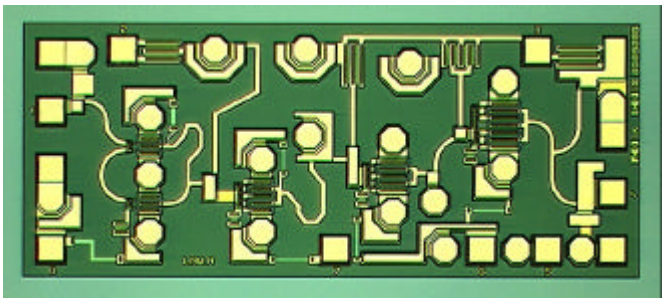
HEMT MMIC BROADBAND AMPLIFIER, 20 - 40GHz



Features

- 21dBm Typical Saturated Output Power
- 20dB Typical Gain
- 1.72 x 0.76mm Die Size
- Low Current Typically <200mA @4.5V

Description

The P35-5140-000-200 is a high performance 20-40GHz Gallium Arsenide amplifier. This product is intended for use in military and mm-Wave Communication systems.

The die is fabricated using Caswell Technology's 0.20µm gate length, pHEMT process and is fully protected using Silicon Nitride passivation for excellent performance and reliability.

Electrical Performance

Ambient Temperature 22±3° C, Z_O = 50Ω, Vdd = 4.5V, Vg_1, Vg_2 & $Vg_{3,4}$ Set to give Id_1 & Id_{234} as detailed below

Parameter	Conditions	Min	Typ	Max	Units
Small Signal Gain	21 – 40GHz	18	20	-	dB
Small Signal Gain Flatness	21 – 40GHz	-	± 1.5	-	dB
Input Return Loss	21 – 40GHz	8	10	-	dB
Output Return Loss	21 – 40GHz	8	10	-	dB
Output Power @P1dB	Vdd 4.5V	18	20	-	dBm
Saturated Output Power		-	21	-	dBm
Drain Voltage Vd_1 & $Vd_{2,3,4}$		2	4.5	5	V
Gate Voltage Vg_1, Vg_2, $Vg_{3,4}$		-	-0.45	-0.3	V
Total Current Idd		-	192	230	mA

