NEC

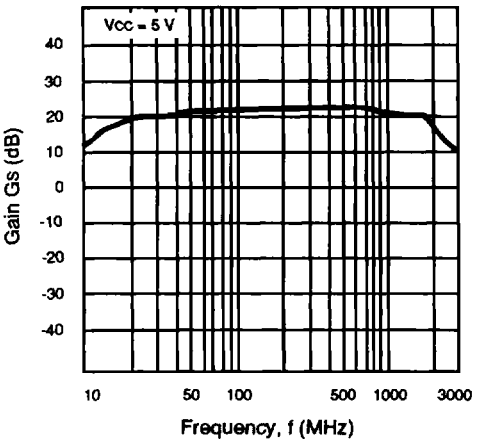
1.9 GHz MEDIUM POWER BROADBAND SILICON MMIC AMPLIFIER

UPC1678B
UPC1678G
UPC1678P

FEATURES

- **HIGH OUTPUT POWER:** +18 dBm
- **EXCELLENT FREQUENCY RESPONSE:** 1.9 GHz TYP at 3 dB Down
- **HIGH POWER GAIN:** 23 dB TYP at 0.5 GHz
- **SINGLE SUPPLY VOLTAGE:** 5 V
- **AVAILABLE IN TAPE AND REEL (UPC1678G)**

UPC1678G
NOISE FIGURE vs. FREQUENCY



DESCRIPTION

The UPC1678 is a silicon monolithic integrated circuit designed as a wide-band amplifier covering the HF to UHF bands. The device features high output power, 18 dBm TYP, high gain, 23 dB TYP and operates from a single 5 volt supply. The UPC1678 is available in two package styles: an 8 lead ceramic flat package (UPC1678B), an 8 pin mini flat (UPC1678G), and in chip form (UPC1678P).

ELECTRICAL CHARACTERISTICS (T_A = 25°C, VCC = +5 V)

PART NUMBER PACKAGE OUTLINE			UPC1678B B08			UPC1678G G08			UPC1678P CHIP		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
I_{CC}	Circuit Current at No Input Signal	mA	40	49	60	40	49	60	40	49	60
G_S	Small Signal Gain at f = 0.5 GHz	dB	21	23	25	21	23	25	21	23	25
f_{3dB}	Upper Limit Operating Frequency at 3 dB down below the Gain at 0.1 GHz	GHz		1.9		1.7	1.9			1.9	
P_{SAT}	Saturated Output Power at f = 0.5 GHz	dBm	15.5	18		15.5	17.5		15.5	18	
NF	Noise Figure at f = 0.5 GHz	dB		6			6	8		6	
RL_{IN}	Input Return Loss at f = 0.5 GHz	dB		13		11	14			13	
RL_{OUT}	Output Return Loss at f = 0.5 GHz	dB		4		1	4			4	
ISOL	Isolation at f = 0.5 GHz	dB			34		30	35			34
$R_{TH(J-A)}$	Thermal Resistance, Junction to Ambient	°C/W			200[1]			200[1]			
$R_{TH(J-C)}$	Thermal Resistance, Junction to Case	°C/W			50[2]						
ΔG_T	Gain Temperature Coefficient	dB°C					0.003				

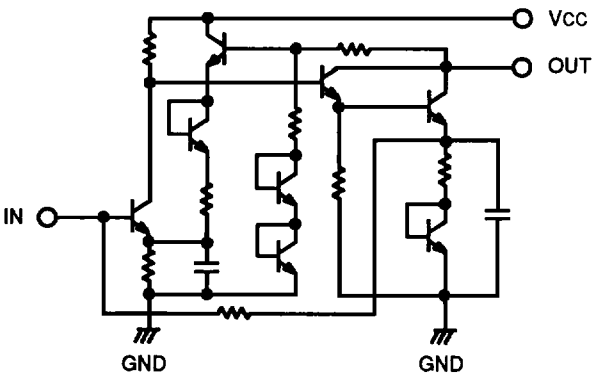
Notes:
1. Mounted on a 5 cm x 5 cm x 1.6 mm glass epoxy PWB.
2. Measured without heat sink.

