



# BIPOLAR ANALOG INTEGRATED CIRCUITS

# UPC2711TB, UPC2712TB

## 5 V, SUPER MINIMOLD SILICON MMIC WIDEBAND AMPLIFIER

### FEATURES

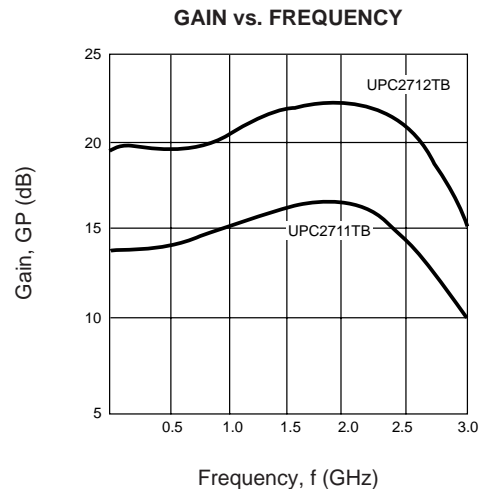
- **HIGH DENSITY SURFACE MOUNTING:**  
6 pin super minimold or SOT-363 package
- **SUPPLY VOLTAGE:**  $V_{CC} = 4.5$  to  $5.5$  V
- **WIDEBAND RESPONSE:**  
UPC2711TB:  $f_u = 2.9$  GHz TYP  
UPC2712TB:  $f_u = 2.6$  GHz TYP
- **POWER GAIN:**  
UPC2711TB:  $G_P = 13$  dB TYP  
UPC2712TB:  $G_P = 20$  dB TYP

### DESCRIPTION

NEC's UPC2711TB and UPC2712TB are Silicon MMIC Wideband Amplifiers manufactured using NEC's 20 GHz  $f_T$  NESAT™ III silicon bipolar process. These devices are designed for use as buffer amps in DBS tuners. The UPC2711/12TB are pin compatible and have comparable performance as the larger UPC2711/12T, so they are suitable for use as a replacement to help reduce system size. These IC's are housed in a 6 pin super minimold or SOT-363 package.

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

### TYPICAL PERFORMANCE CURVES



### ELECTRICAL CHARACTERISTICS ( $T_A = +25$ °C, $V_{CC} = 5.0$ V, $Z_L = Z_s = 50$ W)

PART NUMBER PACKAGE OUTLINE			UPC2711TB S06			UPC2712TB S06		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX
$I_{CC}$	Circuit Current (no signal)	mA	9	12	15	9	12	15
$G_P$	Power Gain, $f = 1$ GHz	dB	11	13	16.5	18	20	23.5
$f_u$	Upper Limit Operating Frequency (The gain at $f_u$ is 3 dB down from the gain at 100 MHz)	GHz	2.7	2.9		2.2	2.6	
$\Delta G_P$	Gain Flatness, $f = 0.1$ GHz to 2.5 GHz	dB		$\pm 0.8$			$\pm 0.8$	
$P_{O(SAT)}$	Maximum Output Level, $f = 1$ GHz, $P_{IN} = 0$ dBm	dBm	-2	+1		0	+3	
NF	Noise Figure, $f = 1$ GHz	dB		5	6.5		4.5	6
$RL_{IN}$	Input Return Loss, $f = 1$ GHz	dB	20	25		9	12	
$RL_{OUT}$	Output Return Loss, $f = 1$ GHz	dB	9	12		10	13	
ISOL	Isolation, $f = 1$ GHz	dB	25	30		28	33	

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CC</sub>	Supply Voltage	V	6
P <sub>IN</sub>	Input Power	dBm	+10
P <sub>T</sub>	Total Power Dissipation <sup>2</sup>	mW	200
T <sub>OP</sub>	Operating Temperature	°C	-45 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 double sided copper clad 50 x 50 x 1.6 mm epoxy glass PWB (T<sub>A</sub> = +85°C).

**RECOMMENDED OPERATING CONDITIONS**

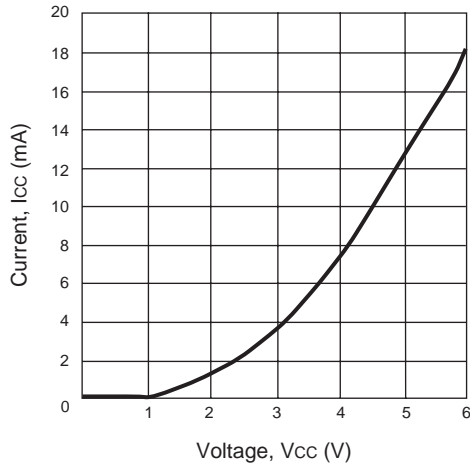
SYMBOL	PARAMETER	UNITS	MIN	TYP	MAX
V <sub>CC</sub>	Supply Voltage	V	4.5	5.0	5.5
T <sub>OP</sub>	Operating Temperature	°C	-40	+25	+85