Notes

1. All parameters measured RFOW

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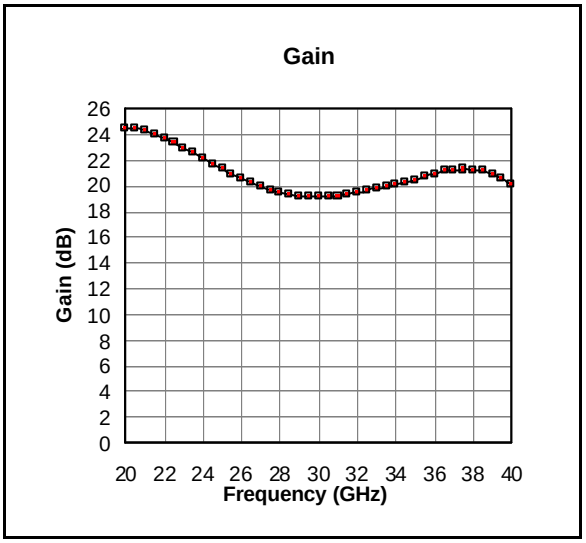
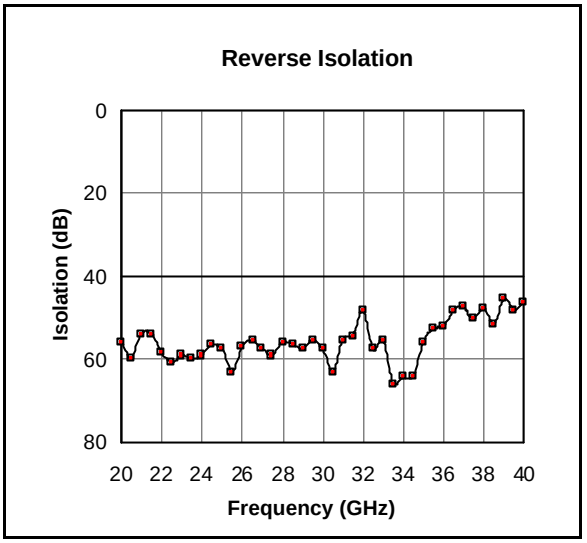
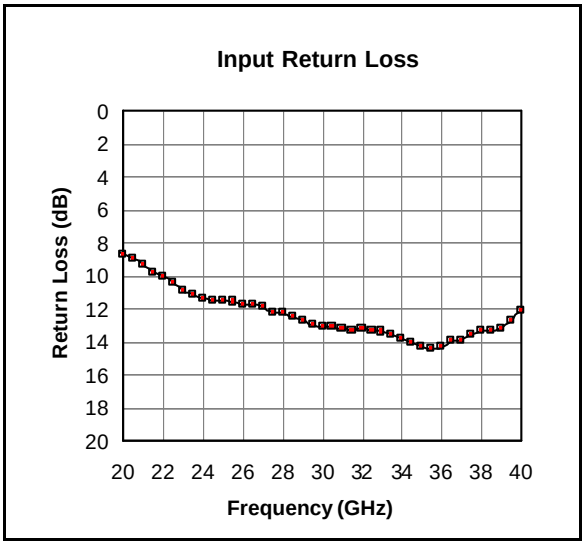
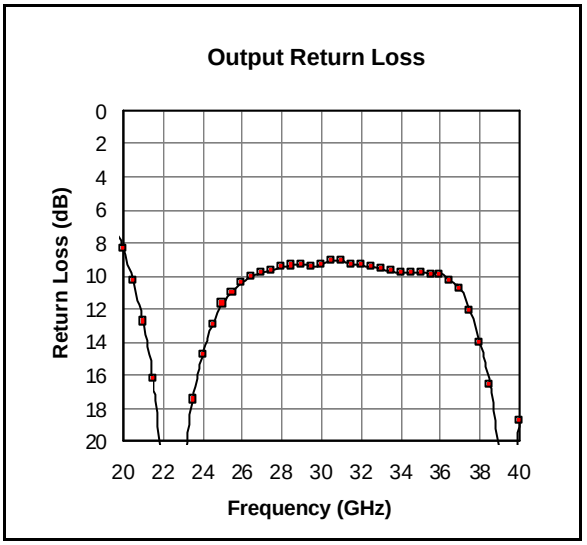
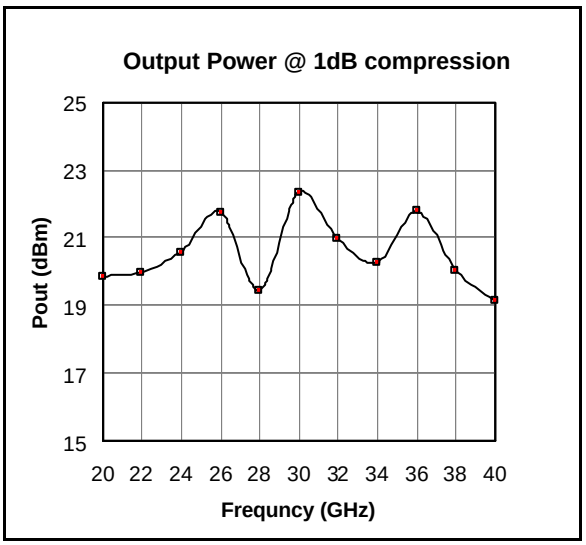
Typical RFOW Performance

