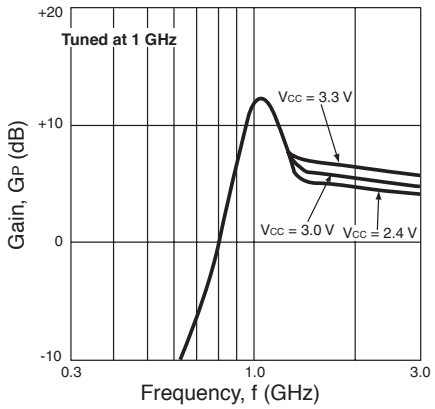
SILICON RFIC LOW CURRENT AMPLIFIER FOR CELLULAR/CORDLESS TELEPHONES

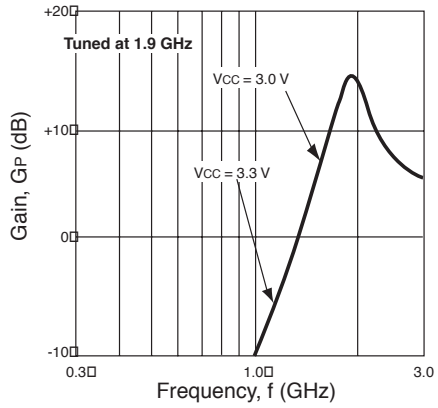
UPC8151TB

FEATURES

- **SUPPLY VOLTAGE:** Vcc = 2.4 to 3.3 V
- **LOW CURRENT CONSUMPTION:**
  UPC8151TB; Icc = 4.2 mA TYP @ 3.0 V
- **HIGH EFFICIENCY:**
  UPC8151TB; P_{1dB} = +2.5 dBm TYP @ f = 1 GHz
- **POWER GAIN:**
  UPC8151TB; G_P = 12.5 dB TYP @ f = 1 GHz
- **OPERATING FREQUENCY:**
  100 MHz to 1900 MHz (Output port LC matching)
- **EXCELLENT ISOLATION:**
  UPC8151TB; ISOL = 38 dB TYP @ f = 1 GHz
- **HIGH DENSITY SURFACE MOUNTING:**
  6 pin super minimold or SOT-363 package

INSERTION POWER GAIN vs. FREQUENCY AND VOLTAGE





DESCRIPTION

NEC's UPC8151TB is a silicon RFIC designed as a buffer amplifier for cellular or cordless telephones. This low current amplifier operates on 3.0 V and is housed in a 6 pin super minimold package.

The IC is manufactured using NEC's 20 GHz f_T NESAT™ III silicon bipolar process. This process uses silicon nitride passivation film and gold electrodes. These materials protect the chip surface from external pollution and prevent corrosion/ migration. Thus, this IC has excellent performance, uniformity and reliability.

ELECTRICAL CHARACTERISTICS (T_A = 25 °C, V_{CC} = V_{OUT} = 3.0 V, Z_L = Z_S = 50 Ω, at LC matched frequency)

PART NUMBER PACKAGE OUTLINE			UPC8151TB SO6		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
Icc	Circuit Current, No signal	mA	2.8	4.2	5.8
G_P	Power Gain f = 1.00 GHz f = 1.90 GHz	dB	9.5 12.0	12.5 15.0	14.5 17.0
ISOL	Isolation f = 1.00 GHz f = 1.90 GHz	dB	33.0 29.0	38.0 34.0	– –
P_{1dB}	Output Power at 1 dB Compression Point f = 1.00 GHz f = 1.90 GHz	dBm	 -1.0 -3.0	 +2.5 +0.5	 – –
NF	Noise Figure f = 1.00 GHz f = 1.90 GHz	dB	– –	6.0 6.0	7.5 7.5
RL_{IN}	Input Return Loss(without matching circuit) f = 1.00 GHz f = 1.90 GHz	dB	 2.0 1.0	 5.0 4.0	 – –
RL_{OUT}	Output Return Loss (with external matching circuit) f = 1.00 GHz f = 1.90 GHz	dB		 10.0 12.0	
IM_3	3rd Order Intermodulation Distortion f_1 = 1.000 GHz, f_2 = 1.001 GHz, $P_{O(each)}$ = -20 dBm f_1 = 1.900 GHz, f_2 = 1.901 GHz, $P_{O(each)}$ = -20 dBm	dBc		 -62.0 54.0	

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

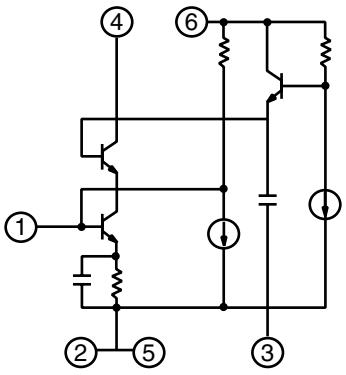
SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CC}	Supply Voltage	V	3.6
P_D	Total Power Dissipation[2]	mW	200
T_A	Operating Temperature	°C	-40 to +85
T_{STG}	Storage Temperature	°C	-55 to +150

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_A = 85°C).