ABSOLUTE MAXIMUM RATINGS[1] (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CC}	Power Supply Voltage	V	-0.5 to 6.0
P_T	Total Power Dissipation UPC1678B/P UPC1678G	 W mW	 1.5 (T_C = +125°C) 330[2]
T_{OP}	Operating Temperature UPC1678B/P UPC1678G	 °C °C	 -55 to +150 -40 to +85
T_{STG}	Storage Temperature UPC1678B/P UPC1678G	 °C °C	 -65 to +200 -55 to +150

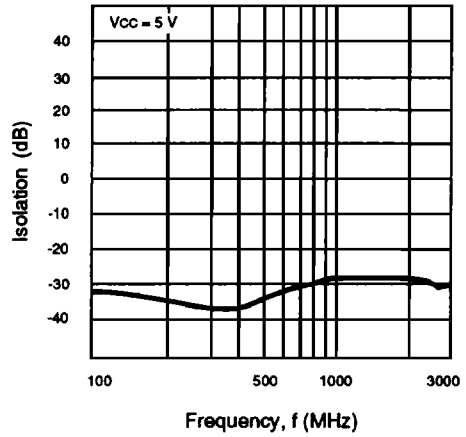
Note
1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on 5 cm x 5 cm x 1.6 mm glass epoxy PWB at 85°C.

EQUIVALENT CIRCUIT

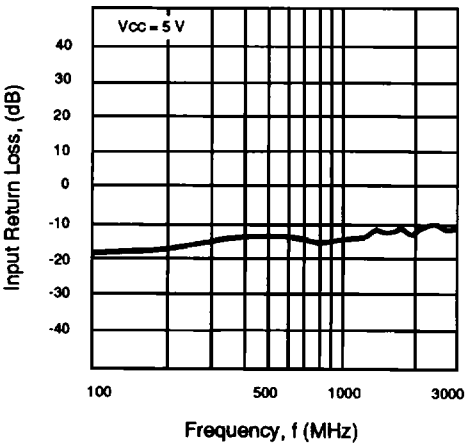


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

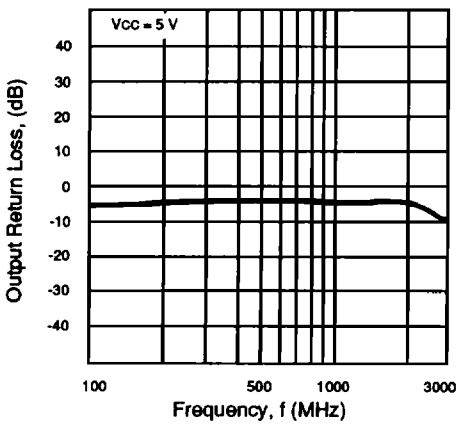
UPC1678B/P
ISOLATION vs. FREQUENCY



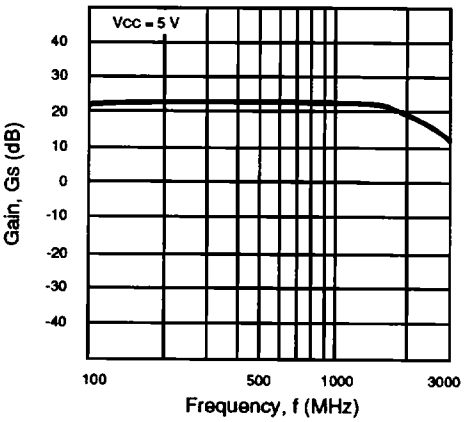
UPC1678B/P
INPUT RETURN LOSS vs. FREQUENCY