**PIN DESCRIPTION**

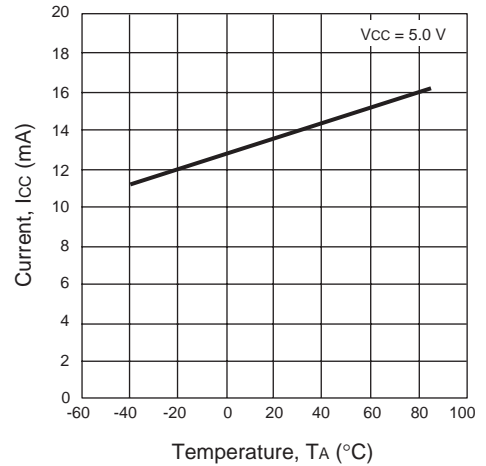
Pin No.	Pin Name	Applied Voltage (V)	Description	Internal Equivalent Circuit
1	Input		Signal input pin. An internal matching circuit, configured with resistors, enables 50 Ω connection over a wide bandwidth. A multi-feedback circuit is designed to cancel the deviations of h <sub>FE</sub> and resistance. This pin must be coupled to the signal source with a blocking capacitor.	
4	Output		Signal output pin. An internal matching circuit, configured with resistors, enables 50 Ω connection over a wide bandwidth. This pin must be coupled to the output load with a blocking capacitor.	
6	V <sub>CC</sub>	4.5 to 5.5	Power supply pin. This pin should be externally equipped with a bypass capacitor to minimize ground impedance.	
2 3 5	GND	0	Ground pin. This pin should be connected to system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. All the ground pins must be connected together with wide ground pattern to minimize impedance difference.	

**TYPICAL PERFORMANCE CURVES** ( $T_A = 25^\circ\text{C}$ )

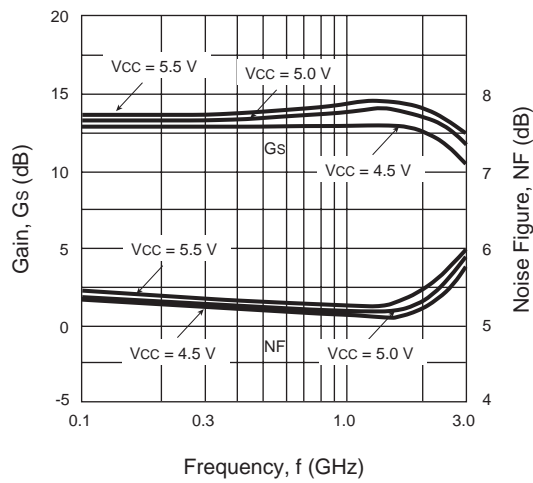
**UPC2711TB  
CURRENT vs. VOLTAGE**



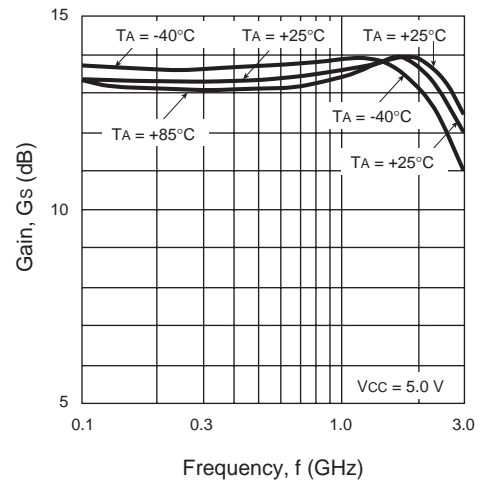
**UPC2711TB  
CURRENT vs. TEMPERATURE**



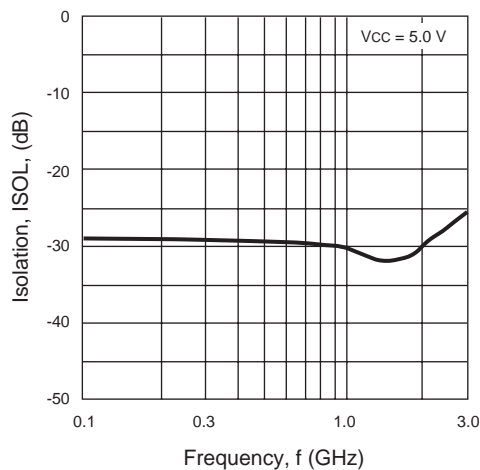
**UPC2711TB  
GAIN AND NOISE FIGURE vs.  
FREQUENCY AND VOLTAGE**