RECOMMENDED OPERATING CONDITIONS

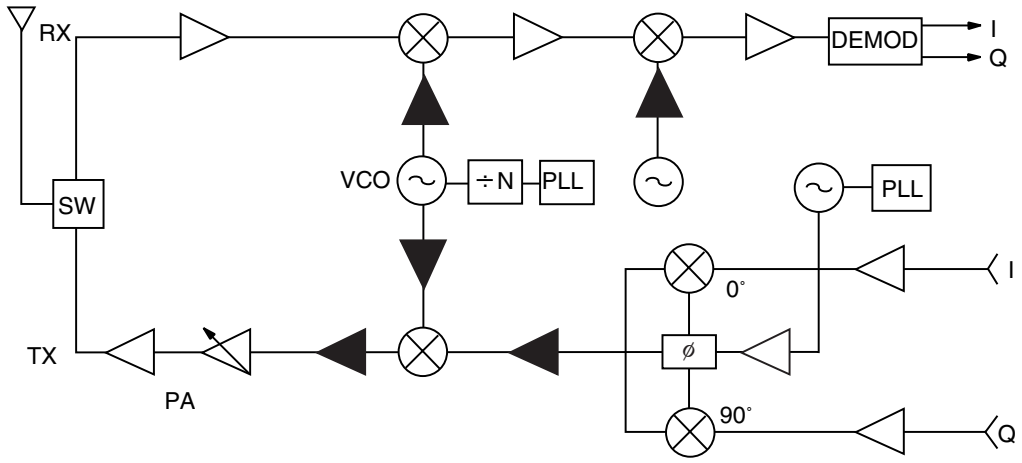
SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
V_{CC}	Supply Voltage	V	2.4	3.0	3.3
T_A	Operating Temperature	°C	-40	+25	+85
f	Operating Frequency	MHz	100		1900

PIN FUNCTIONS

Pin No.	Symbol	Applied Voltage	Description	Internal Equivalent Circuit
1	INPUT		Signal input pin. An internal matching circuit provides a 50 Ω match over a wide bandwidth. This pin must be coupled to signal source with a blocking capacitor.	
4	OUTPUT	Vcc through external inductor.	Signal output pin. This output is designed as an open collector. Due to the high impedance output this pin should be externally equipped with an LC matching circuit.	
6	Vcc	2.4 to 3.3	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 APPLICATION EXAMPLE

Location Examples in Digital Cellular

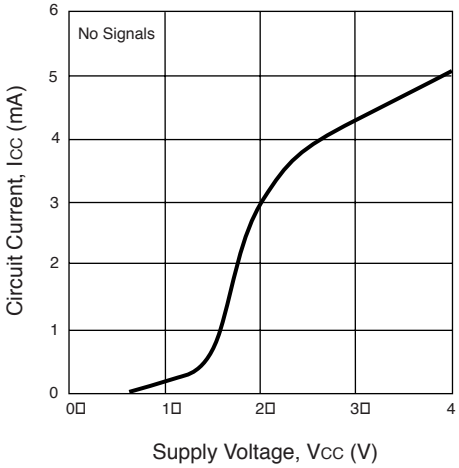


PRODUCT LINE-UP (T_A = +25 °C, V_{CC} = 3.0 V, Z_L = Z_S = 50 Ω)

