

OKI electronic components

KGF1203

Balanced Mixer

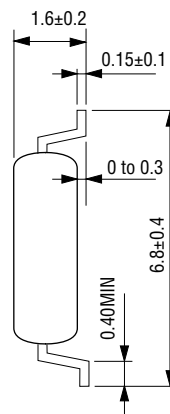
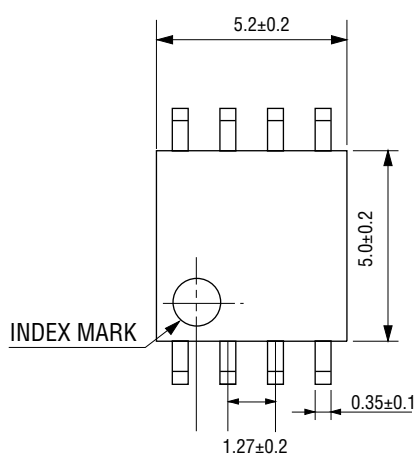
GENERAL DESCRIPTION

The KGF1203, designed for UHF-band up-converters, is a balanced-mixer IC that features high conversion gain, high local isolation, low voltage, and low current operation. Single-ended inputs are possible because input phase shifters are integrated into this device. The KGF1203 specifications are guaranteed to a fixed matching circuit for 3 V, 770-MHz LO input, and 915 MHz RF output, although external impedance-matching circuits are also required. Because of its high local isolation, the KGF1203 is ideal as a transmitter up-converter for personal handy phones.

FEATURES

- Low voltage and low current operation: 3 V, 15 mA (max.)
- High conversion gain: 4 dB (min.)
- High local isolation: -8 dB (max.)
- Self-bias circuit configuration with built-in source capacitor
- Package: 8PSOP

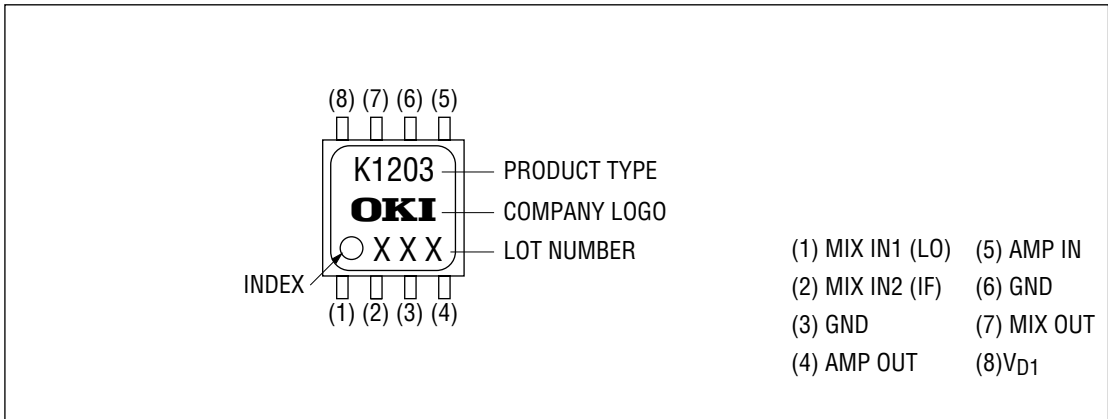
PACKAGE DIMENSIONS



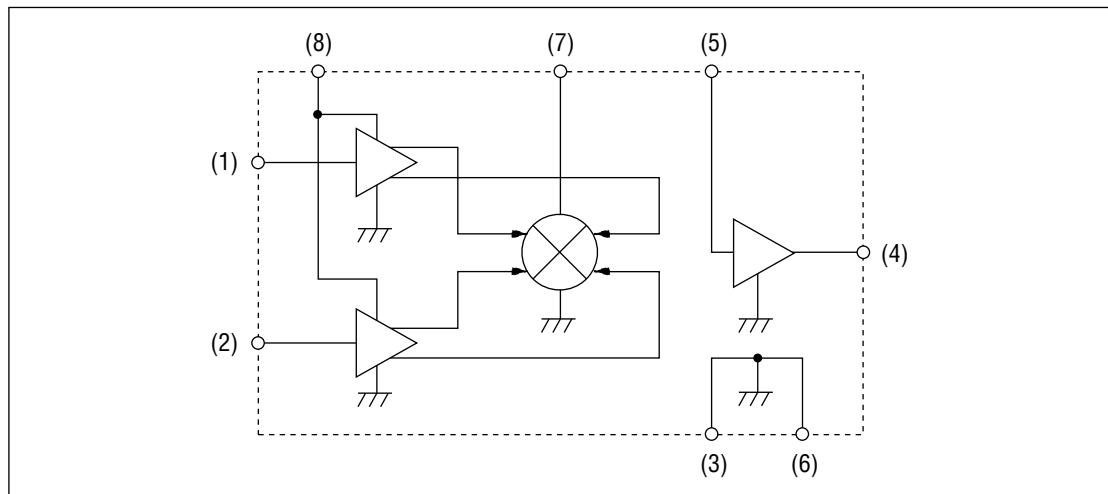
Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating
Solder plate thickness	5 μm or more

(Unit: mm)

MARKING



CIRCUIT



ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Condition	Unit	Min.	Max.
Supply voltage	V_{DD}	$T_a = 25^\circ\text{C}$	V	—	7
Input level	P_{IN}	$T_a = 25^\circ\text{C}$	dBm	—	6
Operating current	I_D	$T_a = 25^\circ\text{C}$	mA	—	60
Total power dissipation	P_{tot}	$T_a = 25^\circ\text{C}$	mW	—	200
Channel temperature	T_{ch}	—	$^\circ\text{C}$	—	150
Storage temperature	T_{stg}	—	$^\circ\text{C}$	-45	125

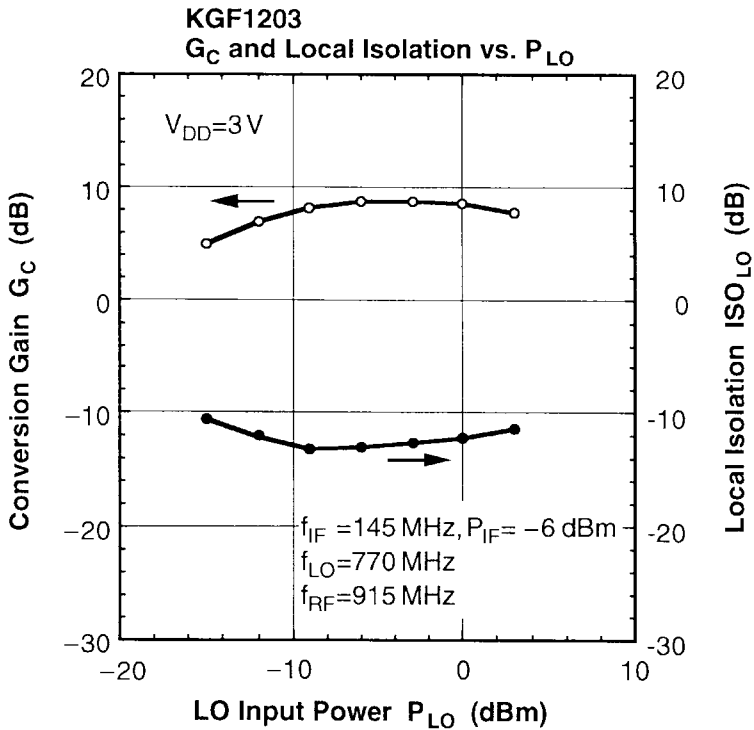
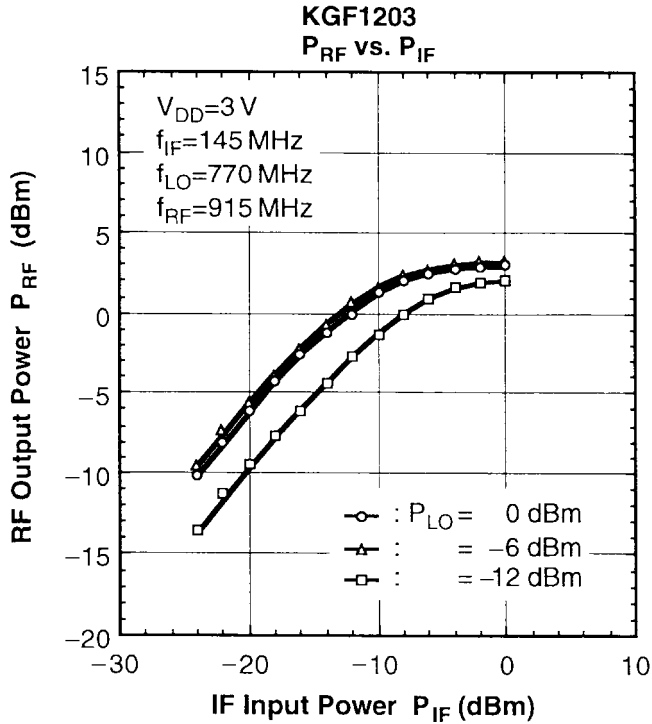
ELECTRICAL CHARACTERISTICS