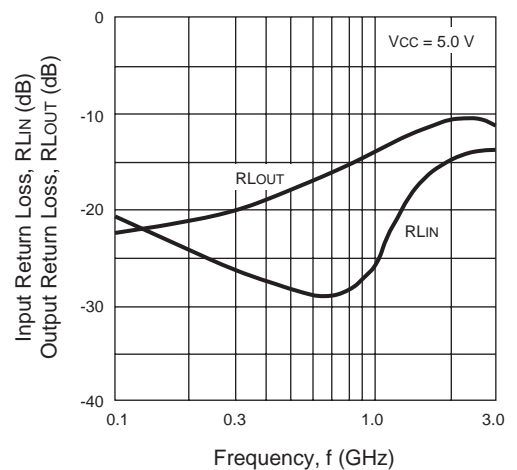
**UPC2711TB  
GAIN vs. FREQUENCY AND  
TEMPERATURE**



**UPC2711TB  
ISOLATION vs. FREQUENCY**

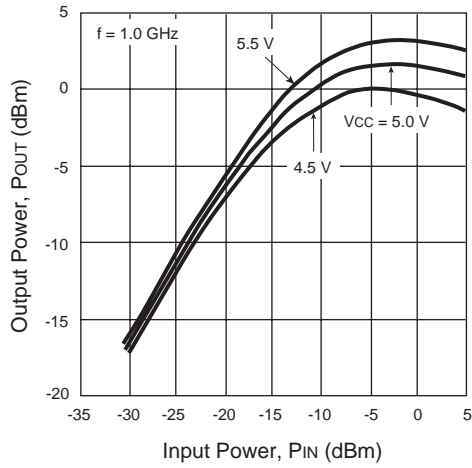


**UPC2711TB  
INPUT RETURN LOSS AND  
OUTPUT RETURN LOSS vs. FREQUENCY**

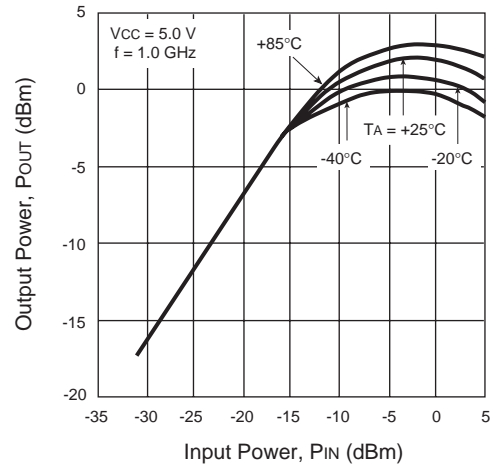


**TYPICAL PERFORMANCE CURVES** ( $T_A = 25^\circ\text{C}$ )

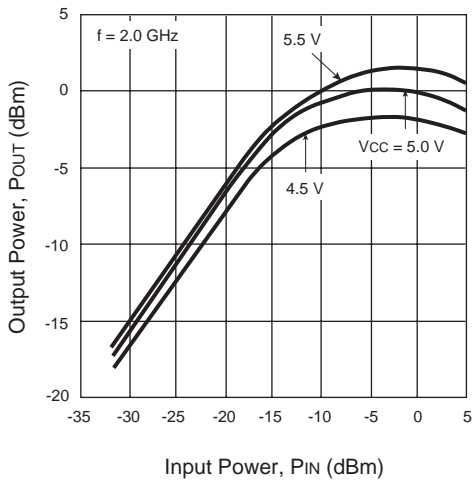
**UPC2711TB**  
**OUTPUT POWER vs.**  
**INPUT POWER VOLTAGE**



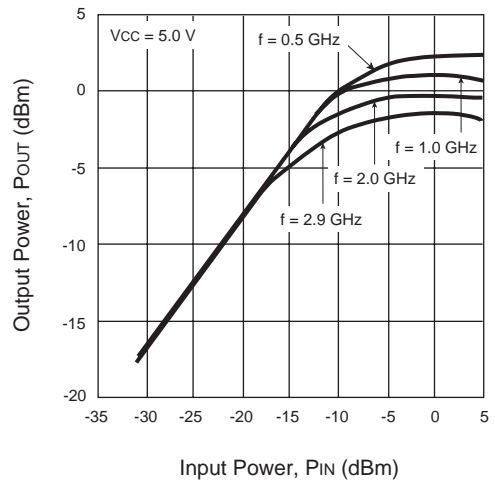
**UPC2711TB**  
**OUTPUT POWER vs.**  
**INPUT POWER AND TEMPERATURE**