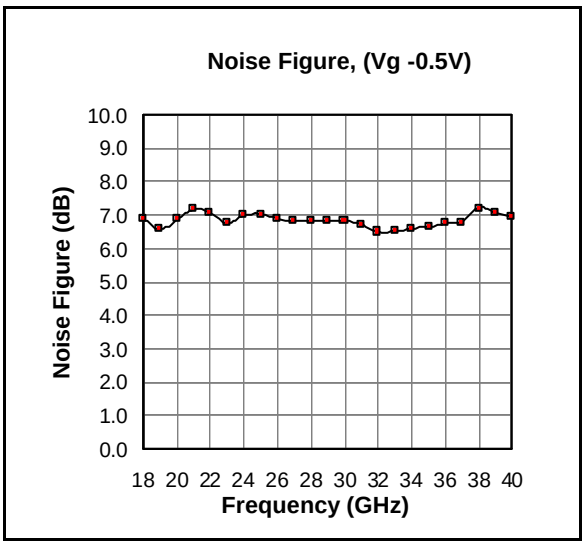












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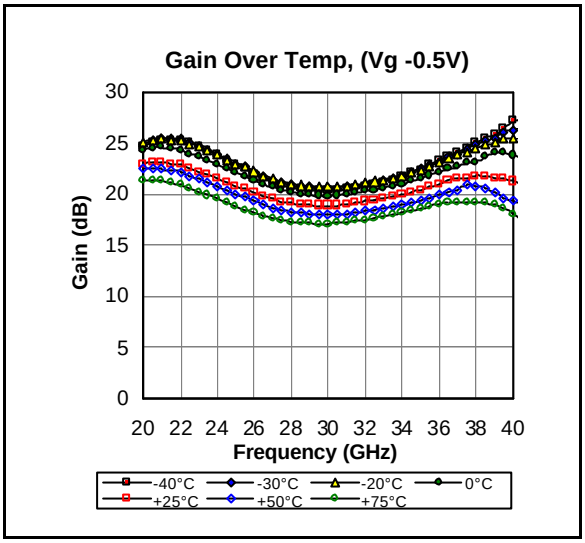