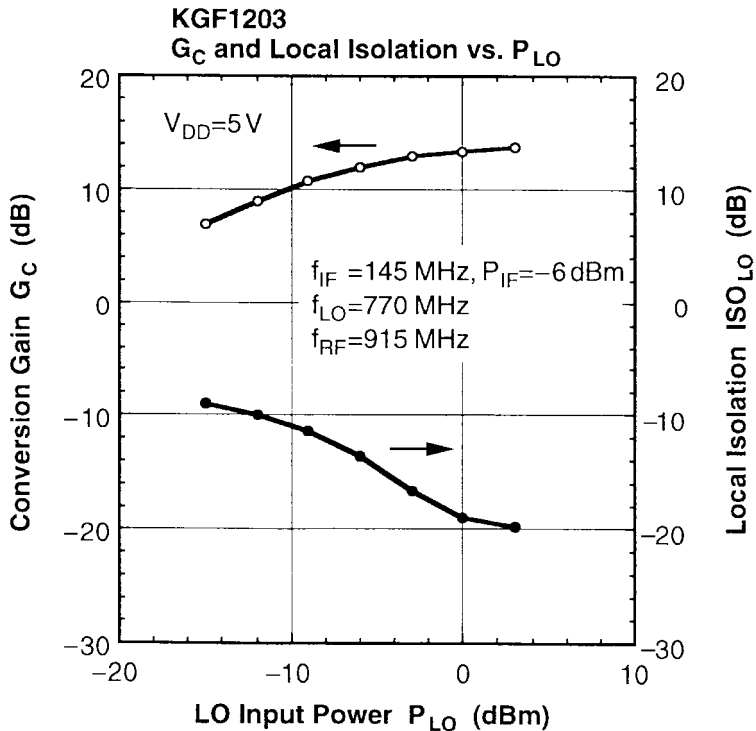
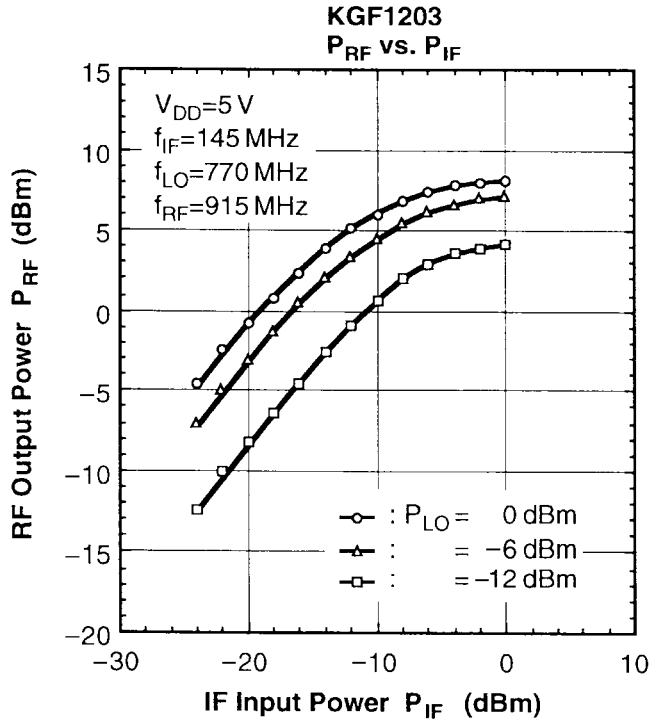
(Ta = 25°C)

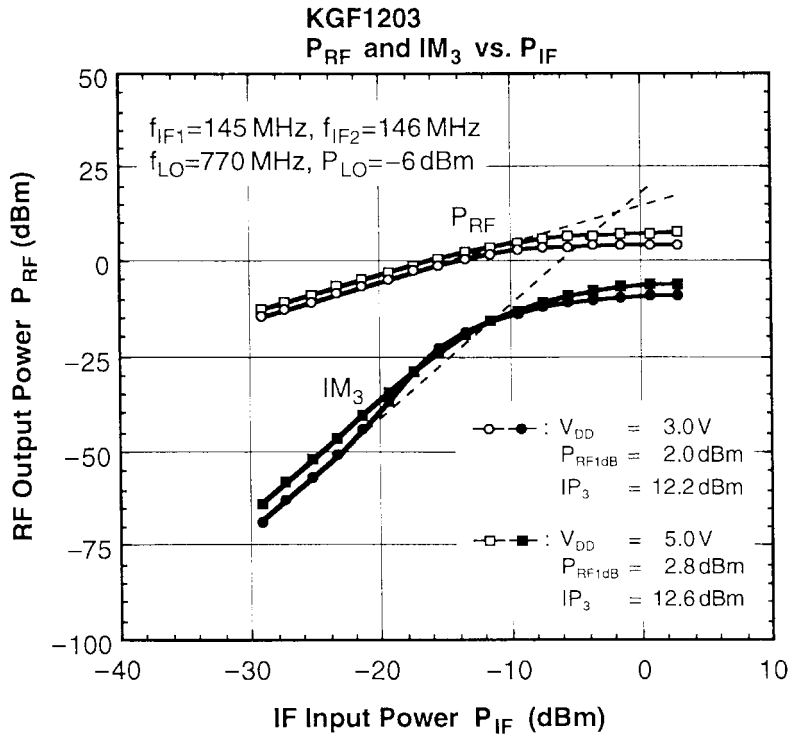
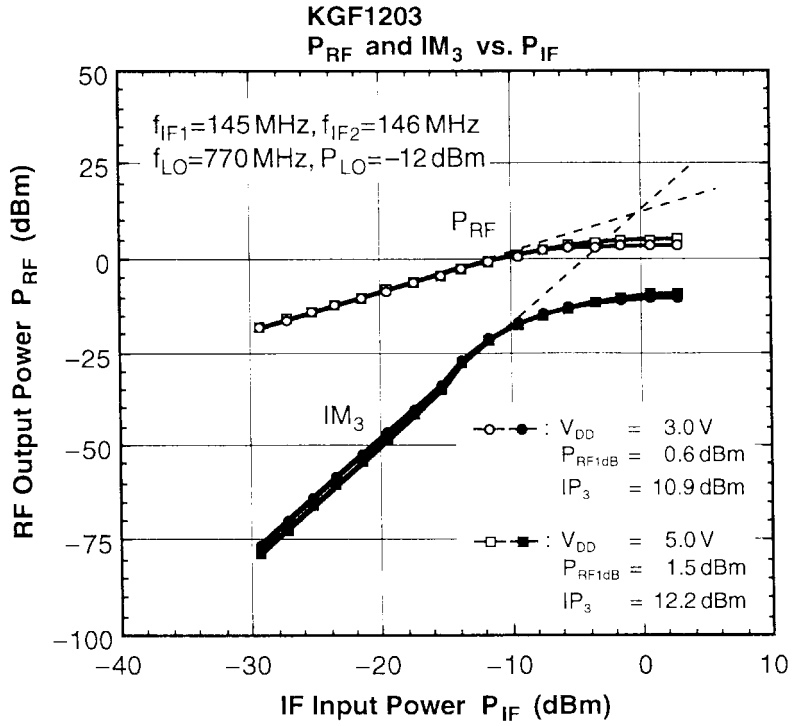
Item	Symbol	Condition	Unit	Min.	Typ.	Max.
Operating current	I_D	(*1)	mA	—	9.0	15.0
Conversion gain	G_C	(*1), $f_{RF} = 915 \text{ MHz}$	dB	4.0	—	—
Carrier suppression	C_{SUP}	(*1), $P_{LO(770 \text{ MHz})} - P_{RF(915 \text{ MHz})}$	dBc	—	—	-10.0
Local isolation	ISO_{LO}	(*1), LO→RF	dB	—	—	-8.0

