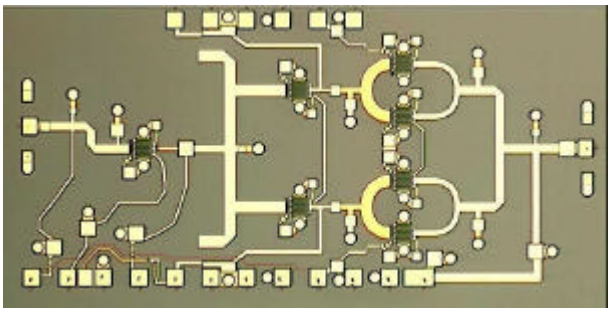
HEMT MMIC 0.5W POWER AMPLIFIER, 28GHz



Features

- Gain; 16dB typical @ 28GHz
- P-1dB; 27dBm typical @ 28GHz
- 5dB Typical Noise Figure

Description

The P35-5135-000-200 is a high performance 28GHz Gallium Arsenide power amplifier, capable of output powers in excess of 0.5 Watt. It is intended for use in point-to-point digital radio and point-to- multipoint communications.

The die is fabricated using Caswell Technology's 0.20um 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 = 5V, Vgg Set for Typical Drain Currents. U.O.S

Parameter	Conditions	Min	Typ	Max	Units
Small Signal Gain	26 – 29GHz	-	16	-	dB
Gain Flatness	26 – 29GHz	-	± 0.5	± 1.0	dB
Input Return Loss	26 – 29GHz	-	10	-	dB
Output Return Loss	26 – 29GHz	-	10	-	dB
P-1dB Output Power	26 – 29GHz				
Vdd=5V	-	-	27	-	dBm
Noise Figure	26 – 29GHz	-	5	-	dB
Drain Voltage Vdd	-	-	5	7	Volts
Gate Voltage Vgg	-	-	-0.3	-	Volts
Id1/2	Set Vgg	-	270	-	mA
Id3	Set Vgg	-	360	-	mA
Thermal Resistance	-	-	22	-	°C/W

