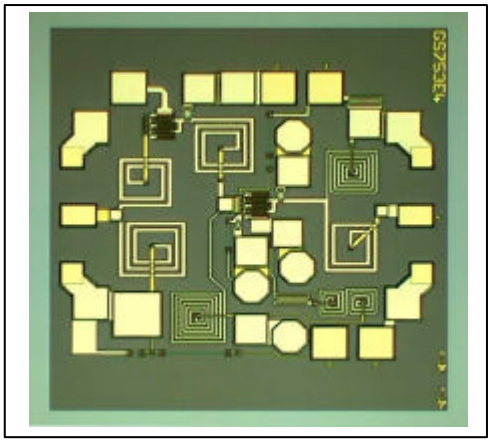
HEMT MMIC LOW NOISE AMPLIFIER, 5-6GHz



Features

- 22 dB Gain typical
- Less than 1.75 dB Noise Figure
- 0.20 µm pHEMT technology
- Simple bias arrangement
- Low supply current; 20mA typ.

Description

The P35-5700-000-200 is a high performance Gallium Arsenide Low Noise Amplifier MMIC. It is primarily intended for wireless applications in the 5 - 6 GHz bandwidth such as U-NII (Unlicensed National Information Infrastructure) and HIPERLAN (High Performance Local Area Network). It is also suitable for use as a low noise gain block in broadband communications and applications over the 4 - 7 GHz region.

The two stage amplifier requires plus and minus 5V power supplies, and exhibits optimum performance when bondwires are included at the input and output. The die is fabricated using MCL's 0.20µm gate length pHEMT process (H40) and is fully protected using Silicon Nitride passivation for excellent performance and reliability.

Electrical Performance

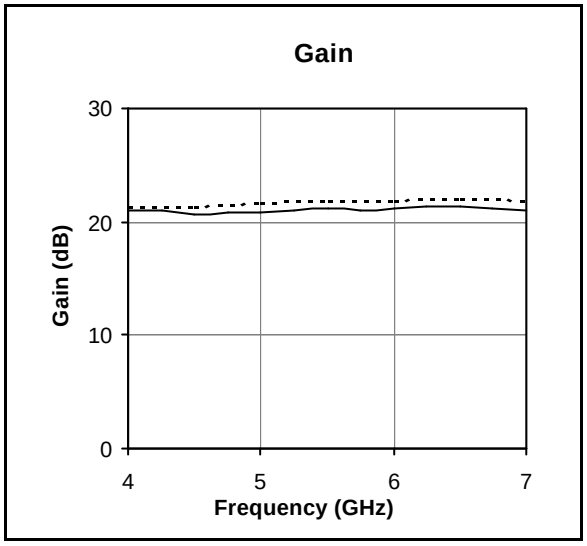
Ambient temperature = 22±3° C, Z_O = 50Ω, V_{gg} = -5V, V_{dd} = +5V

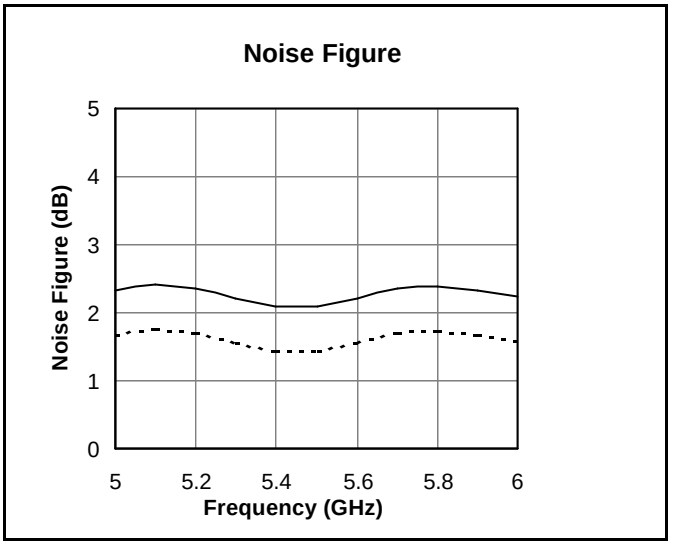
Parameter	Condition	Min	Typ	Max	Units
Small signal gain	5GHz - 6GHz	20	22	-	dB
	4GHz - 7GHz	19	21	-	dB
Gain Flatness	5GHz - 6GHz	-	±1.0	-	dB
Input Return Loss	5GHz - 6GHz	-	12	-	dB
	4GHz - 7GHz	-	12	-	dB
Output Return Loss	5GHz - 6GHz	-	17	-	dB
	4GHz - 7GHz	-	15	-	dB
Noise figure[1]	5GHz - 6GHz	-	1.5	2.0	dB
	4GHz - 7GHz	-	2.0	2.5	dB
TOI	5GHz - 6GHz	-	19	-	dBm
Supply current (Idd)		-	20	30	mA