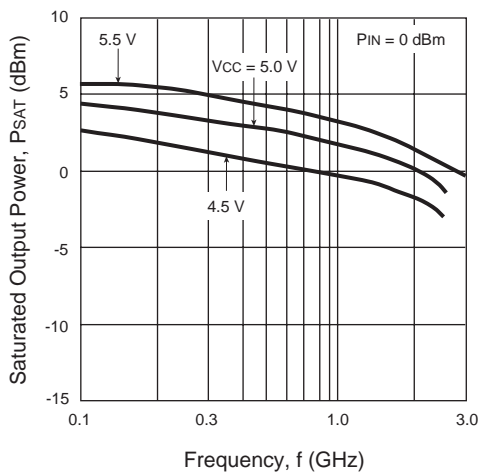
**UPC2711TB**  
**OUTPUT POWER vs.**  
**INPUT POWER AND VOLTAGE**



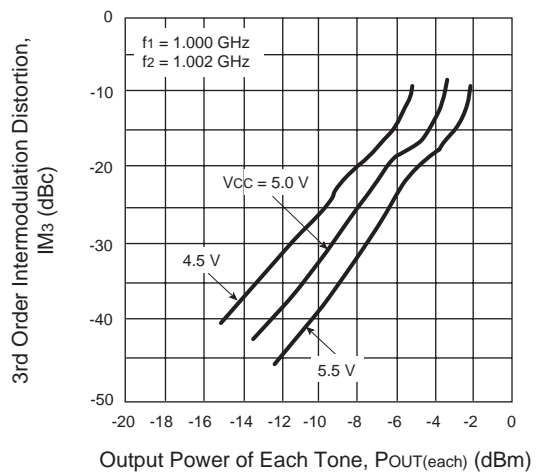
**UPC2711TB**  
**OUTPUT POWER vs.**  
**INPUT POWER AND FREQUENCY**



**UPC2711TB**  
**SATURATED OUTPUT POWER vs.**  
**FREQUENCY AND VOLTAGE**

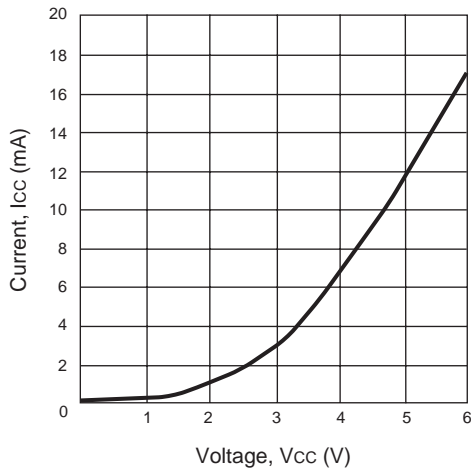


**UPC2711TB**  
**3RD ORDER INTERMODULATION**  
**DISTORTION vs. OUTPUT POWER**  
**AND VOLTAGE**

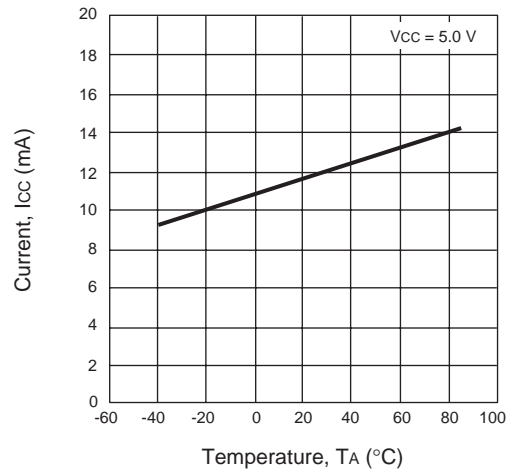


TYPICAL PERFORMANCE CURVES (TA = 25°C)

