

CMM-9 2.0 to 9.0 GHz GaAs MMIC Amplifier

- ❑ Wide Bandwidth
- ❑ 13 dB Typical Gain
- ❑ Small Size: 39 x 35 mils
- ❑ Directly Cascadable
- ❑ Self-Biased
- ❑ Single Power Supply

Celeritek CMM-9 GaAs MMIC Amplifier

The CMM-9 is a 2 to 9 GHz GaAs MMIC amplifier. It is a two-stage feedback design which provides high gain and good power from a single power supply. Applications include oscillator buffers, RF and IF gain blocks and driver amplifiers.

The CMM-9 is a very small chip which provides 13 dB of gain and 17 dBm of power from a 6 volt supply. The chip is directly cascadable with no additional components. The circuit's self-biasing feature provides excellent performance from a 5 to 7 volt supply. Care must be taken to isolate the input from external DC voltages.

Celeritek MMIC's are fabricated on ion-implanted GaAs material with gold-based metalization. The FET gates are sub-half micron, tee cross-section construction. Air bridges are used for top level interconnection. Silicon nitride serves as capacitor dielectric and surface passivation. Mesa resistors are used for feedback and bias functions.

The CMM-9 is available in chip form. It can be screened to meet commercial, military Hi-Rel or space grade reliability requirements. Custom wafer qualification for special electrical and/or reliability requirements is also available.



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Specifications ($T_A = 25^\circ\text{C}$, $V_{DD} = 6\text{V}$, 2-9 GHz)				
Parameters	Units	Min	Typ	Max
Small Signal Gain	dB	11.5	13.0	
Gain Flatness	$\pm\text{dB}$		1.5	2.0
Input VSWR	—		1.8:1	2.0:1
Output VSWR	—		1.8:1	2.0:1
Reverse Isolation	dB	25	30	
Gain Variation Over Temperature (-55 to +95°C)	$\pm\text{dB}$		1.2	1.5
Noise Figure	dB		5.5	6.5
1 dB Gain Compression Power Output	dBm	15	17	
Current	mA		80	120

Absolute Maximum Ratings

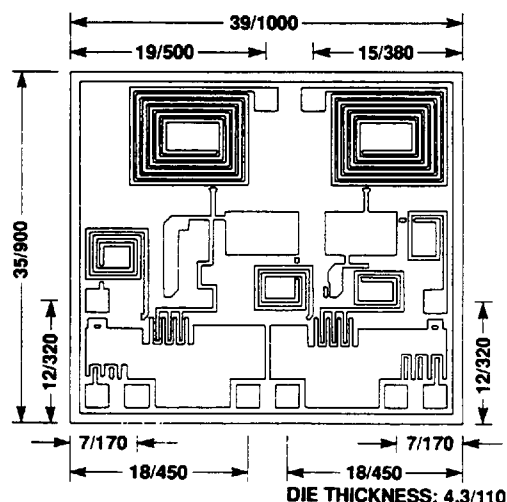
Parameter	Rating
Voltage	8V
Continuous Power Dissipation	1.25 W
Channel Temperature	+175°C
Storage Temperature	-65°C to +175°C
Mounting Temperature	+320°C
Input Power	+20 dBm
θ_{JC}	80°C/W

Die Attach and Bonding Procedures

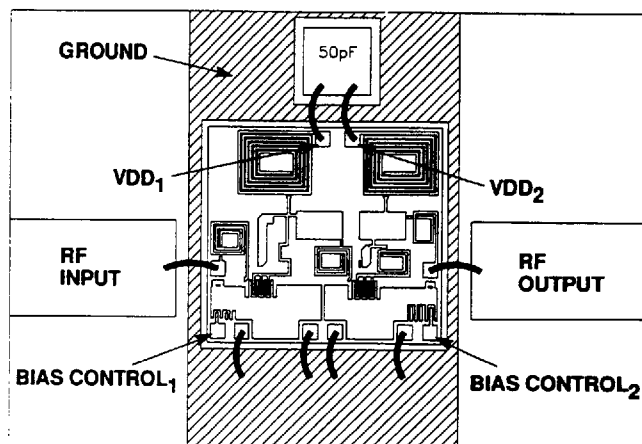
Die Attach: Conductive epoxy or preform die attach is recommended. For preform die attach: Preform: AuSn (80% Au, 20% Sn); Stage Temperature: 290°C, $\pm 5^\circ\text{C}$; Handling Tool: Tweezers; Time: 1 min or less.

Wire Bonding: Wire Size: 0.7 to 1.0 mil in diameter (pre-stressed); Thermocompression bonding is preferred over thermosonic bonding. For thermocompression bonding: Stage Temperature: 250°C; Bond Tip Temperature: 150°C; Bonding Tip Pressure: 18 to 40 gms depending on size of wire.