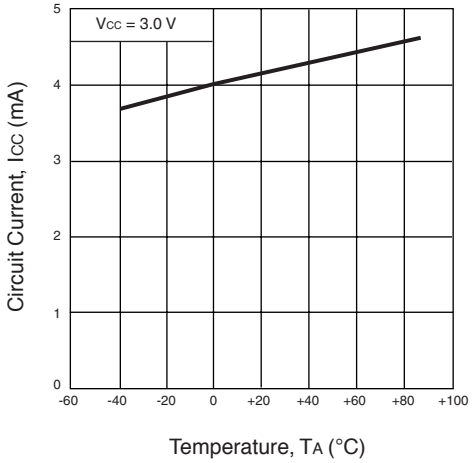
PARAMETER PART NO.	Icc (mA)	OUTPUT PORT MATCHING FREQUENCY						PACKAGES
		1 GHz			1.9 GHz			
		G_P (dB)	ISOL (dB)	P_{1dB} (dBm)	G_P (dB)	ISOL (dB)	P_{1dB} (dBm)	
UPC8128TB	2.8	12.5	39	-4.0	13.0	37	-4.0	6 pin super minimold
UPC8151TB	4.5	12.5	38	+2.5	15.0	34	+0.5	6 pin super minimold
UPC8152TB	5.6	23.0	40	-4.5	17.5	35	-8.5	6 pin super minimold

TYPICAL PERFORMANCE CURVES (T_A = 25°C unless otherwise specified)

CIRCUIT CURRENT vs. VOLTAGE



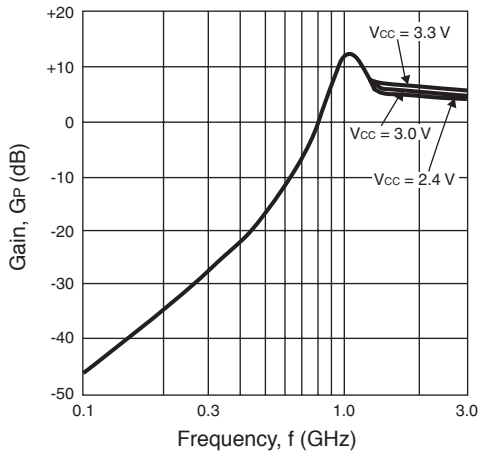
CIRCUIT CURRENT vs. TEMPERATURE



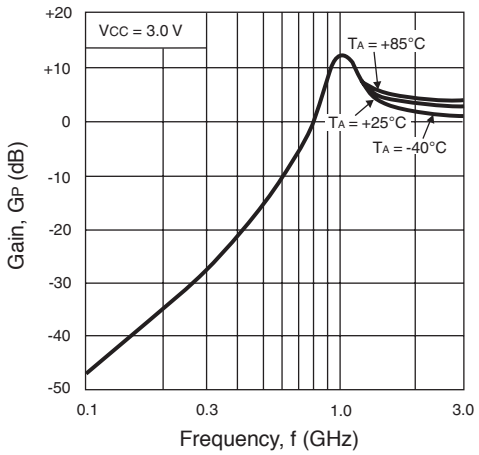
TYPICAL PERFORMANCE CURVES (T_A = 25°C unless otherwise specified)

1.0 GHz OUTPUT PORT MATCHING

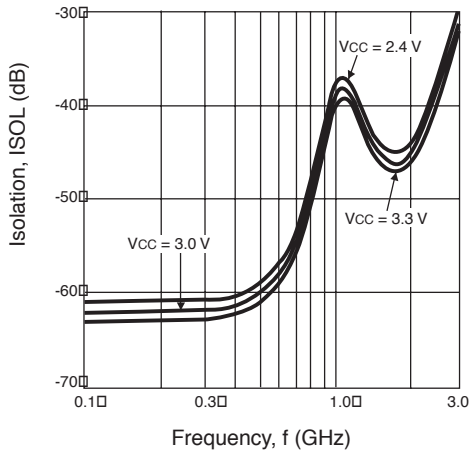
INSERTION POWER GAIN vs. FREQUENCY AND VOLTAGE



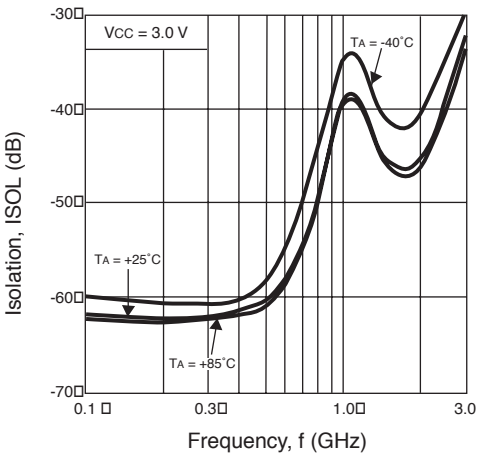
INSERTION POWER GAIN vs. FREQUENCY AND TEMPERATURE



