

CMM-4 2.0 to 20.0 GHz GaAs MMIC Amplifier

- ❑ Flat Gain
- ❑ +16 dBm P₁ dB
- ❑ Small Size: 39 x 74 mils
- ❑ Directly Cascadable
- ❑ Self-Biased
- ❑ Single Power Supply
- ❑ Guaranteed Performance

Celeritek CMM-4 GaAs MMIC Amplifier

The CMM-4 is a 2 to 20 GHz GaAs MMIC amplifier. It is a distributed design which provides flat gain and good power from a single power supply. Applications include oscillator buffers, RF gain blocks and driver amplifiers.

The CMM-4 is a small chip which provides 6.5 dB of gain and +16 dBm of power from a 6 volt supply. The chip is directly cascadable with no additional components. It also contains input and output DC blocking capacitors. The circuit's self-biasing feature provides excellent performance from a 4 to 6 volt supply. Two CMM-4 amplifiers can be biased in a current-sharing configuration where DC current flows through one amplifier then the other with a single 8 volt minimum power supply.

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. Via holes provide grounding.

The CMM-4 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 ($T_A = 25^\circ\text{C}$, $V_{DD} = 6\text{V}$, 2-20 GHz)				
Parameters	Units	Min	Typ	Max
Small Signal Gain	dB	6.0	6.5	
Gain Flatness	$\pm\text{dB}$		0.50	1.0
Input VSWR	—		2.0:1	
Output VSWR	—		2.0:1	
Reverse Isolation	dB		18	
Gain Variation Over Temperature (-55 to +95°C)	$\pm\text{dB}$		1.1	1.5
Noise Figure	dB		6.0	8.0
1 dB Gain Compression Power Output	dBm	15	16	
Current	mA	80		120

Absolute Maximum Ratings

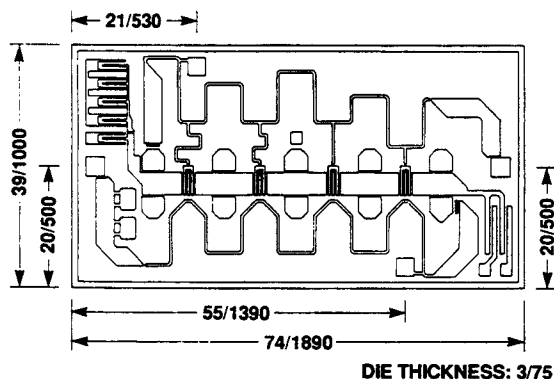
Parameter	Rating
Voltage	8V
Continuous Power Dissipation	1.5 W
Channel Temperature	+175°C
Storage Temperature	-65°C to +175°C
Mounting Temperature	+320°C
Input Power	+20 dBm
θ_{JC}	50°C/W

Die Attach and Bonding Procedures

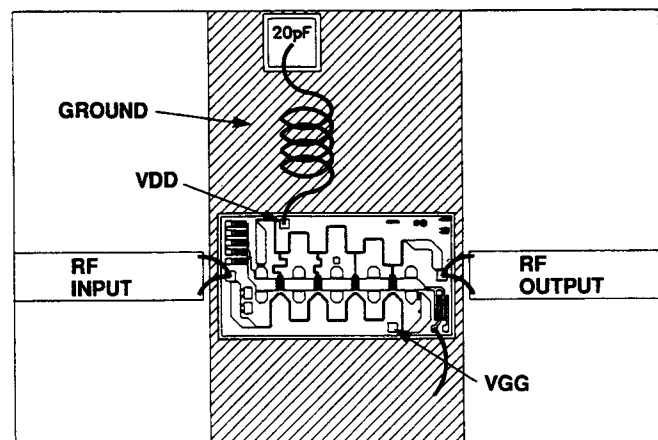
Die Attach: Conductive epoxy or preform die attach is recommended. For preform die attach: Preform: AuSn (80% Au, 20% Sn); Stage Temperature: 290°C, $\pm 5^\circ\text{C}$; Handling Tool: Tweezers; Time: 1 min or less.

