

# NEC

## 3 V, 900 MHz Si MMIC AMPLIFIER

## UPC2747T

### FEATURES

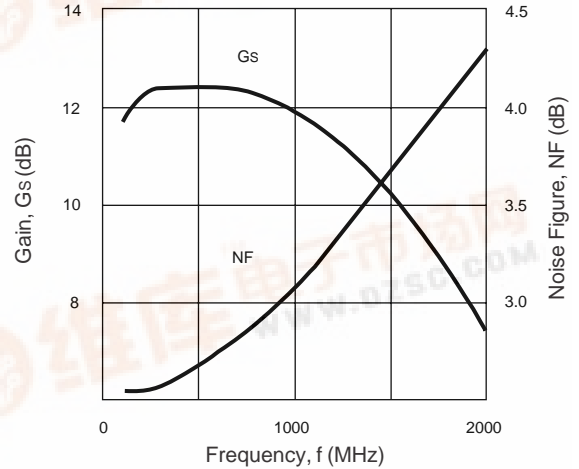
- **LOW VOLTAGE - LOW CURRENT:** 5 mA at 3 V
- **LOW POWER CONSUMPTION:** 15 mW TYP
- **SUPER SMALL PACKAGE**
- **TAPE AND REEL PACKAGING OPTION AVAILABLE**

### DESCRIPTION

The UPC2747T is a Silicon Monolithic integrated circuit which is manufactured using the NESAT III process. The NESAT III process produces transistors with  $f_T$  approaching 20 GHz. This amplifier was designed for 900 MHz receivers in cellular and cordless telephone applications. Operating on a 3 volt supply (1.8 volt minimum) this IC is ideally suited for hand-held, portable designs.

NEC's stringent quality assurance and test procedures ensure the highest reliability and performance.

**NOISE FIGURE AND GAIN vs. FREQUENCY**  
Vcc = 3.0 V, Icc = 5 mA



### ELECTRICAL CHARACTERISTICS (TA = 25°C, ZL = ZS = 50 Ω)

PART NUMBER PACKAGE OUTLINE			UPC2747T TO6		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
Icc	Circuit Current (no signal) Vcc = 3.0 V Vcc = 1.8 V	mA mA	3.8	5.0 3.0	7.0
Gs	Small Signal Gain, f = 900 MHz, Vcc = 3.0 V f = 900 MHz, Vcc = 1.8 V	dB dB	9	12 5.5	14
fu <sup>1</sup>	Upper Limit Operating Frequency, Vcc = 3.0 V Vcc = 1.8 V	GHz GHz	1.5	1.8 1.8	
PSAT	Saturated Output Power, f = 900 MHz, Vcc = 3.0 V f = 900 MHz, Vcc = 1.8 V	dBm dBm	-9.5	-7 -14	
NF	Noise Figure, f = 900 MHz, Vcc = 3.0 V f = 900 MHz, Vcc = 1.8 V	dB dB		3.3 5.2	4.5
RLIN	Input Return Loss, f = 900 MHz, Vcc = 3.0 V f = 900 MHz, Vcc = 1.8 V	dB dB	11	14 11	
RLOUT	Output Return Loss, f = 900 MHz, Vcc = 3.0 V f = 900 MHz, Vcc = 1.8 V	dB dB	7	10 13	
ISOL	Isolation, f = 900 MHz, Vcc = 3.0 V f = 900 MHz, Vcc = 1.8 V	dB dB	35	40 34	
OIP3	SSB Output Third Order Intercept, f1 = 500 MHz, f2 = 510 MHz, Vcc = 3.0 V f1 = 900 MHz, f2 = 902 MHz, Vcc = 3.0 V f1 = 1000 MHz, f2 = 1010 MHz, Vcc = 3.0 V f1 = 900 MHz, f2 = 902 MHz, Vcc = 1.8 V	dBm dBm dBm dBm		-3 -3 -2 -10	
RTH (J-A)	Thermal Resistance (Junction to Ambient) Free Air Mounted on a 50 x 50 x 1.6 mm epoxy glass PWB	°C/W °C/W			620 230

Note:  
1. The gain at fu is 3 dB down from the gain at 100 MHz.