Notes

1. All parameters measured on wafer

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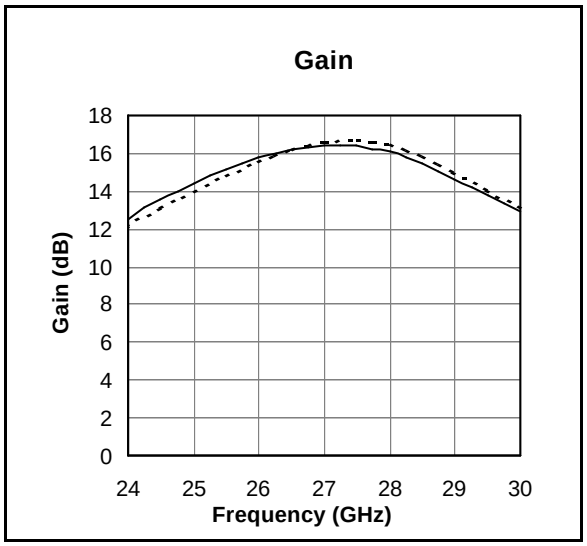
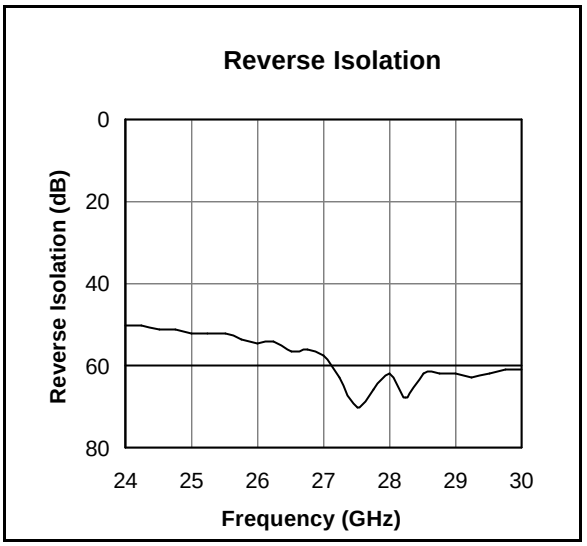
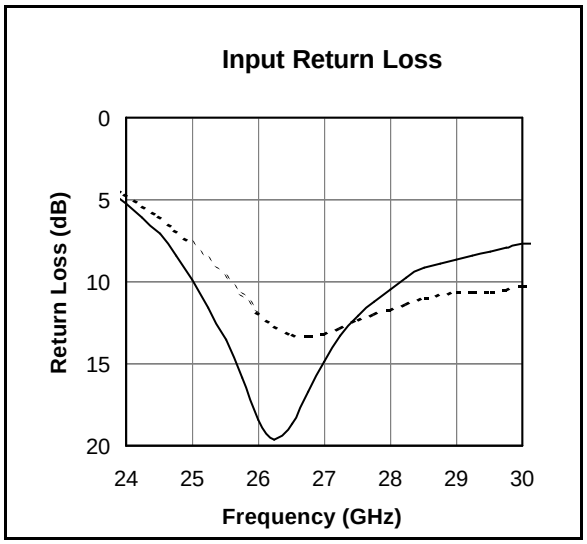
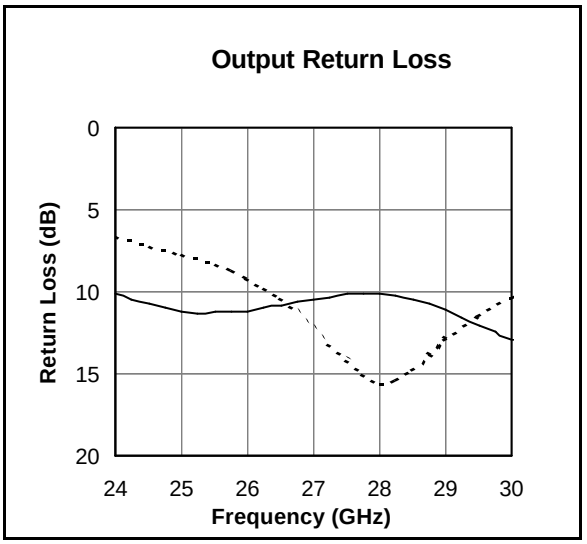
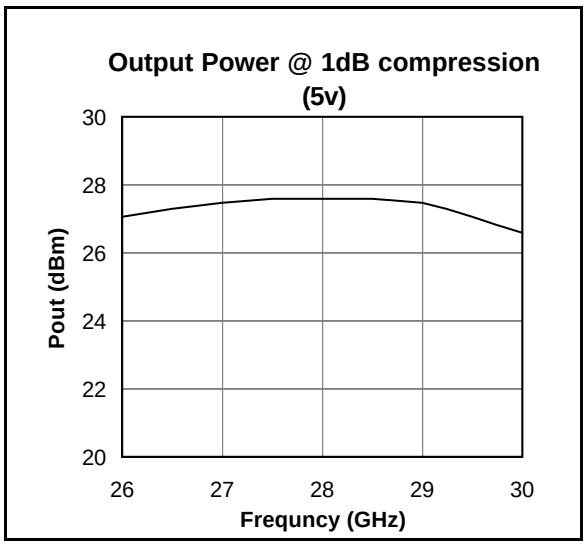
Typical RFOW Performance (----- Jig Measurement)

