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OKI electronic components

KGF1531

Small-Signal Amplifier

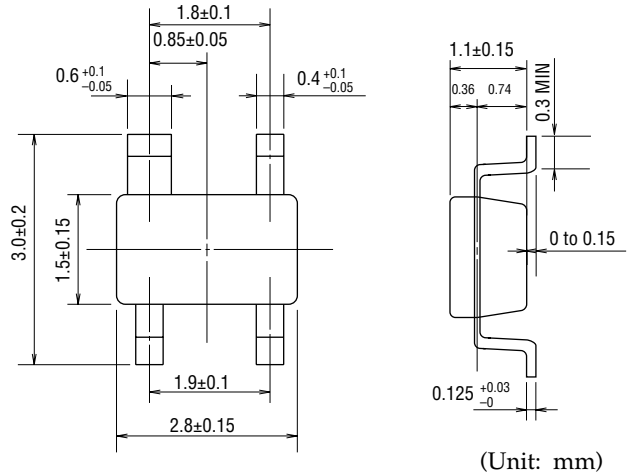
GENERAL DESCRIPTION

The KGF1531 is a high-performance GaAs FET small-signal dual-gate mixer for L-band frequencies that features low voltage operation, low current operation, high conversion gain, and low distortion. The KGF1531 specifications are guaranteed to a fixed matching circuit for 3 V and 1.9 GHz; external impedance-matching circuits are also required. Because of the high 3rd-order intercept point, the KGF1531 is ideal as a small-signal receiving mixer for L-band personal handy phones, such as digital keying cordless phones that require low intermodulation properties.

FEATURES

- Low voltage and low current operation: 3 V, 8 mA (max.)
- Specifications guaranteed as the mixer operation to a fixed matching circuits for 3 V, 1.9 GHz
- High conversion gain: 12 dB (typ.) at 1.9 GHz
- Low distortion: 3rd-order intercept point = 12.5 dBm (typ.) at 1.9 GHz
- Self-bias circuit configuration with built-in source capacitor
- Package: 4PSOP

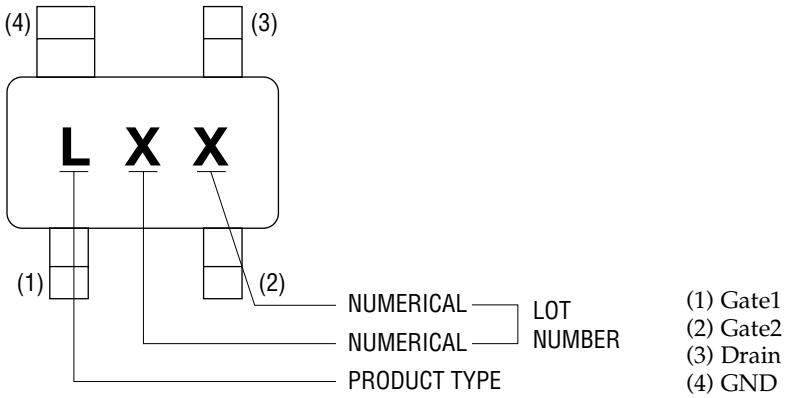
PACKAGE DIMENSIONS



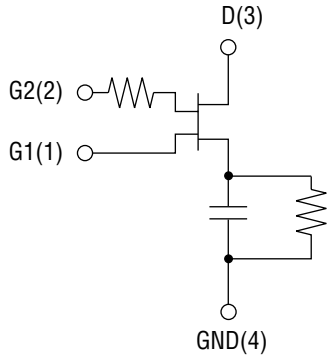
(Unit: mm)

Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating
Solder plate thickness	5 µm or more

MARKING



CIRCUIT



ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Condition	Unit	Min.	Max.
Drain-source voltage	V_{DS}	Ta = 25°C	V	—	4.0
Gate-source voltage	V_{GS}	Ta = 25°C	V	–3.0	0.4
Drain current	I_{DS}	Ta = 25°C	mA	—	50
Total power dissipation	P_{tot}	Ta = 25°C	mW	—	200
Channel temperature	T_{ch}	—	°C	—	150
Storage temperature	T_{stg}	—	°C	–45	125