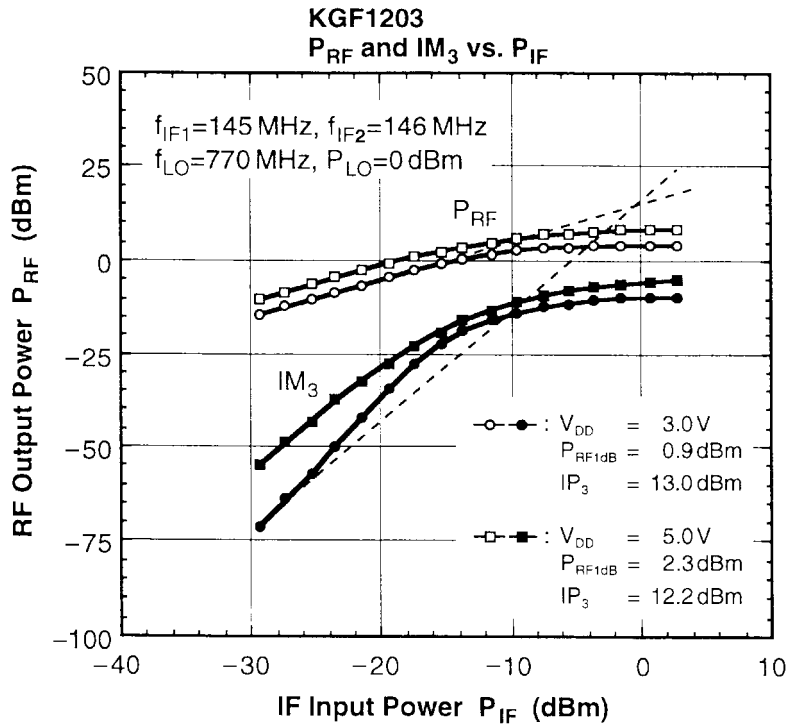
*1 Self-bias condition: $V_{DD} = 3 \pm 0.3 \text{ V}$, (1) MIX IN1 (LO): $f_{LO} = 770 \text{ MHz}$, $P_{LO} = -6 \text{ dBm}$
 (2) MIX IN2 (IF): $f_{IF} = 145 \text{ MHz}$, $P_{IF} = -6 \text{ dBm}$

RF CHARACTERISTICS







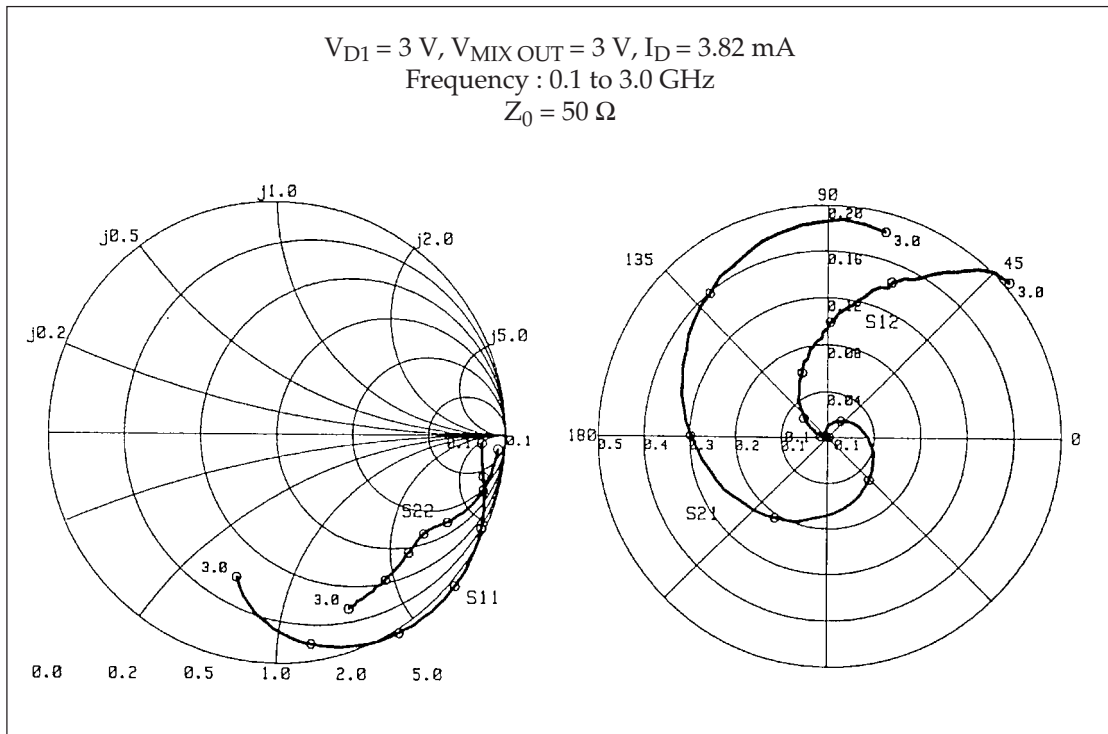


Typical S Parameters (MIX IN1 (LO)-MIX OUT (RF))

