

High Dynamic Range Dual, Low Noise GaAs FET



CFK0301

Product Specifications April 1998

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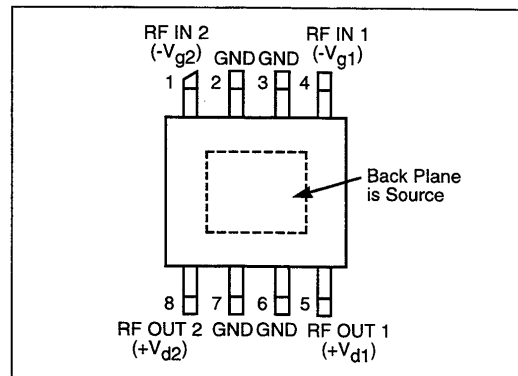
High Dynamic Range Dual, Low-Noise GaAs FET

Features

- ❑ Dual 600 μm 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 μm gate width and 1/4 μm 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 ¹) | | 900 MHz | | | 1.9 GHz | | | |
|---|---|---------|------|------|---------|------|------|-------|
| Parameters | Conditions | Min | Typ | Max | Min | Typ | Max | Units |
| V_d = 4V, I_d = 30 mA | | | | | | | | |
| Noise Figure | | | 0.6 | | | 0.75 | 0.85 | dB |
| Associated Gain | @ Noise Figure | | 22 | | 15.5 | 16.5 | | dB |
| P _{out} | P ₋₁ | | 17.5 | | 17.5 | 18.5 | | dBm |
| IP ₃ | +5 dBm P _{OUT} /Tone | | 27 | | 27 | 28 | | dBm |
| I _d | @ P ₋₁ per FET | | 43 | | | 42 | | mA |
| V_d = 4V, I_d = 70 mA | | | | | | | | |
| Noise Figure | | | 0.6 | | | 0.8 | | dB |
| Associated Gain | @ Noise Figure | | 23.5 | | | 17.5 | | dB |
| P _{out} | P ₋₁ | | 19.5 | | | 19 | | dBm |
| IP ₃ | +5 dBm P _{OUT} /Tone | | 31 | | | 28 | | dBm |
| I _d | @ P ₋₁ per FET | | 72 | | | 71 | | mA |
| DC Characteristics | | | | | | | | |
| Transconductance | V _{ds} = 2 V, V _{gs} = 0 V | 70 | 140 | | | | | mmho |
| Saturated Drain Current | V _{ds} = 2 V, V _{gs} = 0 V | 120 | 150 | 180 | | | | mA |
| Pinchoff Voltages | V _{ds} = 2 V, I _{ds} = 1 mA | -2.5 | -1.3 | -0.5 | | | | V |
| Thermal Resistance ² | @ T _{case} = 150°C liquid crystal test | | 42 | | | | | °C/W |

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

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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 |

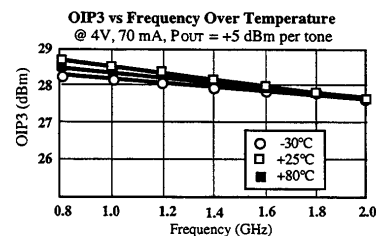
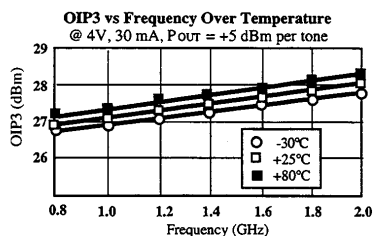
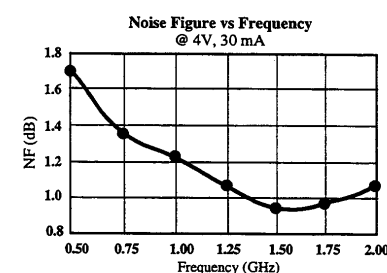
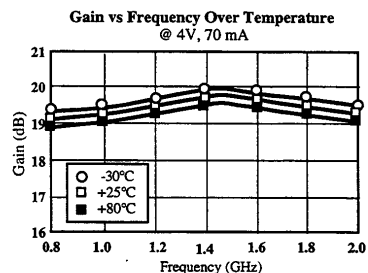
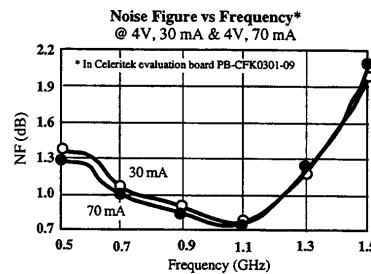
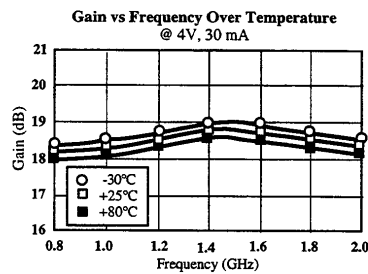
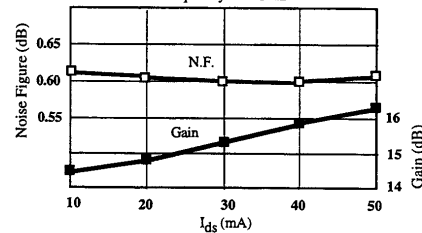
Absolute Maximum Ratings

| 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} | I_{dss} |
| Continuous Dissipation | Pt | 1.5 W |
| Channel Temperature | Tch | 175°C |
| Storage Temperature | Tstg | -65°C to +150°C |