Wire Bonding: Wire Size: 0.7 to 1.0 mil in diameter (prestressed); 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)



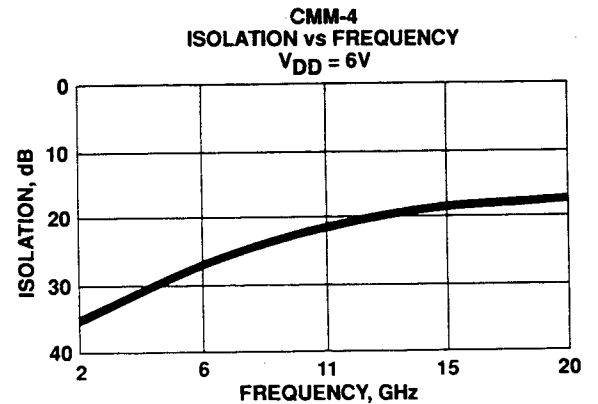
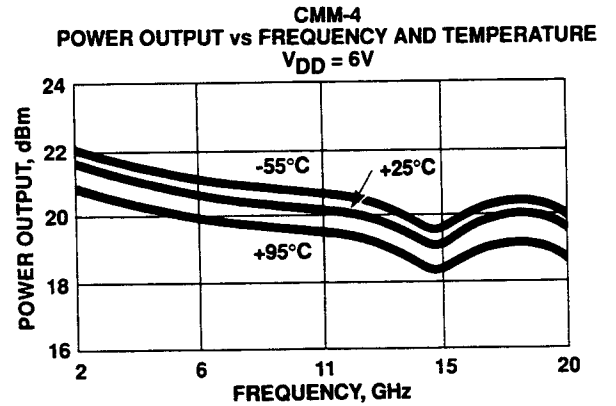
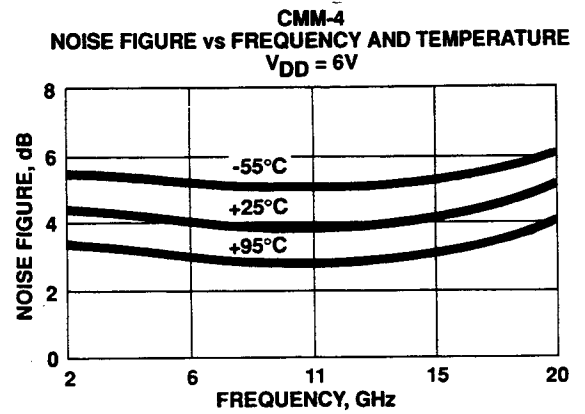
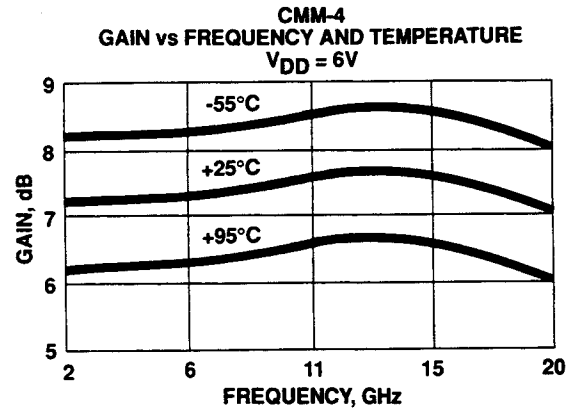
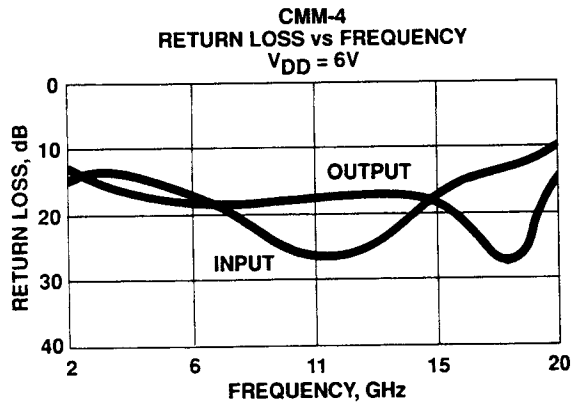
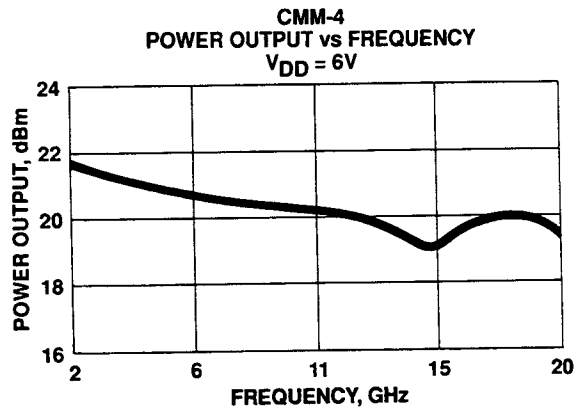
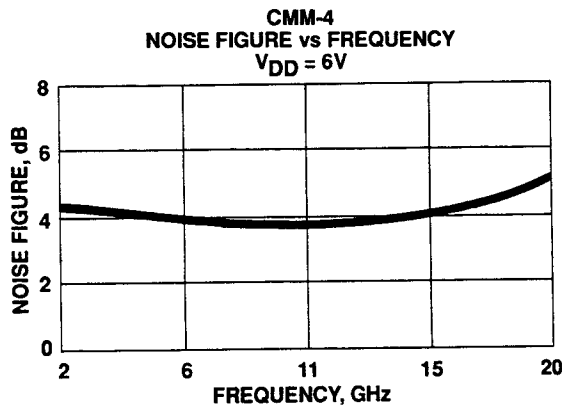
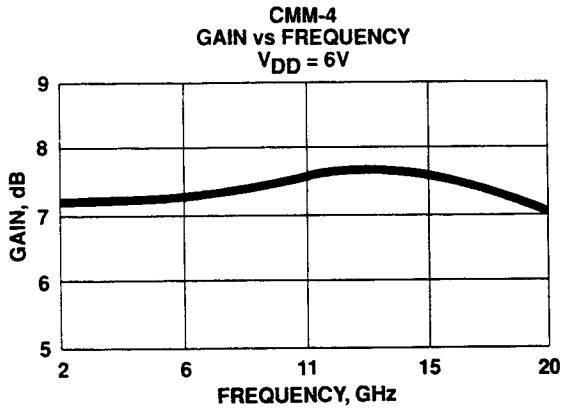
Bonding Diagram