UPC1678B/P
OUTPUT RETURN LOSS vs. FREQUENCY



UPC1678B/P
INSERTION GAIN vs. FREQUENCY



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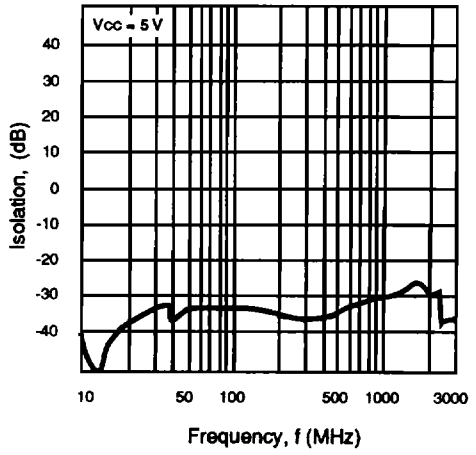
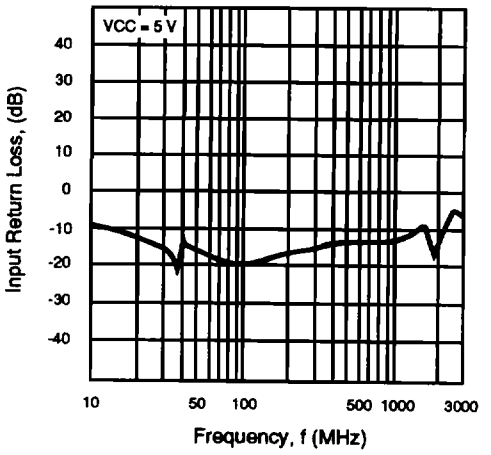
TYPICAL PERFORMANCE CURVES (TA = 25°C unless otherwise noted)

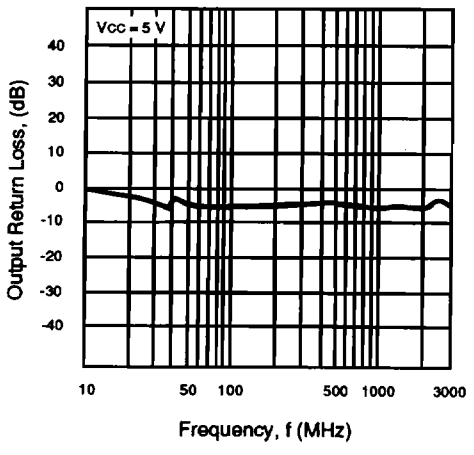
UPC1678G
ISOLATION vs. FREQUENCY



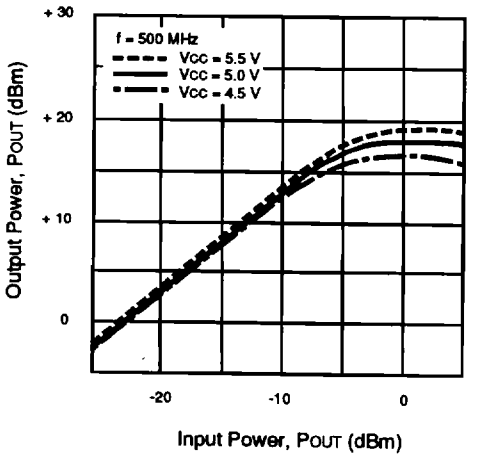
UPC1678G
OUTPUT RETURN LOSS vs. FREQUENCY



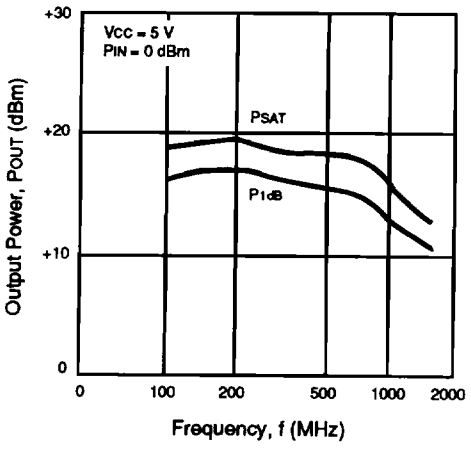
UPC1678G
OUTPUT RETURN LOSS vs. FREQUENCY



