CF005 Series

Broadband Power GaAs MESFET Chips

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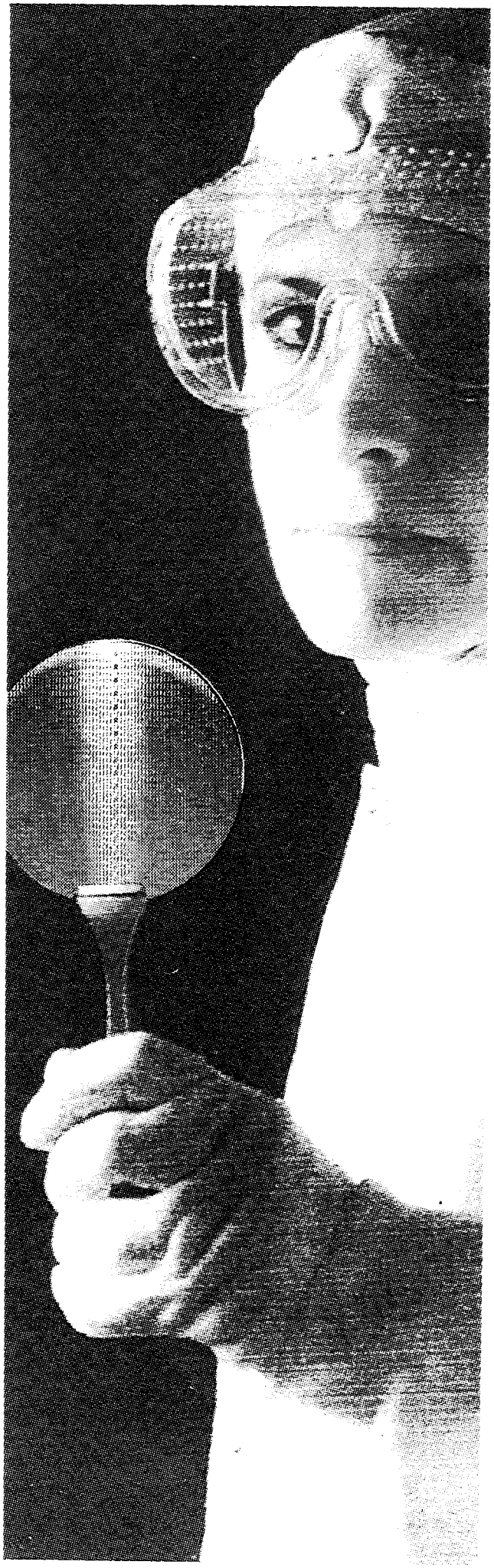
Broadband Power GaAs MESFET Chips

- **P_{1dB} Power:**
  - **CF003-01: +22 dBm**
  - **CF005-01: +25 dBm**
  - **CF010-01: +28 dBm**
- **High Gain (@ 12 GHz):**
  - **CF003-01: 9.0 dB**
  - **CF005-01: 8.5 dB**
  - **CF010-01: 8.0 dB**
- **Broadband: Usable to 18 GHz**
- **Wafer Qualification Procedure**
- **Customer Wafer Selection Available**



Celeritek Broadband Power Chips

Celeritek Medium Power Chips are GaAs MESFETs which include the CF003-01, CF005-01 and CF010-01 models. They are 600 µm, 1200 µm and 2400 µm gate width, respectively. All have sub-half-micron gate lengths, Celeritek's proprietary Silicon Nitride passivation, and are fabricated on ion implanted wafers.

Celeritek's Wafer Qualification Procedure for these devices consists of DC, RF and reliability testing of both individual die and generic 6 to 18 GHz amplifier modules.

Celeritek's broadband power chips make up a family of GaAs FET devices which have high broadband gain and provide up to 1 watt in balanced 6 to 18 GHz amplifier circuits. These devices are also suitable for high power oscillators. In narrow band applications they offer superior associated gain.

These devices are available in chip form and are suitable for airborne, shipboard and ground-based equipment. Screening includes MIL-STD-750 Class B, Class S and commercial screening. These devices are also available in packaged form. Please consult the Packaged Power GaAs FET data sheets or contact the factory for further information.