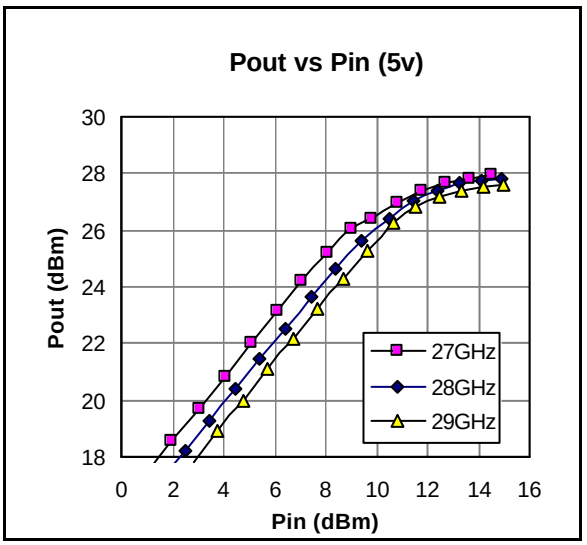












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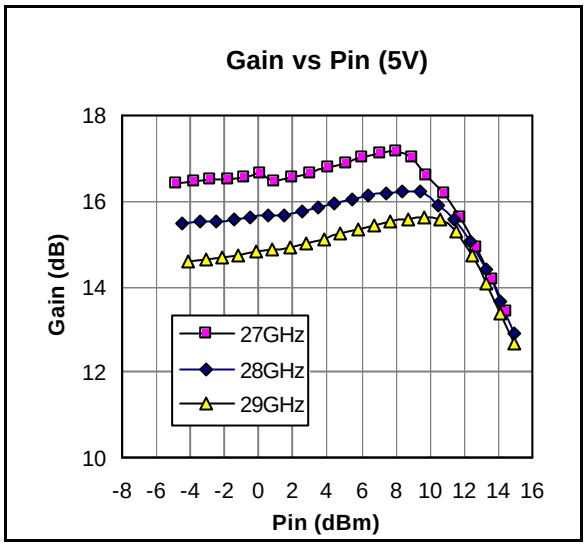