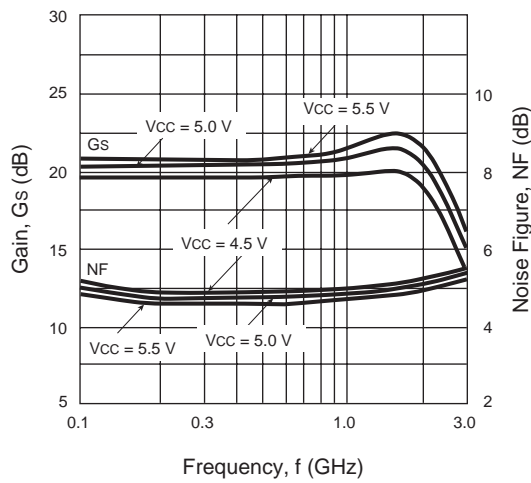
UPC2712TB  
CURRENT vs. VOLTAGE



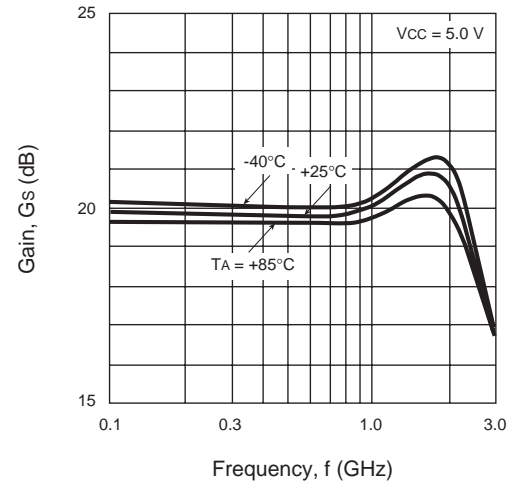
UPC2712TB  
CURRENT vs. TEMPERATURE



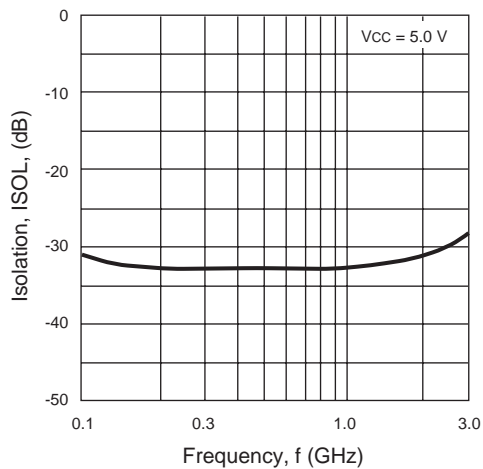
UPC2712TB  
GAIN AND NOISE FIGURE vs.  
FREQUENCY AND VOLTAGE



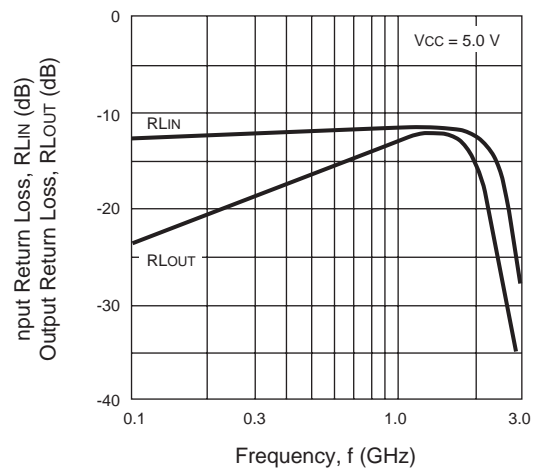
UPC2712TB  
GAIN vs.  
FREQUENCY AND TEMPERATURE



UPC2712TB  
ISOLATION vs. FREQUENCY

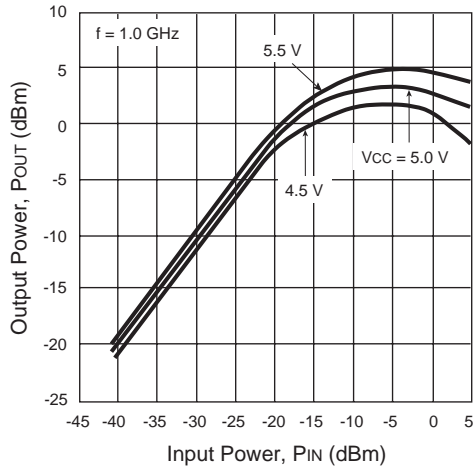


UPC2712TB  
INPUT RETURN LOSS AND OUTPUT  
RETURN LOSS vs. FREQUENCY

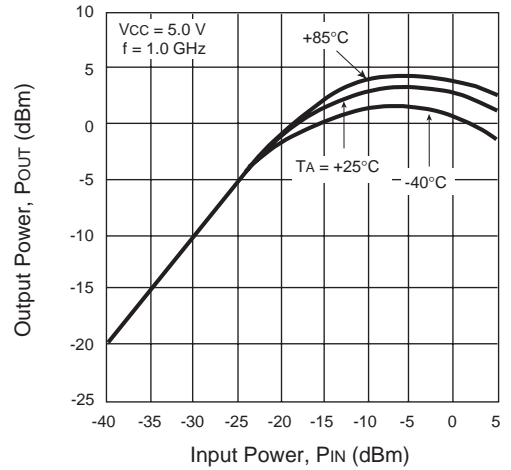


TYPICAL PERFORMANCE CURVES (TA = 25°C)

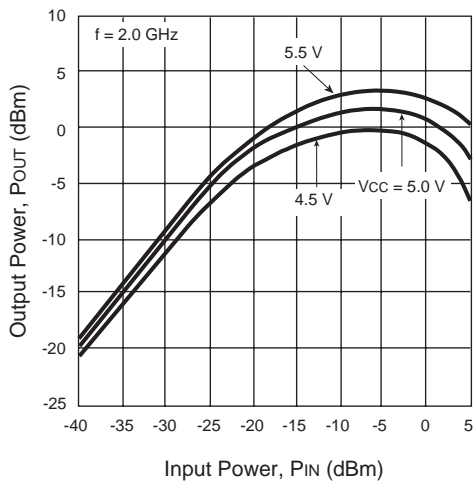
UPC2712TB  
OUTPUT POWER vs.  
INPUT POWER VOLTAGE