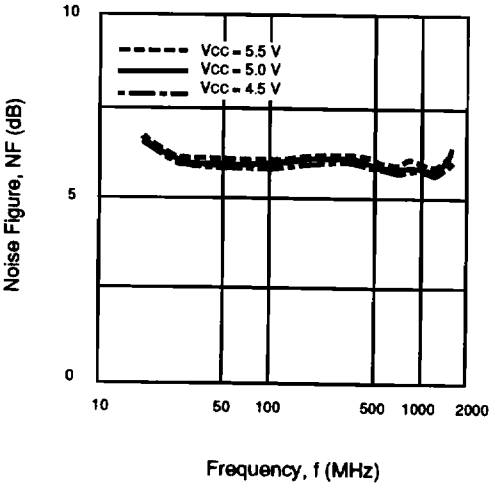
UPC1676G
OUTPUT POWER vs. INPUT POWER



UPC1678G
OUTPUT POWER vs. FREQUENCY

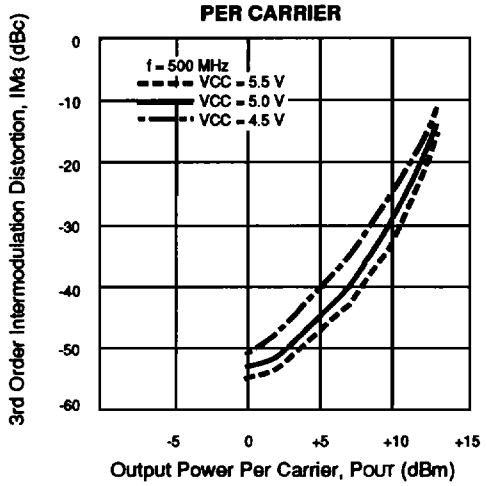


UPC1678G
NOISE FIGURE vs. FREQUENCY



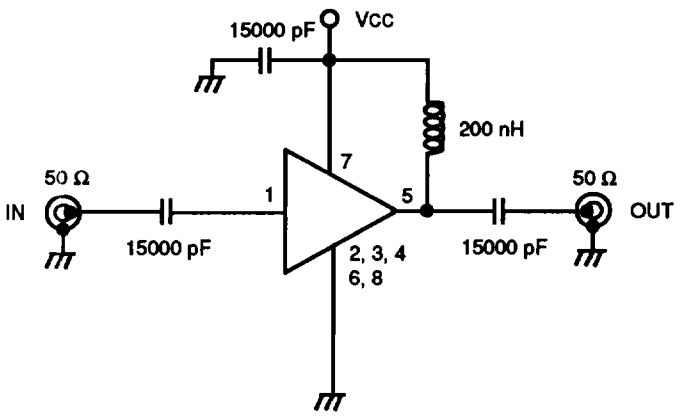
TYPICAL PERFORMANCE CURVES (T_A = 25°C)

UPC1678G
THIRD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER PER CARRIER

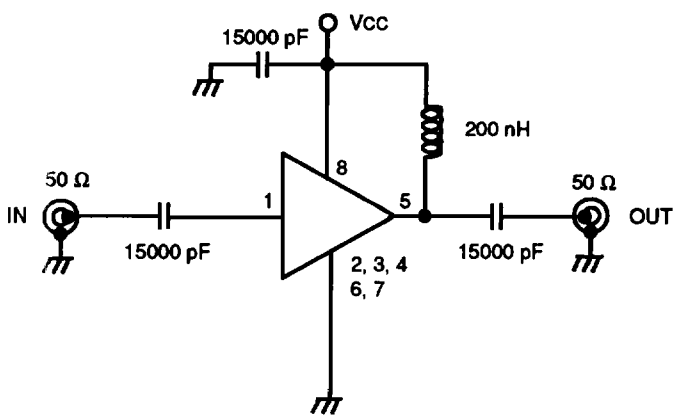


TEST CIRCUIT

UPC1678B



UPC1678G



Precautions: 1) These devices are ESD sensitive. Use proper precautionary measures when handling and installing these devices.

