

## **CFK0301**

High Dynamic Range  
Dual, Low-Noise GaAs FET

**Product Specifications**  
**April 1998**

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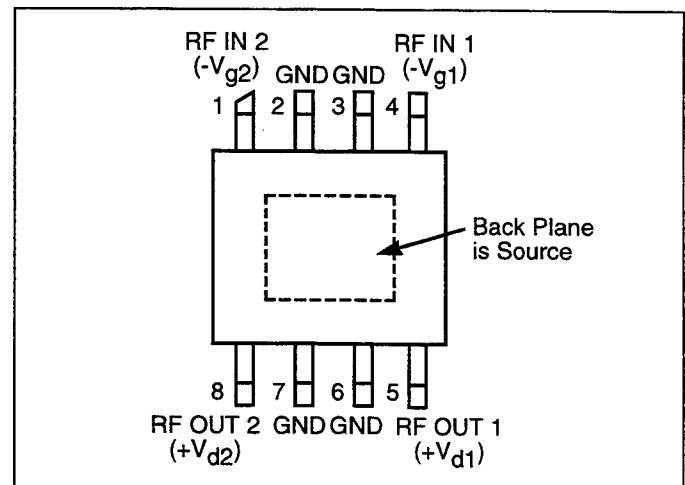
# High Dynamic Range Dual, Low-Noise GaAs FET

**Features**

- Dual 600  $\mu\text{m}$  GaAs FETs in a Single Package
- Guaranteed Low-Noise Figure: 0.8 to 2.0 GHz
- Excellent Gain and Phase Matching
- High Intercept Point
- Easily Matched for Low Noise Figure
- Surface Mount SO-8 Package

**Applications**

- Cellular Base Stations
- PCS Base Stations
- Industrial Data Networks


**Description**

Celeritek's CFK0301 contains two independent GaAs FETs in one surface-mount package. Each device is an 600  $\mu\text{m}$  gate width and 1/4  $\mu\text{m}$  gate length MESFET and provide low-noise figure and high intercept point. As the two GaAs FET die are selected from adjacent areas of the

processed wafer, they are matched in gain and phase.

The CFK0301 is suitable as balanced front-end FETs of a low-noise amplifier of base stations for PCS, Japanese PHS, AMPS, GSM and other communications systems.

The CFK0301 is packaged in a SO-8 package which is surface-mountable and available in tape and reel.

**Electrical Specifications** of a single GaAs FET (TA = 25°C, 2 GHz)

RF Characteristics (Celeritek 1.9 GHz test fixture <sup>1</sup> )		900 MHz			1.9 GHz			Units
Parameters	Conditions	Min	Typ	Max	Min	Typ	Max	
<b>V<sub>d</sub> = 4V, I<sub>d</sub> = 30 mA</b>								
Noise Figure			0.6			0.75	0.85	dB
Associated Gain	@ Noise Figure		22		15.5	16.5		dB
P <sub>out</sub>	P <sub>-1</sub>		17.5		17.5	18.5		dBm
IP <sub>3</sub>	+5 dBm P <sub>OUT</sub> /Tone		27		27	28		dBm
I <sub>d</sub>	@ P <sub>-1</sub> per FET		43			42		mA
<b>V<sub>d</sub> = 4V, I<sub>d</sub> = 70 mA</b>								
Noise Figure			0.6			0.8		dB
Associated Gain	@ Noise Figure		23.5			17.5		dB
P <sub>out</sub>	P <sub>-1</sub>		19.5			19		dBm
IP <sub>3</sub>	+5 dBm P <sub>OUT</sub> /Tone		31			28		dBm
I <sub>d</sub>	@ P <sub>-1</sub> per FET		72			71		mA
<b>DC Characteristics</b>								
Transconductance	V <sub>ds</sub> = 2 V, V <sub>gs</sub> = 0 V	70	140					mmho
Saturated Drain Current	V <sub>ds</sub> = 2 V, V <sub>gs</sub> = 0 V	120	150	180				mA
Pinchoff Voltages	V <sub>ds</sub> = 2 V, I <sub>ds</sub> = 1 mA	-2.5	-1.3	-0.5				V
Thermal Resistance <sup>2</sup>	@ T <sub>case</sub> = 150°C liquid crystal test		42					°C/W

Notes: 1. Input matched for low noise.  
 2. For both FETs.

