CEL

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3241TB

3.3 V, SILICON MMIC MEDIUM OUTPUT POWER AMPLIFIER

DESCRIPTION

The μPC3241TB is a silicon monolithic integrated circuit designed as IF amplifier for DBS LNB.
This device exhibits low noise figure and high power gain characteristics.
This IC is manufactured using our UHS0 (Ultra High Speed Process) bipolar process.

FEATURES

- Low current : I_{CC} = 19.8 mA TYP.
- Power gain : G_P = 23.5 dB TYP. @ f = 1.0 GHz
  : G_P = 24.0 dB TYP. @ f = 2.2 GHz
- Gain flatness : ΔG_P = 0.7 dB TYP. @ f = 1.0 to 2.2 GHz
- Noise figure : NF = 4.0 dB TYP. @ f = 1.0 GHz
  : NF = 4.3 dB TYP. @ f = 2.2 GHz
- High linearity : $P_{O\,(1dB)}$ = +7.5 dBm TYP. @ f = 1.0 GHz
  : $P_{O\,(1dB)}$ = +6.0 dBm TYP. @ f = 2.2 GHz
- Supply voltage : V_{CC} = 3.0 to 3.6 V
- Port impedance : input/output 50 Ω

APPLICATIONS

- IF amplifiers in DBS LNB, other L-band amplifiers, etc.

ORDERING INFORMATION

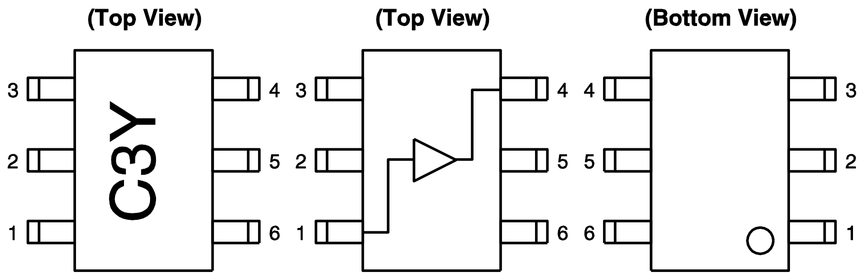
Part Number	Order Number	Package	Marking	Supplying Form
μPC3241TB-E3	μPC3241TB-E3-A	6-pin super minimold (Pb-Free)	C3Y	• Embossed tape 8 mm wide • Pin 1, 2, 3 face the perforation side of the tape • Qty 3 kpcs/reel

Remark To order evaluation samples, please contact your nearby sales office
Part number for sample order: μPC3241TB-A

Caution Observe precautions when handling because these devices are sensitive to electrostatic discharge.

Document No. PU10774EJ01V0DS (1st edition)
Date Published June 2009 NS

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



Pin No.	Pin Name
1	INPUT
2	GND
3	GND
4	OUTPUT
5	GND
6	V_{CC}

PRODUCT LINE-UP OF 3 V or 3.3 V-BIAS SILICON MMIC MEDIUM OUTPUT POWER AMPLIFIER (T_A = +25°C, V_{CC} = V_{out} = 3.0 V or 3.3 V, Z_S = Z_L = 50 Ω)