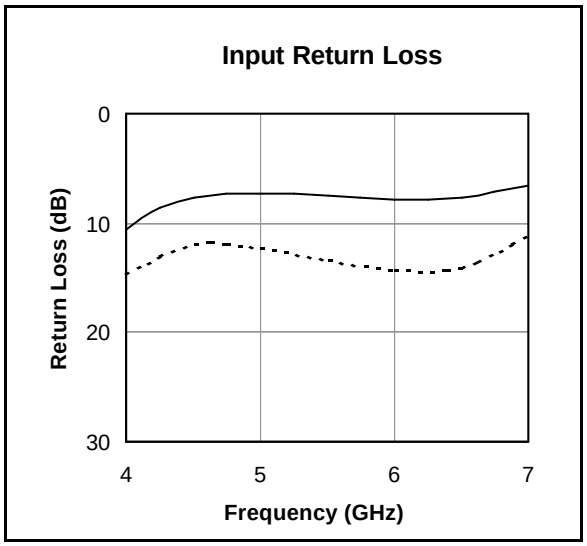
1) Noise figure assumes the inclusion of bondwires.

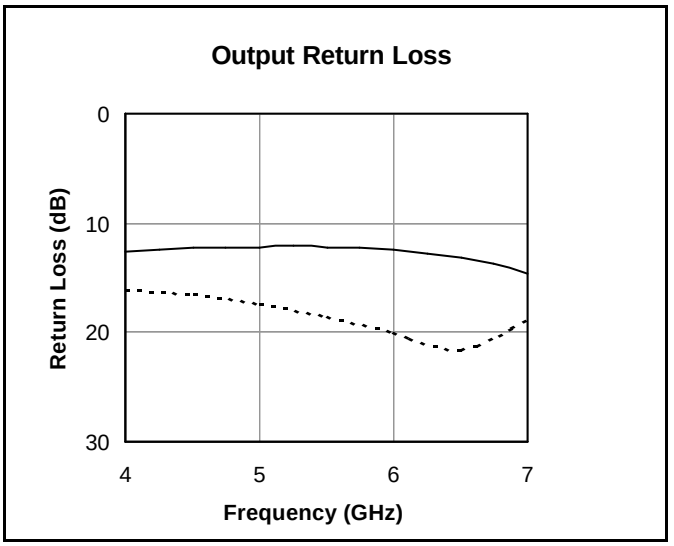
Marconi Caswell Limited, Caswell, Towcester, Northamptonshire, NN12 8EQ
Telephone: + 44 (0) 1327 350581 *Fax:* + 44 (0) 1327 356775 *Website:* www.caswelltechnology.com
Caswell Technology is the trading name of Marconi Caswell Limited which is a wholly owned subsidiary of Marconi plc

