.6 V, TA = 25 °C, F = 15 GHz**

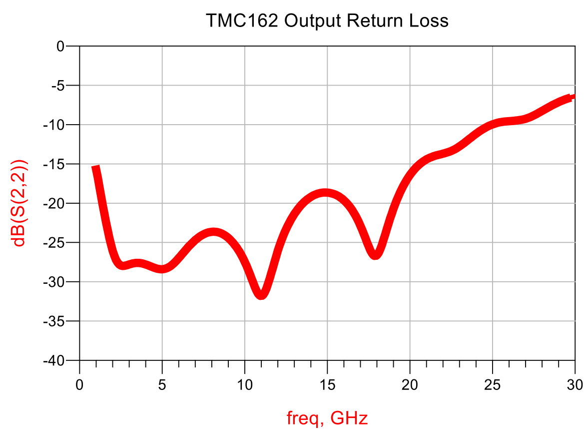
	min	Typ	Max	Units
Frequency	DC		20	GHz
Gain		19		dB
P1dB		24		dBm
Psat		25		dBm
Noise Figure		2.5		dB
OIP3		31		dBm
Bias Voltage		8		V
Bias Current		160		mA

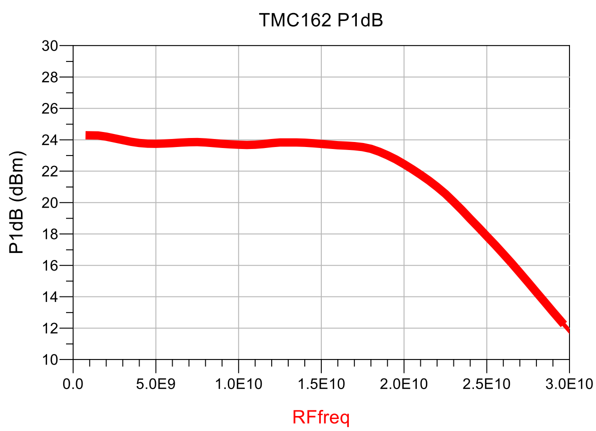


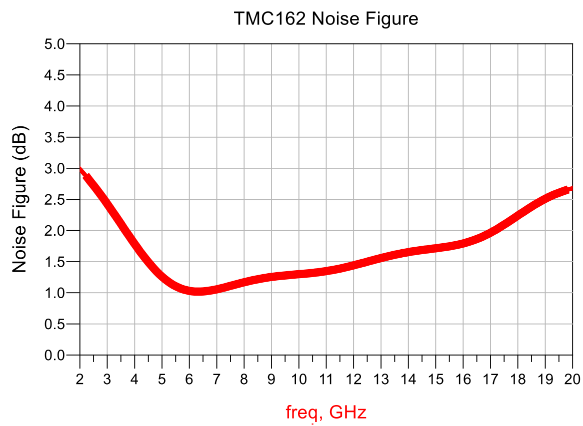

TMC162 Input Return Loss
dB(S(1,1))
0
-5
-10
-15
-20
-25
-30
0
5
10
15
20
25
30
freq, GHz

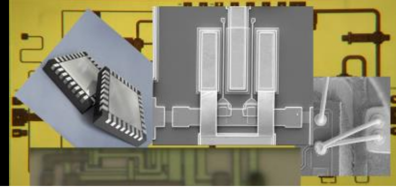

TMC162 Reverse Isolation
dB(S(1,2))
0
-10
-20
-30
-40
-50
-60
-70
-80
0
5
10
15
20
25
30
freq, GHz