Part No.	V_{CC} (V)	I_{CC} (mA)	G_P (dB)	NF (dB)	$P_{O\,(1\,dB)}$ (dBm)	$P_{O\,(sat)}$ (dBm)	Package	Marking
μPC2762TB	3.0	26.5	13.0 (0.9 GHz) 15.5 (1.9 GHz)	6.5 (0.9 GHz) 7.0 (1.9 GHz)	+8.0 (0.9 GHz) +7.0 (1.9 GHz)	+9.0 (0.9 GHz) +8.5 (1.9 GHz)	6-pin super minimold	C1Z
μPC2763TB		27.0	20.0 (0.9 GHz) 21.0 (1.9 GHz)	5.5 (0.9 GHz) 5.5 (1.9 GHz)	+9.5 (0.9 GHz) +6.5 (1.9 GHz)	+11.0 (0.9 GHz) +8.0 (1.9 GHz)		C2A
μPC2771TB		36.0	21.0 (0.9 GHz) 21.0 (1.5 GHz)	6.0 (0.9 GHz) 6.0 (1.5 GHz)	+11.5 (0.9 GHz) +9.5 (1.5 GHz)	+12.5 (0.9 GHz) +11.0 (1.5 GHz)		C2H
μPC8181TB		23.0	19.0 (0.9 GHz) 21.0 (1.9 GHz) 22.0 (2.4 GHz)	4.5 (0.9 GHz) 4.5 (1.9 GHz) 4.5 (2.4 GHz)	+8.0 (0.9 GHz) +7.0 (1.9 GHz) +7.0 (2.4 GHz)	+9.5 (0.9 GHz) +9.0 (1.9 GHz) +9.0 (2.4 GHz)		C3E
μPC8182TB		30.0	21.5 (0.9 GHz) 20.5 (1.9 GHz) 20.5 (2.4 GHz)	4.5 (0.9 GHz) 4.5 (1.9 GHz) 5.0 (2.4 GHz)	+9.5 (0.9 GHz) +9.0 (1.9 GHz) +8.0 (2.4 GHz)	+11.0 (0.9 GHz) +10.5 (1.9 GHz) +10.0 (2.4 GHz)		C3F
μPC3239TB	3.3	29.0	25.0 (1.0 GHz) 25.5 (2.2 GHz)	4.0 (1.0 GHz) 4.3 (2.2 GHz)	+10 (1.0 GHz) +8 (2.2 GHz)	+12.5 (1.0 GHz) +10 (2.2 GHz)		C3V
μPC3241TB		19.8	23.5 (1.0 GHz) 24.0 (2.2 GHz)	4.0 (1.0 GHz) 4.3 (2.2 GHz)	+7.5 (1.0 GHz) +6.0 (2.2 GHz)	–		C3Y

Remark Typical performance. Please refer to **ELECTRICAL CHARACTERISTICS** in detail.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C, pin 4 and 6	4.0	V
Total Circuit Current	I_{CC}	T_A = +25°C, pin 4 and 6	55	mA
Power Dissipation	P_D	T_A = +85°C **Note**	270	mW
Operating Ambient Temperature	T_A		−40 to +85	°C
Storage Temperature	T_{stg}		−55 to +150	°C
Input Power	P_{in}	T_A = +25°C	−10	dBm

Note Mounted on double-sided copper-clad 50 × 50 × 1.6 mm epoxy glass PWB

RECOMMENDED OPERATING RANGE

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}	The same voltage should be applied to pin 4 and 6.	3.0	3.3	3.6	V
Operating Ambient Temperature	T_A		−40	+25	+85	°C

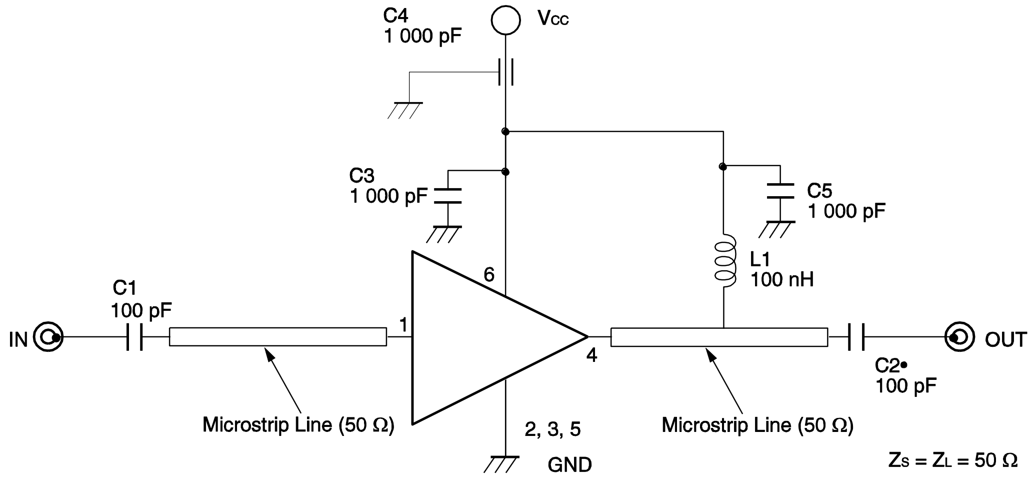
ELECTRICAL CHARACTERISTICS (T_A = +25°C, V_{CC} = V_{out} = 3.3 V, Z_S = Z_L = 50 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No input signal	15	19.8	25	mA
Power Gain 1	G_P1	f = 0.25 GHz, P_{in} = −30 dBm	20	23	26	dB
Power Gain 2	G_P2	f = 1.0 GHz, P_{in} = −30 dBm	20.5	23.5	26.5	
Power Gain 3	G_P3	f = 1.8 GHz, P_{in} = −30 dBm	21	24	27	
Power Gain 4	G_P4	f = 2.2 GHz, P_{in} = −30 dBm	21	24	27	
Gain 1 dB Compression Output Power 1	$P_{O\,(1\,dB)}$ 1	f = 1.0 GHz	+4.5	+7.5	–	dBm
Gain 1 dB Compression Output Power 2	$P_{O\,(1\,dB)}$ 2	f = 2.2 GHz	+3.0	+6.0	–	
Noise Figure 1	NF1	f = 1.0 GHz	–	4.0	4.8	dB
Noise Figure 2	NF2	f = 2.2 GHz	–	4.3	5.1	
Isolation 1	ISL1	f = 1.0 GHz, P_{in} = −30 dBm	27	32	–	dB
Isolation 2	ISL2	f = 2.2 GHz, P_{in} = −30 dBm	28	33	–	
Input Return Loss 1	RL_{in}1	f = 1.0 GHz, P_{in} = −30 dBm	15	20	–	dB
Input Return Loss 2	RL_{in}2	f = 2.2 GHz, P_{in} = −30 dBm	10	16	–	
Output Return Loss 1	RL_{out}1	f = 1.0 GHz, P_{in} = −30 dBm	11	17	–	dB
Output Return Loss 2	RL_{out}2	f = 2.2 GHz, P_{in} = −30 dBm	13	25	–	