RFOW Performance at 22°C





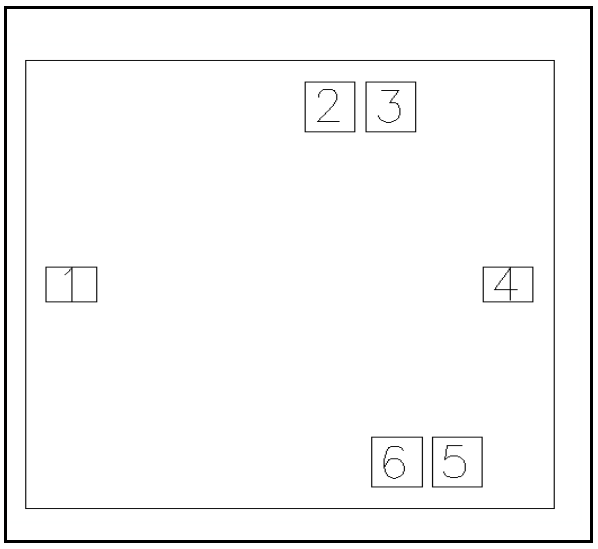




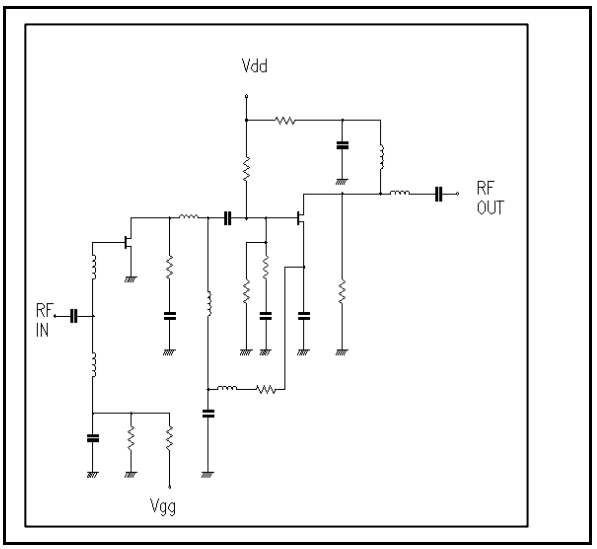
— RFOW Result
--- 0.7nH Inductance on both RF input and output

Marconi Caswell Limited, Caswell, Towcester, Northamptonshire, NN12 8EQ
Telephone: + 44 (0) 1327 350581 *Fax:* + 44 (0) 1327 356775 *Website:* www.caswelltechnology.com
Caswell Technology is the trading name of Marconi Caswell Limited which is a wholly owned subsidiary of Marconi plc

Die Outline



Electrical Schematic



Die size: 1.36 x 1.116mm
DC Bond pad size: 120µm square
RF Bond pad size: 80µm x 120µm
Die thickness: 100µm

Pad Details

Pad	Function
1	RF Input
2	NC
3	V_{dd} = +5V
4	RF Output
5	NC
6	V_{gg} = -5V

Marconi Caswell Limited, Caswell, Towcester, Northamptonshire, NN12 8EQ
Telephone: + 44 (0) 1327 350581 *Fax:* + 44 (0) 1327 356775 *Website:* www.caswelltechnology.com
Caswell Technology is the trading name of Marconi Caswell Limited which is a wholly owned subsidiary of Marconi plc

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 MCL's H40 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.

Conductive epoxy mounting is recommended for the assembly of H40 circuits. Recommended epoxies are Ablestick 84-1LMI or 84-1LMIT cured at 150°C for 1 hour in a nitrogen atmosphere. The epoxy should be applied sparingly to avoid encroachment of the epoxy on to the top surface of the die. An epoxy fillet should be visible around the total die periphery.

Eutectic mounting can also 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 work station 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 P35-5700-000-200 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.