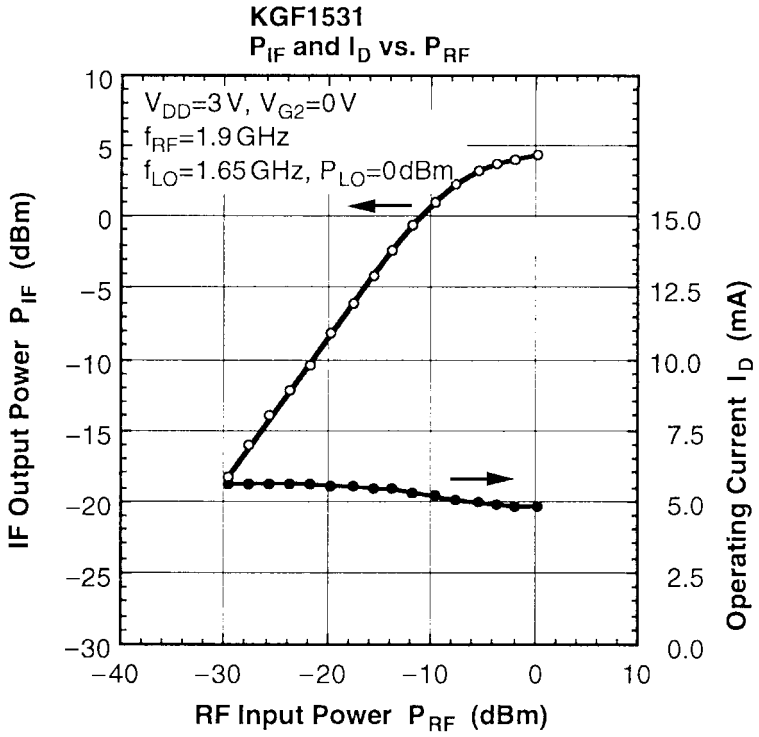
ELECTRICAL CHARACTERISTICS

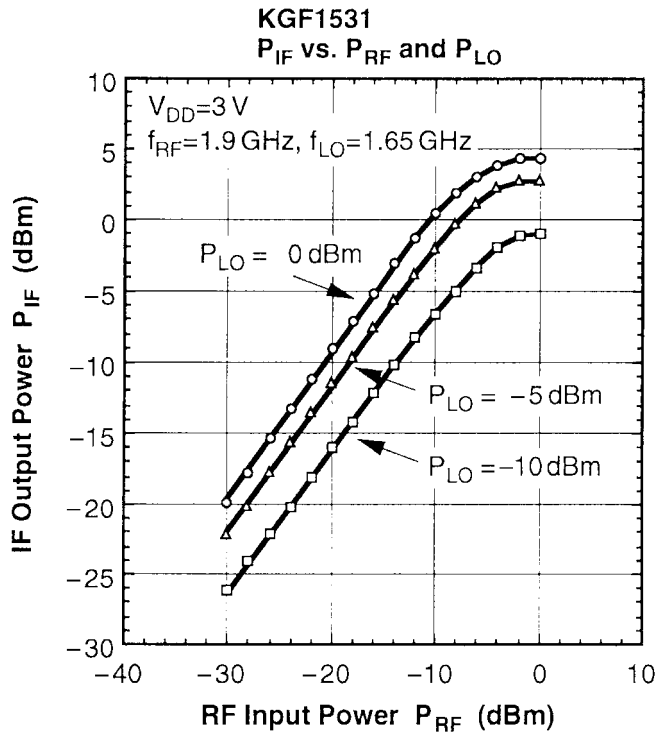
(Ta = 25°C)