STANDARD CHARACTERISTICS FOR REFERENCE
(T_A = +25°C, V_{CC} = V_{out} = 3.3 V, Z_S = Z_L = 50 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	Reference Value	Unit
Power Gain 5	G_P5	f = 2.6 GHz, P_{in} = −30 dBm	24	dB
Power Gain 6	G_P6	f = 3.0 GHz, P_{in} = −30 dBm	23	
Gain Flatness	ΔG_P	f = 1.0 to 2.2 GHz, P_{in} = −30 dBm	0.7	dB
K factor 1	K1	f = 1.0 GHz, P_{in} = −30 dBm	1.4	–
K factor 2	K2	f = 2.2 GHz, P_{in} = −30 dBm	1.5	–
Output 3rd Order Intercept Point 1	$OIP_3$1	f1 = 1 000 MHz, f2 = 1 001 MHz	19.5	dBm
Output 3rd Order Intercept Point 2	$OIP_3$2	f1 = 2 200 MHz, f2 = 2 201 MHz	15	
Input 3rd Order Intercept Point 1	$IIP_3$1	f1 = 1 000 MHz, f2 = 1 001 MHz	−4	dBm
Input 3rd Order Intercept Point 2	$IIP_3$2	f1 = 2 200 MHz, f2 = 2 201 MHz	−9	
2nd Order Intermodulation Distortion	IM_2	f1 = 1 000 MHz, f2 = 1 001 MHz, P_{out} = −5 dBm/tone	50	dBc
2nd Harmonics	$2f_0$	f0 = 1.0 GHz, P_{out} = −15 dBm	65	dBc

TEST CIRCUIT



The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

COMPONENTS OF TEST CIRCUIT FOR MEASURING ELECTRICAL CHARACTERISTICS

	Type	Value
L1 Note	Chip Inductor	100 nH
C1, C2	Chip Capacitor	100 pF
C3, C5	Chip Capacitor	1 000 pF
C4	Feed-through Capacitor	1 000 pF

Note There is a case to show a dimple wave of characteristic by a chip inductor L1 part in the high frequency area. In that case, please reduce a value of L1.

INDUCTOR FOR THE OUTPUT PIN

The internal output transistor of this IC, to output medium power. To supply current for output transistor, connect an inductor between the V_{CC} pin (pin 6) and output pin (pin 4). Select inductance, as the value listed above.

The inductor has both DC and AC effects. In terms of DC, the inductor biases the output transistor with minimum voltage drop to output enable high level. In terms of AC, the inductor makes output-port impedance higher to get enough gain. In this case, large inductance and Q is suitable (Refer to the following page).