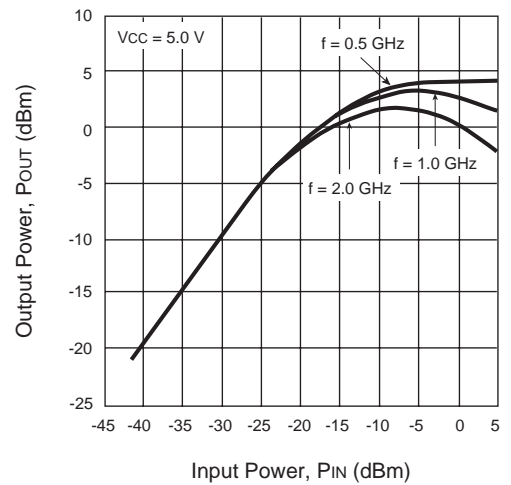
UPC2712TB  
OUTPUT POWER vs.  
INPUT POWER AND TEMPERATURE



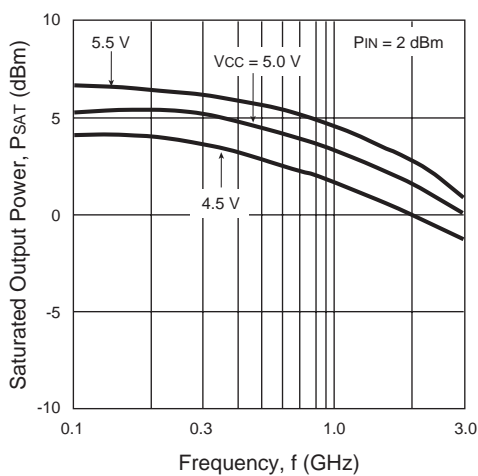
UPC2712TB  
OUTPUT POWER vs.  
INPUT POWER AND VOLTAGE



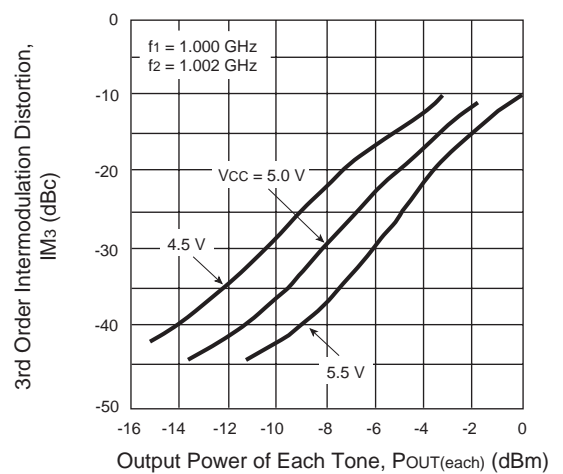
UPC2712TB  
OUTPUT POWER vs.  
INPUT POWER AND FREQUENCY