 $V_{D1} = 3\text{ V}$, $V_{MIX\ OUT} = 3\text{ V}$, $I_D = 3.82\text{ mA}$

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	0.896	-2.26	0.005	144.61	0.001	28.48	0.966	-3.60
200.0	0.899	-4.41	0.013	125.95	0.001	-176.17	0.961	-6.25
300.0	0.903	-6.69	0.022	95.03	0.001	-157.53	0.952	-9.12
400.0	0.911	-9.08	0.033	73.74	0.003	160.59	0.944	-11.88
500.0	0.919	-11.27	0.046	53.56	0.006	166.53	0.933	-14.91
600.0	0.930	-13.56	0.063	32.36	0.009	155.76	0.919	-17.71
700.0	0.944	-16.08	0.077	10.64	0.013	155.08	0.901	-20.38
800.0	0.956	-18.79	0.094	-9.98	0.017	148.63	0.881	-22.85
900.0	0.968	-21.61	0.109	-28.00	0.022	145.56	0.859	-25.00
1000.0	0.981	-24.53	0.127	-46.11	0.027	140.24	0.839	-27.01
1100.0	0.994	-27.48	0.145	-63.25	0.035	133.17	0.820	-28.60
1200.0	1.002	-30.72	0.161	-79.30	0.041	129.15	0.803	-30.14
1300.0	1.011	-33.84	0.176	-96.23	0.047	121.61	0.791	-31.32
1400.0	1.019	-37.07	0.194	-108.57	0.055	117.18	0.783	-32.55
1500.0	1.023	-40.27	0.209	-123.06	0.061	111.60	0.775	-33.82
1600.0	1.027	-43.72	0.226	-135.48	0.069	107.31	0.774	-35.15
1700.0	1.026	-47.08	0.243	-147.79	0.078	101.31	0.771	-36.80
1800.0	1.025	-50.79	0.261	-158.99	0.084	95.91	0.772	-38.16
1900.0	1.025	-54.46	0.278	-169.74	0.091	92.72	0.774	-40.07
2000.0	1.017	-58.11	0.299	-179.35	0.100	88.84	0.776	-41.72
2100.0	1.009	-62.40	0.319	-168.93	0.108	84.77	0.777	-43.66
2200.0	0.997	-66.65	0.339	158.74	0.116	79.69	0.783	-45.88
2300.0	0.978	-71.07	0.361	148.46	0.125	75.53	0.786	-48.04
2400.0	0.956	-75.40	0.383	139.45	0.137	70.89	0.792	-50.52
2500.0	0.925	-80.58	0.400	129.83	0.144	67.81	0.795	-53.05
2600.0	0.892	-85.88	0.421	119.17	0.154	92.23	0.801	-55.55
2700.0	0.847	-91.29	0.445	108.87	0.166	57.79	0.806	-58.53
2800.0	0.791	-96.79	0.460	97.65	0.180	52.40	0.808	-61.18
2900.0	0.724	-101.82	0.471	86.33	0.194	48.21	0.811	-64.10
3000.0	0.650	-105.74	0.458	74.51	0.205	40.70	0.824	-67.45

Typical S Parameters (MIX IN1 (LO)-MIX OUT (RF))

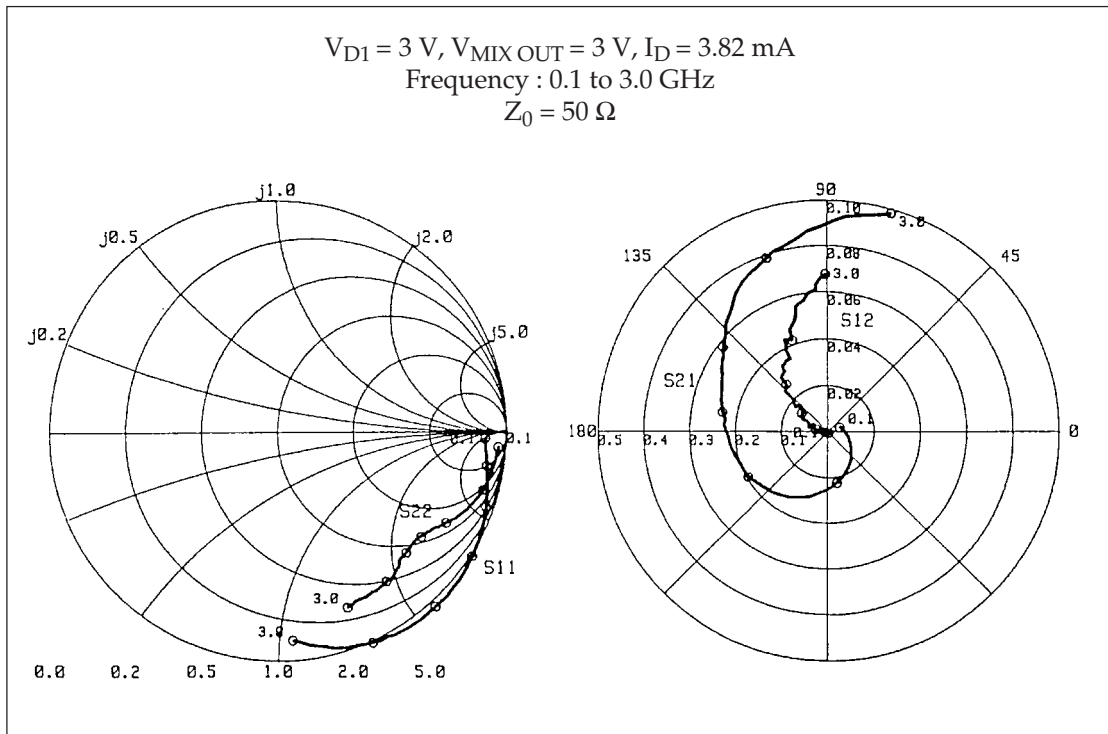


Typical S Parameters (MIX IN2 (IF)-MIX OUT (RF))

 $V_{D1} = 3\text{ V}$, $V_{\text{MIX OUT}} = 3\text{ V}$, $I_D = 3.82\text{ mA}$

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	0.906	-1.68	0.027	20.75	0.001	-45.27	0.964	-3.81
200.0	0.909	-3.45	0.045	-12.45	0.001	33.59	0.957	-6.49
300.0	0.912	-5.28	0.065	-38.58	0.001	152.13	0.949	-9.58
400.0	0.918	-7.04	0.089	-60.17	0.001	167.32	0.943	-12.50
500.0	0.923	-9.04	0.113	-80.03	0.001	-176.36	0.931	-15.60
600.0	0.930	-10.92	0.134	-97.42	0.003	-172.45	0.914	-18.44
700.0	0.938	-13.18	0.154	-112.33	0.003	-171.87	0.897	-21.17
800.0	0.947	-15.12	0.171	-127.00	0.002	166.56	0.878	-23.71
900.0	0.956	-17.54	0.183	-139.35	0.004	167.51	0.859	-26.09
1000.0	0.965	-19.73	0.197	-150.52	0.005	168.05	0.836	-28.09
1100.0	0.972	-22.21	0.202	-160.46	0.007	151.06	0.818	-30.01
1200.0	0.981	-24.66	0.211	-169.55	0.009	166.64	0.801	-31.38
1300.0	0.990	-27.17	0.216	-177.77	0.011	150.46	0.793	-33.00
1400.0	0.997	-29.85	0.227	175.64	0.012	153.03	0.784	-34.26
1500.0	1.007	-32.55	0.232	169.42	0.014	144.18	0.776	-35.86
1600.0	1.012	-35.18	0.243	162.61	0.016	138.59	0.769	-36.95
1700.0	1.019	-38.35	0.249	157.21	0.017	137.09	0.765	-38.51
1800.0	1.021	-41.36	0.259	151.59	0.021	136.20	0.766	-39.80
1900.0	1.029	-44.58	0.276	145.82	0.023	135.63	0.770	-41.21
2000.0	1.027	-47.82	0.290	141.04	0.027	130.81	0.771	-42.98
2100.0	1.028	-51.12	0.307	135.58	0.033	124.83	0.774	-44.92
2200.0	1.027	-54.74	0.330	130.05	0.035	121.92	0.772	-46.16
2300.0	1.024	-58.25	0.355	124.16	0.036	116.80	0.793	-48.06
2400.0	1.014	-61.85	0.377	116.42	0.042	114.95	0.803	-50.45
2500.0	1.008	-65.54	0.395	109.31	0.042	110.87	0.807	-53.68
2600.0	0.994	-69.64	0.412	102.36	0.050	106.60	0.812	-56.21
2700.0	0.981	-73.90	0.435	95.57	0.056	104.25	0.813	-59.55
2800.0	0.957	-77.80	0.455	88.58	0.060	98.04	0.817	-62.10
2900.0	0.937	-81.89	0.475	80.71	0.064	94.30	0.815	-65.22
3000.0	0.911	-86.00	0.491	73.63	0.068	90.62	0.824	-68.20