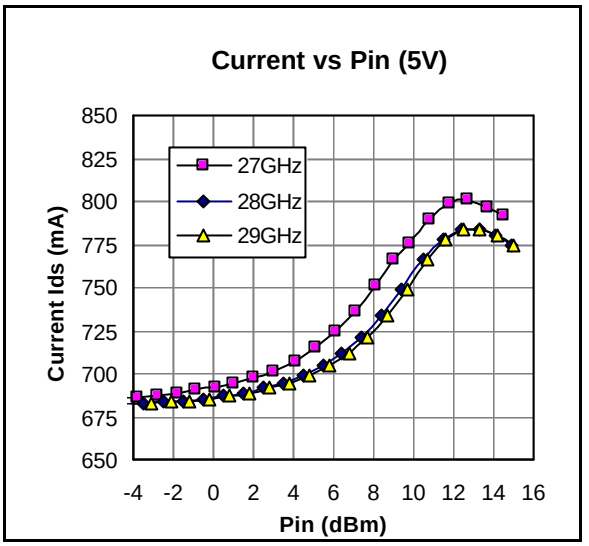

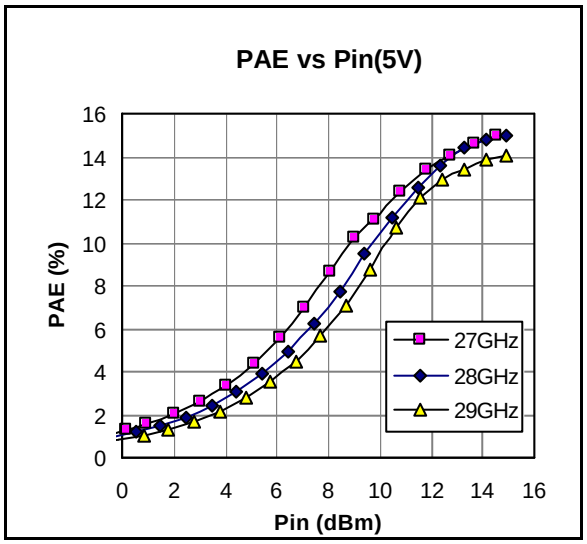

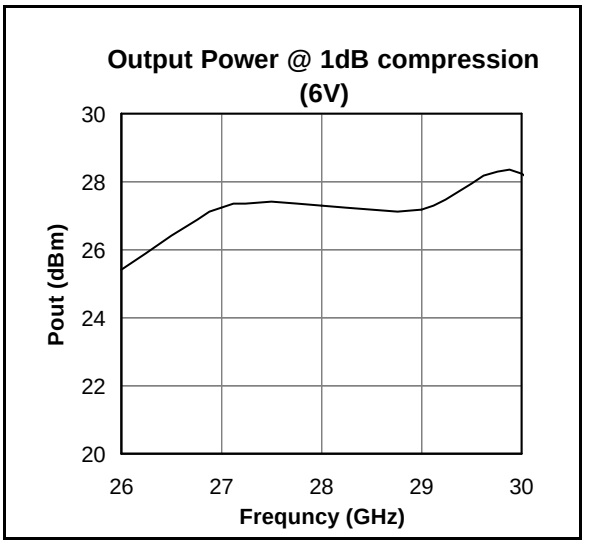

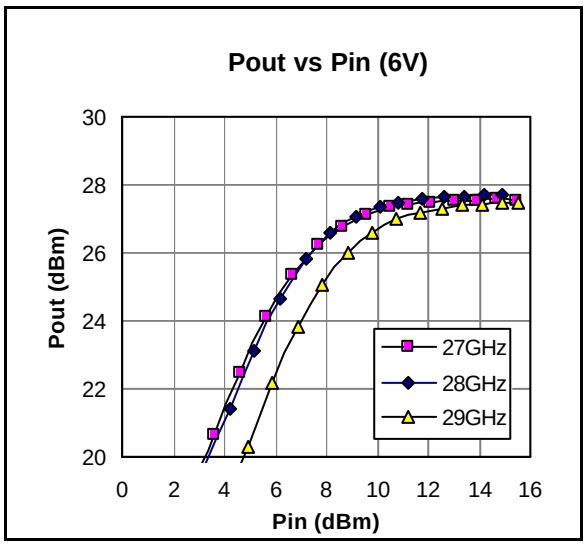

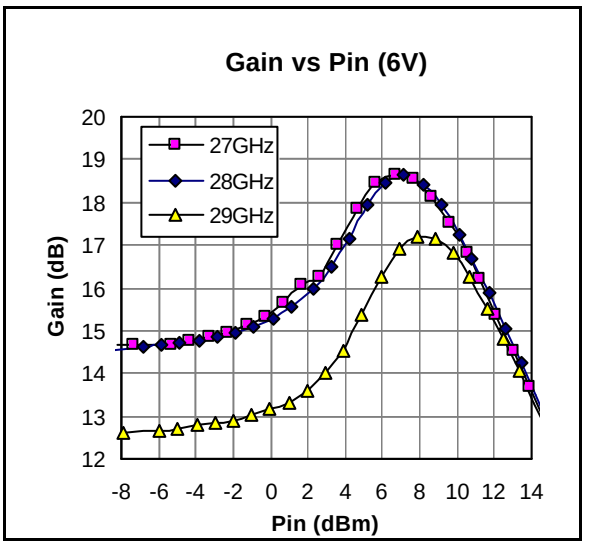