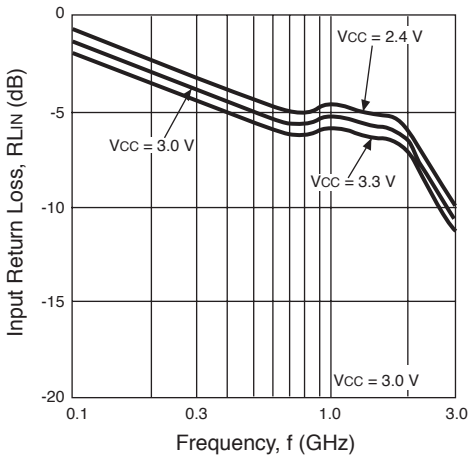
ISOLATION vs. FREQUENCY AND VOLTAGE



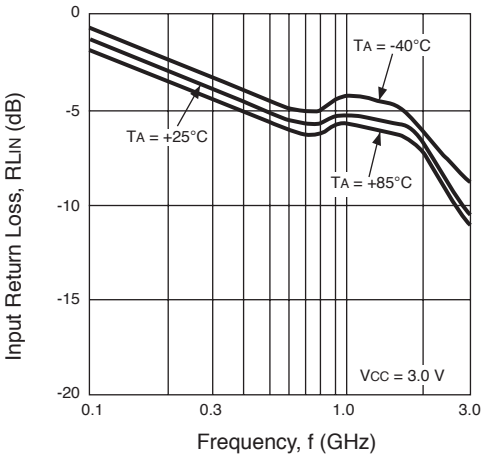
ISOLATION vs. FREQUENCY AND TEMPERATURE



INPUT RETURN LOSS vs. FREQUENCY AND VOLTAGE



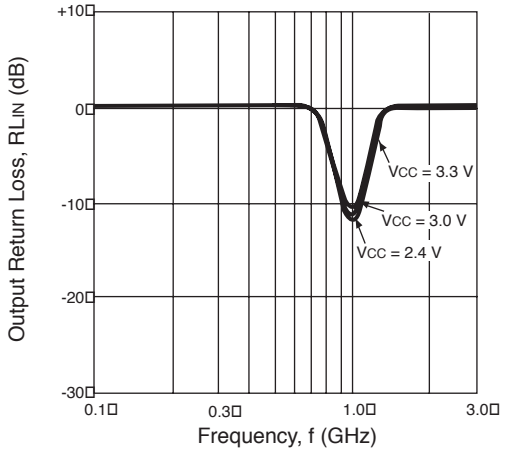
INPUT RETURN LOSS vs. FREQUENCY AND TEMPERATURE



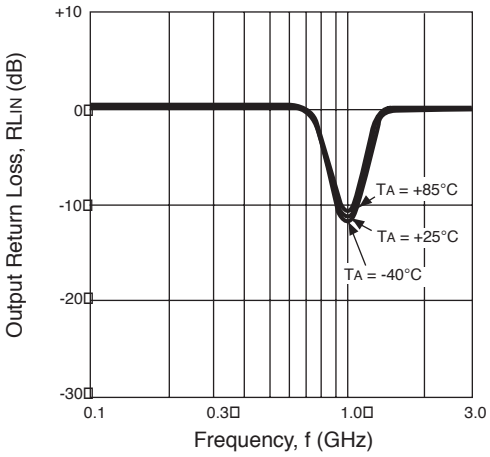
TYPICAL PERFORMANCE CURVES (T_A = 25°C unless otherwise specified)

1.0 GHz OUTPUT PORT MATCHING

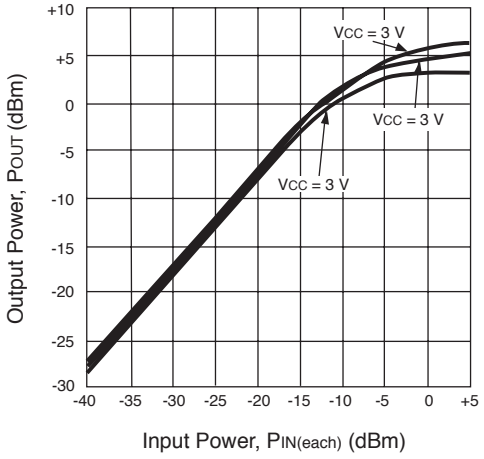
OUTPUT RETURN LOSS vs. FREQUENCY AND VOLTAGE