Typical S Parameters (MIX IN2 (IF)-MIX OUT (RF))

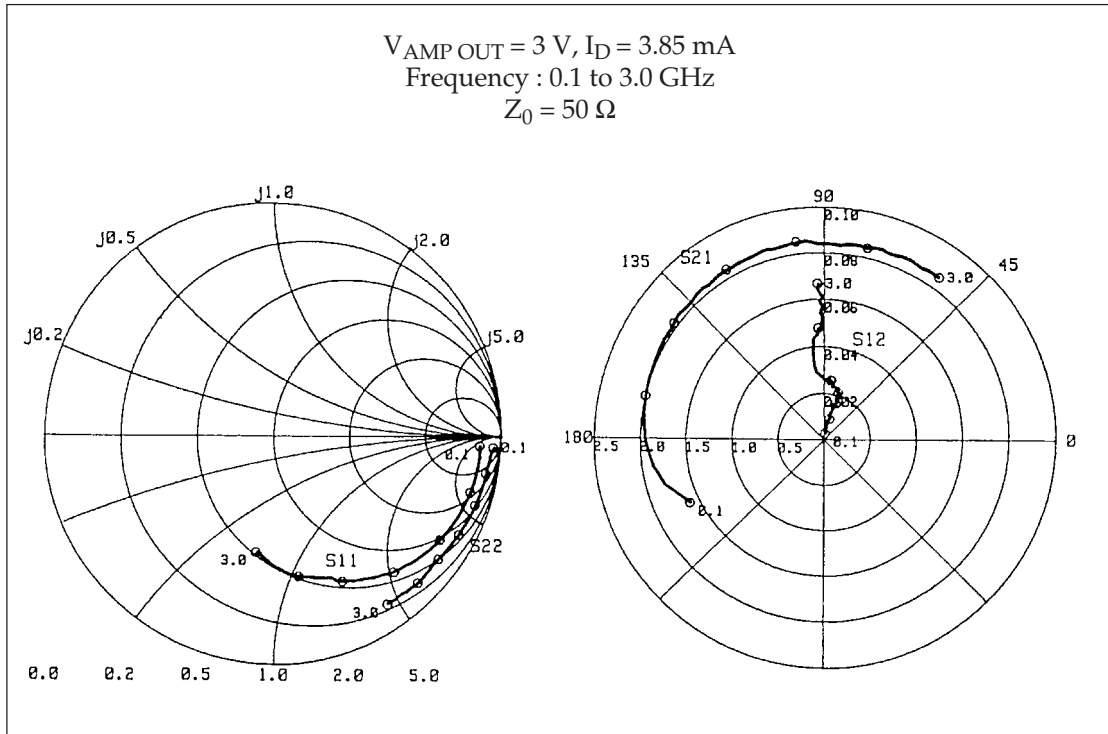


Typical S Parameters (AMP IN-AMP OUT)

 $V_{AMP\ OUT} = 3\ V, I_D = 3.85\ mA$

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	0.906	-2.75	1.614	-153.90	0.002	79.49	0.965	-3.01
200.0	0.909	-6.05	1.887	-170.50	0.004	81.86	0.955	-4.62
300.0	0.907	-9.39	1.957	179.94	0.005	78.37	0.952	-6.31
400.0	0.903	-12.62	1.985	172.77	0.007	81.81	0.949	-8.06
500.0	0.899	-15.89	1.997	167.05	0.009	74.91	0.947	-9.87
600.0	0.893	-18.99	2.013	161.71	0.010	77.52	0.946	-11.62
700.0	0.886	-22.35	2.021	156.63	0.012	74.43	0.943	-13.50
800.0	0.879	-25.44	2.029	152.03	0.014	74.38	0.941	-15.25
900.0	0.872	-28.80	2.032	147.17	0.015	75.29	0.938	-17.08
1000.0	0.862	-31.85	2.039	143.16	0.016	70.98	0.935	-18.89
1100.0	0.852	-35.20	2.048	138.28	0.018	72.01	0.934	-20.77
1200.0	0.841	-38.46	2.050	134.12	0.018	70.53	0.930	-22.49
1300.0	0.828	-41.83	2.073	129.45	0.019	71.84	0.928	-24.30
1400.0	0.813	-44.89	2.071	125.52	0.021	70.59	0.925	-26.07
1500.0	0.799	-48.41	2.087	120.69	0.021	72.76	0.923	-27.88
1600.0	0.781	-51.52	2.092	116.33	0.023	74.90	0.917	-29.61
1700.0	0.765	-54.88	2.095	112.23	0.023	76.75	0.914	-31.33
1800.0	0.747	-57.91	2.119	107.35	0.023	81.59	0.912	-33.06
1900.0	0.730	-61.34	2.107	103.24	0.025	81.77	0.909	-34.78
2000.0	0.708	-64.57	2.127	98.31	0.025	83.17	0.904	-36.60
2100.0	0.675	-67.76	2.100	93.12	0.025	89.46	0.897	-38.19
2200.0	0.669	-69.74	2.090	89.63	0.031	98.38	0.902	-39.69
2300.0	0.656	-72.95	2.075	85.59	0.038	97.87	0.904	-41.57
2400.0	0.639	-76.08	2.100	81.64	0.043	96.65	0.905	-43.46
2500.0	0.628	-79.94	2.089	77.19	0.048	93.22	0.906	-45.50
2600.0	0.609	-84.11	2.118	72.73	0.050	91.54	0.902	-47.80
2700.0	0.585	-87.82	2.104	68.56	0.053	91.36	0.902	-49.83
2800.0	0.563	-91.54	2.123	63.95	0.056	91.04	0.895	-51.76
2900.0	0.537	-95.04	2.103	59.58	0.060	90.85	0.897	-53.76
3000.0	0.518	-98.68	2.115	54.58	0.066	92.64	0.894	-55.83

Typical S Parameters (AMP IN-AMP OUT)