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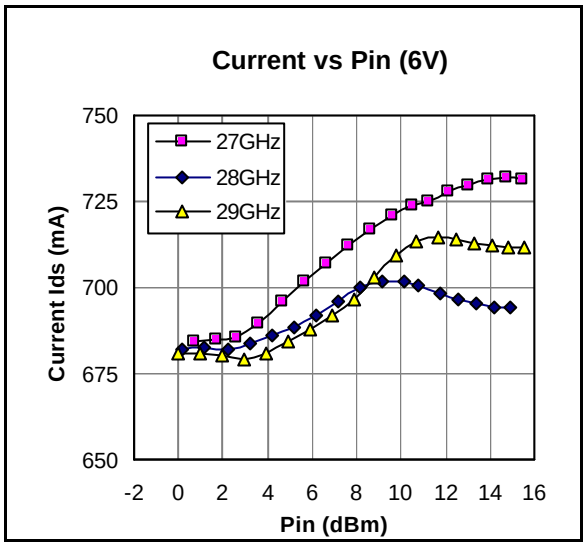
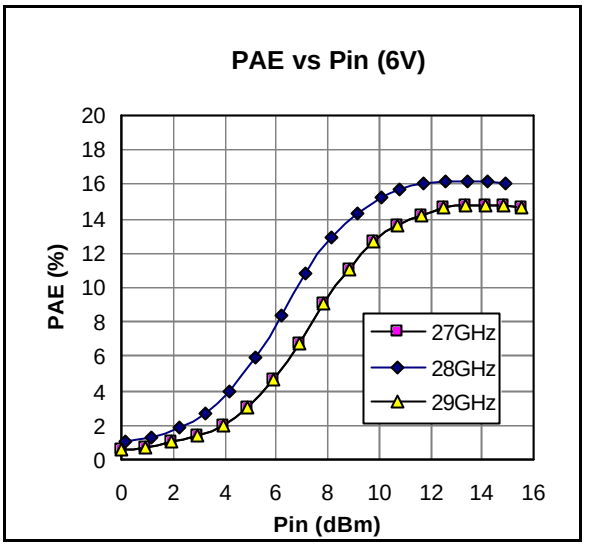
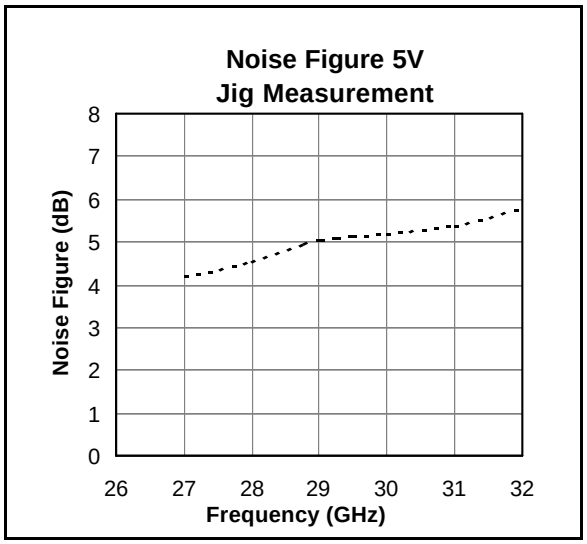
Typical RFOW Performance (----- Jig Measurement)







Typical S-parameters (RFOW)