### Typical Noise Parameters ( $V_{ds} = 4\text{ V}$ , $I_{ds} = 30\text{ mA}$ )

Frequency (GHz)	$F_{min}$ (dB)	Gamma Opt		RN/50
		Mag	Ang	
0.6	0.3	0.9169	30	0.20
0.8	0.3	0.8840	33	0.19
1.0	0.4	0.8490	36	0.17
1.2	0.5	0.8390	40	0.18
1.4	0.5	0.7753	44	0.18
1.6	0.5	0.7419	47	0.17
1.8	0.6	0.7257	50	0.16
2.0	0.6	0.7120	53	0.16

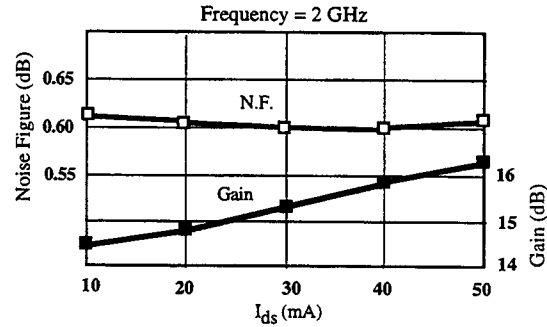
### Typical Performance

(In Celeritek PB-CFK0301-P3-00 Evaluation Board)

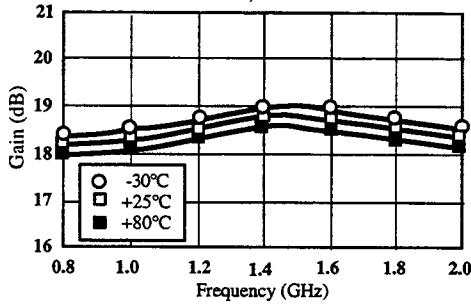
### Absolute Maximum Ratings

Parameter	Symbol	Rating
Drain-Source Voltage	$V_{ds}$ 1, 2	+6V
Gate-Source Voltage	$V_{gs}$ 1, 2	-4V
Drain Current of Each Device	$I_{ds}$	Idss
Continuous Dissipation	Pt	1.5 W
Channel Temperature	Tch	175°C
Storage Temperature	Tstg	-65°C to +150°C

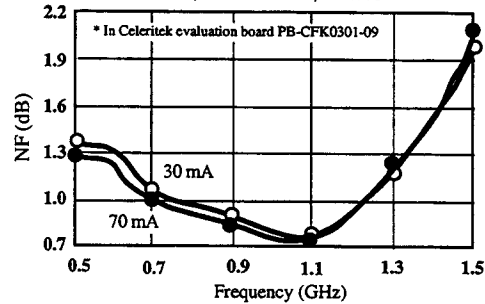
Noise Figure & Gain vs  $I_{ds}$



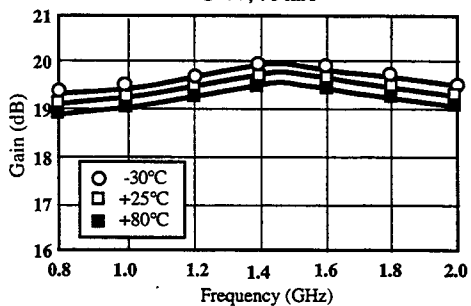
Gain vs Frequency Over Temperature @ 4V, 30 mA



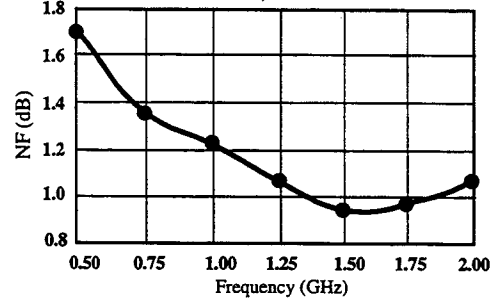
Noise Figure vs Frequency\* @ 4V, 30 mA & 4V, 70 mA



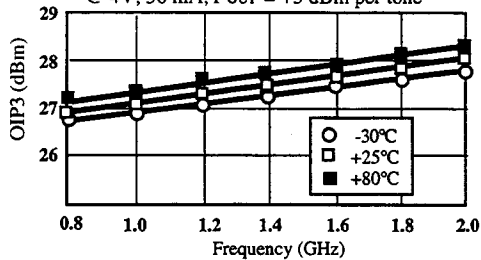
Gain vs Frequency Over Temperature @ 4V, 70 mA