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

UPC1678B
V_{CC} = 5 V, I_{CC} = 49 mA

FREQ	S_{11}		S_{21}		S_{12}		S_{22}		K	S_{21}
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.1	0.144	144	10.7	23	0.018	25	0.717	81	1.43	20.6
0.2	0.122	138	12.9	-6	0.018	10	0.646	34	1.43	22.3
0.4	0.150	102	14.2	-47	0.020	25	0.668	-24	1.11	23.0
0.6	0.141	52	13.4	-83	0.030	22	0.642	-64	0.86	22.6
0.8	0.122	2	12.5	-112	0.036	8	0.603	-94	0.85	22.0
1.0	0.108	-51	11.9	-140	0.041	-7	0.586	-118	0.85	21.5
1.2	0.109	-103	11.5	-170	0.043	-19	0.584	-139	0.87	21.2
1.4	0.121	-154	11.0	160	0.043	-28	0.576	-160	0.93	20.8
1.6	0.140	161	10.1	128	0.043	-37	0.540	178	1.04	20.1
1.8	0.150	120	8.8	96	0.044	-42	0.465	156	1.24	18.9
2.0	0.139	88	7.3	66	0.046	-50	0.355	136	1.49	17.2

UPC1678G
V_{CC} = 5 V, I_{CC} = 49 mA

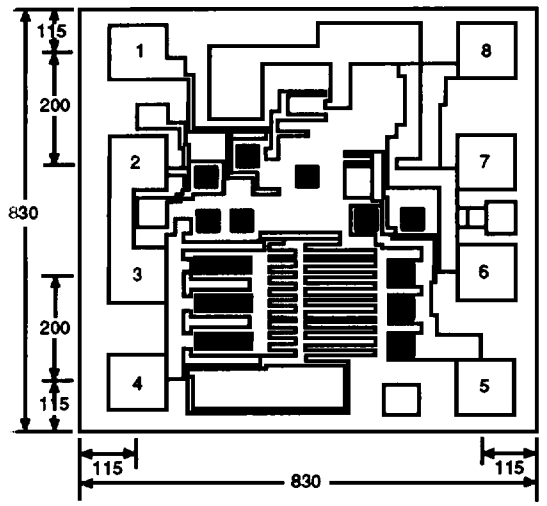
FREQ	S_{11}		S_{21}		S_{12}		S_{22}		K	S_{21}
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.05	0.168	167	10.8	36	0.016	33	0.737	90	1.50	20.6
0.10	0.121	154	12.5	9	0.019	13	0.617	46	1.48	21.9
0.20	0.134	140	13.4	-18	0.018	-4	0.623	10	1.45	22.6
0.40	0.206	96	14.1	-59	0.016	4	0.691	-34	1.28	23.0
0.60	0.250	54	13.6	-96	0.023	2	0.669	-71	0.95	22.7
0.80	0.258	19	12.7	-130	0.030	-16	0.624	-101	0.87	22.1
1.00	0.242	-12	12.1	-163	0.035	-31	0.599	-128	0.84	21.7
1.20	0.206	-43	11.6	164	0.040	-52	0.617	-157	0.79	21.3
1.40	0.165	-81	11.5	133	0.045	-70	0.611	176	0.77	21.2
1.60	0.111	-135	11.0	97	0.045	-89	0.648	142	0.76	20.8
1.80	0.071	143	9.8	58	0.047	-118	0.664	105	0.80	19.9
2.00	0.188	101	8.7	26	0.044	-134	0.595	65	1.00	18.8
2.20	0.220	60	7.2	-8	0.038	-154	0.545	28	1.40	17.2
2.40	0.252	35	5.9	-39	0.035	-174	0.480	-8	1.91	15.4
2.50	0.272	24	5.4	-55	0.035	176	0.433	-27	2.16	14.6