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Specifications (T_A = 25°C)				CF003-01			CF005-01			CF010-01		
Active Layer				Ion Implanted			Ion Implanted			Ion Implanted		
Symbol	Parameters and Conditions	Frequency (GHz)	Units	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
G_L	Linear Power Gain	12.0	dB									
	V_{DS} = 6.0 V, I_{DS} = 80 mA			8.0	9.0							
	V_{DS} = 6.0 V, I_{DS} = 160 mA						7.5	8.5				
	V_{DS} = 6.0 V, I_{DS} = 300 mA									7.0	8.0	
P_{1dB}	Power Output @ 1 dB GC	12.0	dBm									
	V_{DS} = 6.0 V, I_{DS} = 80 mA			21.5	22.0							
	V_{DS} = 6.0 V, I_{DS} = 160 mA						24.0	25.0				
	V_{DS} = 6.0 V, I_{DS} = 300 mA									27.0	28.0	
g_m	Transconductance V_{DS} = 3.0 V, V_{GS} = 0 V		mS		120			240			480	
I_{DSS}	Drain Current V_{DS} = 3.0 V, V_{GS} = 0 V		mA	120	180	240	220	350	440	440	700	880
V_P	Pinchoff Voltage V_{DS} = 3.0 V, I_{DS} = 1 mA		Volts	-0.7	-1.3	-2.5	-0.7	-1.3	-2.5	-0.7	-1.3	-2.5
BV_{GD}	Breakdown Voltage, Gate-Drain		Volts									
	I_{GD} = 100 µA			-5.5	-8.0							
	I_{GD} = 200 µA						-5.5	-8.0				
	I_{GD} = 400 µA									-5.5	-8.0	
R_{th}	Thermal Resistance		°C/W		80			50			25	

Absolute Maximum Ratings

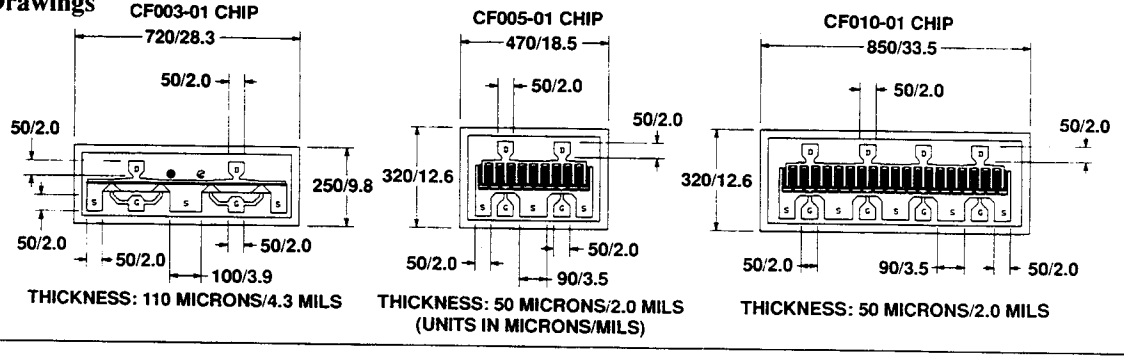
Parameter	Symbol	Ratings
Drain-Source Voltage	V_{DS}	8V
Gate-Source Voltage	V_{GS}	-5V
Drain Current	I_{DS}	I_{DSS}
Continuous Dissipation		
CF003-01	P_T	1.6 W
CF005-01	P_T	3.0 W
CF010-01	P_T	6.0 W
Channel Temperature	T_{CH}	175°C
Storage Temperature	T_{STG}	-65°C to +175°C

Die Attach and Bonding Procedures

Die Attach: Eutectic die attach is recommended. For eutectic die attach: Preform: AuSn (80% Au, 20% Sn); Stage Temperature: 290°C, ±5°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.