Frequency	S11		S21		S12		S22	
(GHz)	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
20.00	0.92	-103.6	1.36	111.9	0.002	95.8	0.60	157.6
20.25	0.91	-106.4	1.45	102.7	0.002	90.0	0.58	153.4
20.50	0.90	-109.0	1.56	93.5	0.002	81.2	0.56	149.1
20.75	0.90	-111.8	1.68	84.1	0.002	80.8	0.54	144.7
21.00	0.89	-115.0	1.80	74.4	0.002	73.6	0.52	140.2
21.25	0.87	-118.1	1.94	64.4	0.002	71.2	0.50	135.5
21.50	0.86	-121.6	2.09	54.3	0.003	59.1	0.48	130.7
21.75	0.84	-125.1	2.25	43.8	0.002	45.4	0.47	125.7
22.00	0.82	-128.8	2.42	33.2	0.002	43.9	0.45	120.5
22.25	0.80	-133.0	2.61	22.1	0.002	45.2	0.43	115.0
22.50	0.77	-137.0	2.81	11.0	0.002	51.9	0.41	109.3
22.75	0.75	-141.5	3.02	-0.4	0.003	39.9	0.39	103.7
23.00	0.71	-146.2	3.24	-12.2	0.003	35.8	0.37	97.6
23.25	0.67	-151.0	3.47	-24.2	0.003	40.2	0.35	91.4
23.50	0.64	-156.2	3.72	-36.4	0.003	20.5	0.34	84.9
23.75	0.59	-162.1	3.97	-49.1	0.003	14.8	0.32	77.9
24.00	0.55	-168.1	4.24	-62.2	0.003	-0.4	0.31	70.1
24.25	0.50	-174.8	4.52	-75.4	0.003	-9.1	0.30	62.1
24.50	0.44	177.9	4.78	-89.0	0.003	-20.4	0.29	53.4
24.75	0.38	170.2	5.03	-102.8	0.003	-22.5	0.28	44.1
25.00	0.32	161.2	5.27	-116.9	0.002	-30.6	0.28	34.8
25.25	0.26	151.7	5.51	-131.0	0.002	-32.2	0.27	25.0
25.50	0.21	139.1	5.74	-145.6	0.002	-41.3	0.27	14.9
25.75	0.16	121.4	5.95	-160.2	0.002	-58.1	0.27	3.8
26.00	0.12	97.8	6.13	-175.0	0.002	-60.9	0.28	-6.9
26.25	0.10	63.8	6.30	170.0	0.002	-67.1	0.28	-18.1
26.50	0.12	31.7	6.44	154.6	0.002	-92.9	0.29	-29.5
26.75	0.15	8.8	6.55	139.0	0.002	-99.2	0.29	-40.5
27.00	0.18	-6.5	6.62	123.2	0.001	-125.3	0.30	-51.9
27.25	0.22	-17.9	6.64	107.4	0.001	-133.2	0.30	-62.8
27.50	0.25	-26.4	6.59	91.1	0.000	-97.4	0.31	-73.5
27.75	0.28	-33.3	6.49	74.9	0.001	-83.3	0.31	-84.9
28.00	0.30	-39.4	6.34	58.8	0.001	-116.9	0.31	-96.5
28.25	0.33	-44.6	6.17	42.8	0.000	-167.3	0.31	-108.2
28.50	0.35	-50.1	5.91	26.9	0.001	98.0	0.30	-119.7
28.75	0.36	-54.3	5.66	11.5	0.001	29.6	0.29	-130.9
29.00	0.37	-57.6	5.40	-4.0	0.001	-10.5	0.28	-142.7
29.25	0.38	-60.8	5.15	-19.2	0.001	-23.9	0.27	-155.1
29.50	0.39	-64.0	4.90	-34.1	0.001	-26.0	0.25	-167.9
29.75	0.40	-66.9	4.67	-49.2	0.001	-25.7	0.24	178.2
30.00	0.41	-69.6	4.43	-64.3	0.001	-39.7	0.22	163.8