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



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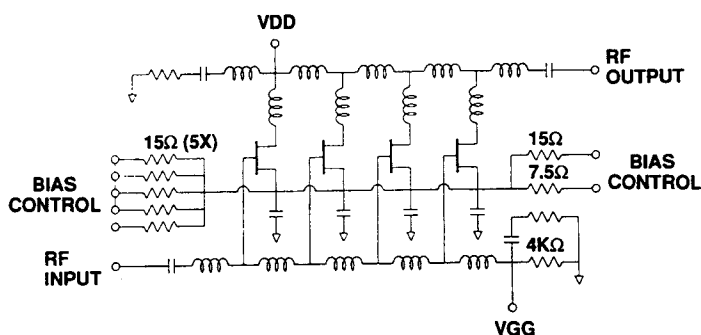
Typical Scattering Parameters, $T_A = 25^\circ\text{C}$ (S-Parameters Include Bonding Wire Parasitics)

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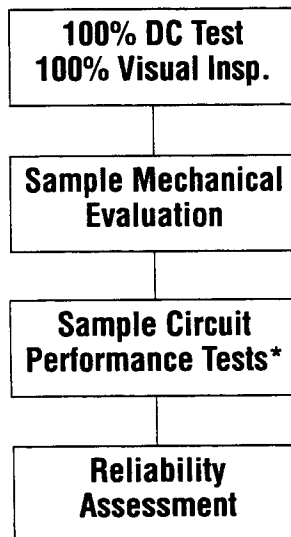
$V_{DS} = 6\text{ V}$

Frequency (GHz)	S_{11}		S_{21}			S_{12}			S_{22}			
	(dB)	(Mag)	(Ang)	(dB)	(Mag)	(Ang)	(dB)	(Mag)	(Ang)	(dB)	(Mag)	(Ang)
2.0	-14.7	0.184	-96.6	7.2	2.298	172.6	-34.9	0.018	55.7	-13.6	0.209	-160.0
4.0	-13.7	0.207	-135.9	7.3	2.330	113.4	-30.5	0.030	22.2	-14.1	0.197	150.6
6.0	-17.0	0.142	-162.6	7.3	2.324	65.8	-27.5	0.042	-19.9	-17.9	0.128	94.1
8.0	-19.6	0.105	132.2	7.2	2.290	22.8	-25.4	0.054	-57.9	-17.5	0.134	59.4
10.0	-26.7	0.046	49.8	7.4	2.339	-18.6	-23.1	0.070	-100.2	-17.8	0.129	4.7
12.0	-25.0	0.056	-112.0	7.7	2.422	-63.2	-21.3	0.086	-139.6	-17.5	0.133	-51.4
14.0	-17.0	0.141	-174.1	7.7	2.436	-108.7	-19.9	0.101	179.3	-17.3	0.137	-90.7
16.0	-14.7	0.185	129.3	7.5	2.365	-154.0	-18.9	0.113	137.8	-20.5	0.094	-104.3
18.0	-13.6	0.208	68.3	7.0	2.237	160.1	-18.6	0.117	91.0	-28.0	0.040	-51.8
20.0	-10.1	0.31	1.2	7.0	2.241	119.0	-18.9	0.113	48.6	-14.2	0.195	-12.0

Equivalent Circuit



Wafer Qualification Procedure



NF, Gain, P_{-1} dB,
VSWR

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

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Specifications subject to change.

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