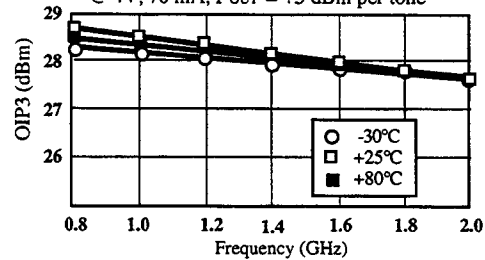
Noise Figure vs Frequency @ 4V, 30 mA



OIP3 vs Frequency Over Temperature @ 4V, 30 mA,  $P_{out} = +5\text{ dBm}$  per tone



OIP3 vs Frequency Over Temperature @ 4V, 70 mA,  $P_{out} = +5\text{ dBm}$  per tone





## Product Specifications - April 1998

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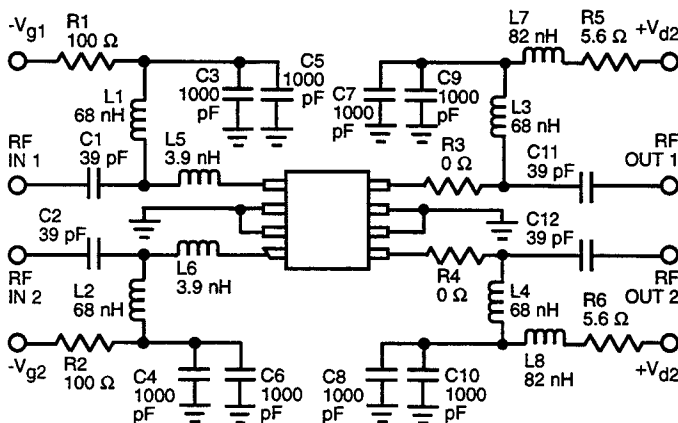
Typical Scattering Parameters (TA = 25°C, V<sub>DS</sub> = 4 V, I<sub>DS</sub> = 30 mA) Information is available on disk.

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	Mag	Ang	Mag (dB)	Ang	MAG (dB)	ANG	MAG	ANG
0.5	0.99	-27.9	17.37	157.0	0.01	69.3	0.37	-22.3
0.7	0.98	-39.3	17.24	147.9	0.02	61.6	0.37	-31.4
0.8	0.98	-44.9	17.15	143.3	0.02	58.9	0.37	-36.1
0.9	0.97	-50.4	17.00	138.6	0.03	54.1	0.37	-40.4
1.0	0.97	-55.8	16.91	134.3	0.03	50.5	0.37	-44.7
1.3	0.96	-71.4	16.54	121.5	0.03	39.2	0.36	-57.6
1.5	0.95	-81.1	16.25	113.2	0.04	32.0	0.36	-65.7
1.8	0.93	-94.3	15.80	101.5	0.04	22.6	0.35	-76.8
1.9	0.92	-98.4	15.66	97.9	0.05	19.1	0.34	-80.5
2.0	0.91	-102.2	15.52	94.4	0.05	14.8	0.33	-83.4
2.5	0.87	-122.0	15.06	77.3	0.06	1.6	0.32	-99.7
3.0	0.86	-145.0	14.71	58.5	0.06	-13.1	0.31	-117.4
3.5	0.84	-131.9	14.03	40.4	0.07	-27.9	0.31	-129.4
4.0	0.85	68.8	13.07	24.8	0.07	-39.8	0.29	-136.6

Typical Scattering Parameters (TA = 25°C, V<sub>DS</sub> = 4 V, I<sub>DS</sub> = 70 mA) Information is available on disk.