OUTPUT RETURN LOSS vs. FREQUENCY AND TEMPERATURE



OUTPUT POWER vs. INPUT POWER AND VOLTAGE



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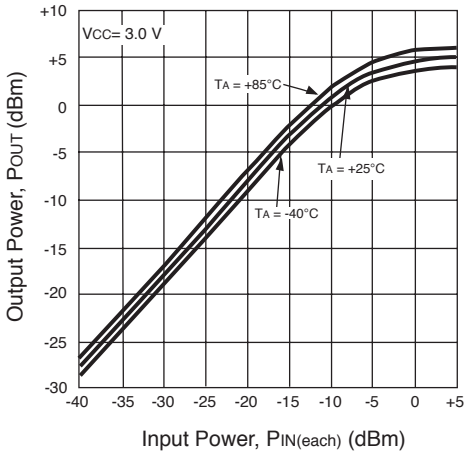
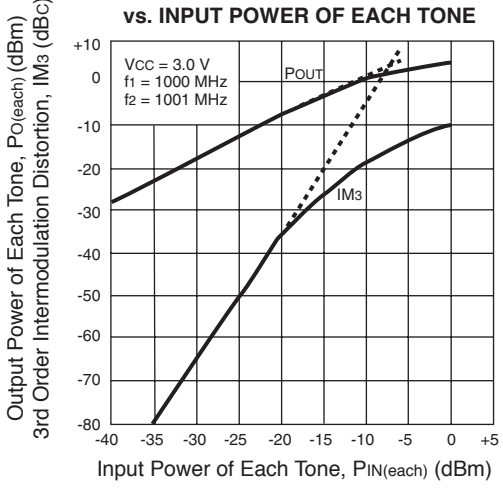
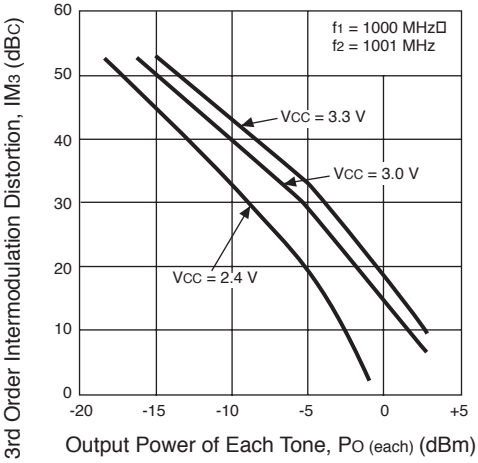


OUTPUT POWER OF EACH TONE AND 3rd ORDER INTERMODULATION DISTORTION vs. INPUT POWER OF EACH TONE



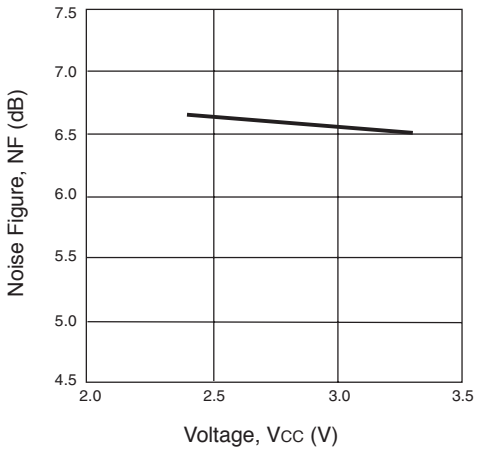
3rd ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER OF EACH TONE AND VOLTAGE



TYPICAL PERFORMANCE CURVES (T_A = 25°C unless otherwise specified)