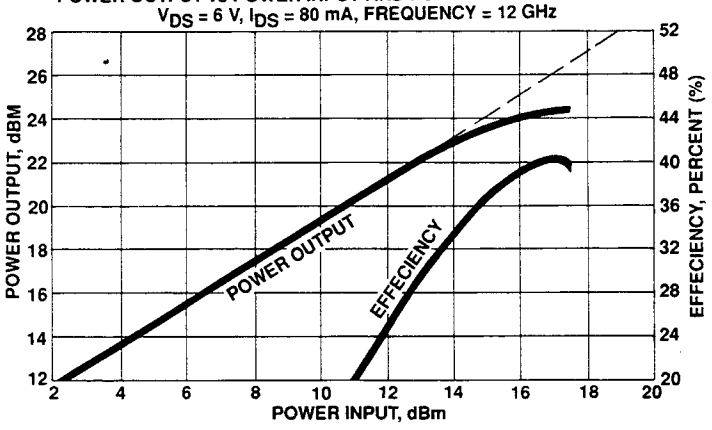
Chip Outline Drawings



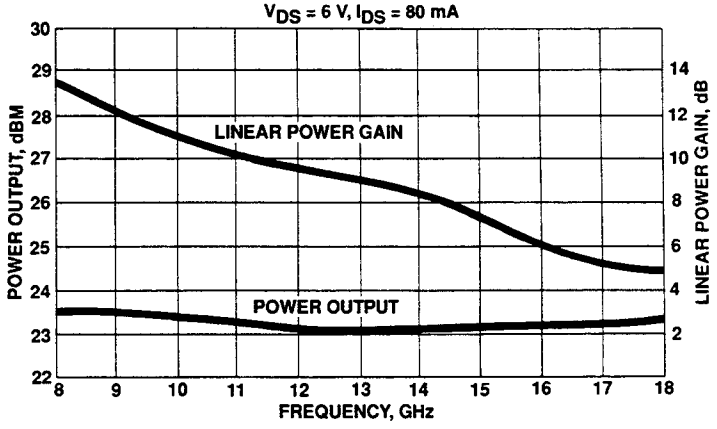
(UNITS IN MICRONS/MILS)

Typical Performance (T_A = 25°C)

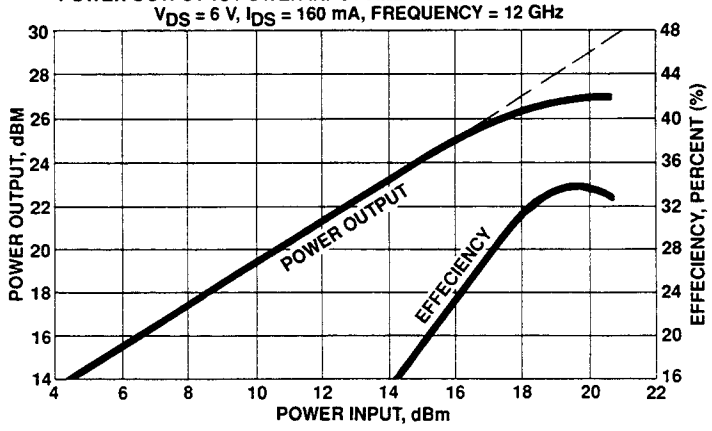
CF003-01
POWER OUTPUT vs POWER INPUT AND POWER ADDED EFFICIENCY
V_{DS} = 6 V, I_{DS} = 80 mA, FREQUENCY = 12 GHz



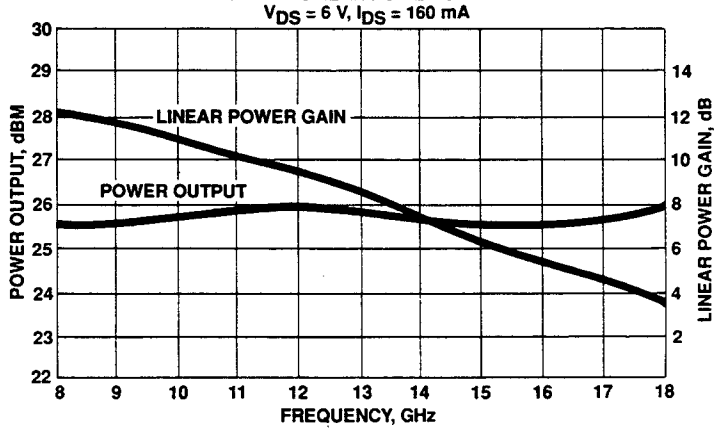
CF003-01
POWER OUTPUT AND LINEAR POWER GAIN vs FREQUENCY
V_{DS} = 6 V, I_{DS} = 80 mA



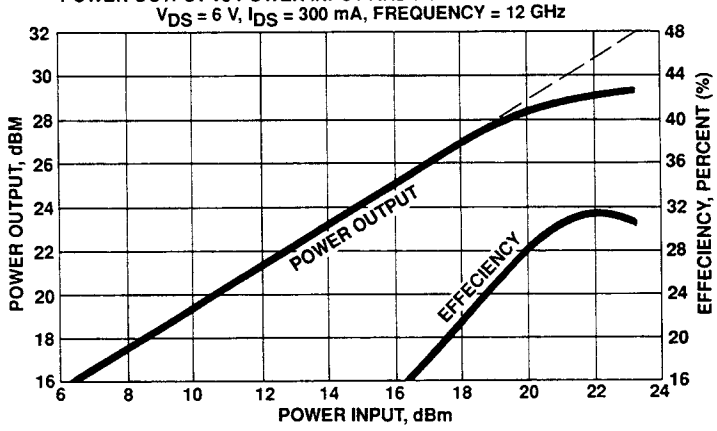
CF005-01
POWER OUTPUT vs POWER INPUT AND POWER ADDED EFFICIENCY
V_{DS} = 6 V, I_{DS} = 160 mA, FREQUENCY = 12 GHz