# UPC2747T

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup> (T<sub>A</sub> = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CC</sub>	Supply Voltage	V	4.0
I <sub>CC</sub>	Total Supply Current	mA	15
P <sub>IN</sub>	Input Power	dBm	0
P <sub>T</sub>	Total Power Dissipation <sup>2</sup>	mW	280
T <sub>OP</sub>	Operating Temperature	°C	-40 to +85
T <sub>STG</sub>	Storage Temperature	°C	-55 to +150

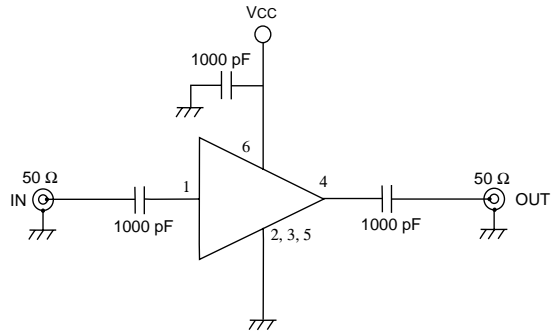
**Notes:**

1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on a 50 x 50 x 1.6 mm epoxy glass PWB (T<sub>A</sub> = 85°C).

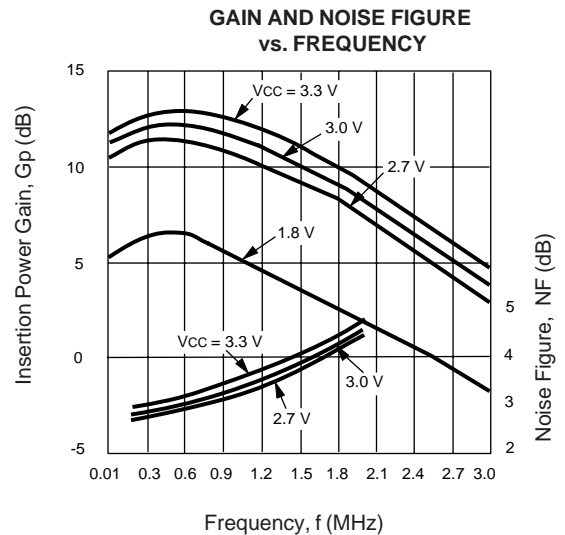
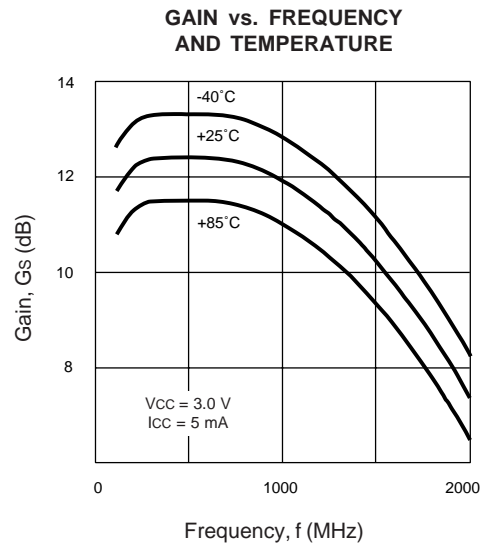
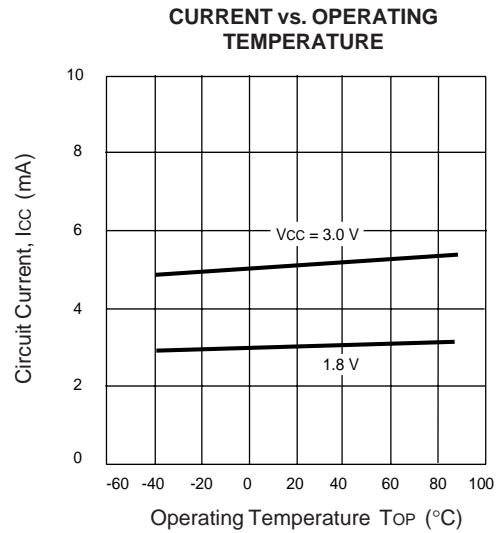
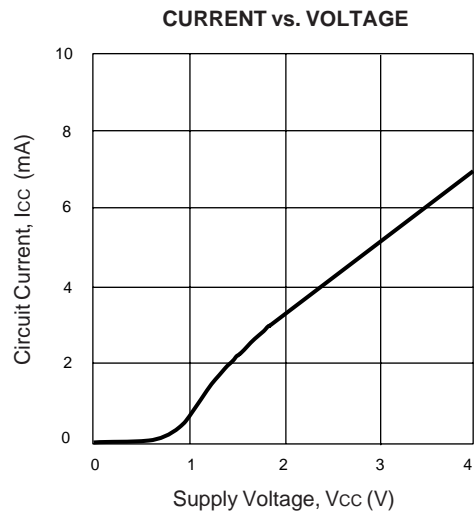
## RECOMMENDED OPERATING CONDITIONS

SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
V <sub>CC</sub>	Supply Voltage	V	1.8	3	3.3
T <sub>OP</sub>	Operating Temperature	°C	-40	25	85

## TEST CIRCUIT

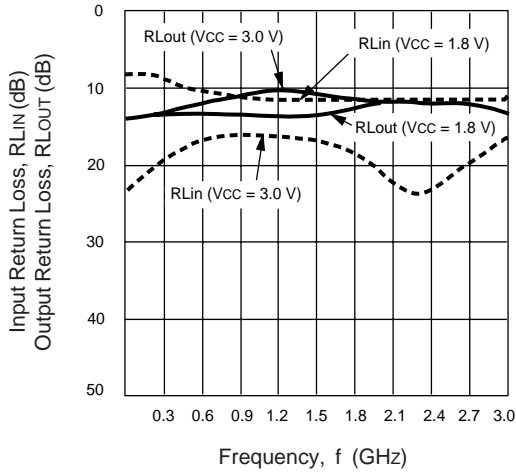


## TYPICAL PERFORMANCE CURVES (T<sub>A</sub> = 25°C)

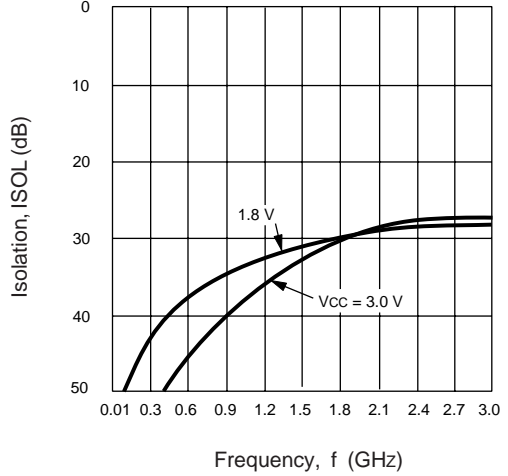


**TYPICAL PERFORMANCE CURVES** (TA = 25°C, unless otherwise specified)

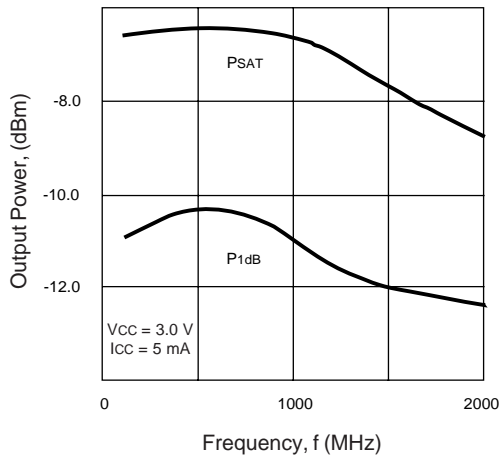
**RETURN LOSS vs. FREQUENCY**



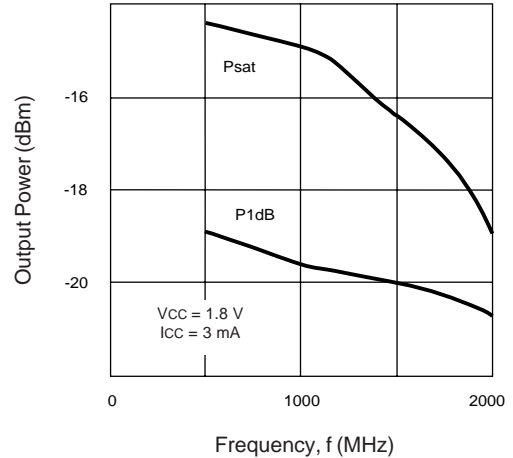
**ISOLATION vs. FREQUENCY**



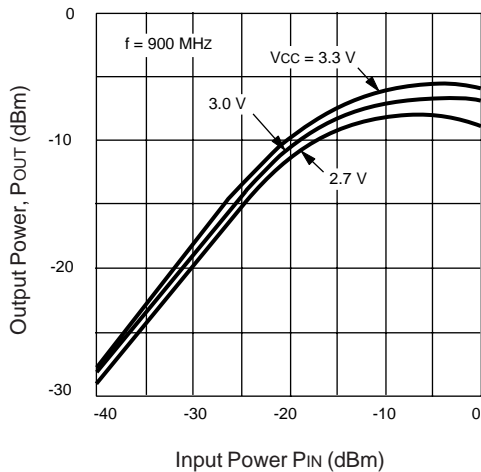
**POWER vs. FREQUENCY**



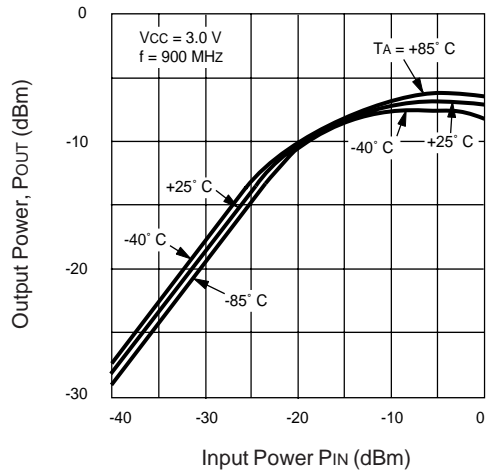
**POWER vs. FREQUENCY**



**OUTPUT POWER vs. INPUT POWER AND VOLTAGE**



**OUTPUT POWER vs. INPUT POWER AND TEMPERATURE**



# UPC2747T

## TYPICAL SCATTERING PARAMETERS (TA = 25°C)

Vcc = 3.0 V, Icc = 5.0 mA

FREQUENCY (GHz)	S11		S21		S12		S22		K <sup>1</sup>	S21 (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
0.1	0.061	-175.8	3.84	-4.0	0.001	120.5	0.249	-1.9	121.68	11.7
0.2	0.075	-168.9	4.10	-12.5	0.001	118.8	0.255	-4.2	113.38	12.3