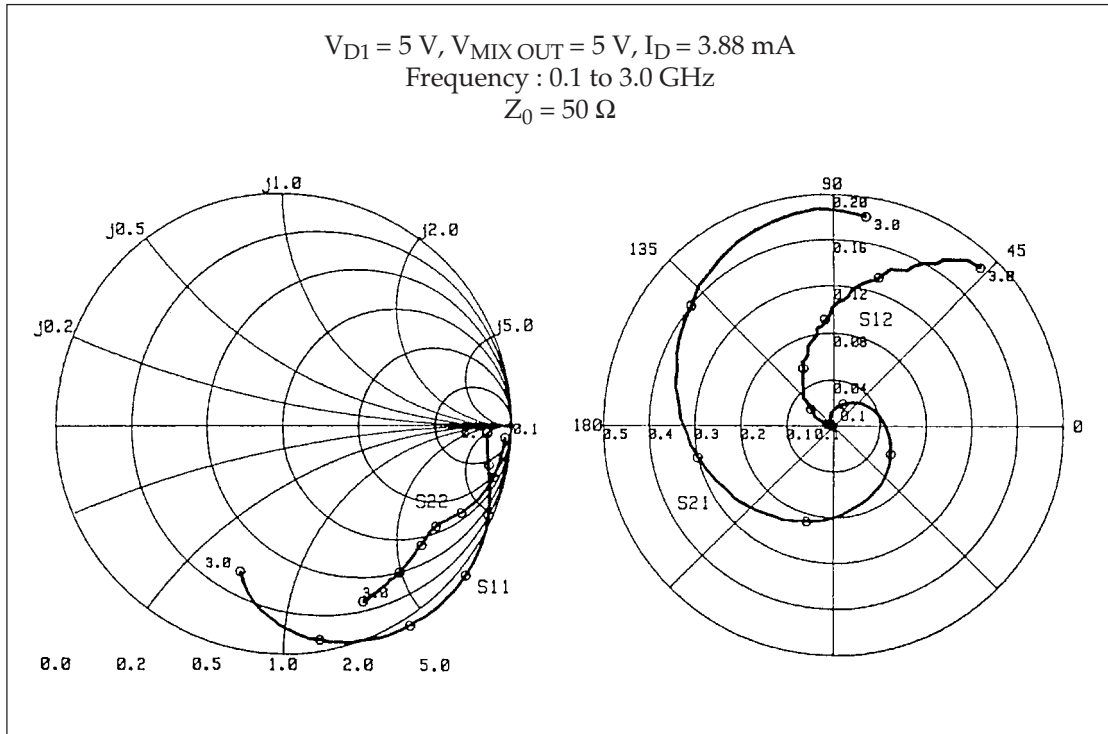


Typical S Parameters (MIX IN1 (LO)-MIX OUT (RF))

 $V_{D1} = 5\text{ V}$, $V_{MIX\ OUT} = 5\text{ V}$, $I_D = 3.88\text{ mA}$

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	0.897	-2.14	0.004	125.04	0.000	151.16	0.974	-3.15
200.0	0.898	-4.32	0.012	128.48	0.001	95.36	0.970	-5.64
300.0	0.903	-6.53	0.025	103.99	0.001	-159.64	0.964	-8.39
400.0	0.910	-8.76	0.037	86.10	0.003	152.56	0.959	-10.94
500.0	0.919	-10.90	0.052	66.14	0.005	160.69	0.951	-13.78
600.0	0.929	-13.21	0.071	47.37	0.007	163.45	0.941	-16.39
700.0	0.943	-15.68	0.087	28.89	0.011	159.27	0.925	-19.07
800.0	0.957	-18.11	0.104	9.45	0.015	154.77	0.909	-21.66
900.0	0.970	-20.87	0.122	-8.55	0.019	152.76	0.889	-23.74
1000.0	0.984	-23.62	0.138	-26.11	0.024	142.13	0.872	-25.94
1100.0	0.999	-26.53	0.156	-43.38	0.030	138.39	0.852	-27.64
1200.0	1.010	-29.77	0.170	-59.11	0.036	137.39	0.835	-29.35
1300.0	1.020	-32.86	0.185	-75.78	0.042	128.39	0.822	-30.79
1400.0	1.031	-36.16	0.203	-89.97	0.049	123.46	0.812	-31.91
1500.0	1.036	-39.29	0.215	-105.06	0.056	117.23	0.803	-33.17
1600.0	1.042	-42.84	0.232	-118.08	0.062	112.81	0.799	-34.58
1700.0	1.042	-46.24	0.247	-131.30	0.072	107.57	0.795	-36.00
1800.0	1.045	-49.86	0.266	-143.42	0.077	102.16	0.797	-37.27
1900.0	1.044	-53.65	0.281	-154.89	0.086	99.16	0.799	-39.16
2000.0	1.038	-57.44	0.300	-166.71	0.092	94.34	0.803	-40.70
2100.0	1.031	-61.57	0.319	-178.01	0.102	90.53	0.802	-42.51
2200.0	1.020	-65.99	0.340	170.86	0.108	85.52	0.809	-44.62
2300.0	1.001	-70.44	0.359	159.92	0.119	81.73	0.813	-46.67
2400.0	0.981	-74.81	0.383	150.39	0.129	75.36	0.819	-49.01
2500.0	0.951	-80.10	0.399	140.09	0.133	72.82	0.822	-51.31
2600.0	0.9191	-85.46	0.423	128.83	0.145	67.80	0.829	-54.05
2700.0	0.873	-91.15	0.444	117.91	0.155	62.83	0.833	-56.76
2800.0	0.816	-96.77	0.458	105.91	0.165	57.53	0.835	-59.36
2900.0	0.747	-102.13	0.470	94.01	0.177	53.45	0.840	-62.18
3000.0	0.666	-106.27	0.456	81.03	0.186	46.79	0.848	-65.32

Typical S Parameters (MIX IN1 (LO)-MIX OUT (RF))

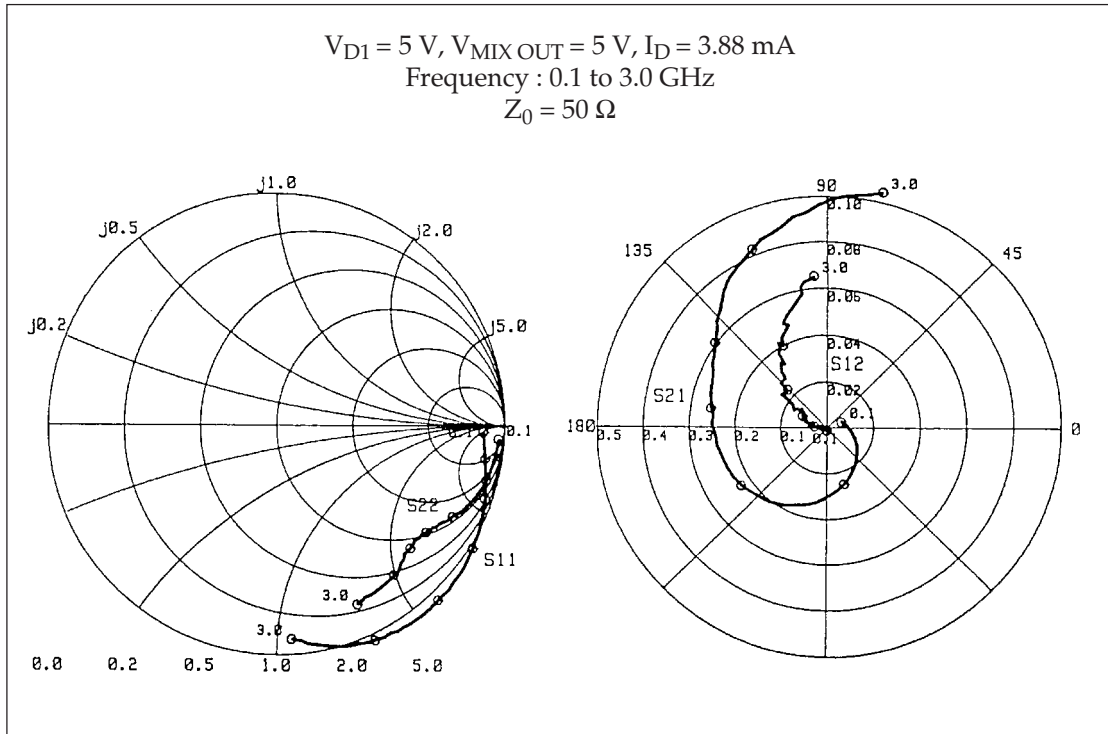


Typical S Parameters (MIX IN2 (IF)-MIX OUT (RF))

