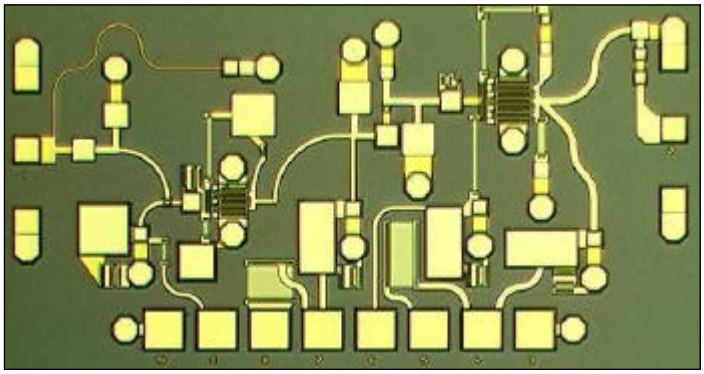
HEMT MMIC Driver Amplifier, 25 - 30GHz



Features

· Over 22dBm Output Power @ 28GHz
· 10dB Gain from 25 to 30GHz
· Small 2 x 1mm Die Size

Description

The P35-5126-000-200 is a high performance 25-30GHz Gallium Arsenide driver amplifier. This product is intended for use in fixed-point microwave systems and satellite communications.

The die is fabricated using MOC's 0.20μm gate length, Power HEMT process (H40P) and is fully protected using Silicon Nitride passivation for excellent performance and reliability.

Electrical Performance

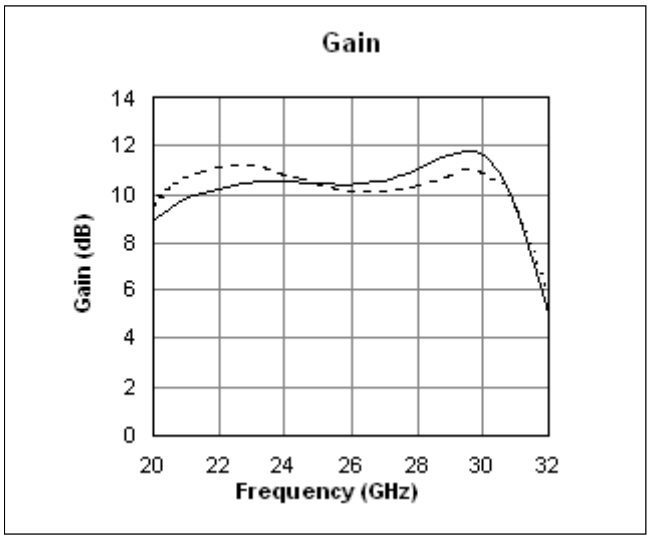
Ambient Temperature 22±3° C, Z_O = 50Ω, Vdd = 4.V, Vg1 set for Id1=50mA, Vg2 set for Id2=90mA U.O.S

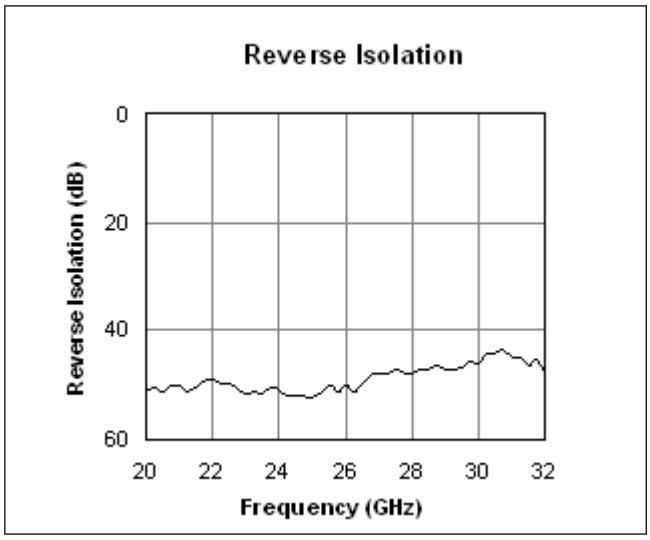
Parameter	Conditions	Min	Typ	Max	Units
Small Signal Gain	25 - 30GHz	8	10	-	dB
Gain slope	25 - 30GHz	-	± 0.5	-	dB
Input Return Loss	25 - 30GHz	4	10	-	dB
Output Return Loss	25 - 30GHz	10	12	-	dB
Output power at 1dB gain compression	28GHz, Vdd 5V	19	22	-	dBm
First Stage Current	-	-	50	-	mA
Second Stage Current	-	-	90	-	mA
Thermal Resistance	-	-	130	-	°C/W