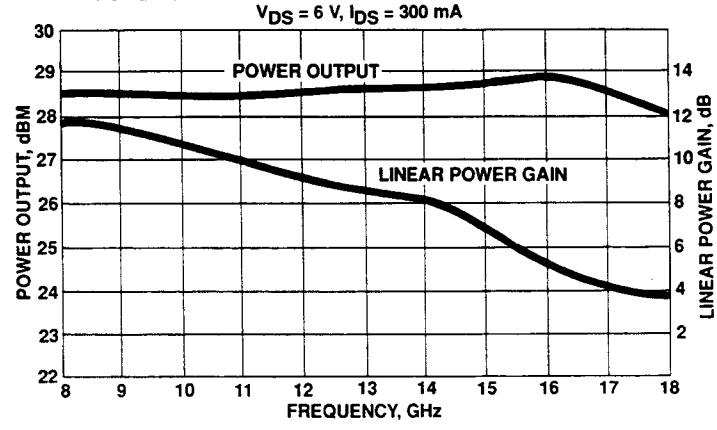
CF005-01
POWER OUTPUT AND LINEAR POWER GAIN vs FREQUENCY
V_{DS} = 6 V, I_{DS} = 160 mA



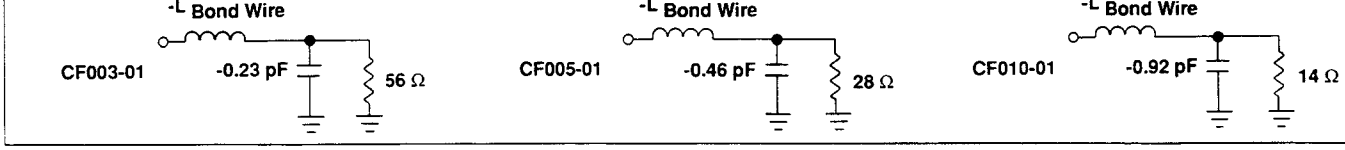
CF0010-01
POWER OUTPUT vs POWER INPUT AND POWER ADDED EFFICIENCY
V_{DS} = 6 V, I_{DS} = 300 mA, FREQUENCY = 12 GHz



CF0010-01
POWER OUTPUT AND LINEAR POWER GAIN vs FREQUENCY
V_{DS} = 6 V, I_{DS} = 300 mA



Output Power Match Models



Typical Scattering Parameters, Common Source (S-Parameters Include Bonding Wire Parasitics)

CF003-01 at Power Bias V_{DS} = 6 V, I_{DS} = 80 mA

Frequency	S_{11}		S_{21}			S_{12}			S_{22}		K	MSG
(GHz)	(Mag)	(Ang)	(dB)	(Mag)	(Ang)	(dB)	(Mag)	(Ang)	(Mag)	(Ang)		(dB)
2.0	0.91	-62	16.7	6.86	138	-28.6	0.04	59	0.23	-37	0.38	22.7
4.0	0.83	-108	14.1	5.10	107	-25.1	0.06	41	0.18	-74	0.53	19.6
6.0	0.80	-132	11.8	3.88	88	-24.0	0.06	33	0.17	-90	0.71	17.9
8.0	0.79	-155	9.6	3.01	71	-23.7	0.07	26	0.19	-120	0.88	16.6
10.0	0.78	-172	7.6	2.39	57	-24.1	0.06	24	0.23	-134	1.15	15.8
12.0	0.80	177	6.2	2.03	45	-23.3	0.07	21	0.27	-147	1.10	14.7
14.0	0.80	166	5.0	1.78	33	-23.2	0.07	17	0.31	-156	1.20	14.1
16.0	0.79	150	4.1	1.61	20	-22.1	0.08	14	0.33	-163	1.20	13.1
18.0	0.80	135	3.5	1.49	5	-21.3	0.09	9	0.32	179	1.18	12.4