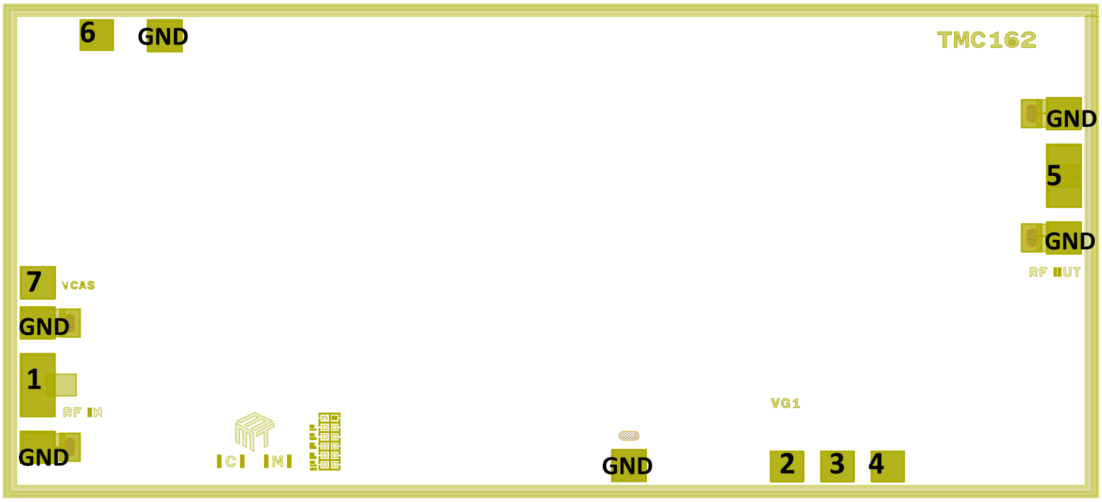

TMC162 Gain
dB(S(2,1))
25
23
21
19
17
15
13
11
9
7
5
0
5
10
15
20
25
30
freq, GHz


TMC162 Output Return Loss
dB(S(2,2))
0
-5
-10
-15
-20
-25
-30
-35
-40
0
5
10
15
20
25
30
freq, GHz


TMC162 P1dB
P1dB (dBm)
30
28
26
24
22
20
18
16
14
12
10
0.0
5.0E9
1.0E10
1.5E10
2.0E10
2.5E10
3.0E10
RFfreq

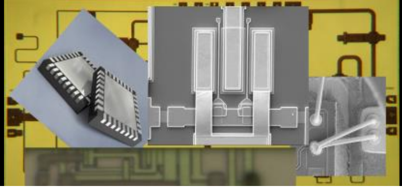

TMC162 Noise Figure
Noise Figure (dB)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
freq, GHz





Pad #	Function	Description
1	RF INPUT	This pad is DC coupled and matched to 50 Ohms. Blocking capacitor is required.
2	VGG1 Bias	Gate control 1 for amplifier. Attach 100pF/0.01uF bypass capacitors.
3	ACG1	Low frequency termination. Attach 1000pF chip bypass capacitor.
4	ACG2	Low frequency termination. Attach 0.47uF chip bypass capacitor.
5	RF OUTPUT & VDD	RF output for amplifier. Connect DC bias (Vdd) network to provide drain current (Idd). See application circuit herein.
6	ACG3	Low frequency termination. Attach 100pF/0.01uF chip bypass capacitors.
7	VGG2 (VCAS)	Gate 2 for amplifier. Attach 100pF/0.01uF chip bypass capacitors. Typical operation has VGG2(VCAS) biased internal to IC. Setting VGG2 externally can be used to adjust NF, Gain and OIP3.

- Backside of the IC must be connected to a DC/RF ground with high thermal and electrical conductivity.
- DXF and detailed assembly drawings are available on request.