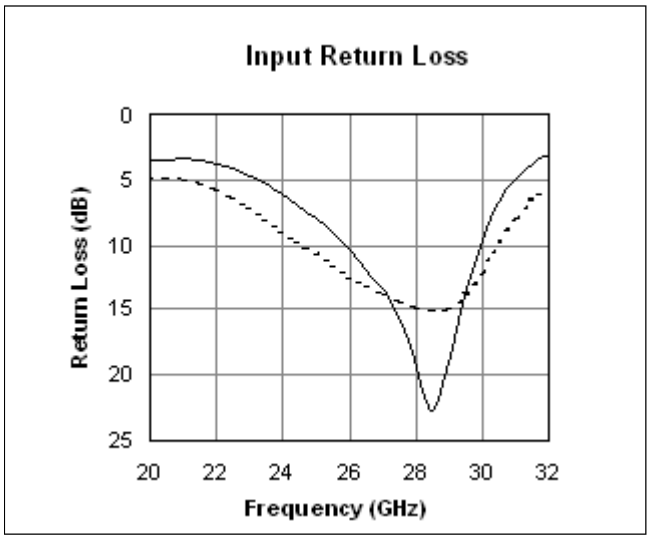
Notes

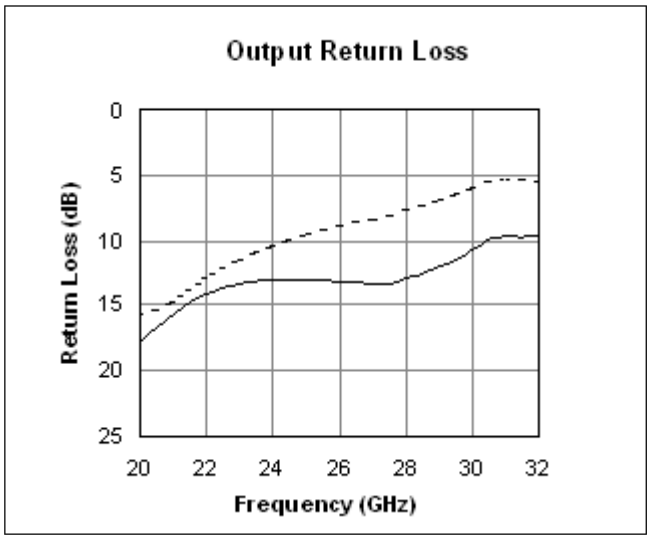
1. All parameters measured on wafer

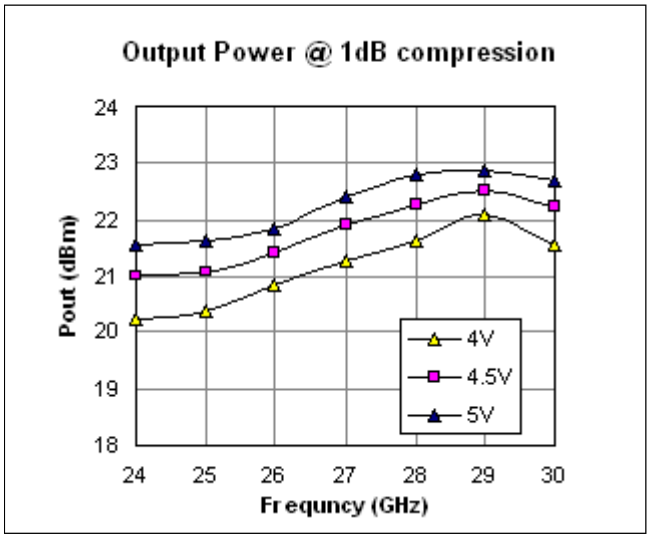
Typical RFOW Performance (----- With Bondwires)