UPC2712TB  
SATURATED OUTPUT POWER vs.  
FREQUENCY AND VOLTAGE



UPC2712TB  
3RD ORDER INTERMODULATION  
DISTORTION vs. OUTPUT POWER  
AND VOLTAGE



**TYPICAL SCATTERING PARAMETERS** (T<sub>A</sub> = 25°C)

**UPC2711TB**

V<sub>CC</sub> = 5 V, I<sub>CC</sub> = 13.8 mA

FREQUENCY (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>		K
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100.00	0.085	-22.40	4.447	-14.90	0.035	-12.70	0.113	-3.10	3.18
200.00	0.086	-25.00	4.468	-30.10	0.035	-23.00	0.119	1.20	3.21
300.00	0.098	-29.20	4.491	-44.90	0.034	-32.10	0.136	1.60	3.23
400.00	0.081	-29.40	4.510	-60.30	0.033	-42.50	0.142	6.50	3.34
500.00	0.066	-33.90	4.540	-74.90	0.033	-50.10	0.156	10.10	3.32
600.00	0.041	-54.50	4.572	-90.20	0.033	-59.60	0.161	12.70	3.34
700.00	0.053	-104.30	4.624	-105.30	0.032	-69.30	0.161	8.80	3.33
800.00	0.070	-119.70	4.664	-120.70	0.031	-78.40	0.176	6.20	3.36
900.00	0.098	-121.90	4.729	-136.10	0.032	-86.60	0.192	1.90	3.27
1000.00	0.101	-112.50	4.781	-152.00	0.031	-94.90	0.228	0.10	3.29
1100.00	0.090	-108.50	4.843	-167.90	0.031	-103.90	0.256	-0.60	3.15
1200.00	0.060	-95.60	4.945	175.80	0.029	-111.00	0.290	-1.10	3.24
1300.00	0.019	-79.20	4.999	159.50	0.029	-120.20	0.308	-0.30	3.16
1400.00	0.023	54.80	5.062	143.00	0.028	-128.90	0.322	-1.40	3.18
1500.00	0.062	80.70	5.114	126.40	0.029	-133.10	0.327	-2.20	3.08
1600.00	0.087	80.40	5.142	109.50	0.029	-140.90	0.333	-4.80	3.07
1700.00	0.113	78.70	5.160	92.70	0.029	-146.20	0.344	-7.00	3.02
1800.00	0.126	72.00	5.146	75.40	0.030	-151.40	0.356	-9.70	2.88
1900.00	0.154	63.50	5.123	58.00	0.032	-159.70	0.371	-11.10	2.70
2000.00	0.178	59.00	5.113	41.30	0.035	-168.30	0.378	-12.00	2.51
2100.00	0.212	54.20	5.063	24.00	0.036	-175.70	0.383	-12.80	2.39
2200.00	0.232	55.20	5.006	6.90	0.038	175.20	0.378	-13.60	2.27
2300.00	0.246	53.80	4.954	-10.40	0.041	165.20	0.367	-16.10	2.13
2400.00	0.248	53.60	4.865	-27.70	0.045	155.30	0.359	-18.00	1.99
2500.00	0.240	49.20	4.783	-45.00	0.048	143.60	0.356	-21.10	1.88
2600.00	0.238	43.70	4.664	-62.30	0.049	131.20	0.359	-23.60	1.85
2700.00	0.240	36.20	4.529	-79.60	0.052	119.80	0.366	-26.20	1.76
2800.00	0.262	31.70	4.384	-96.60	0.054	108.70	0.374	-28.60	1.72
2900.00	0.285	28.80	4.255	-113.10	0.056	95.50	0.372	-31.10	1.68
3000.00	0.316	29.70	4.117	-129.60	0.057	83.60	0.361	-35.00	1.69