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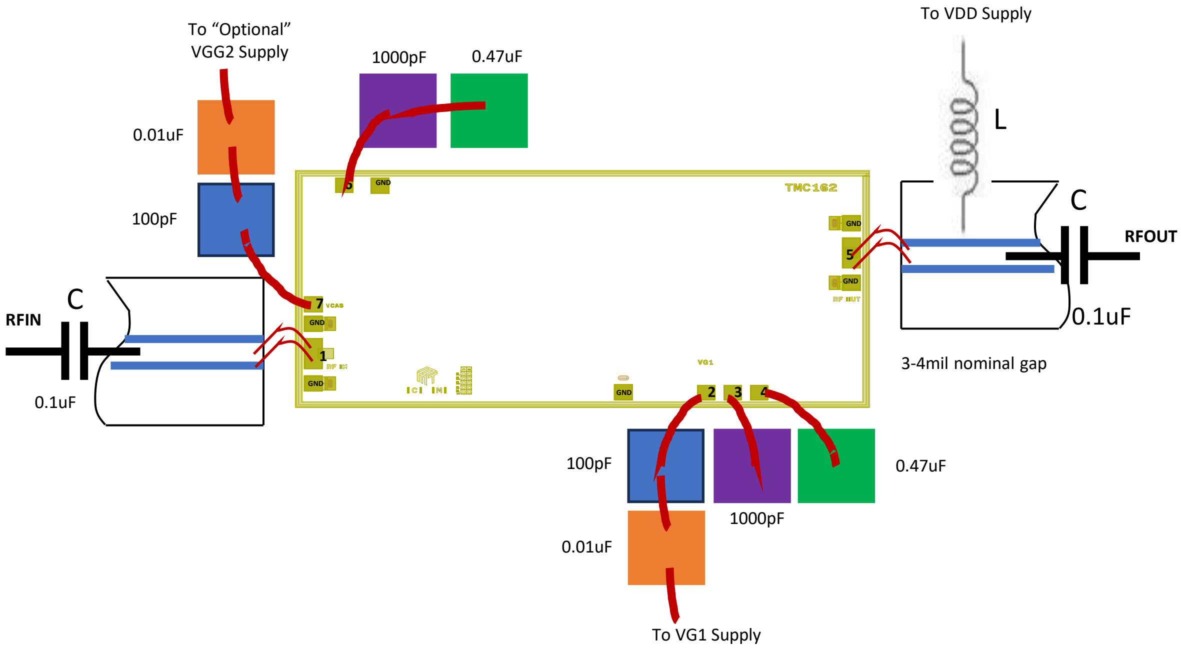
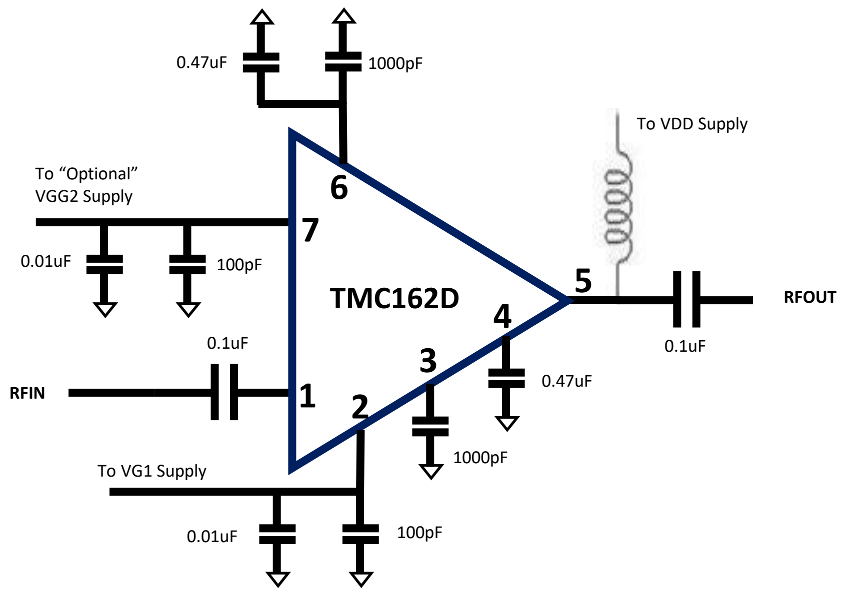
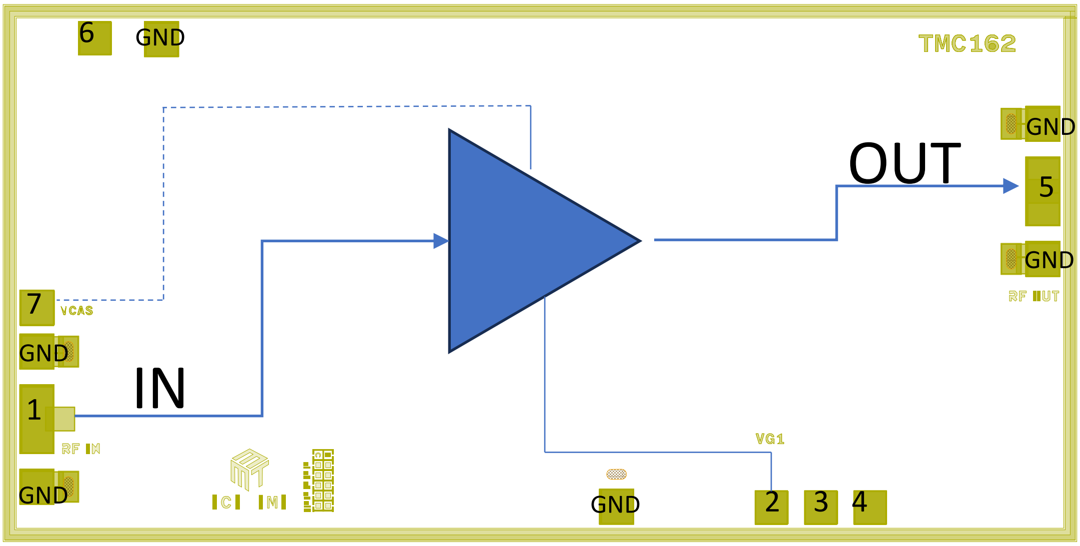
Assembly Diagram