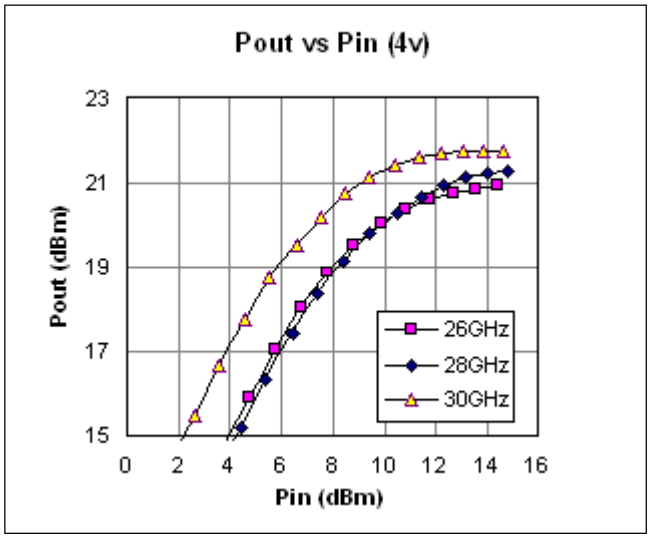




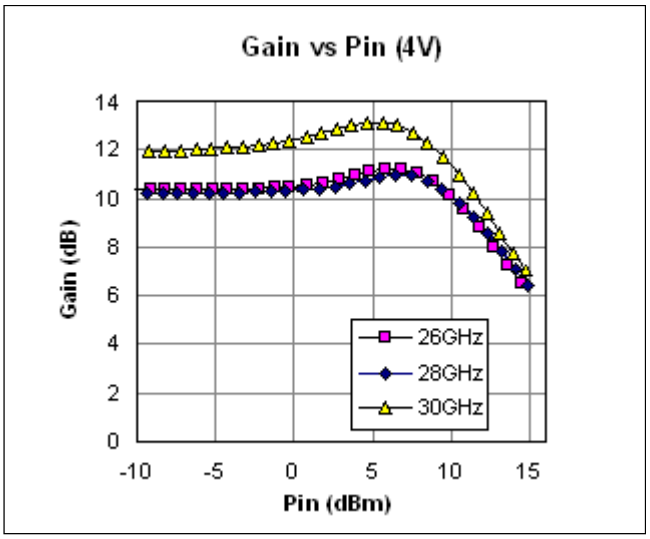


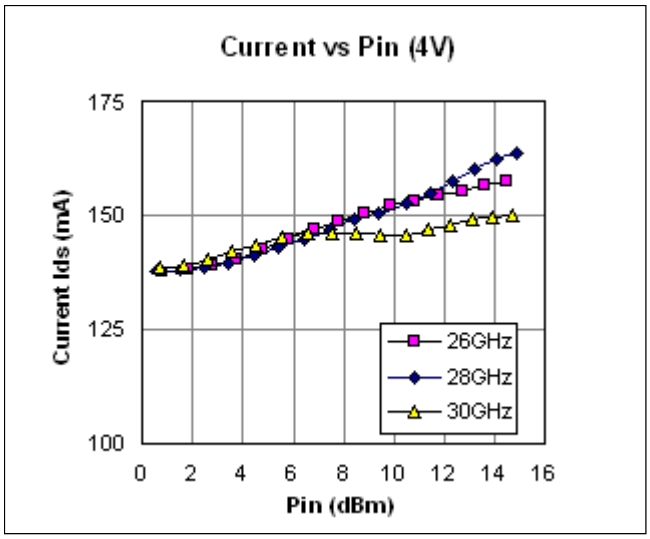


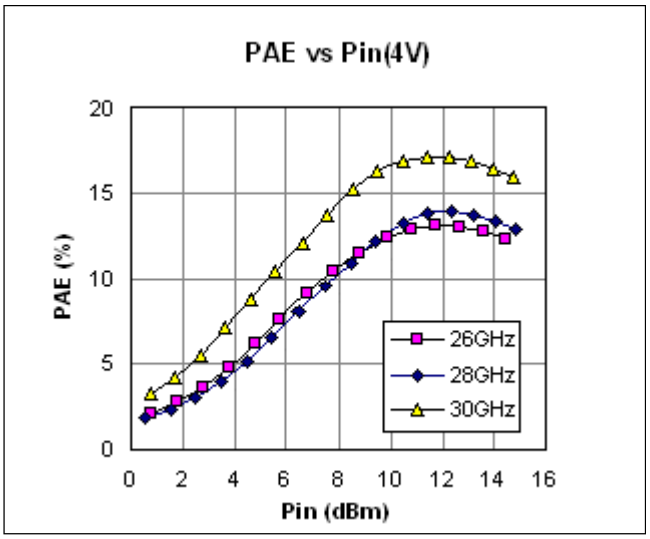