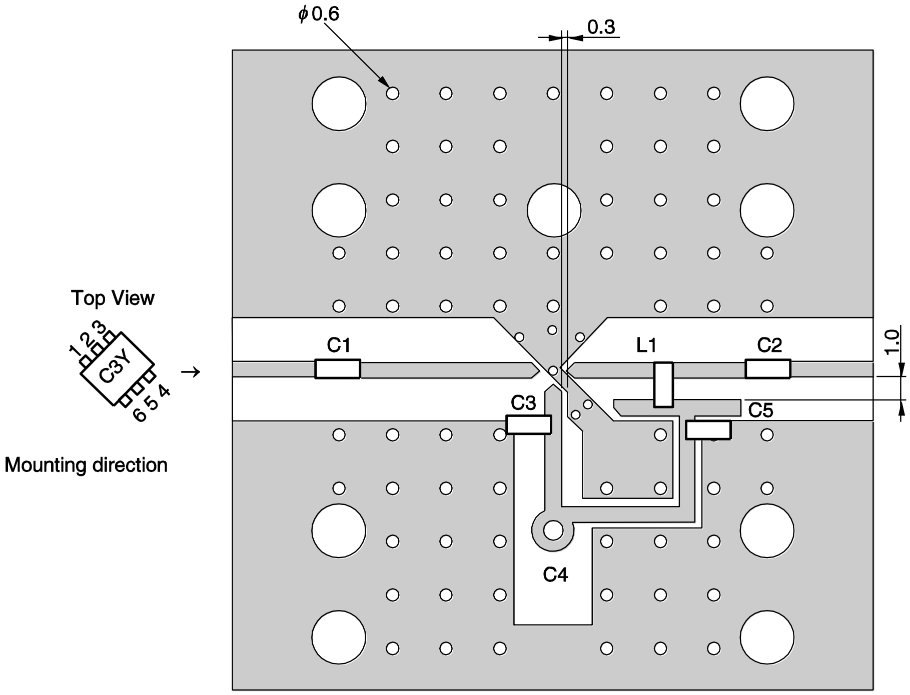
CAPACITORS FOR THE V_{CC}, INPUT AND OUTPUT PINS

Capacitors of 1 000 pF are recommendable as the bypass capacitor for the V_{CC} pin and the coupling capacitors for the input and output pins.

The bypass capacitor connected to the V_{CC} pin is used to minimize ground impedance of V_{CC} pin. So, stable bias can be supplied against V_{CC} fluctuation.

The coupling capacitors, connected to the input and output pins, are used to cut the DC and minimize RF serial impedance. Their capacitances are therefore selected as lower impedance against a 50 Ω load. The capacitors thus perform as high pass filters, suppressing low frequencies to DC.

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



C4: Feed-through Capacitor (Unit: mm)

COMPONENT LIST

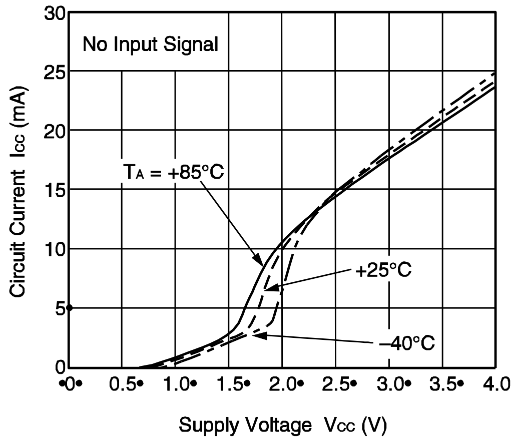
	Type	Value	Size
L1	Chip Inductor	100 nH	1005
C1, C2	Chip Capacitor	100 pF	1608
C3, C5	Chip Capacitor	1 000 pF	1005
C4	Feed-through Capacitor	1 000 pF	–

Notes

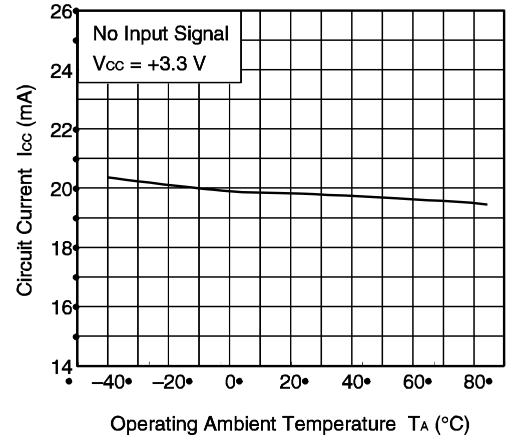
1. 30 × 30 × 0.4 mm double sided 35 μm copper clad polyimide board.
2. Back side: GND pattern
3. Solder plated on pattern
4. ∘ ○: Through holes