Typical Performance

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

Noise Figure & Gain vs I_{ds}
Frequency = 2 GHz



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August 2006 - Rev 03-Aug-06

CFK0301



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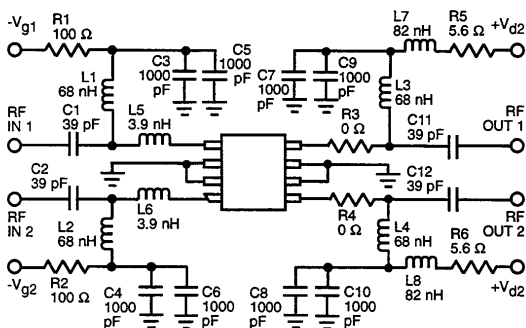
Typical Scattering Parameters (TA = 25°C, V_{DS} = 4 V, I_{DS} = 30 mA) Information is available on disk.

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|-----------------|-----------------|--------|-----------------|-------|-----------------|-------|-----------------|--------|
| | 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_{DS} = 4 V, I_{DS} = 70 mA) Information is available on disk.

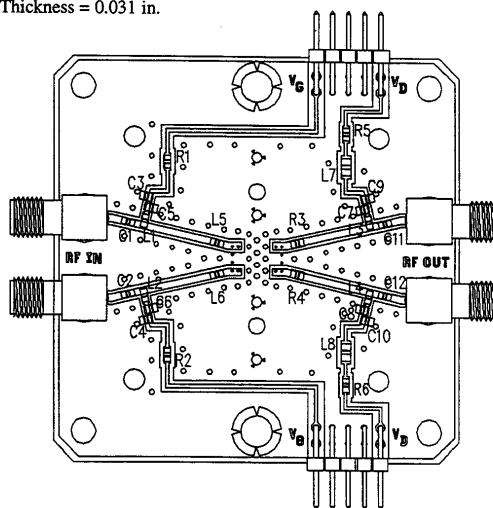
| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|-----------------|-----------------|--------|-----------------|-------|-----------------|-------|-----------------|--------|
| | Mag | Ang | Mag (dB) | Ang | MAG (dB) | ANG | MAG | ANG |
| 0.5 | 0.99 | -29.9 | 19.10 | 156.0 | 0.01 | 68.8 | 0.34 | -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



PB-CFK0301-P1-00 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, 3.9 nH | 2 |
| 7 | L7, L8 | Inductor, 82 nH | 2 |
| 8 | R3, R4 | Resistor, 0 Ω | 2 |

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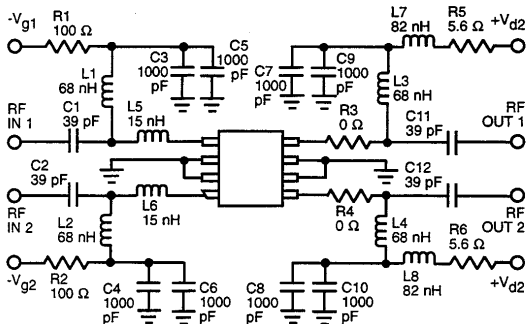
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High Dynamic Range Dual, Low Noise GaAs FET

CFK0301

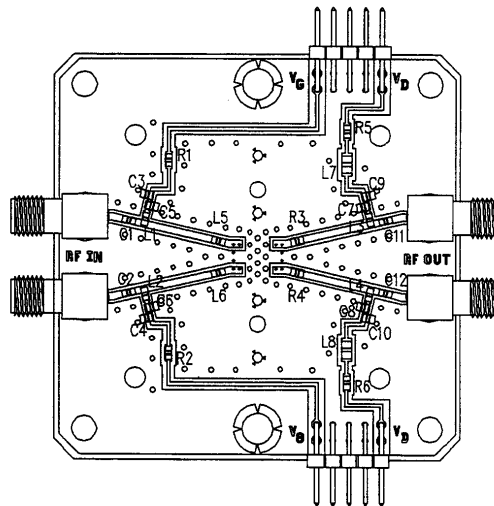
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Test Circuit - 1.9 GHz



PB-CFK0301-P3-00 Evaluation Board

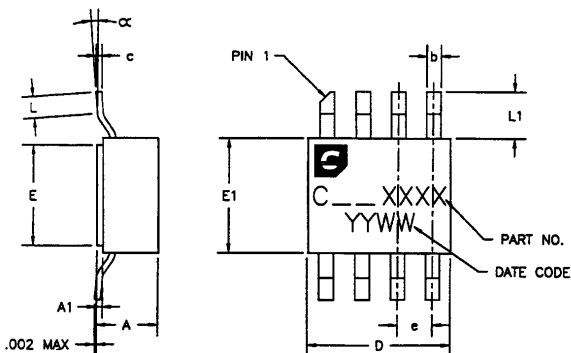
Evaluation Board Substrate:
ER = 4.65
Thickness = 0.031 in.



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 | 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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