Chip Diagram (Dimensions in mils/ μm)



Bonding Diagram

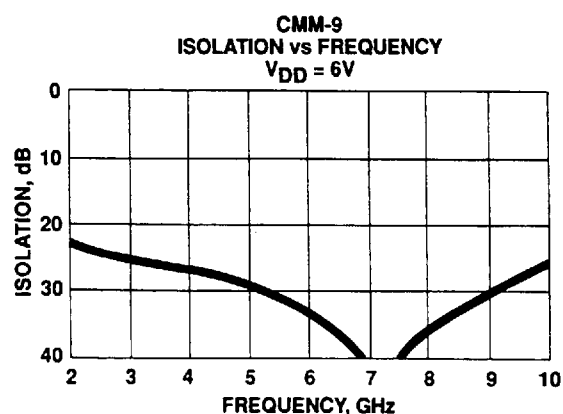
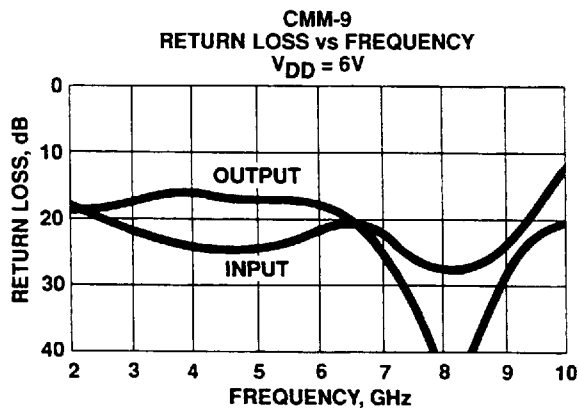
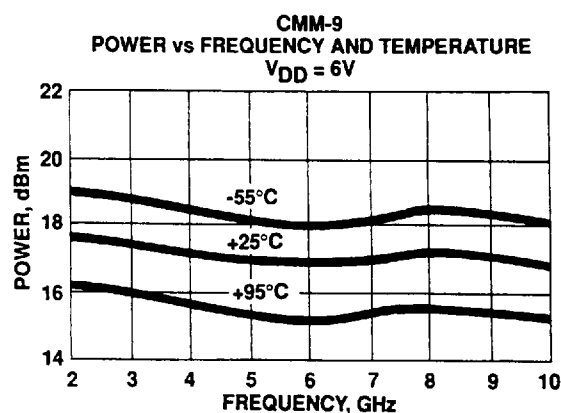
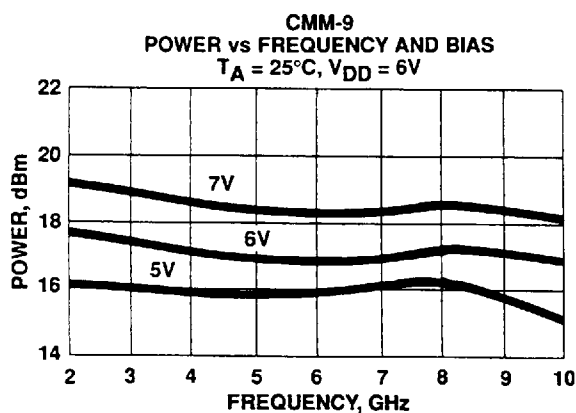
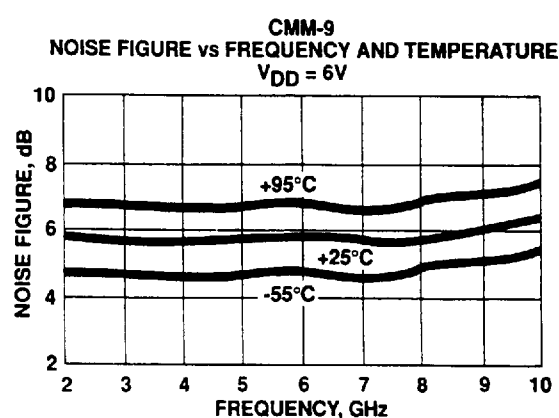
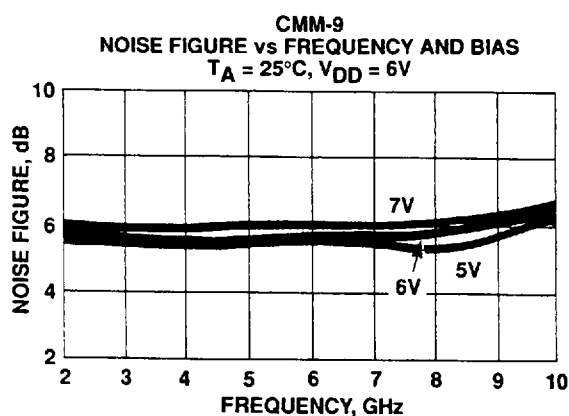
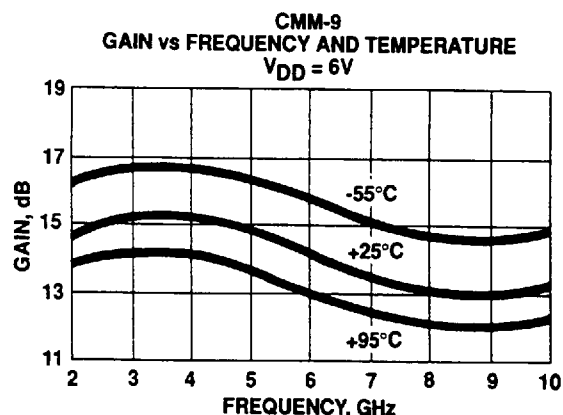
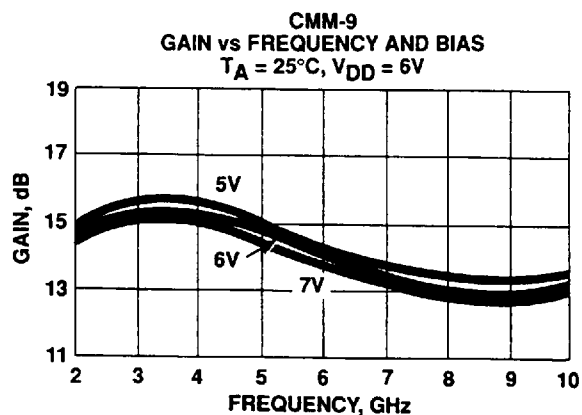