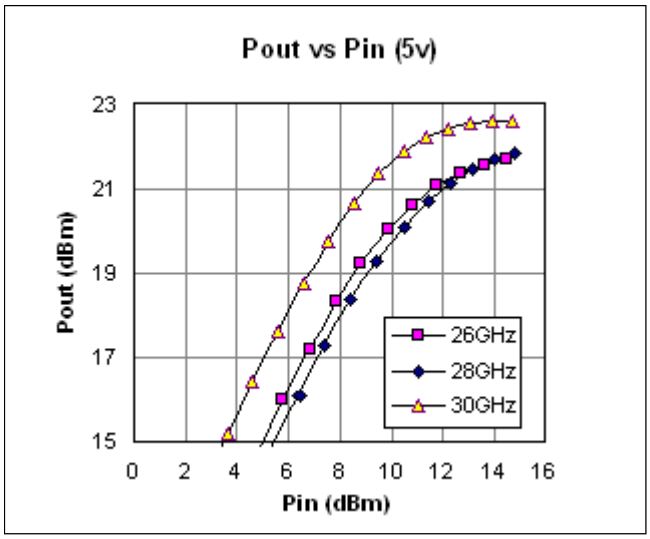


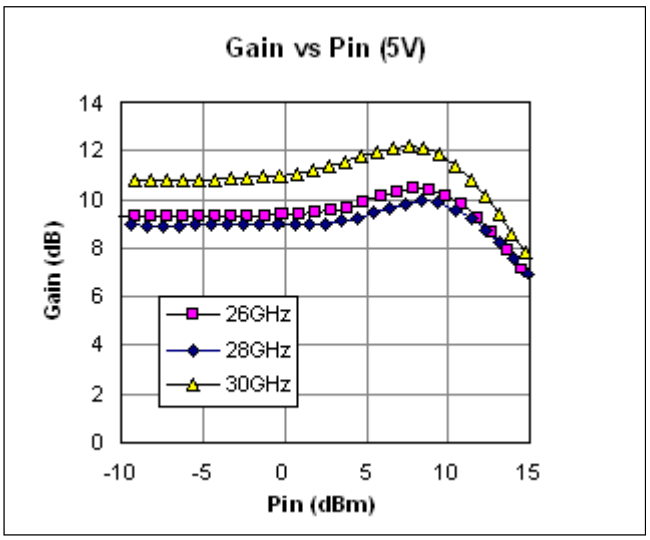
Typical RFOW Performance

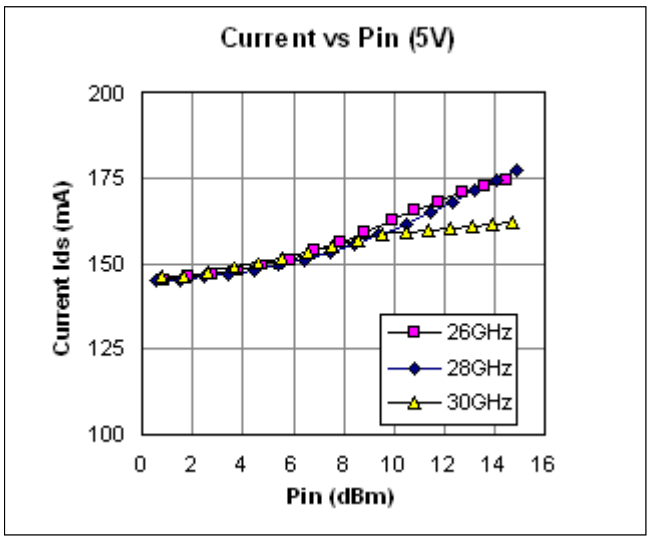