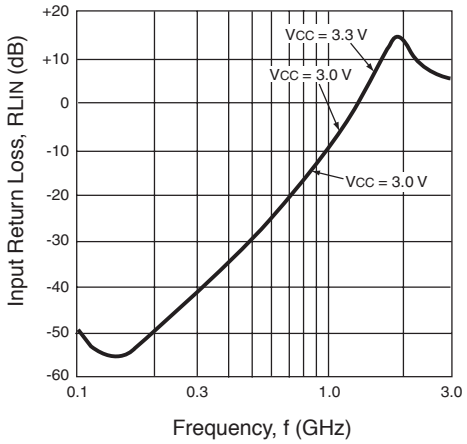
1.0 GHz Output Port Matching

NOISE FIGURE vs. VOLTAGE

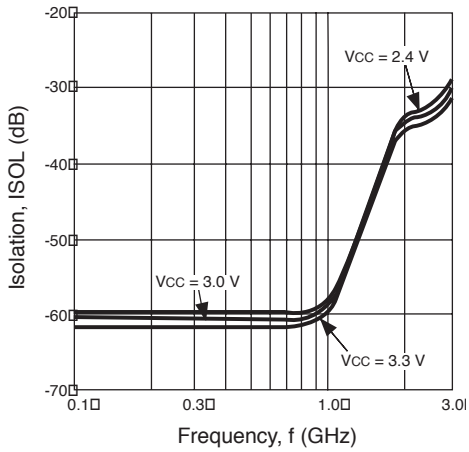


1.9 GHz Output Port Matching

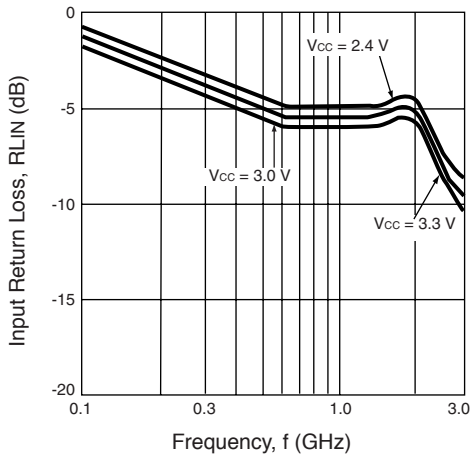
INSERTION POWER GAIN vs. FREQUENCY AND VOLTAGE



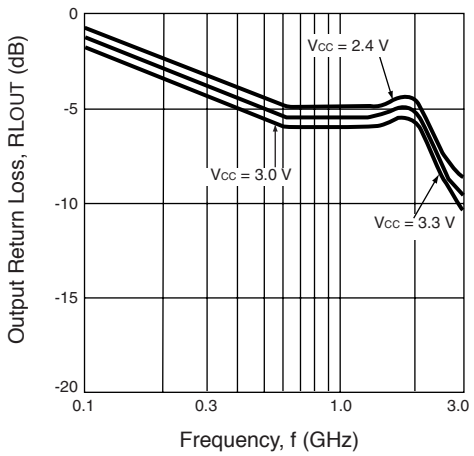
ISOLATION vs. FREQUENCY AND VOLTAGE



INPUT RETURN LOSS vs. FREQUENCY AND VOLTAGE



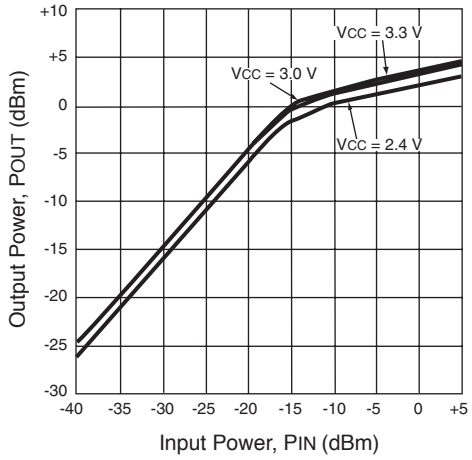
OUTPUT RETURN LOSS vs. FREQUENCY AND VOLTAGE



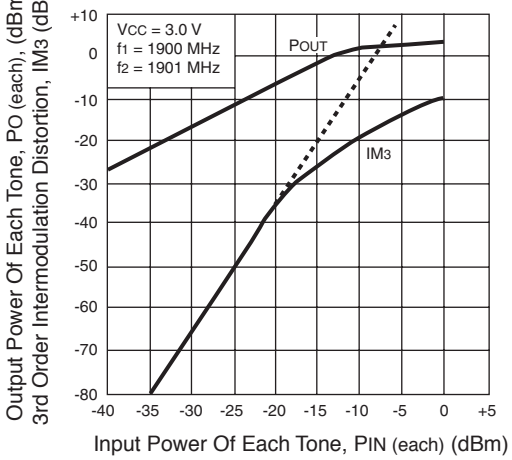
TYPICAL PERFORMANCE CURVES (T_A = 25°C unless otherwise specified)

1.9 GHz Output Port Matching

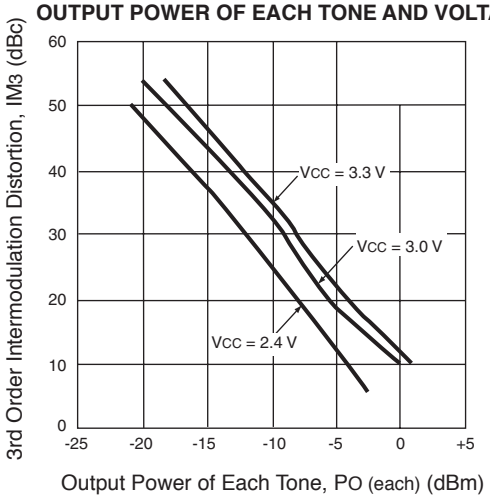
OUTPUT POWER vs. INPUT POWER AND VOLTAGE