CF005-01 at Power Bias V_{DS} = 6 V, I_{DS} = 160 mA

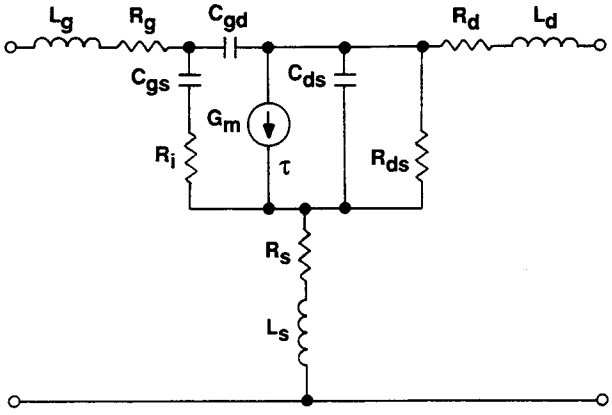
Frequency	S_{11}		S_{21}			S_{12}			S_{22}		K	MSG
(GHz)	(Mag)	(Ang)	(dB)	(Mag)	(Ang)	(dB)	(Mag)	(Ang)	(Mag)	(Ang)		(dB)
2.0	0.78	-109	16.1	6.35	121	-27.2	0.04	30	0.35	-177	0.69	21.6
4.0	0.82	-153	11.7	3.85	90	-25.4	0.05	23	0.42	177	0.74	18.6
6.0	0.83	-174	8.5	2.67	72	-24.8	0.06	19	0.45	172	0.88	16.7
8.0	0.84	177	6.2	2.03	59	-24.5	0.06	20	0.47	170	1.02	15.3
10.0	0.85	171	4.2	1.62	49	-24.5	0.06	21	0.47	167	1.20	14.3
12.0	0.86	165	2.8	1.38	39	-23.5	0.07	18	0.49	164	1.14	13.2
14.0	0.86	160	1.7	1.22	29	-23.2	0.07	19	0.51	162	1.16	12.4
16.0	0.86	154	0.5	1.06	20	-22.5	0.08	15	0.53	160	1.14	11.5
18.0	0.87	143	-0.9	0.91	9	-22.7	0.07	13	0.57	156	1.18	10.9

CF010-01 at Power Bias V_{DS} = 6 V, I_{DS} = 300 mA

Frequency	S_{11}		S_{21}			S_{12}			S_{22}		K	MSG
(GHz)	(Mag)	(Ang)	(dB)	(Mag)	(Ang)	(dB)	(Mag)	(Ang)	(Mag)	(Ang)		(dB)
2.0	0.89	-146	14.1	5.09	100	-30.4	0.03	29	0.62	180	0.54	22.3
4.0	0.90	-173	8.4	2.64	78	-29.1	0.04	29	0.66	176	0.76	18.8
6.0	0.90	175	5.0	1.77	65	-28.2	0.04	31	0.67	174	0.94	16.6
8.0	0.91	170	2.6	1.34	56	-27.4	0.04	36	0.68	174	1.08	15.0
10.0	0.91	166	0.6	1.07	49	-27.4	0.04	40	0.67	174	1.26	14.0
12.0	0.91	163	-0.9	0.90	41	-26.0	0.05	37	0.69	174	1.15	12.6
14.0	0.92	161	-2.1	0.78	35	-25.5	0.05	41	0.70	175	1.10	11.7
16.0	0.91	158	-3.3	0.68	28	-24.9	0.06	36	0.72	175	1.05	10.8
18.0	0.92	149	-4.6	0.59	19	-24.8	0.06	33	0.74	173	1.04	10.1

Device Model

Parameters	CF003-01 VDS = 6V, IDS=80mA	CF005-01 VDS = 6V, IDS=160mA	CF010-01 VDS = 6V, IDS=300mA	Units
L_g	0.21	0.19	0.15	nH
R_g	0.50	0.25	0.12	Ω
C_{gs}	0.71	1.13	2.58	pF
R_i	1.40	0.65	0.42	Ω
C_{gd}	0.053	0.120	0.210	pF
G_m	134	254	578	mS
τ	2.8	3.0	2.8	ps
C_{ds}	0.16	0.26	0.50	pF
R_{ds}	87	36	20	Ω
R_d	0.67	0.33	0.17	Ω
L_d	0.21	0.19	0.10	nH
R_s	0.53	0.33	0.26	Ω
L_s	0.040	0.030	0.018	nH



Wafer Qualification Procedure

- 100% DC Test, 100% Visual Insp.
- Sample Chip Performance Test — Power, S-Parameters, IP3, Power Blast
- Sample Circuit Performance Tests 6-18 GHz Module — Power, Gain, VSWR
- Reliability Assessment — Power Blast & Burn-In

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

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Specifications subject to change.

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