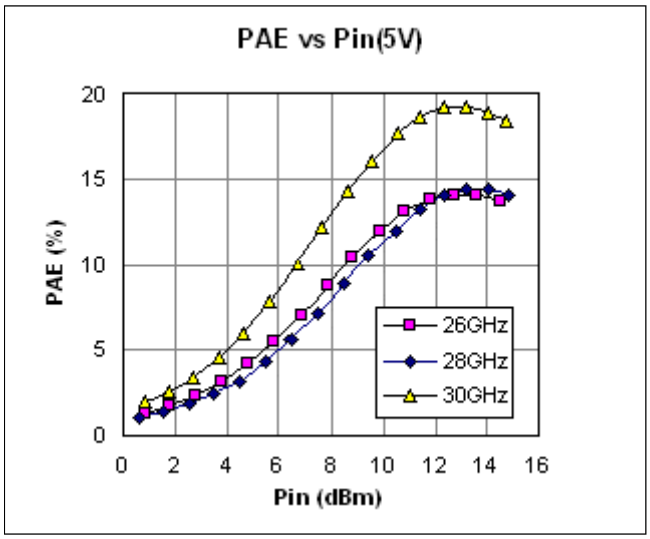








Typical RFOW Performance



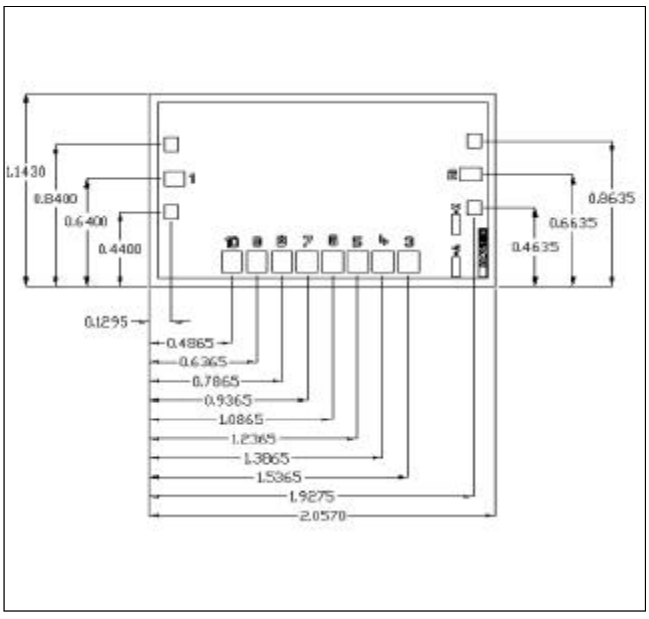
Typical S-parameters (RFOW)