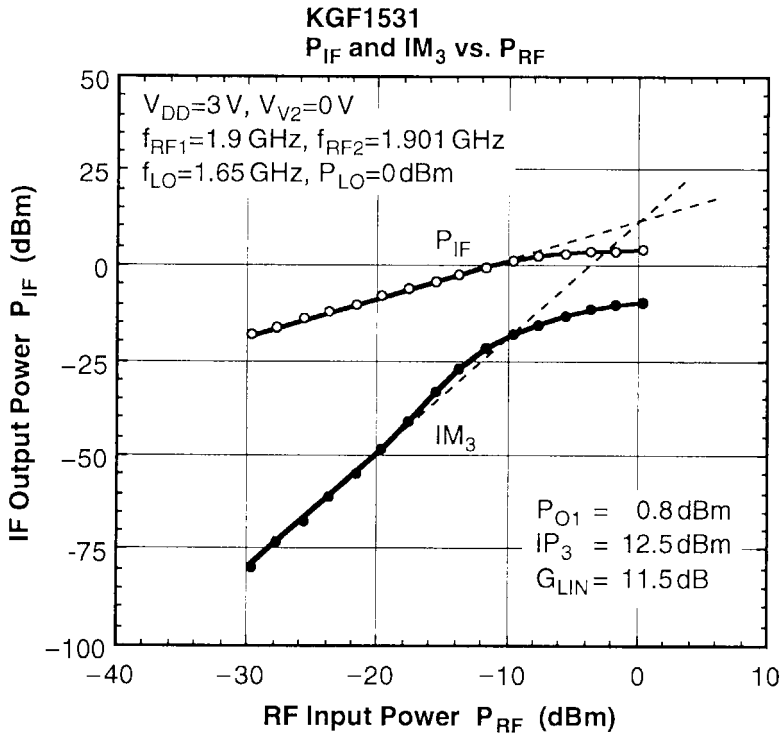
Item	Symbol	Condition	Unit	Min.	Typ.	Max.
Gate-source leakage current	I_{GSS}	V_{GS} = –3 V	µA	—	—	30
Gate-drain leakage current	I_{GDO}	$V_{GD(1,2)}$ = –6 V	µA	—	—	30
Drain-source leakage current	$I_{DS(off)}$	V_{DS} = 3 V, $V_{GS(1,2)}$ = –2 V	µA	—	—	30
Drain current	I_{DSS}	V_{DS} = 3 V, V_{GS} = 0 V	mA	15	25	—
Operating current	I_D	(*1), P_{IN} = –20 dBm	mA	—	6.0	8.0
Gate-source cut-off voltage	$V_{GS(off)}$	V_{DS} = 3 V, I_{DS} = 100 µA	V	–1.4	—	–0.6
Transconductance	gm	V_{DS} = 3 V, I_{DS} = 6 mA	mS	23	30	—
Noise figure	F	(*1)	dB	—	5.0	—
Conversion gain	G_C	(*1), P_{RF} = –20 dBm	dB	10	12	—
Output power	P_{O1}	(*1)	dBm	0	1.0	—
Port to port Isolation L-R	ISO	(*1), P_{RF} = –20 dBm	dB	—	15	—
Port to port Isolation R-I					22	
Port to port Isolation L-I					28	
Third-order intercept point	IP_3	(*2), f_2 = 1.901 GHz	dBm	—	12.5	—

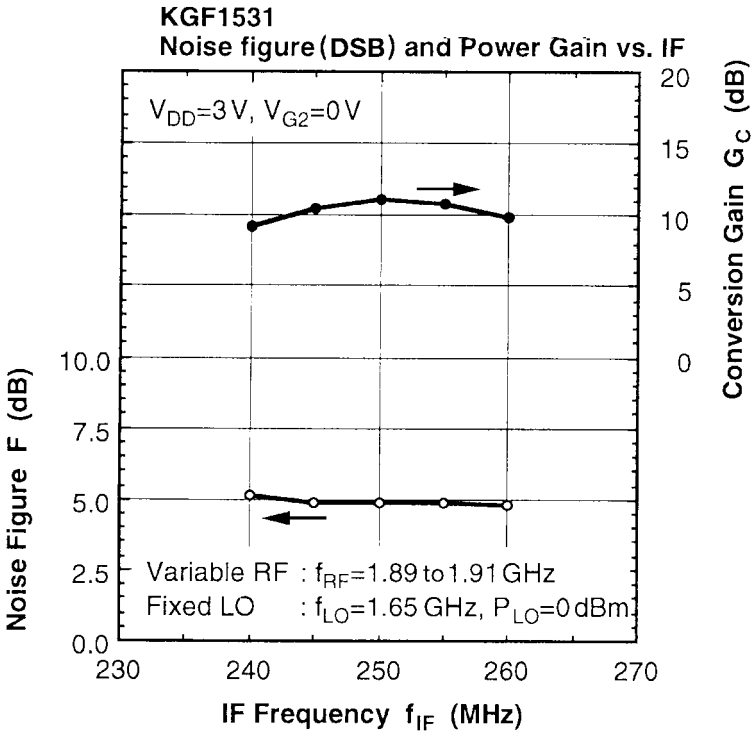
*1 Self-bias condition: $V_{DD} = 3\,V \pm 0.3\,V$, $V_{G(1,2)} = 0\,V$, $f_{RF} = 1.9\,GHz$, $f_{LO} = 1.65\,GHz$, $P_{LO} = 0\,dBm$