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	Mag	Ang	Mag (dB)	Ang	MAG (dB)	ANG	MAG	ANG
0.5	0.99	-29.9	19.10	156.0	0.01	68.8	0.34	-22.2
0.7	0.98	-42.0	18.94	146.4	0.02	62.0	0.34	-31.3
0.8	0.98	-48.0	18.83	141.0	0.02	58.8	0.34	-36.1
0.9	0.97	-53.9	18.65	136.7	0.02	-54.3	0.33	-40.5
1.0	0.97	-59.5	18.54	132.3	0.02	50.3	0.33	-44.6
1.3	0.95	-75.9	18.13	119.2	0.03	39.4	0.33	-57.3
1.5	0.94	-85.9	17.78	110.7	0.03	32.1	0.32	-65.2
1.8	0.92	-99.7	17.28	98.9	0.03	22.8	0.31	-75.9
1.9	0.91	-104.0	17.13	95.1	0.04	20.0	0.31	-79.6
2.0	0.90	-107.8	16.95	91.7	0.04	15.0	0.30	-82.0
2.5	0.86	-128.4	16.42	74.1	0.04	2.7	0.28	-97.8
3.0	0.85	-152.1	15.96	55.3	0.05	-11.3	0.27	-114.7
3.5	0.82	-67.2	15.20	37.2	0.05	-25.0	0.28	-125.6
4.0	0.83	134.1	14.19	21.8	0.05	-36.0	0.26	-131.3

### Test Circuit - 900 MHz

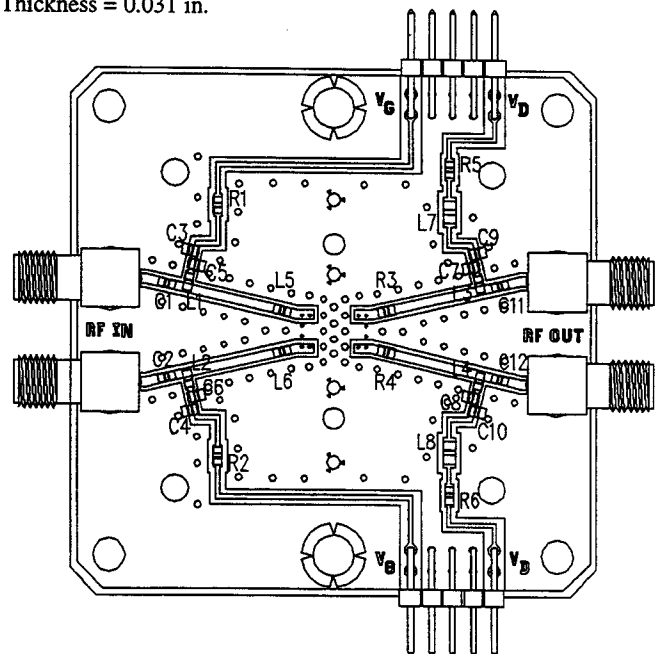


### Evaluation Board Parts List

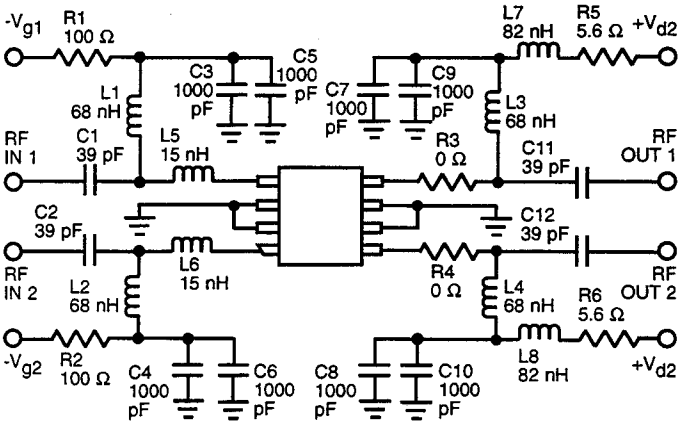
Item	Reference Designator	Description	Quantity
1	C1, C2, C11, C12	Capacitor, 39 pF	4
2	C3, C4, C5, C6, C7, C8, C9, C10	Capacitor, 1000 pF	8
3	R5, R6	Resistor, 5.6 Ω, 5%	2
4	R1, R2	Resistor, 100 Ω, 5%	2
5	L1, L2, L3, L4	Inductor, 68 nH	4
6	L5, L6	Inductor, 3.9 nH	2
7	L7, L8	Inductor, 82 nH	2
8	R3, R4	Resistor, 0 Ω	2

### PB-CFK0301-P1-00 Evaluation Board

Evaluation Board Substrate:  
 ER = 4.65  
 Thickness = 0.031 in.