Frequency	S11		S21		S12		S22	
(GHz)	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
20.00	0.66	-49.9	2.78	162.6	0.003	76.5	0.13	-144.1
20.25	0.67	-53.3	2.87	151.5	0.003	71.8	0.14	-142.9
20.50	0.67	-56.9	2.95	140.8	0.003	67.1	0.15	-142.4
20.75	0.67	-60.5	3.02	130.3	0.003	53.2	0.15	-142.0
21.00	0.67	-64.5	3.09	119.9	0.003	48.3	0.16	-142.3
21.25	0.67	-68.6	3.14	109.7	0.003	41.1	0.17	-143.4
21.50	0.67	-72.6	3.17	99.8	0.003	30.4	0.18	-145.4
21.75	0.66	-76.6	3.21	90.2	0.003	29.1	0.19	-147.1
22.00	0.65	-80.7	3.25	80.7	0.004	20.7	0.19	-149.1
22.25	0.64	-84.8	3.28	71.2	0.003	14.7	0.20	-151.4
22.50	0.62	-88.7	3.31	61.8	0.003	6.8	0.20	-154.0
22.75	0.60	-92.8	3.33	52.4	0.003	-4.2	0.21	-156.5
23.00	0.58	-96.2	3.34	43.1	0.003	-12.2	0.21	-159.1
23.25	0.56	-99.8	3.36	33.9	0.003	-5.1	0.22	-161.6
23.50	0.54	-103.2	3.36	24.7	0.003	-18.2	0.22	-164.6
23.75	0.52	-106.4	3.37	15.6	0.003	-19.6	0.22	-167.1
24.00	0.49	-109.5	3.36	6.5	0.003	-30.2	0.22	-170.0
24.25	0.47	-112.4	3.35	-2.3	0.003	-37.5	0.22	-172.7
24.50	0.45	-114.9	3.34	-11.0	0.003	-45.2	0.22	-175.2
24.75	0.42	-117.6	3.33	-19.7	0.003	-47.9	0.22	-178.0
25.00	0.40	-119.9	3.32	-28.3	0.002	-47.7	0.22	179.2
25.25	0.37	-122.3	3.32	-37.0	0.003	-54.0	0.22	176.2
25.50	0.35	-124.3	3.31	-45.5	0.003	-73.0	0.22	173.3
25.75	0.32	-125.7	3.31	-54.0	0.003	-84.0	0.22	170.8
26.00	0.30	-127.1	3.32	-62.4	0.003	-87.6	0.22	168.3
26.25	0.28	-128.3	3.32	-70.8	0.003	-92.2	0.22	166.0
26.50	0.25	-129.2	3.34	-79.5	0.003	-104.2	0.22	163.2
26.75	0.23	-129.6	3.35	-88.2	0.004	-111.7	0.22	160.5
27.00	0.21	-129.7	3.38	-96.9	0.004	-123.0	0.21	158.1
27.25	0.19	-129.4	3.41	-105.6	0.004	-143.7	0.21	156.5

Typical S-parameters (RFOW) cont.

Frequency	S11		S21		S12		S22	
(GHz)	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
27.50	0.16	-128.4	3.45	-114.6	0.004	-151.9	0.21	154.6
27.75	0.13	-125.8	3.51	-123.9	0.004	-163.3	0.22	152.5
28.00	0.11	-119.5	3.57	-133.5	0.004	-172.5	0.22	149.8
28.25	0.08	-105.6	3.62	-143.4	0.004	-166.1	0.23	147.1
28.50	0.07	-79.5	3.69	-153.6	0.004	-177.9	0.23	144.9
28.75	0.09	-52.8	3.75	-164.5	0.005	172.6	0.24	141.6
29.00	0.12	-36.7	3.81	-175.9	0.004	153.8	0.25	137.2
29.25	0.16	-29.1	3.86	172.3	0.004	157.1	0.26	133.2
29.50	0.21	-27.2	3.89	159.8	0.005	151.4	0.27	129.4
29.75	0.27	-27.6	3.88	146.4	0.005	138.1	0.28	124.8
30.00	0.33	-30.6	3.82	132.4	0.005	121.4	0.29	119.9
30.25	0.40	-34.8	3.70	117.9	0.006	110.7	0.30	114.0
30.50	0.46	-40.0	3.51	103.2	0.006	103.9	0.32	107.5
30.75	0.52	-46.0	3.24	88.5	0.007	82.5	0.33	99.9
31.00	0.57	-52.2	2.94	74.5	0.006	74.7	0.33	92.9
31.25	0.61	-58.1	2.63	61.3	0.006	65.1	0.33	86.2
31.50	0.65	-63.6	2.33	48.9	0.005	52.4	0.33	80.0
31.75	0.67	-68.6	2.05	37.1	0.005	52.5	0.33	73.4
32.00	0.70	-73.3	1.79	26.1	0.004	39.2	0.32	67.8