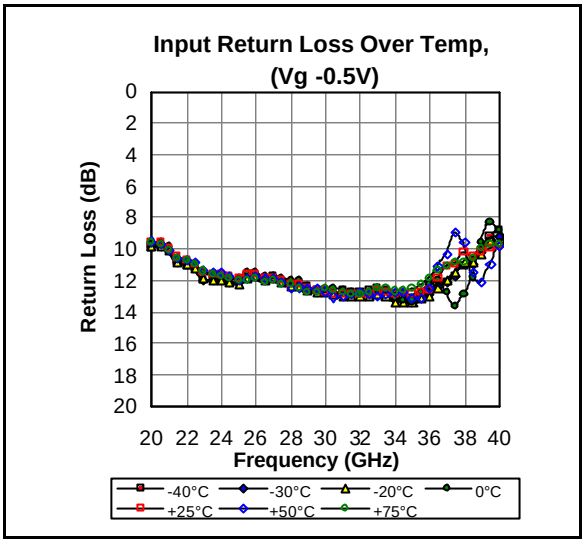

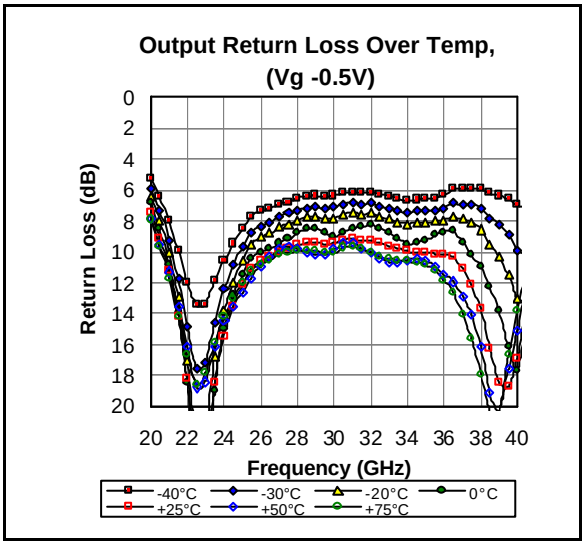

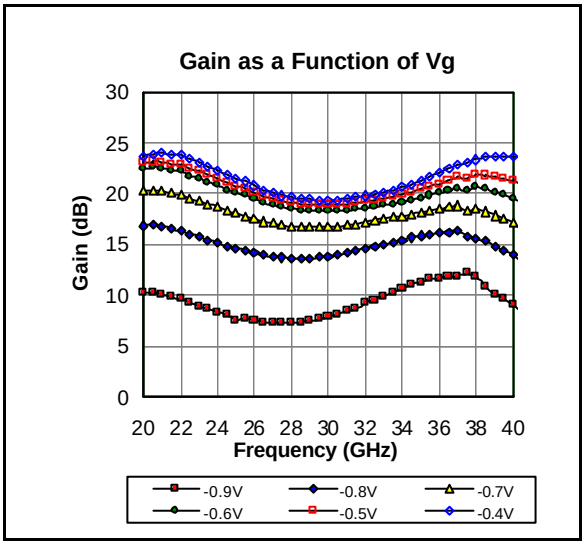

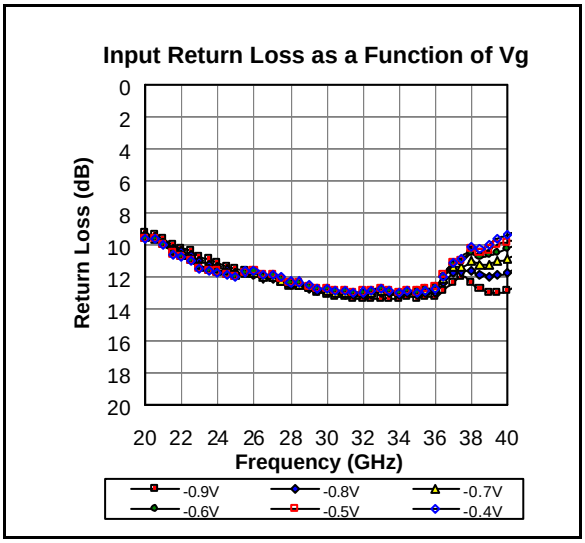

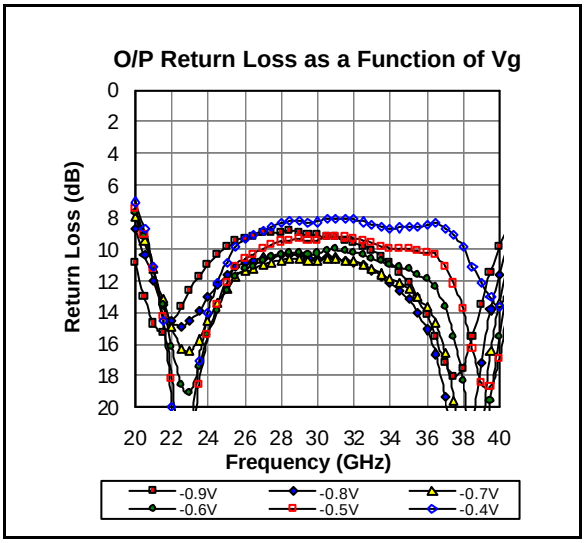

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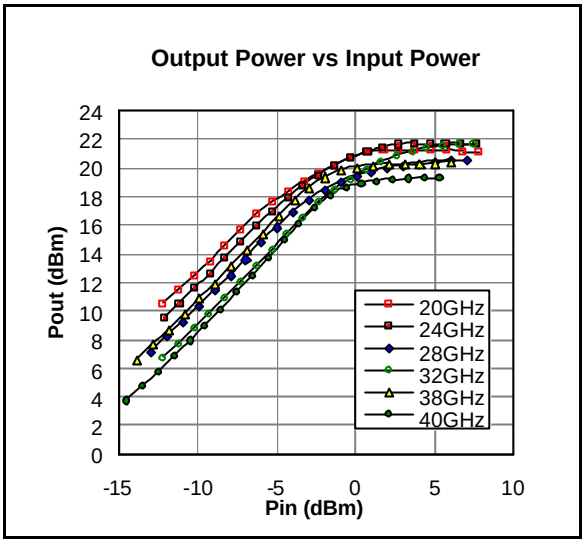