 $V_{D1} = 5\text{ V}$, $V_{MIX\ OUT} = 5\text{ V}$, $I_D = 3.88\text{ mA}$

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	0.905	-1.67	0.034	24.69	0.001	-105.95	0.973	-3.34
200.0	0.909	-3.38	0.053	-8.31	0.001	76.77	0.968	-5.91
300.0	0.912	-5.12	0.075	-30.69	0.001	150.85	0.962	-8.78
400.0	0.918	-6.87	0.101	-53.29	0.001	123.64	0.957	-11.49
500.0	0.924	-8.87	0.128	-72.99	0.001	-91.10	0.949	-14.47
600.0	0.930	-10.67	0.152	-91.08	0.001	95.64	0.937	-17.18
700.0	0.940	-12.85	0.176	-106.82	0.002	163.99	0.923	-19.90
800.0	0.948	-14.81	0.195	-121.50	0.002	146.46	0.906	-22.42
900.0	0.957	-17.07	0.209	-134.37	0.003	162.45	0.890	-24.96
1000.0	0.968	-19.21	0.224	-145.79	0.005	171.63	0.868	-27.06
1100.0	0.976	-21.71	0.232	-156.93	0.007	157.87	0.852	-29.13
1200.0	0.985	-24.04	0.238	-167.05	0.008	174.99	0.835	-30.60
1300.0	0.995	-26.54	0.243	-175.59	0.010	162.56	0.825	-32.39
1400.0	1.002	-29.15	0.252	177.69	0.011	155.82	0.813	-33.73
1500.0	1.013	-31.79	0.255	170.63	0.012	153.09	0.804	-35.20
1600.0	1.019	-34.42	0.264	163.78	0.014	146.22	0.795	-36.37
1700.0	1.030	-37.54	0.267	158.72	0.016	146.52	0.793	-38.05
1800.0	1.033	-40.63	0.278	152.80	0.019	143.60	0.789	-39.21
1900.0	1.043	-43.71	0.290	147.70	0.021	143.35	0.792	-40.44
2000.0	1.041	-47.01	0.304	143.08	0.024	135.63	0.794	-42.16
2100.0	1.045	-50.27	0.320	138.01	0.028	129.48	0.796	-44.04
2200.0	1.045	-53.96	0.342	132.76	0.033	127.39	0.793	-45.16
2300.0	1.040	-57.64	0.370	127.27	0.033	123.59	0.809	-46.66
2400.0	1.033	-61.27	0.395	120.08	0.041	120.21	0.821	-48.67
2500.0	1.029	-65.05	0.416	113.13	0.040	118.06	0.831	-51.66
2600.0	1.017	-69.22	0.436	106.04	0.048	110.21	0.839	-54.20
2700.0	1.005	-73.45	0.462	99.26	0.052	109.37	0.843	-57.25
2800.0	0.980	-77.47	0.483	92.18	0.056	103.78	0.847	-59.59
2900.0	0.960	-81.74	0.506	84.32	0.062	100.59	0.845	-62.84
3000.0	0.932	-85.88	0.523	76.75	0.065	95.07	0.856	-65.51

Typical S Parameters (MIX IN2 (IF)-MIX OUT (RF))

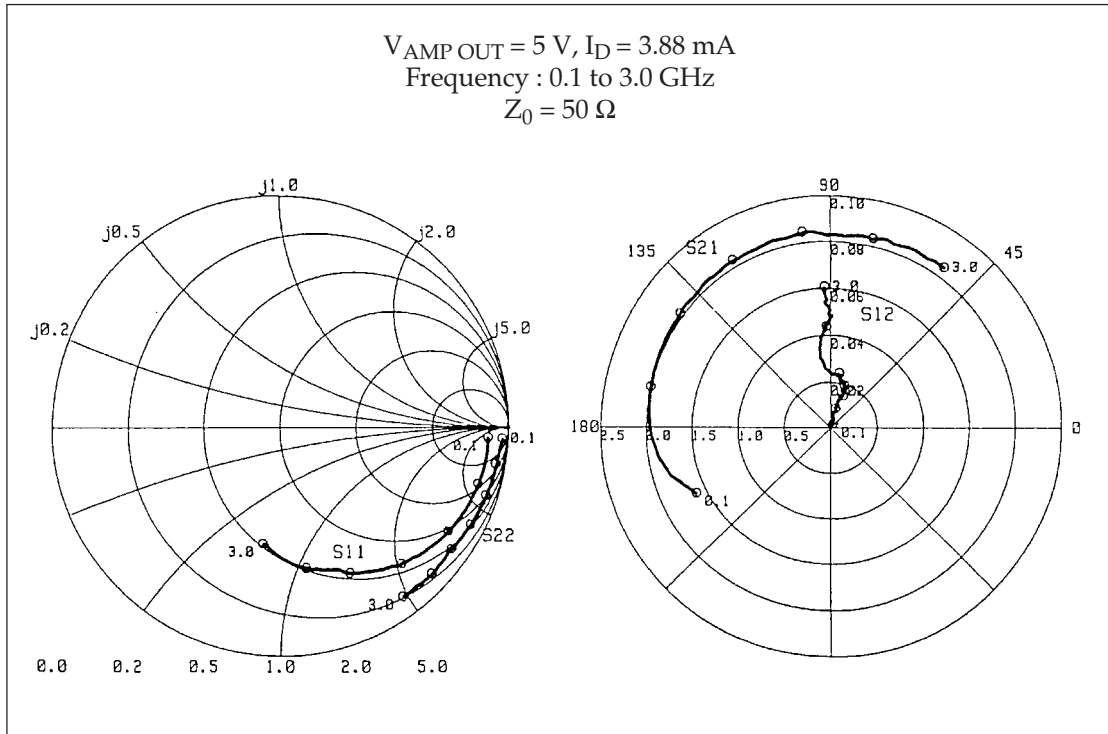


Typical S Parameters (AMP IN-AMP OUT)