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Typical Performance ($T_A = 25^\circ\text{C}$)



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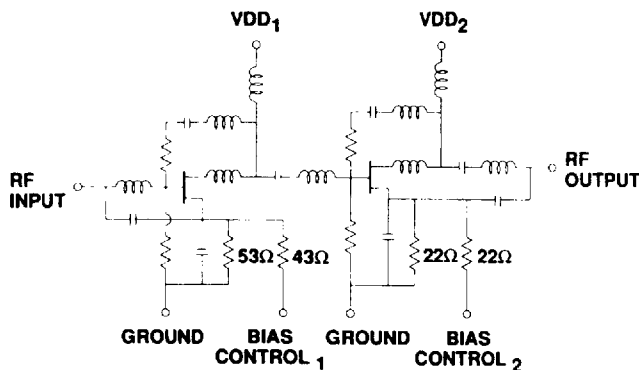
Typical Scattering Parameters, $T_A = 25^\circ\text{C}$ (S-Parameters Include Bonding Wire Parasitics)

CMM-9

$V_{DD} = 6\text{ V}$

Frequency (GHz)	S_{11} (dB)	S_{11} (Mag)	S_{11} (Ang)	S_{21} (dB)	S_{21} (Mag)	S_{21} (Ang)	S_{12} (dB)	S_{12} (Mag)	S_{12} (Ang)	S_{22} (dB)	S_{22} (Mag)	S_{22} (Ang)
2.0	-18.8	0.115	-113.94	14.8	5.505	-19.71	-33.8	0.020	38.50	-19.5	0.106	-87.88
3.0	-22.0	0.079	-126.77	15.3	5.821	-71.15	-35.3	0.017	15.38	-18.0	0.126	-133.66
4.0	-24.7	0.058	-135.91	15.2	5.754	-118.33	-36.9	0.014	6.02	-17.0	0.141	-174.54
5.0	-26.2	0.049	-156.87	14.8	5.495	-161.63	-39.8	0.010	1.40	-17.7	0.130	148.74
6.0	-21.2	0.087	166.67	14.1	5.070	158.96	-43.7	0.006	10.60	-18.6	0.117	139.19
7.0	-22.7	0.073	151.20	13.4	4.677	122.26	-51.3	0.005	27.55	-24.7	0.058	116.68
8.0	-27.3	0.043	116.76	13.0	4.467	87.16	-46.6	0.005	107.50	-44.4	0.006	112.43
9.0	-24.3	0.061	6.11	13.0	4.467	51.62	-40.4	0.010	124.79	-27.9	0.040	-93.09
10.0	-13.3	0.216	-32.75	13.3	4.624	12.23	-36.0	0.016	128.34	-20.4	0.095	-84.82

Equivalent Circuit



Wafer Qualification Procedure

100% DC Test
100% Visual Insp.

Sample Mechanical
Evaluation

Sample Circuit
Performance Tests*

NF, Gain, $P_{-1\text{ dB}}$,
VSWR

Reliability
Assessment

*80% of tested samples must meet specifications
for wafer acceptance.

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Specifications subject to change.

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