RF CHARACTERISTICS






KGF1531
P_{IF} and IM_3 vs. P_{RF}
V_{DD}=3 V, V_{V2}=0 V
f_{RF1}=1.9 GHz, f_{RF2}=1.901 GHz
f_{LO}=1.65 GHz, P_{LO}=0 dBm
P_{IF}
IM_3
P_{O1} = 0.8 dBm
IP_3 = 12.5 dBm
G_{LIN} = 11.5 dB
IF Output Power P_{IF} (dBm)
RF Input Power P_{RF} (dBm)
50
25
0
−25
−50
−75
−100
−40
−30
−20
−10
0
10


KGF1531
Noise figure (DSB) and Power Gain vs. IF
V_{DD}=3 V, V_{G2}=0 V
Variable RF : f_{RF}=1.89 to 1.91 GHz
Fixed LO : f_{LO}=1.65 GHz, P_{LO}=0 dBm
Noise Figure F (dB)
Conversion Gain G_C (dB)
IF Frequency f_{IF} (MHz)
10.0
7.5
5.0
2.5
0.0
20
15
10
5
0
230
240
250
260
270

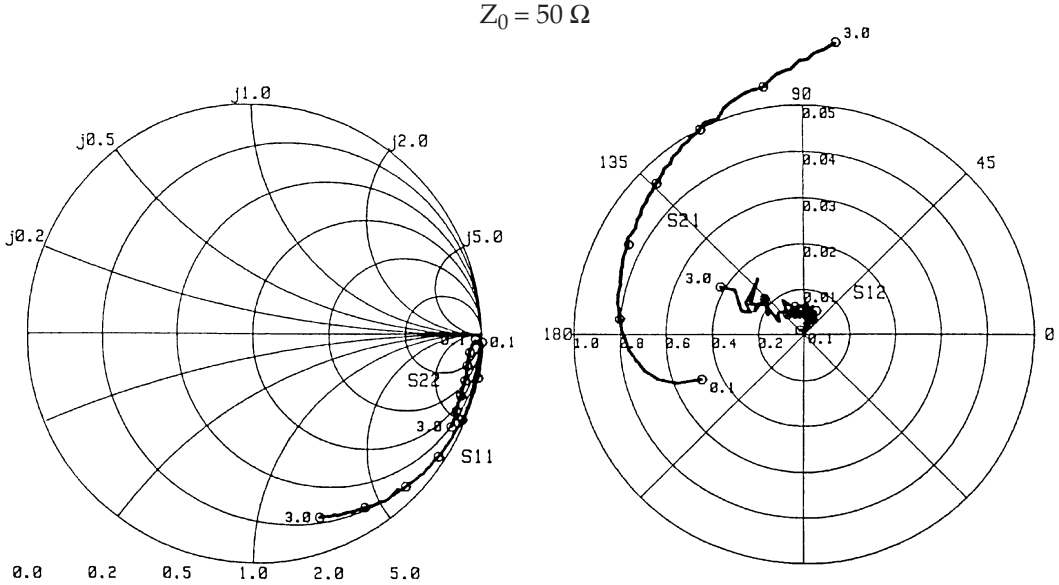
Typical S Parameters

V_{DD} = 3 V, V_{G2} = 0 V, I_D = 6.13 mA

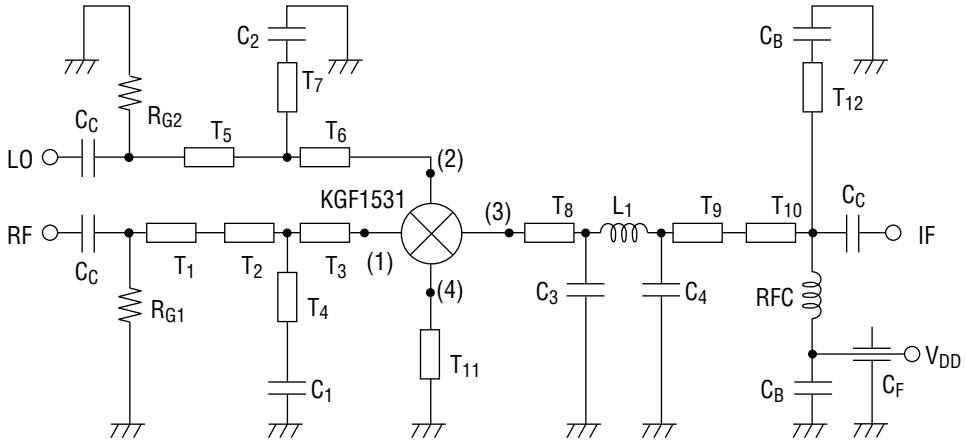
Freq(MHz)	MAG(S_{11})	ANG(S_{11})	MAG(S_{21})	ANG(S_{21})	MAG(S_{12})	ANG(S_{12})	MAG(S_{22})	ANG(S_{22})
100.0	1.002	–2.06	0.485	–156.45	0.001	134.30	0.973	–1.54
200.0	1.006	–4.21	0.660	–163.21	0.001	89.30	0.963	–2.43
300.0	1.003	–6.32	0.735	–171.52	0.002	49.34	0.959	–3.20
400.0	1.003	–8.72	0.777	–178.89	0.004	67.00	0.954	–4.02
500.0	1.005	–10.85	0.804	175.03	0.004	76.91	0.952	–4.71
600.0	0.999	–13.27	0.821	170.22	0.003	77.54	0.953	–5.26
700.0	0.996	–15.36	0.824	164.84	0.005	61.41	0.950	–6.06
800.0	0.995	–17.66	0.838	160.75	0.004	76.89	0.947	–6.90
900.0	0.992	–19.96	0.854	156.05	0.005	59.09	0.950	–7.42
1000.0	0.987	–22.12	0.858	152.38	0.006	62.64	0.947	–8.21
1100.0	0.983	–24.16	0.868	148.70	0.004	62.28	0.949	–8.92
1200.0	0.979	–26.53	0.882	144.57	0.004	67.53	0.948	–9.94
1300.0	0.977	–28.56	0.894	141.09	0.004	71.94	0.951	–10.48
1400.0	0.972	–31.19	0.906	137.65	0.003	88.94	0.950	–11.45