TYPICAL CHARACTERISTICS (T_A = +25°C, V_{CC} = V_{out} = 3.3 V, Z_S = Z_L = 50 Ω, unless otherwise specified)

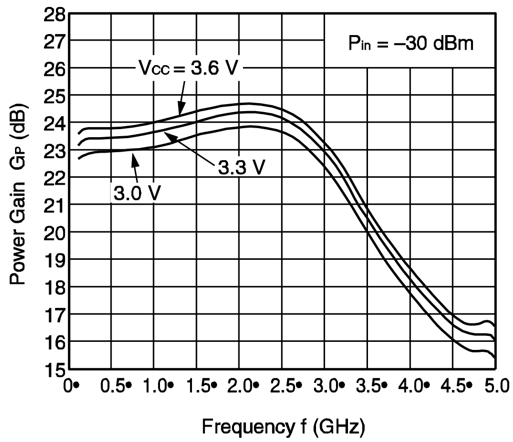
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



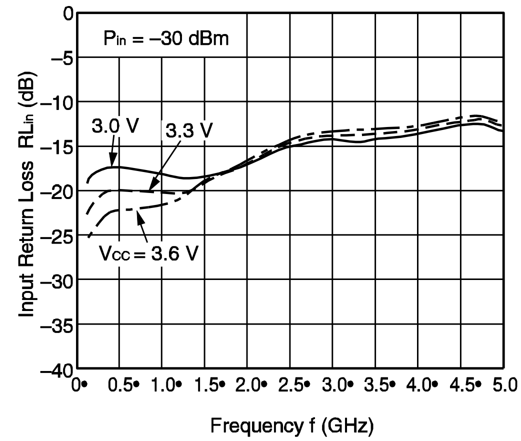
CURCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