Chip Outline



Die size:	2.05 x 1.14mm
RF bond pads (1 & 2):	80 x 80µm
All other bond pads:	120µm x 120µm
Die Thickness:	100µm

Pad Details

Pad	Function
1	RF Input
2	RF Output
3	Gnd
4	Vd2
5	N/C
6	Vg2
7	Vd1
8	N/C
9	Vg1
10	Gnd

Handling and Assembly Information

Gallium Arsenide (GaAs) devices are susceptible to electrostatic and mechanical damage. Dice are supplied in antistatic containers, which should be opened in cleanroom conditions at an appropriately grounded anti-static workstation. Devices need careful handling using correctly designed collets, vacuum pickups or, with care, sharp tweezers.

GaAs Products from MOC's H40P Foundry process are 100µm thick and have through GaAs vias to enable grounding to the circuit. Windows in the surface passivation above the bond pads are provided to allow wire bonding to the die.

The surface to which the die are to be attached should be cleaned with a proprietary de-greasing cleaner.

Eutectic mounting should be used and entails the use of a gold-tin (AuSn) preform, approximately 0.001^2 thick, placed between the die and the attachment surface. The preferred method of mounting is the use of a machine such as a Mullins 8-140 die bonder. This utilises a heated collet and workstation with a facility for applying a scrubbing action to ensure total wetting and avoid the formation of voids. Dry nitrogen gas is directed across the work piece.

The gold-tin eutectic (80% Au 20% Sn) has a melting point of approximately 280°C (Note: Gold Germanium with a higher melting temperature should be avoided, in particular for MMICs). The work station temperature should be 310°C ± 10°C. The collet should be heated, and the die pre-heated to avoid excessive thermal shock. The strength of the bonding formed by this method will result in fracture of the die, rather than the bond under die strength testing.

The P35-5126-000-200 amplifier die has gold bond pads. The recommended wire bonding procedure uses 25µm (0.001") 99.99% pure gold wire with 0.5-2% elongation. Thermo-compression wedge bonding is preferred though thermosonic wire bonding may be used providing the ultrasonic content of the bond is minimised. A work station temperature of 260°C ± 10°C with a wedge tip temperature of 120°C ± 10°C is recommended. The wedge force should be 45 ± 5 grams. Bonds should be made from the bond pads on the die to the package or substrate.