**TYPICAL SCATTERING PARAMETERS** (T<sub>A</sub> = 25°C)

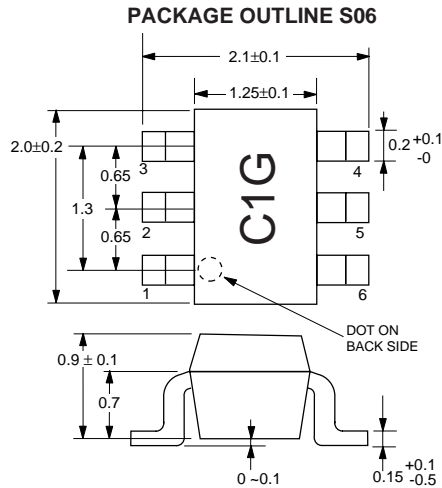
**UPC2712TB**

V<sub>CC</sub> = 5 V, I<sub>CC</sub> = 13.9 mA

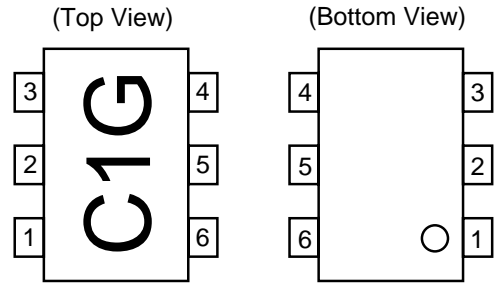
FREQUENCY (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>		K
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100.00	0.303	-8.10	8.864	-16.70	0.023	-11.40	0.043	2.30	2.32
200.00	0.291	-10.10	8.827	-33.50	0.023	-19.20	0.055	11.50	2.35
300.00	0.295	-11.80	8.936	-49.50	0.022	-25.50	0.078	8.50	2.38
400.00	0.276	-11.30	9.044	-67.60	0.023	-34.60	0.095	13.40	2.33
500.00	0.265	-11.00	9.051	-82.20	0.023	-42.80	0.112	13.60	2.37
600.00	0.243	-12.30	9.096	-98.80	0.023	-50.00	0.120	11.10	2.35
700.00	0.222	-20.30	9.089	-115.20	0.023	-59.80	0.120	1.70	2.37
800.00	0.219	-25.40	9.080	-131.50	0.023	-66.20	0.136	-6.00	2.38
900.00	0.230	-33.90	9.096	-147.60	0.023	-73.00	0.155	-14.40	2.39
1000.00	0.267	-35.50	9.044	-164.20	0.024	-82.90	0.189	-17.50	2.26
1100.00	0.290	-35.50	9.197	179.50	0.024	-89.50	0.212	-19.90	2.12
1200.00	0.316	-33.20	9.421	162.40	0.024	-98.40	0.240	-21.40	2.02
1300.00	0.317	-30.60	9.524	144.90	0.024	-107.00	0.245	-23.20	1.94
1400.00	0.314	-29.40	9.512	126.60	0.026	-115.70	0.248	-27.10	1.82
1500.00	0.296	-28.10	9.574	109.10	0.026	-122.30	0.236	-31.80	1.78
1600.00	0.290	-29.40	9.598	91.10	0.027	-133.20	0.231	-38.00	1.74
1700.00	0.278	-31.10	9.480	72.90	0.028	-139.40	0.221	-43.80	1.72
1800.00	0.282	-34.90	9.372	54.30	0.029	-148.10	0.215	-49.80	1.69
1900.00	0.284	-35.50	9.193	35.60	0.030	-157.60	0.199	-53.00	1.70
2000.00	0.280	-36.60	9.198	18.40	0.031	-167.40	0.170	-55.30	1.69
2100.00	0.273	-36.00	9.011	0.10	0.033	-175.10	0.134	-56.20	1.68
2200.00	0.244	-38.20	8.784	-17.90	0.033	176.50	0.090	-55.20	1.74
2300.00	0.222	-40.00	8.717	-35.10	0.034	164.80	0.050	-53.70	1.74
2400.00	0.189	-45.70	8.388	-52.90	0.036	154.80	0.025	1.80	1.75
2500.00	0.177	-52.90	8.217	-70.10	0.037	143.50	0.039	33.40	1.74
2600.00	0.164	-57.40	7.890	-87.40	0.039	133.30	0.071	39.30	1.72
2700.00	0.158	-59.60	7.597	-104.60	0.041	123.80	0.099	34.30	1.70
2800.00	0.143	-53.90	7.313	-121.40	0.041	114.00	0.131	26.00	1.72
2900.00	0.128	-44.30	7.078	-138.40	0.043	101.40	0.149	22.80	1.70
3000.00	0.111	-22.20	6.086	-154.90	0.046	90.20	0.157	19.40	1.70



**OUTLINE DIMENSIONS** (Units in mm)



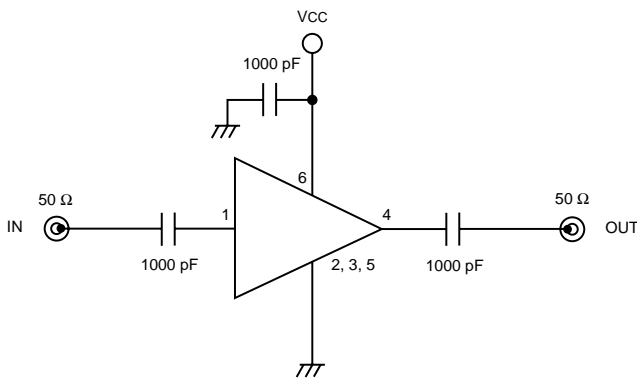
**PIN CONNECTIONS**



Marking is an example of UPC2711TB

- 1. Input    4. Output
- 2. GND    5. GND
- 3. GND    6. Vcc

**TEST CIRCUIT**



**ORDERING INFORMATION (Solder Contains Lead)**

PART NUMBER	MARKING	QTY
UPC2711TB-E3	C1G	3K/reel
UPC2712TB-E3	C1H	3K/reel

Note: Embossed tape, 8 mm wide. Pins 1, 2, and 3 face perforated side of tape.

**ORDERING INFORMATION (Pb-Free)**

PART NUMBER	MARKING	QTY
UPC2711TB-E3-A	C1G	3K/reel
UPC2712TB-E3-A	C1H	3K/reel

Note: Embossed tape, 8 mm wide. Pins 1, 2, and 3 face perforated side of tape.

**Life Support Applications**

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

**CEL** California Eastern Laboratories, Your source for NEC RF, Microwave, Optoelectronic, and Fiber Optic Semiconductor Devices.  
4590 Patrick Henry Drive • Santa Clara, CA 95054-1817 • (408) 919-2500 • FAX (408) 988-0279 • [www.cel.com](http://www.cel.com)

DATA SUBJECT TO CHANGE WITHOUT NOTICE

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (\*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

Important Information and Disclaimer: Information provided by CEL on its website or in other communications concerning the substance content of its products represents knowledge and belief as of the date that it is provided. CEL bases its knowledge and belief on information provided by third parties and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. CEL has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. CEL and CEL suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall CEL's liability arising out of such information exceed the total purchase price of the CEL part(s) at issue sold by CEL to customer on an annual basis.

See CEL Terms and Conditions for additional clarification of warranties and liability.