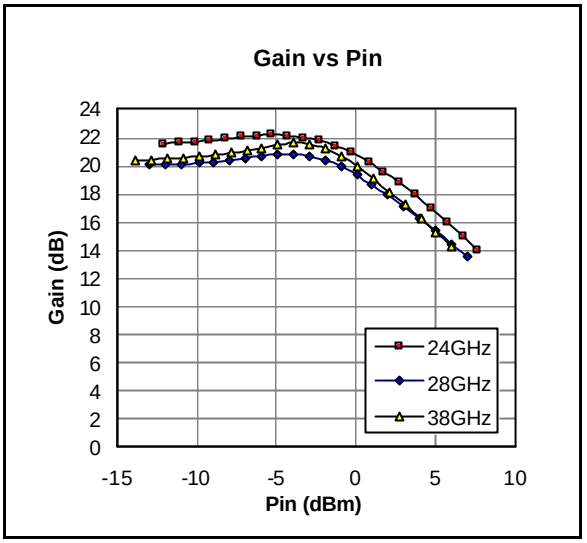

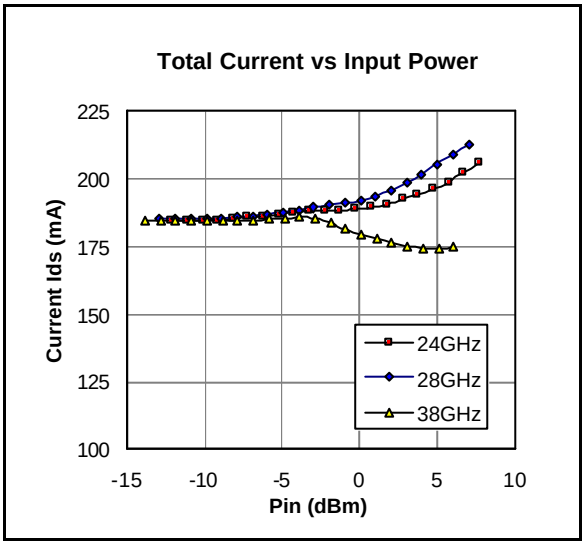

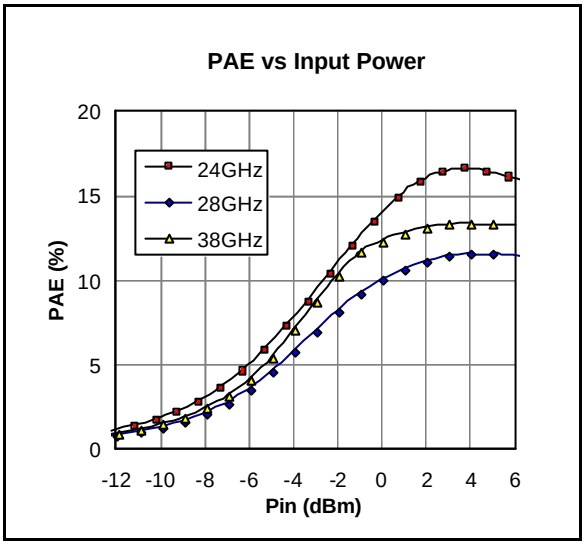