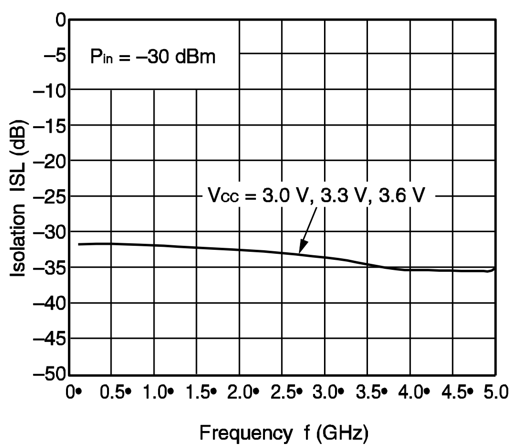
POWER GAIN vs. FREQUENCY



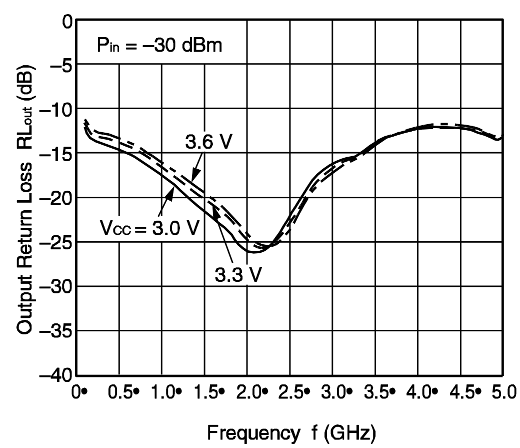
INPUT RETURN LOSS vs. FREQUENCY



ISOLATION vs. FREQUENCY

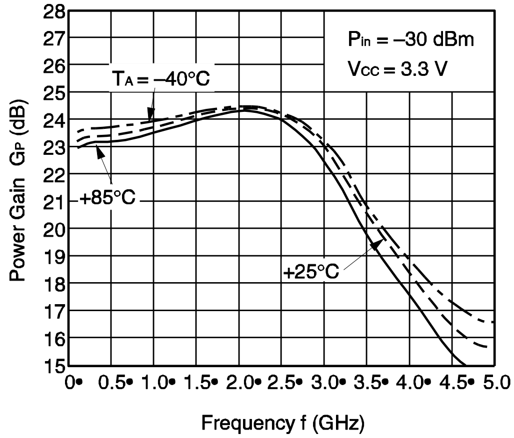


OUTPUT RETURN LOSS vs. FREQUENCY

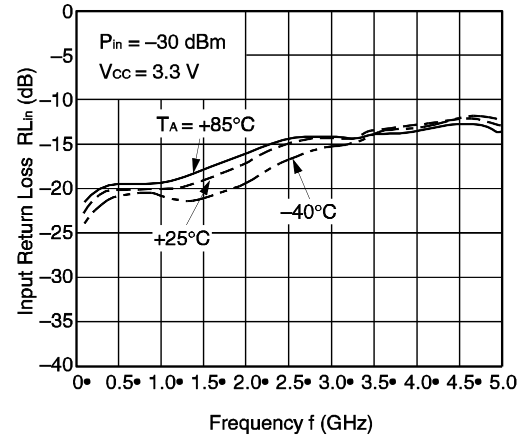


Remark The graphs indicate nominal characteristics.