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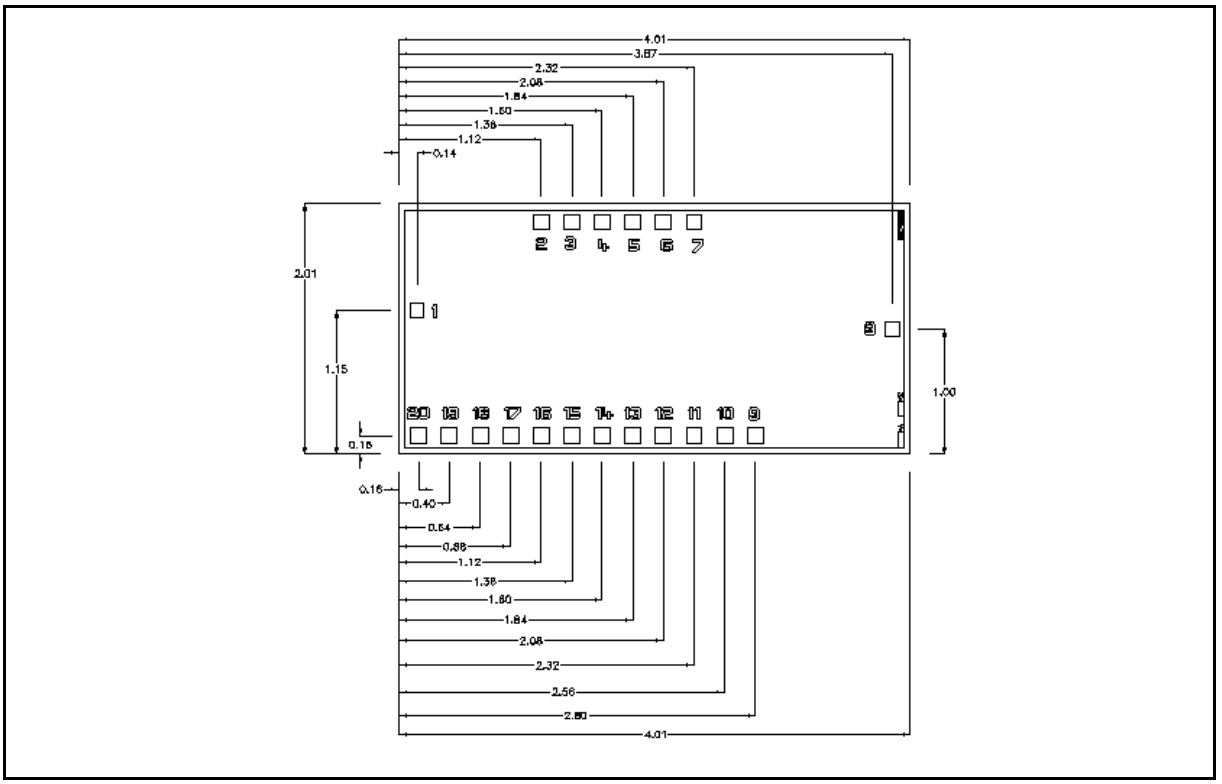
Chip Outline



Die size:	4.01 x 2.01mm
RF bond pads (1 & 8):	120 x 120µm
All other bond pads:	120µm x 120µm
Die Thickness:	100µm

Pad Details

Pad	Function
1	RF Input
2	Vd1/2 (Alternative)
3	Gnd
4	Gnd
5	Gnd
6	Vgg (Alternative)
7	Gnd
8	RF Output
9	Vd3
10	Gnd
11	Gnd
12	Vgg
13	Gnd
14	Gnd
15	Gnd
16	Vd1/2
17	Vgg
18	Gnd
19	N/C
20	Vgg

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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 Caswell Technology'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″ 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 P35-5135-000-200 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.