1500.0	0.970	–33.26	0.921	133.84	0.007	107.44	0.950	–12.14
1600.0	0.963	–35.49	0.933	130.62	0.004	76.87	0.950	–13.12
1700.0	0.959	–37.73	0.945	127.43	0.006	74.93	0.950	–13.80
1800.0	0.953	–40.11	0.967	123.66	0.005	106.06	0.948	–14.62
1900.0	0.947	–42.58	0.981	120.52	0.005	104.31	0.947	–15.36
2000.0	0.940	–44.82	0.999	116.72	0.006	128.87	0.948	–16.33
2100.0	0.922	–47.03	1.017	112.95	0.006	106.36	0.949	–17.37
2200.0	0.927	–49.42	1.029	110.02	0.006	115.80	0.948	–17.95
2300.0	0.925	–51.84	1.064	106.74	0.006	153.54	0.948	–18.82
2400.0	0.913	–54.35	1.081	103.70	0.009	152.18	0.949	–19.59
2500.0	0.900	–57.14	1.091	99.12	0.012	137.58	0.949	–20.37
2600.0	0.891	–59.49	1.121	96.98	0.012	146.84	0.952	–21.07
2700.0	0.880	–62.22	1.152	93.75	0.013	150.18	0.957	–22.18
2800.0	0.874	–64.94	1.196	90.37	0.015	151.42	0.950	–22.78
2900.0	0.863	–66.98	1.227	87.35	0.015	158.84	0.957	–24.27
3000.0	0.851	–70.00	1.277	83.46	0.021	149.86	0.955	–24.83

Typical S Parameters

V_{DD} = 3 V, V_{G2} = 0 V, I_D = 6.13 mA
Frequency : 0.5 to 3.0 GHz
Z_0 = 50 Ω



Test Circuit and Bias Configuration for KGF1531



f = 1.9GHz

T_1: Z_0 = 75 Ω, E = 25 deg
T_2: Z_0 = 100 Ω, E = 2 deg
T_3: Z_0 = 100 Ω, E = 68 deg
$T_4 = T_7$: Z_0 = 100 Ω, E = 10 deg
T_5: Z_0 = 75 Ω, E = 24 deg
T_6: Z_0 = 100 Ω, E = 72 deg
T_{11}: Z_0 = 100 Ω, E = 5 deg
T_8: Z_0 = 100 Ω, E = 5 deg
T_9: Z_0 = 100 Ω, E = 65 deg
T_{10}: Z_0 = 75 Ω, E = 21 deg
T_{12}: Z_0 = 75 Ω, E = 40 deg

L_1 = 60 nH, C_1 = 1.15 pF, C_2 = 1.30 pF, C_3 = 2.50 pF, C_4 = 18.0 pF
$C_{C(DC\ Block)}$ = 1000 pF, $C_{B(By\text{-}pass)}$ = 1000 pF, $C_{F(Feed\ through)}$ = 1000 pF
RFC = 60 nH, $R_{G1} = R_{G2}$ = 1000 Ω