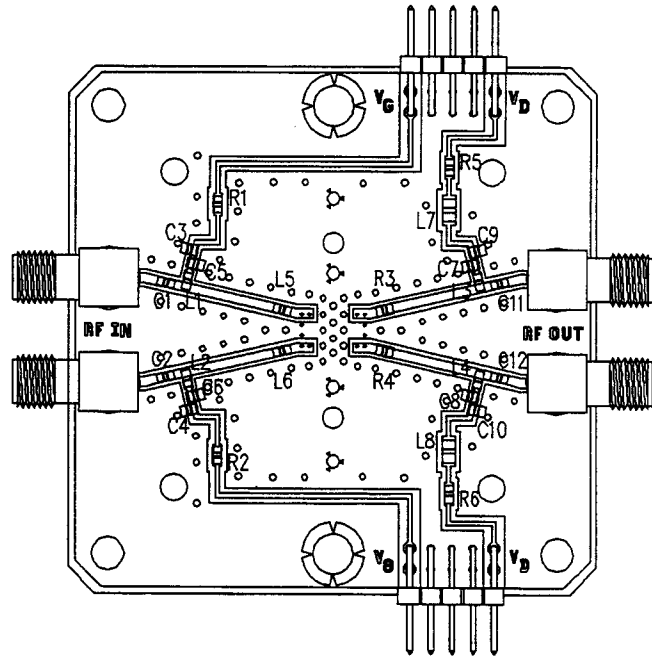


## Test Circuit - 1.9 GHz



## PB-CFK0301-P3-00 Evaluation Board

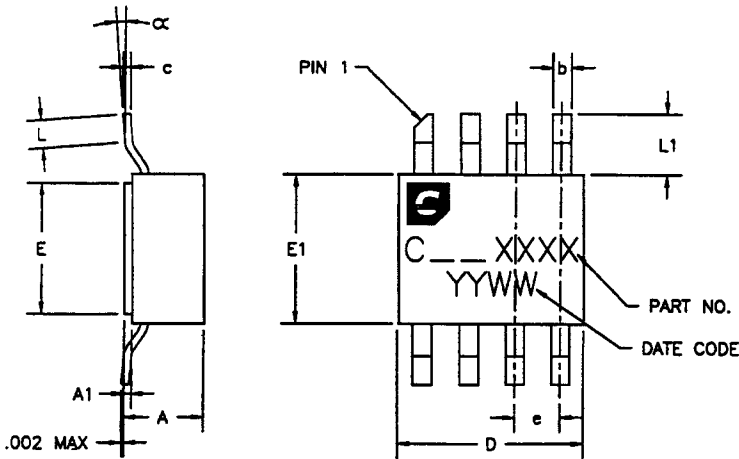
Evaluation Board Substrate:  
ER = 4.65  
Thickness = 0.031 in.



## Evaluation Board Parts List

Item	Reference Designator	Description	Quantity
1	C1, C2, C11, C12	Capacitor, 39 pF	4
2	C3, C4, C5, C6, C7, C8, C9, C10	Capacitor, 1000 pF	8
3	R5, R6	Resistor, 5.6 Ω, 5%	2
4	R1, R2	Resistor, 100 Ω, 5%	2
5	L1, L2, L3, L4	Inductor, 68 nH	4
6	L5, L6	Inductor, 15 nH	2
7	L7, L8	Inductor, 82 nH	2
8	R3, R4	Resistor, 0 Ω	2

## SO-8 Power Package Physical Dimensions



DIMENSION	MINIMUM	NOMINAL	MAXIMUM
A		.086[.0034]	.100[.0039]
A1	.005[.0002]	.008[.0003]	.011[.0004]
b	.017[.0007]	.020[.0008]	.023[.0009]
c	.007[.0003]	.008[.0003]	.009[.0004]
D	.195[.0077]	.200[.0079]	.205[.0081]
E	.135[.0053]	.140[.0055]	.145[.0057]
E1	.155[.0061]	.160[.0063]	.165[.0065]
e		.050[.0020]	
L	.020[.0009]		.040[.0016]
L1	.055[.0022]	.065[.0026]	.075[.0030]
α	0°		8°

DIMENSIONS IN INCHES

## Ordering Information

The CFK0301GaAs FET is available in tape and reel. An evaluation board is also available. Ordering part numbers are listed.

### Part Number for Ordering

Part Number	Function	Package
CFK0301-AK-0000	Dual, Low-Noise high dynamic range FET	SO-8 package
CFK0301-AK-000T	900 MHz, Dual, Low-Noise high dynamic range FET	SO-8 package in tape and reel
PB-CFK0301-P1-000	900 MHz, Evaluation Board	
PB-CFK0301-P3-000	1.9 GHz, Evaluation Board	

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