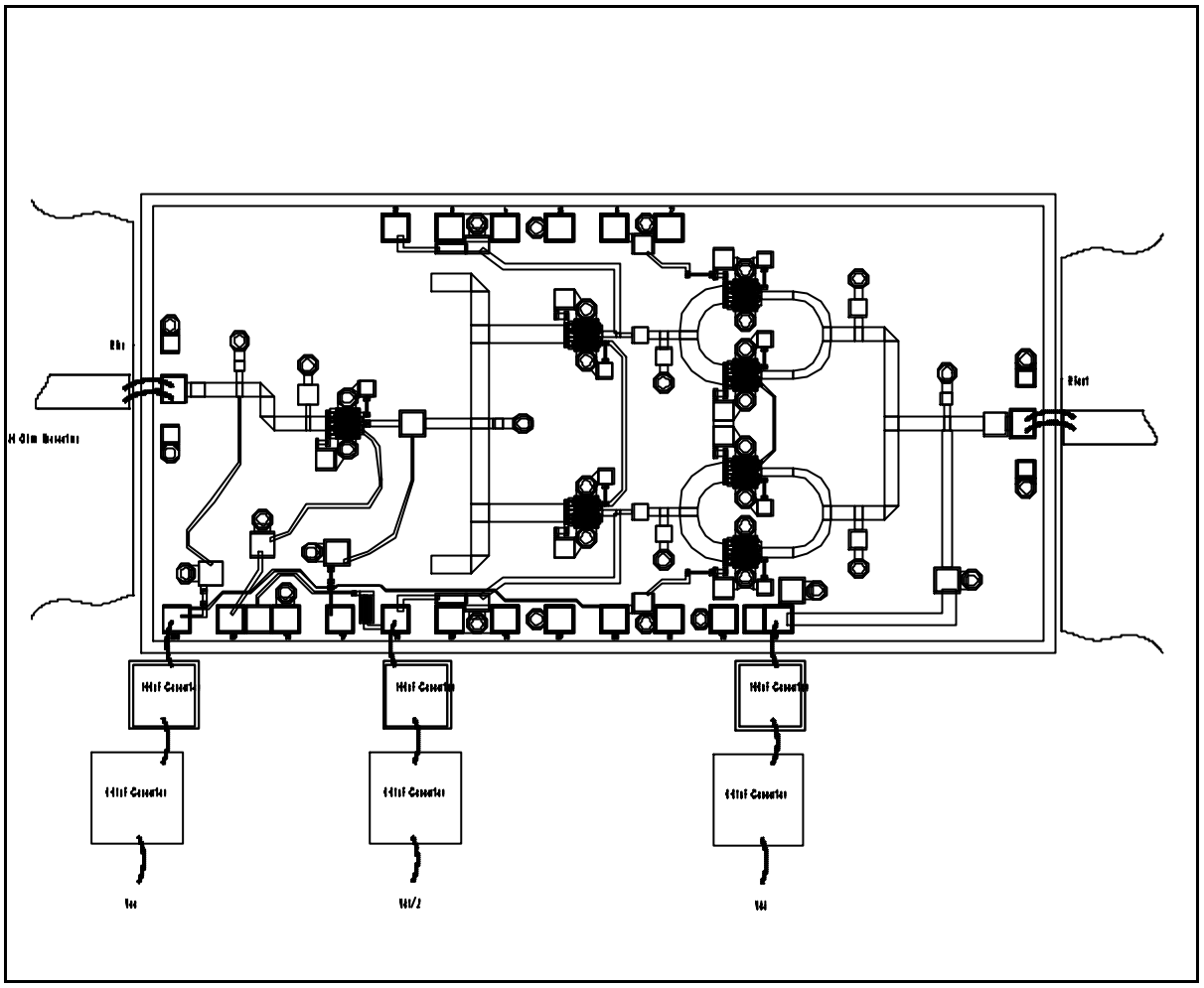
The RF bond pads at the input and output are 120µm x 120µm; all other bond pads are 120µm x 120µm.

The P35-5135-000-200 has been designed to include the inductance of two 0.2mm length, 25µm bond wires at both the input and output, facilitating the integration of the die into a 50Ω environment.

Operating and Biasing of the P35-5135-000-200

The P35-5135-000-200 is a three-stage amplifier. The drain bias for all three stages (Vd1/2 & Vd3) should be set to 5.0 volts. The first two drains are ganged together at Vd1/2 and the third drain is connected separately. The gate voltage Vgg is typically set to -0.3V to give the indicated drain currents, Vgg is accessible from various positions around the chip. Vgg and Vd1/2 can be connected to either side of the amplifier. DC bias supplies should be decoupled to ground using 100pF chip capacitors placed close to the chip with short bondwires to the amplifier bond pad, larger 0.01uF capacitors should be used to decouple the supplies further, as indicated on the bonding diagram.

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

P35-5135-000-200

This is a pre production specification, sample parts available 1999 Quarter 3
Prototype samples are devices which have determined to be a potential product but which have not completed all pre-production and production release requirements.
Samples can be supplied for customer evaluation purposes only but are not stocked. Further devices may not be the same

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