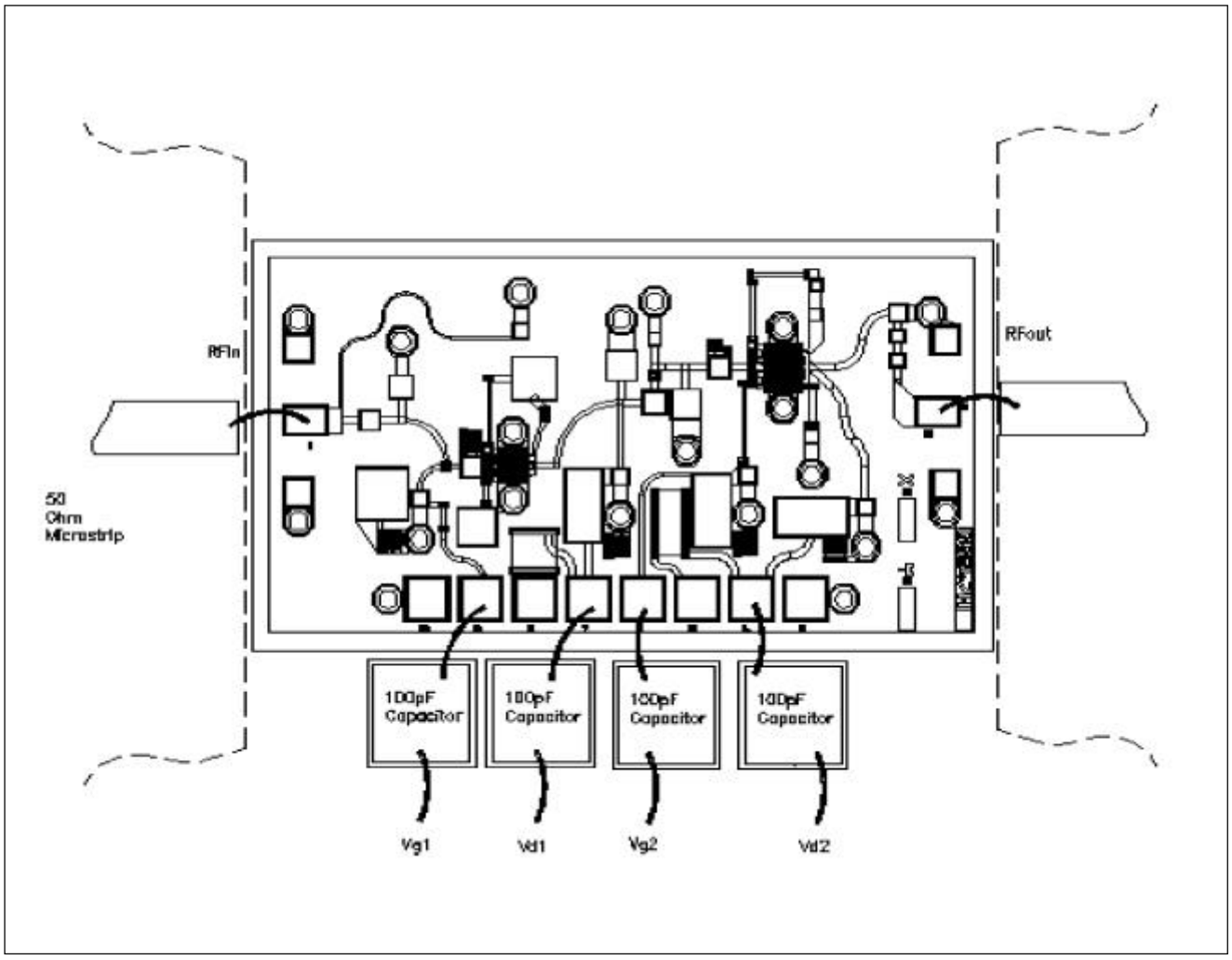
The RF bond pads at the input and output are 100µm x 100µm; all other bond pads are 120µm x 120µm.

The P35-5126-000-200 has been designed to include the inductance of a single 0.2mm length of 25µm bond wire at both the input and output, facilitating the integration of the die into a 50Ω environment.

Operating and Biasing of the P35-5126-000-200

The P35-5126-000-200 is a two-stage amplifier. The drain bias for both stages (Vd1 & Vd2) should be set to 4.0 volts. The gate voltages (Vg1 & Vg2) are typically set to -0.3V(50% Idss) to give an Id1 of 50mA and Id2 of 90mA. The separate drain and gate voltage supplies for both stages can be combined into single supplies (Vdd & Vgg). DC bias supplies should be decoupled to ground using 100pF chip capacitors placed close to the chip with short bondwires to the amplifier bond pads.

Typical Bonding Detail



Absolute Maximum Ratings

Max Vdd	+7V
Max Vgg	-2V
Max channel temperature	150°C
Storage temperature	-65°C to +150°C

Ordering Information: P35-5126-000-200

462/SM/02580/200 Iss 2

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