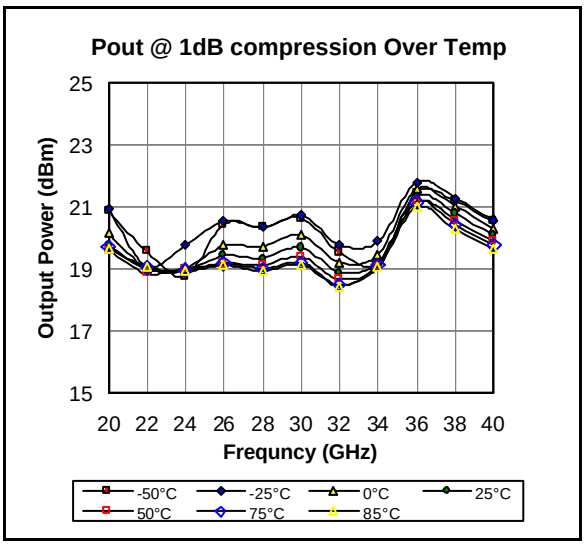

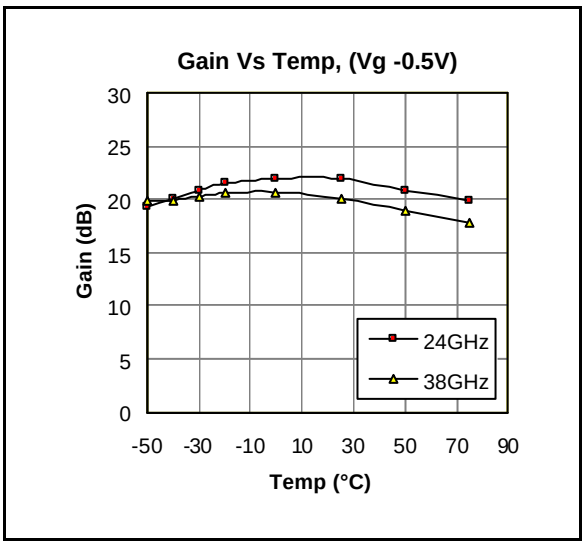

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