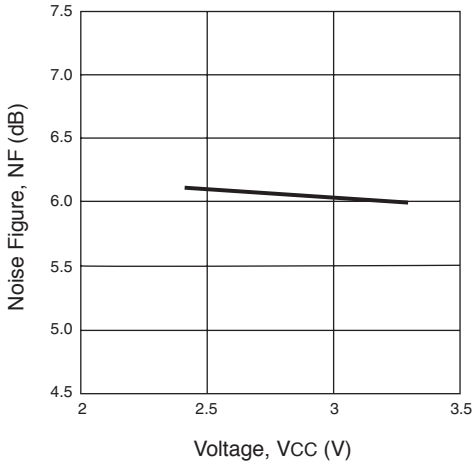
OUTPUT POWER OF EACH TONE AND 3RD ORDER INTERMODULATION DISTORTION vs. INPUT POWER OF EACH TONE



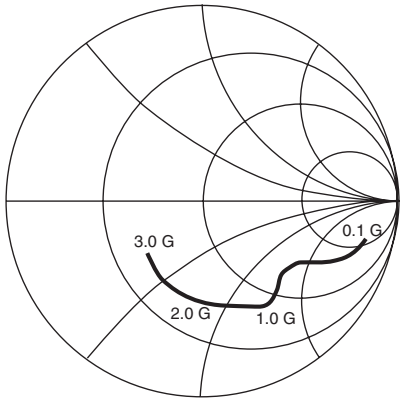
3RD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER OF EACH TONE AND VOLTAGE



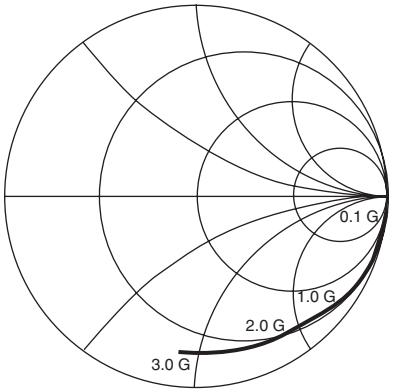
NOISE FIGURE vs. VOLTAGE



TYPICAL SCATTERING PARAMETERS (T_A = 25°C)