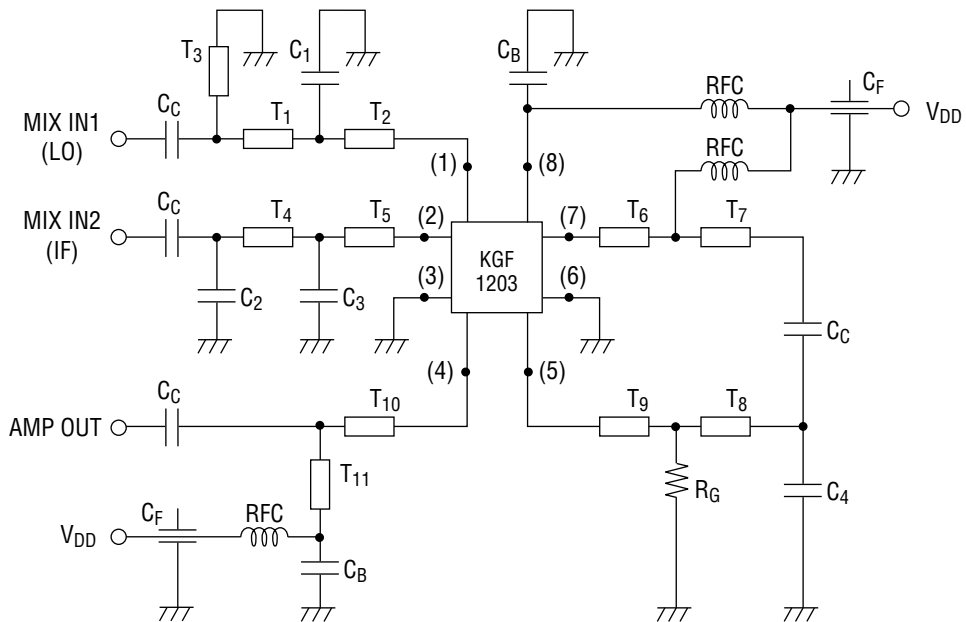
 $V_{AMP\ OUT} = 5\ V, I_D = 3.88\ mA$

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	0.906	-2.75	1.621	-153.84	0.002	71.27	0.970	-2.77
200.0	0.909	-6.03	1.898	-170.50	0.004	88.33	0.963	-4.39
300.0	0.903	-9.38	1.968	179.97	0.005	75.78	0.958	-6.05
400.0	0.903	-12.56	1.994	172.81	0.008	79.01	0.956	-7.76
500.0	0.899	-15.87	2.009	167.08	0.009	78.49	0.955	-9.54
600.0	0.893	-19.01	2.023	161.64	0.010	75.13	0.953	-11.24
700.0	0.887	-22.30	2.028	156.59	0.012	75.55	0.951	-13.06
800.0	0.879	-25.44	2.039	152.00	0.014	73.86	0.950	-14.77
900.0	0.871	-28.75	2.043	147.09	0.014	73.28	0.947	-16.53
1000.0	0.862	-31.80	2.048	143.09	0.015	70.56	0.945	-18.25
1100.0	0.852	-35.18	2.055	138.22	0.017	69.71	0.943	-20.09
1200.0	0.840	-38.32	2.057	134.07	0.017	68.57	0.939	-21.73
1300.0	0.827	-41.76	2.079	129.40	0.018	73.51	0.938	-23.54
1400.0	0.812	-44.84	2.073	125.48	0.019	71.64	0.935	-25.22
1500.0	0.799	-48.40	2.092	120.81	0.020	73.65	0.933	-27.00
1600.0	0.780	-51.39	2.092	116.39	0.021	73.74	0.928	-28.68
1700.0	0.765	-54.78	2.096	112.26	0.022	76.71	0.926	-30.37
1800.0	0.746	-57.85	2.120	107.40	0.021	79.63	0.924	-32.01
1900.0	0.728	-61.21	2.104	103.32	0.024	79.65	0.921	-33.68
2000.0	0.707	-64.46	2.125	98.37	0.024	82.04	0.917	-35.43
2100.0	0.675	-67.62	2.100	93.20	0.024	89.19	0.912	-37.03
2200.0	0.667	-69.53	2.087	89.74	0.030	97.48	0.916	-38.47
2300.0	0.655	-72.81	2.070	85.70	0.036	98.25	0.918	-40.23
2400.0	0.640	-75.90	2.096	81.80	0.039	96.72	0.920	-42.13
2500.0	0.628	-79.75	2.084	77.38	0.044	92.77	0.920	-44.08
2600.0	0.608	-83.97	2.114	73.01	0.047	91.04	0.918	-46.31
2700.0	0.585	-87.68	2.098	68.77	0.049	89.35	0.918	-48.34
2800.0	0.562	-91.40	2.116	64.24	0.051	90.33	0.912	-50.17
2900.0	0.536	-94.88	2.097	59.94	0.056	91.63	0.914	-52.10
3000.0	0.516	-98.53	2.108	54.83	0.061	92.69	0.912	-54.06

Typical S Parameters (AMP IN-AMP OUT)



Test Circuit and Bias Configuration for KGF1203



$f_{LO} = 770 \text{ MHz}$

$T_1: Z_0 = 90 \Omega, E = 20 \text{ deg}$

$C_1 = 3.1 \text{ pF}$

$f_{IF} = 145 \text{ MHz}$

$T_4: Z_0 = 50 \Omega, E = 5 \text{ deg}$

$C_2 = 0.10 \text{ pF}, C_3 = 12.0 \text{ pF}$

$f_{RF} = 915 \text{ MHz}$

$T_6: Z_0 = 90 \Omega, E = 30 \text{ deg}$

$T_8: Z_0 = 90 \Omega, E = 15 \text{ deg}$

$T_{10}: Z_0 = 90 \Omega, E = 55 \text{ deg}$

$C_4 = 0.5 \text{ pF}$

$R_G = 1000 \Omega, RFC = 200 \text{ nH}$

$C_C(\text{DC Block}) = 1000 \text{ pF}, C_B(\text{By-pass}) = 1000 \text{ pF}, C_F(\text{Feed through}) = 1000 \text{ pF}$

$T_2: Z_0 = 90 \Omega, E = 17 \text{ deg}$

$T_5: Z_0 = 50 \Omega, E = 1 \text{ deg}$

$T_7: Z_0 = 90 \Omega, E = 14 \text{ deg}$

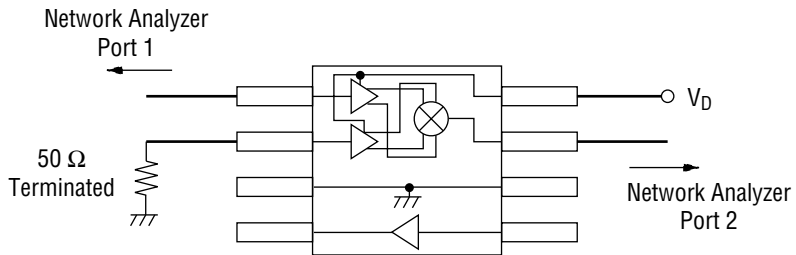
$T_9: Z_0 = 90 \Omega, E = 32 \text{ deg}$

$T_{11}: Z_0 = 60 \Omega, E = 15 \text{ deg}$

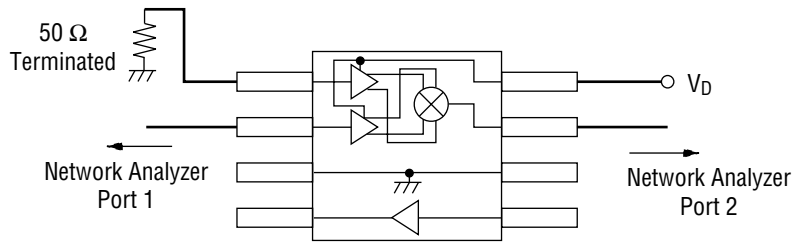
$T_3: Z_0 = 60 \Omega, E = 10 \text{ deg}$

S-Parameter Measurement Circuit for KGF1203

1. S Parameters between MIN IN1 (LO) and MIX OUT (RF)



2. S Parameters between MIN IN2 (IF) and MIX OUT (RF)



3. S Parameters between AMP IN and AMP OUT