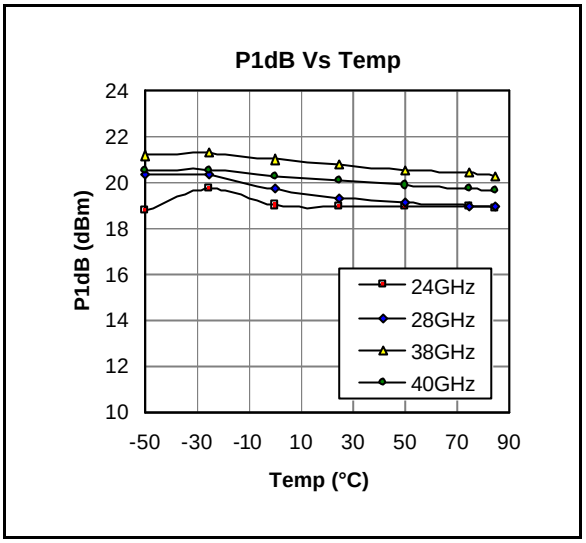
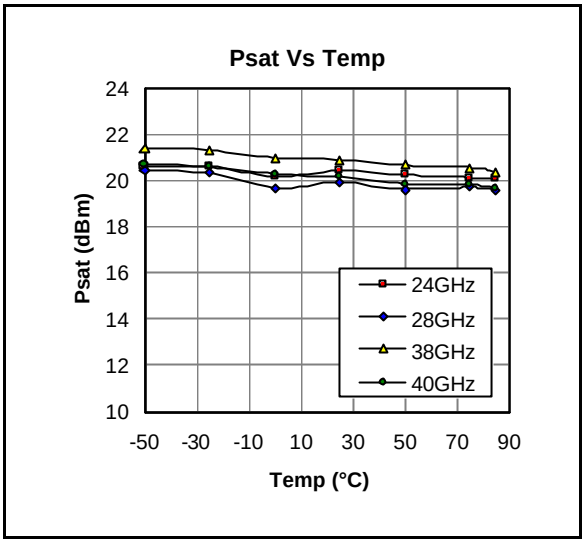
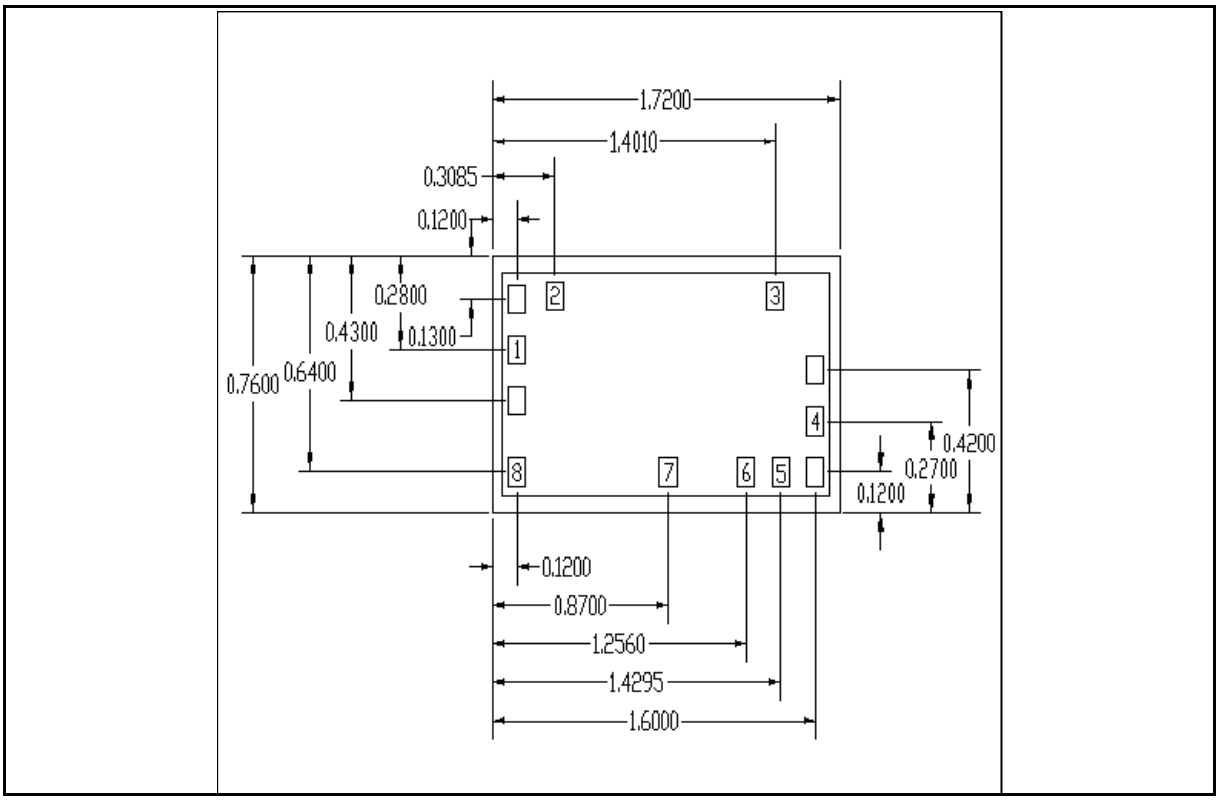