UPC1678P
V_{CC} = 5 V, I_{CC} = 49 mA

FREQ	S11		S21		S12		S22		K	S_{21}
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.1	0.151	158	14.2	-12	0.025	20	0.567	-4	1.19	23.0
0.2	0.337	164	18.0	-18	0.011	27	0.794	-14	1.14	25.1
0.4	0.252	80	13.0	-52	0.027	27	0.525	-35	1.10	22.2
0.6	0.225	48	11.2	-67	0.032	28	0.515	-40	1.07	21.0
0.8	0.234	25	10.7	-82	0.039	29	0.522	-54	0.92	20.6
1.0	0.250	0	10.0	-97	0.043	26	0.533	-60	0.86	20.0
1.2	0.270	-24	9.7	-112	0.049	21	0.585	-68	0.72	19.7
1.4	0.296	-46	9.4	-130	0.055	15	0.646	-80	0.59	19.4
1.6	0.321	-68	9.0	-148	0.058	8	0.706	-93	0.48	19.1
1.8	0.349	-89	8.4	-166	0.060	0	0.746	-108	0.42	18.5
2.0	0.354	-111	7.6	174	0.057	-8	0.752	-122	0.45	17.6
2.2	0.357	-130	6.6	157	0.055	-18	0.749	-137	0.52	16.5
2.4	0.348	-147	5.6	141	0.051	-24	0.721	-148	0.73	15.1
2.6	0.335	-163	4.8	127	0.043	-28	0.678	-160	1.16	13.7
2.8	0.315	-175	4.1	115	0.037	-28	0.635	-169	1.78	12.3
3.0	0.300	176	3.4	104	0.034	-26	0.594	-177	2.55	10.7

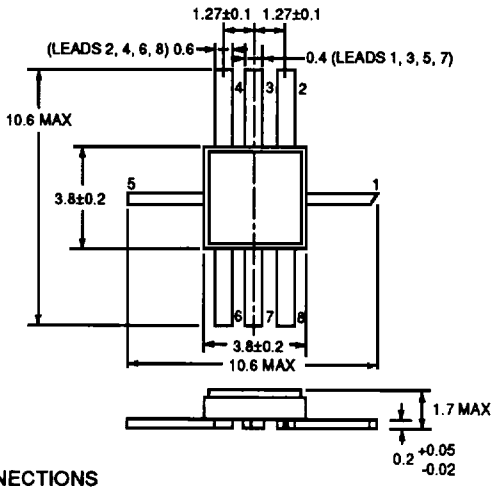
OUTLINE DIMENSIONS (Units in mm)

UPC1678P (CHIP)
(Units in μm)



PAD CONNECTIONS
1. Input 5. Output
2. GND 6. GND
3. GND 7. GND
4. GND 8. Vcc

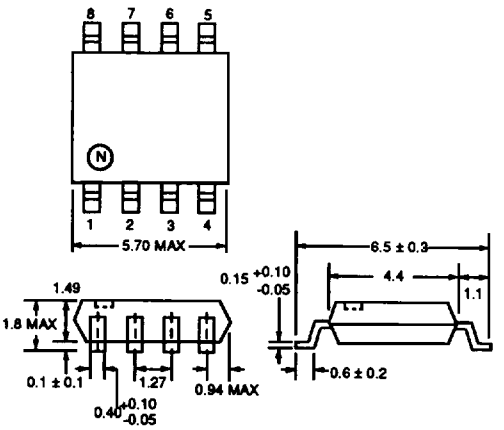
UPC1678B
PACKAGE OUTLINE B08



LEAD
CONNECTIONS
1. Input 5. Output
2. GND 6. GND
3. GND 7. Vcc
4. GND 8. GND

Lead Material: Cu, Fe, Cu
Lead Plating: Ni, Au
Package Material: Al_2O_3

UPC1678G
PACKAGE OUTLINE G08



LEAD
CONNECTIONS
1. Input 5. Output
2. GND 6. GND
3. GND 7. GND
4. GND 8. Vcc

Note:
All dimensions are typical unless otherwise specified.

ORDERING INFORMATION

PART NUMBER	QTY
UPC1678G-E	2500/REEL

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