0.3	0.093	-167.4	4.18	-23.0	0.002	117.0	0.261	-5.7	55.26	12.4
0.4	0.117	-174.1	4.17	-33.0	0.003	115.2	0.266	-7.0	36.64	12.4
0.5	0.134	175.3	4.15	-42.5	0.004	113.7	0.272	-8.7	27.40	12.4
0.6	0.142	163.9	4.12	-52.0	0.004	112.2	0.277	-10.6	27.46	12.3
0.7	0.152	153.7	4.07	-61.1	0.005	110.8	0.281	-13.1	22.12	12.2
0.8	0.159	142.9	4.02	-70.7	0.006	109.3	0.283	-15.8	18.60	12.1
0.9	0.154	131.7	3.97	-80.0	0.008	107.8	0.288	-19.3	14.11	12.0
1.0	0.148	120.7	3.92	-90.2	0.009	106.3	0.287	-22.6	12.73	11.9
1.1	0.143	110.5	3.83	-99.3	0.012	104.8	0.287	-27.6	9.79	11.7
1.2	0.139	101.1	3.70	-108.1	0.013	103.4	0.284	-30.2	9.39	11.4
1.3	0.135	88.5	3.55	-117.0	0.014	101.9	0.279	-34.7	9.12	11.0
1.4	0.131	80.9	3.38	-126.2	0.015	100.4	0.272	-37.3	8.99	10.6
1.5	0.126	71.1	3.23	-134.8	0.016	98.0	0.264	-41.3	8.87	10.2
1.6	0.121	61.5	3.07	-143.3	0.017	95.6	0.256	-43.7	8.84	9.7
1.7	0.120	55.6	2.89	-150.9	0.018	93.2	0.243	-45.8	8.93	9.2
1.8	0.118	48.0	2.72	-158.8	0.020	92.6	0.234	-46.2	8.58	8.7
1.9	0.113	42.9	2.53	-166.6	0.022	91.6	0.219	-47.0	8.46	8.1
2.0	0.105	34.7	2.32	-173.1	0.024	89.2	0.209	-46.4	8.51	7.3