S_{11}—Frequency



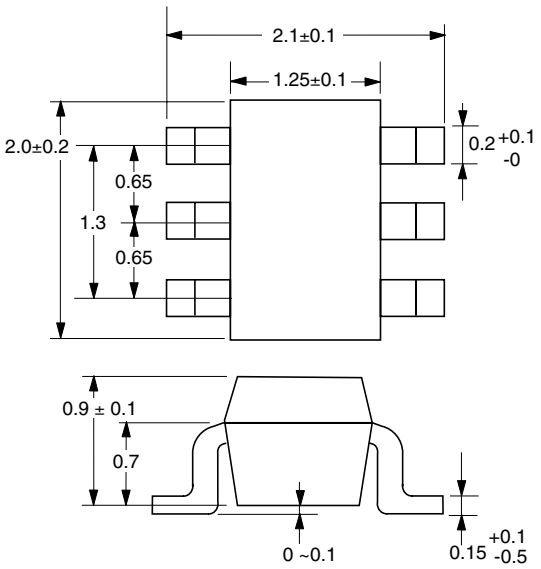
S_{22}—Frequency

V_{CC} = V_{OUT} = 3.0 V, I_{CC} = 4.2 mA

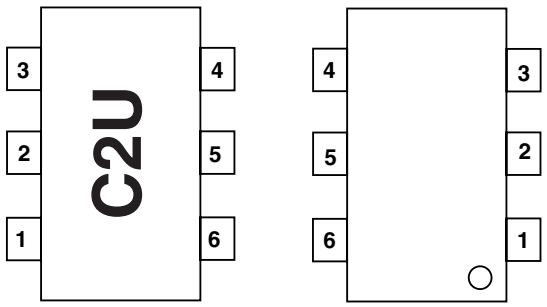
FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	.843	-16.0	1.202	-178.9	.000	69.5	.996	-3.3
200	.752	-27.1	1.197	-177.5	.003	120.2	1.009	-6.9
300	.666	-32.4	1.221	-175.4	.003	103.2	.998	-9.9
400	.603	-36.8	1.299	-174.5	.004	92.8	.986	-13.8
500	.555	-40.5	1.398	-174.0	.005	88.8	.968	-17.3
600	.528	-44.8	1.513	-174.9	.005	95.2	.968	-20.4
700	.517	-49.9	1.691	-176.2	.007	67.5	.971	-23.1
800	.525	-54.4	1.815	-178.2	.007	72.4	.972	-25.8
900	.545	-58.9	2.008	179.5	.006	84.5	.960	-29.3
1000	.571	-62.8	2.189	175.7	.009	78.3	.936	-32.8
1100	.580	-67.3	2.399	171.2	.007	60.0	.926	-36.3
1200	.588	-71.3	2.560	165.9	.007	89.5	.933	-39.5
1300	.571	-76.4	2.736	157.5	.008	67.2	.941	-42.0
1400	.563	-82.3	2.865	151.3	.008	79.6	.930	-45.0
1500	.553	-88.8	2.946	143.3	.006	79.9	.906	-48.1
1600	.552	-95.2	3.077	137.0	.006	91.4	.895	-51.5
1700	.551	-101.5	3.083	130.1	.009	102.3	.888	-54.8
1800	.550	-107.5	3.174	123.9	.009	100.5	.884	-57.3
1900	.536	-113.3	3.164	117.4	.006	109.5	.885	-60.5
2000	.517	-119.8	3.193	110.7	.009	115.9	.881	-63.4
2100	.495	-127.1	3.149	104.4	.010	124.2	.870	-66.6
2200	.484	-135.3	3.143	97.3	.011	122.4	.867	-69.8
2300	.484	-142.6	3.135	90.5	.012	131.7	.866	-72.3
2400	.490	-148.5	3.120	83.5	.015	138.1	.868	-75.5
2500	.499	-152.5	3.053	78.4	.016	136.3	.866	-78.7
2600	.499	-155.8	2.991	71.4	.018	142.9	.864	-82.5
2700	.485	-157.4	2.958	68.0	.018	143.9	.858	-86.6
2800	.464	-160.6	2.810	62.9	.021	142.5	.852	-89.7
2900	.439	-164.1	2.866	57.5	.022	149.3	.872	-93.4
3000	.416	-168.6	2.713	54.5	.025	148.4	.864	-96.6
3100	.403	-173.6	2.635	48.0	.030	143.6	.867	-101.0

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE SO6



LEAD CONNECTIONS



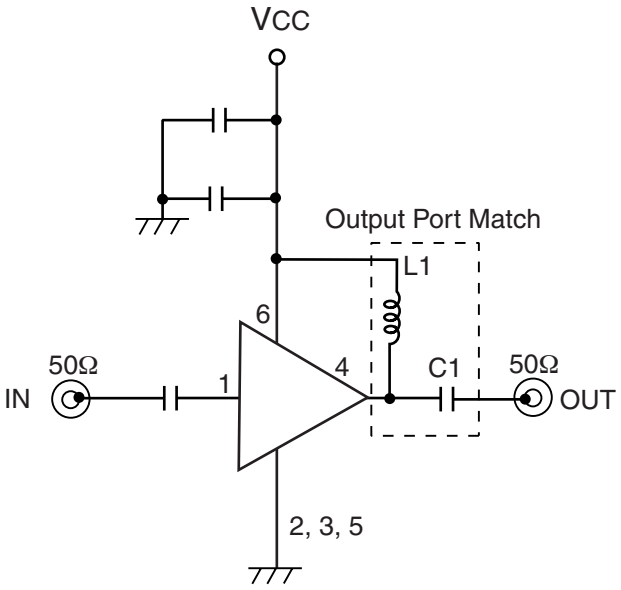
1. INPUT
2. GND
3. GND
4. OUTPUT
5. GND
6. Vcc

ORDERING INFORMATION

PART NUMBER	QUANTITY	MARKING
UPC8151TB-E3-A	3K/Reel	C2U

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

TEST CIRCUIT



FOUR	L1	C1	
900 MHz	12 nH	0.68 pF	All Other
1900 MHz	2.7 nH	0.47 pF	Caps = 1000 pF

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

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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	
Lead (Pb)	< 1000 PPM	-A	-AZ
		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.