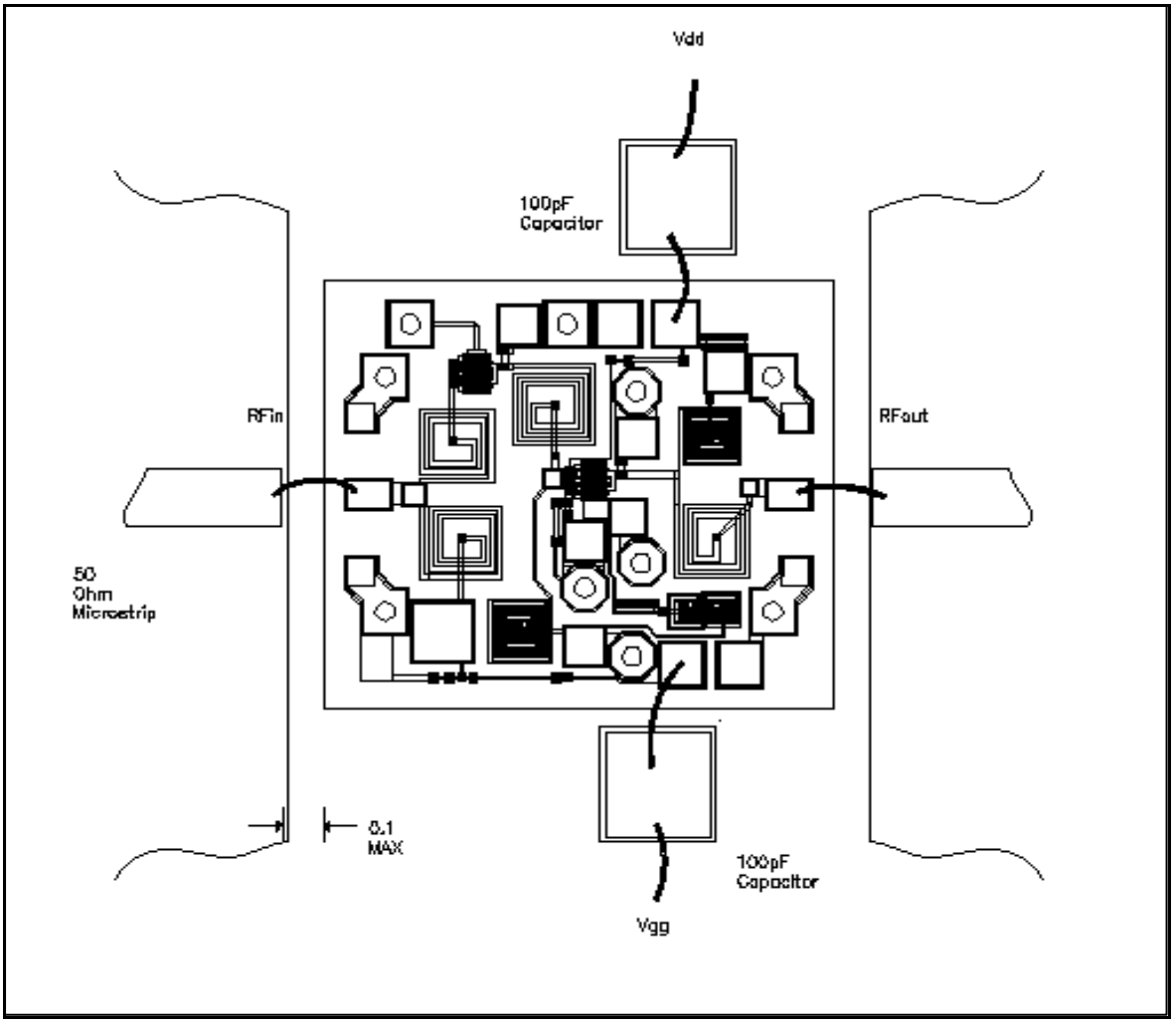
The RF bond pads at the input and output are 80µm x 120µm; all other bond pads are 120µm x 120µm.

The P35-5700-000-200 has been designed to include the inductance of a single 1mm length of 25µm bond wire at both the input and output, facilitating the integration of the die into a 50Ω environment. The design is tolerant to small changes in the length of these bondwires.

Operating and Biasing of the P35-5700-000-200

The P35-5700-000-200 is a two stage amplifier requiring a positive five volt supply and a negative five volt gate bias supply. The DC bias supplies should be decoupled to ground using 100pF chip capacitors placed close to the chip with short bondwire to the amplifier bond pads. Connections to the RF input and output should be around 0.7nH.

Typical bonding detail



Absolute maximum Ratings

Max Vdd	+6V
Max Vgg	-6V
Max I/P power	+10dBm
Operating temperature	-55°C to +125°C
Storage temperature	-65°C to +150°C
Thermal resistance	100°C/W