Vcc = 1.8 V, Icc = 3.0 mA

FREQUENCY GHz	S11		S21		S12		S22		K <sup>1</sup>	S21 (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
0.1	0.436	-6.3	1.79	-5.1	0.003	63.5	0.259	-3.8	70.31	5.1
0.2	0.428	-15.1	1.89	-14.8	0.004	62.0	0.260	-8.1	50.34	5.5
0.3	0.416	-23.9	1.94	-26.3	0.005	60.6	0.259	-11.9	39.74	5.8
0.4	0.388	-30.7	1.97	-37.5	0.006	59.1	0.256	-13.9	33.54	5.9
0.5	0.366	-37.2	1.96	-49.1	0.008	57.6	0.252	-17.5	25.83	5.8
0.6	0.352	-41.4	1.92	-60.3	0.009	56.1	0.247	-19.9	23.77	5.7
0.7	0.337	-46.8	1.87	-71.0	0.011	54.6	0.240	-24.3	29.27	5.4
0.8	0.332	-50.4	1.82	-81.8	0.013	53.2	0.232	-25.9	17.75	5.2
0.9	0.327	-55.0	1.74	-92.4	0.014	51.7	0.224	-31.0	17.37	4.8
1.0	0.328	-60.3	1.67	-104.2	0.015	50.2	0.215	-33.1	16.95	4.5
1.1	0.328	-66.2	1.60	-113.8	0.017	48.7	0.207	-36.1	15.66	4.1
1.2	0.329	-70.9	1.54	-121.2	0.019	47.3	0.199	-36.5	14.60	3.8
1.3	0.328	-76.7	1.48	-130.0	0.021	45.8	0.194	-39.8	13.78	3.4
1.4	0.324	-81.9	1.42	-138.9	0.021	44.3	0.189	-39.9	14.43	3.0
1.5	0.318	-87.2	1.36	-146.6	0.022	42.8	0.185	-41.3	14.47	2.7
1.6	0.311	-92.6	1.29	-154.5	0.022	41.3	0.181	-42.9	15.36	2.2
1.7	0.302	-99.0	1.22	-162.7	0.022	39.9	0.177	-44.2	16.36	1.7
1.8	0.288	-103.8	1.16	-168.3	0.021	38.4	0.172	-45.6	18.23	1.3
1.9	0.267	-109.8	1.10	-176.1	0.020	36.9	0.166	-47.2	20.49	0.8
2.0	0.243	-116.2	1.04	176.8	0.019	35.4	0.156	-48.5	23.20	0.3

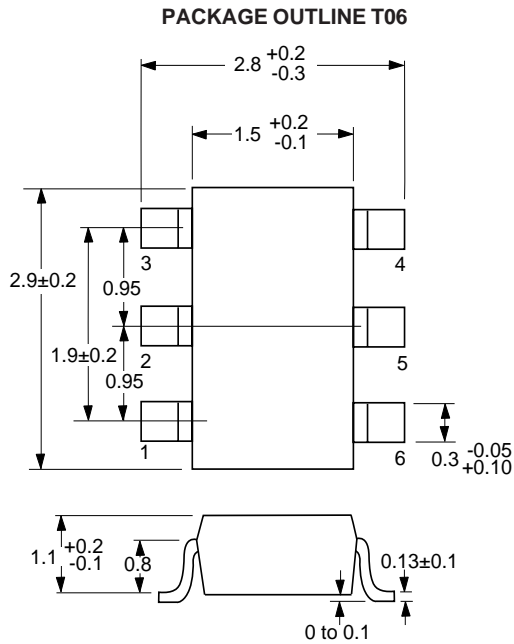
Note:

1. K Factor Calculation:

$$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

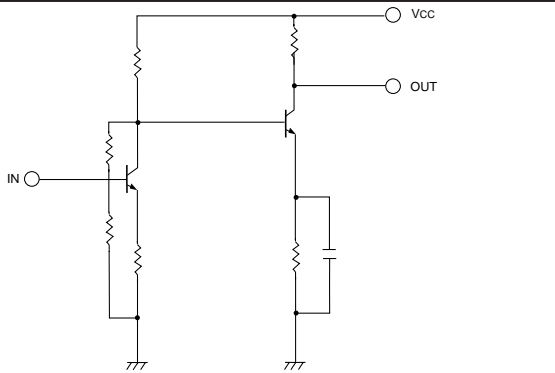
# UPC2747T

## OUTLINE DIMENSIONS (Units in mm)



Note:  
All dimensions are typical unless otherwise specified.

## EQUIVALENT CIRCUIT

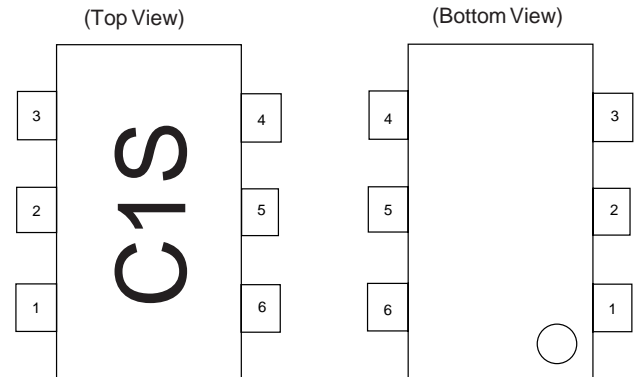


## ORDERING INFORMATION

PART NUMBER	QTY
UPC2747T-E3	3K/Reel

Note:  
Embossed Tape, 8 mm wide.

## LEAD CONNECTIONS



1. INPUT
2. GND
3. GND
4. OUTPUT
5. GND
6. Vcc

## RECOMMENDED P.C.B. LAYOUT (Units in mm)