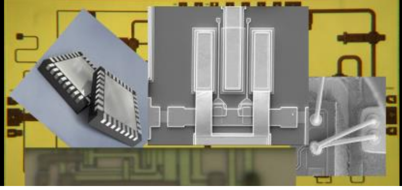


Application Circuit





	Absolute Maximum Ratings
Drain Bias Voltage (VDD)	+10V
Gate Bias Voltage (VG1)	-2 to 0V
Gate Bias Current (IG1)	+4mA
RF Input Power (RFIN)(VDD=+8V)	+25 dBm
Channel Temperature	175 °C
Continuous Pdiss (T = 85 °C) (derate 39.1 mW/°C above 85 °C)	2.56 W
Thermal Resistance (channel to die bottom)	35.2 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature for MTTF > 1E6 hours	-55 to +125 °C



Recommended Biasing

The TMC162D is operated with one positive supply VDD and one negative supply voltage VGG. The positive supply must be connected to the output pad through a bias-T. The negative voltage VGG should be connected to VG1 pad on the die. The VGG is biased to -1V first, then VDD is gradually biased to +8V and finally, VG1 is adjusted to around -0.6V for IDD=160mA DC current.

Reverse the sequence during power down, i.e. bring the VGG to -1V, lower VDD to 0V, and then VGG to 0.

Assembly Techniques

The TMC162D is fabricated using a GaAs-based semiconductor material structure. All bare die are placed Gel based ESD protective containers, and then sealed in an ESD protective bag for shipment. Once the sealed ESD protective bag has been opened, all die should be stored in a humidity-controlled dry nitrogen environment.

Use a vacuum collet sized to handle the chip along the edges to avoid touching the air bridges. The die is back-metalized and can be mounted with standard AuSn eutectic or conductive epoxy assembly techniques. The mounting surface should be clean and flat.

Eutectic Die Attach:

The most common eutectic alloy used in die attach is the gold-tin (AuSn) alloy. With a melting point of 280°C, it provides a strong, reliable bond without requiring excessively high temperatures that could potentially damage the die or the substrate. Eutectic die attach is generally performed in a two-step process. First, the eutectic alloy is deposited onto the die or substrate, often by a process such as electroplating or sputtering. This forms what is known as the "preform". Next, the die is placed onto the preform, and the assembly is heated to the melting point of the alloy. This causes the alloy to reflow, spreading out to cover the entire interface between the die and the substrate. Once cooled, the alloy solidifies, creating a robust bond between the die and the substrate. A 80/20 AuSn preform with a work surface temperature of 255 °C is recommended. The tool temperature of 265 °should be used. The chip should not be exposed to a temperature greater than 300 °C for more than 45 seconds. A maximum 3 seconds of scrubbing should be sufficient for die attachment.

Epoxy Die Attach:

Apply a minimum amount of epoxy such as Ablestick 84-1LMI m(0.25-0.75mil) to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip once it is placed into position. Cure epoxy per the manufacturer's schedule. The epoxy fillet around the die should be approximately half-way up the side of the 4-mil thick MMIC. Too little epoxy may lead to voids, too much epoxy may lead to stringers and shorts to the front-side metal.

Wire Bonding:

RF wadge bonds made with two 1 mil wires are recommended for RF ports. A single 1mil wire can be used for DC pads. Ensure the bonding tool is grounded. These bonds could be bonded thermosonically with a force of 50 grams and a stage temperature of 150 °C. Use a shim under the die to bring the top surface of the die level with the RF input and output transmission line to shorten wirebonds to < 10mil.

ESD Warning

III-V MMICs are ESD-sensitive. Preventative ESD measures must be employed in all aspects of storage, handling, and assembly. Grounding is critical for floors and all work surfaces, bonding and handling equipment, and other test or assembly machinery. MMIC ESD precautions, handling considerations, and die-attach and bonding methods are critical factors in successful III-V MMIC performance and reliability. Operators should always wear wrist or foot ground straps. ESD test equipment should be available to insure proper ESD grounding at all times.

RoHS Compliance

This part is RoHS compliant, meeting the requirements of the EU Restriction of Hazardous Substances Directive 2002/95/EC, commonly known as RoHS. Six substances are regulated: lead, mercury, cadmium, chromium VI (hexavalent chromium), polybrominated biphenyls (PBB), and polybrominated biphenyl ethers (PBDE). RoHS compliance requires that any residual concentration of these substances is below the Directive's maximum concentration values (MCV): cadmium 100ppm by weight and all others 1000ppm by weight.

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