Chip Outline



Physical Details

Die size:	1.72 x 0.76mm
RF bond pads (1 & 4):	80µm x 80µm
All other bond pads:	80µm x 80µm
Die Thickness:	100µm

Pad Details

Pad	Function
1	RF Input
2	Vd1
3	Vd2,3,4
4	RF Output
5	Gnd
6	Vg3,4
7	Vg2
8	Vg1

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 pHEMT 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 P35-5140-000-200 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.

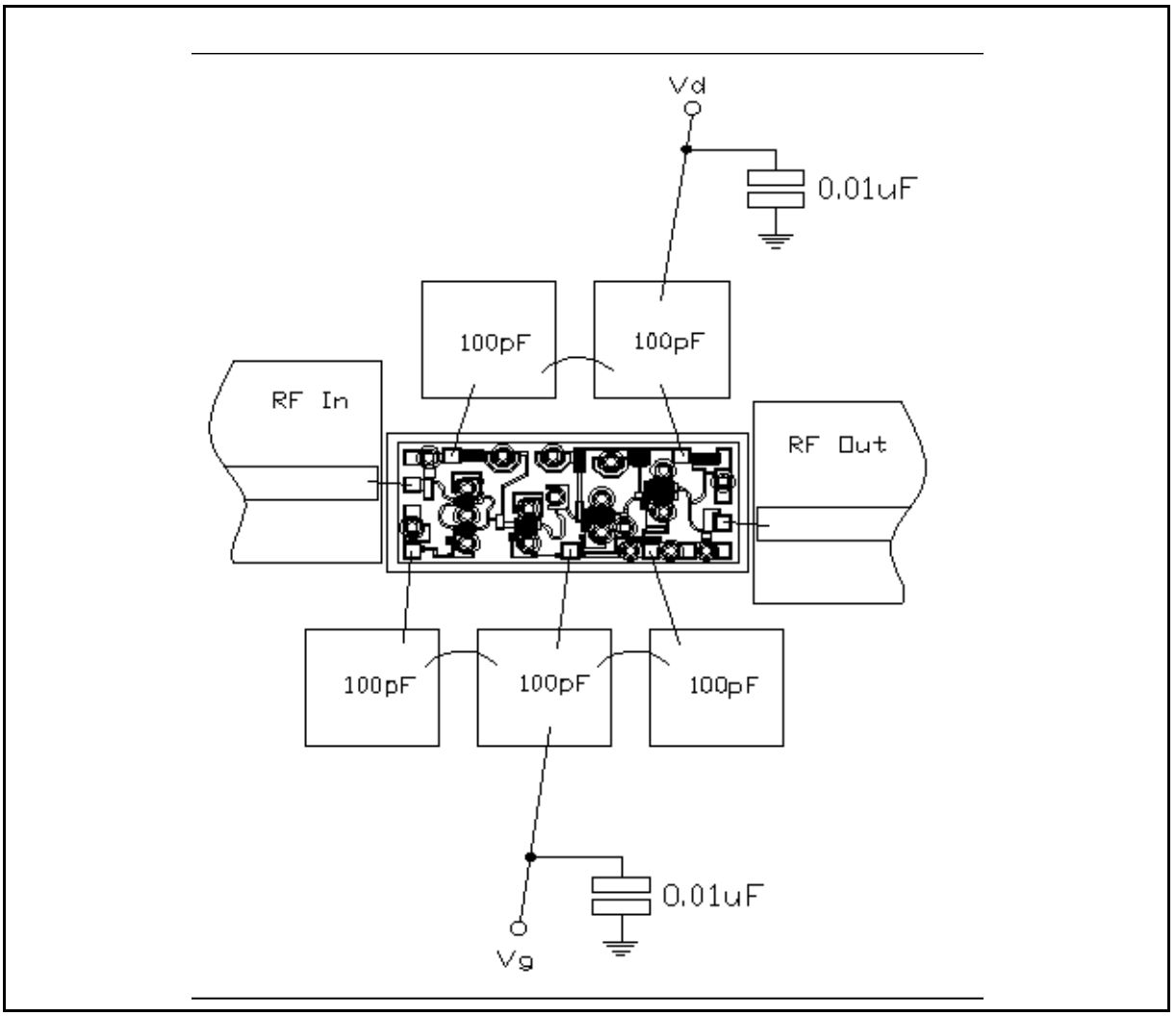
The RF bond pads at the input and output are 80µm x 80µm; all other bond pads are 80µm x 80µm.

Connection to the RF ports of mm-Wave products should be made in such a way as to minimize their inductance. Generally when using bondwires these should be kept to a minimum length, and if possible the use of two parallel bonds to each RF port should be used; other methods with low inductance such as ribbon bonds are also possible. Depending on the thickness of the substrate used the die may need to be raised to bring the top of the die in line with the substrate, this will enable the minimization of the bondwire lengths. For the same reason the gap between the die and the substrate should also be kept to a minimum.

Operating and Biasing of the P35-5140-000-200

The P35-5140-000-200 is a four-stage driver amplifier. The drain biases are connected with two connections, one to Vd1 and the other to Vd2, 3 & 4, the drains should be decoupled with 100pF capacitors close to the die.
The gate voltages (Vg1, Vg2 & Vg3/4) should be set to give the required amount of drain current, the gates should also be decoupled with 100pF capacitors close to the die. The separate drain and gate voltage supplies for both stages can be combined into single supplies (Vd & Vg).
The bondwires from the amplifier DC bond pads to the 100pF capacitors should be kept short (Typically <0.6mm). Also 0.01µF Bypass capacitors should be used on both the Vd and Vg at an appropriate position.

Typical bonding detail



Absolute maximum Ratings

Max $Vd_{1,2,3\ \&\ 4}$	+7V
Max $Vg_{1,2,3\ \&\ 4}$	-2V
Max Total Drain Current	400mA
Max channel temperature	150°C
Storage temperature	-65°C to +150°C

Ordering Information

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