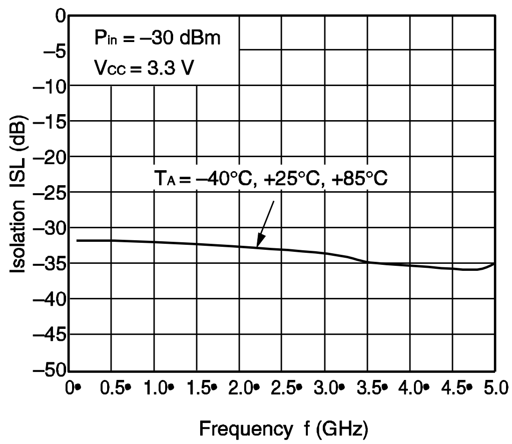
POWER GAIN vs. FREQUENCY



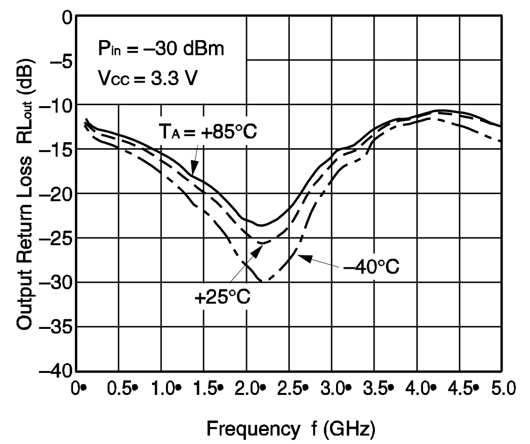
INPUT RETURN LOSS vs. FREQUENCY



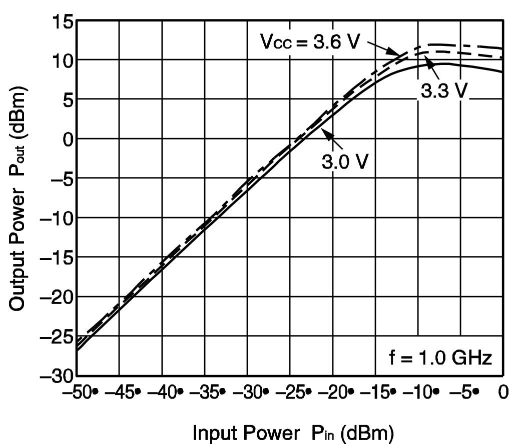
ISOLATION vs. FREQUENCY



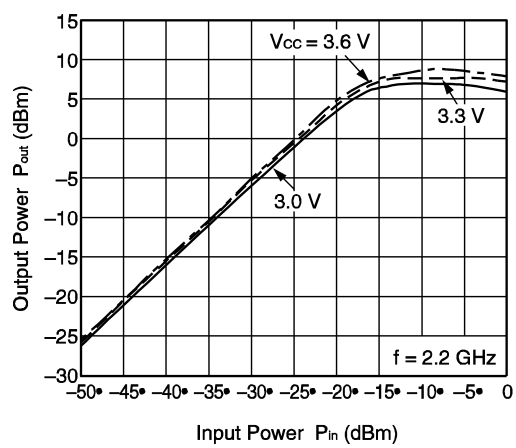
OUTPUT RETURN LOSS vs. FREQUENCY



OUTPUT POWER vs. INPUT POWER

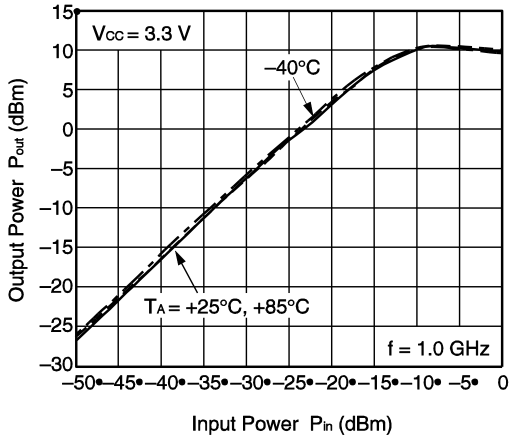


OUTPUT POWER vs. INPUT POWER

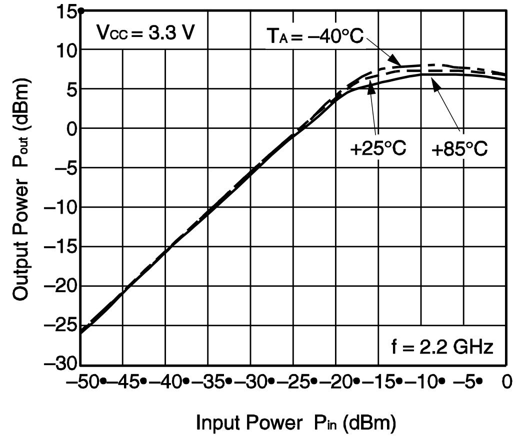


Remark The graphs indicate nominal characteristics.

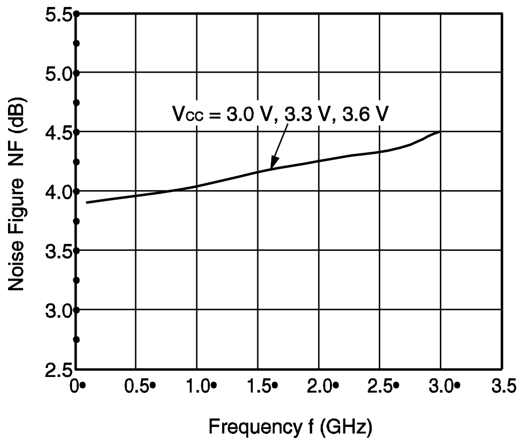
OUTPUT POWER vs. INPUT POWER



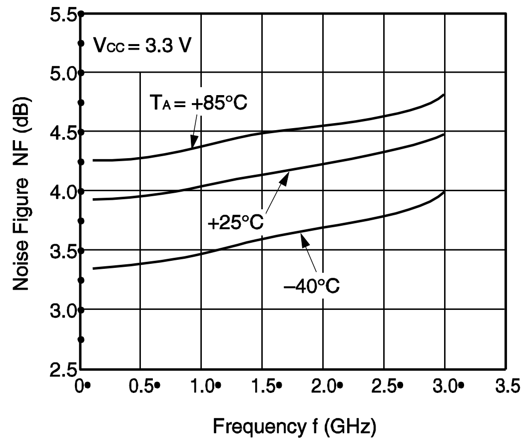
OUTPUT POWER vs. INPUT POWER



NOISE FIGURE vs. FREQUENCY

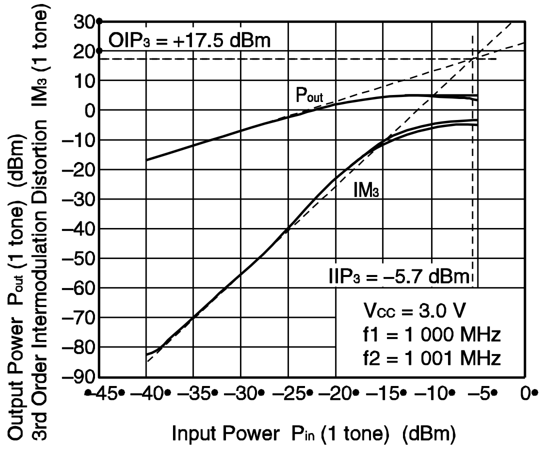


NOISE FIGURE vs. FREQUENCY

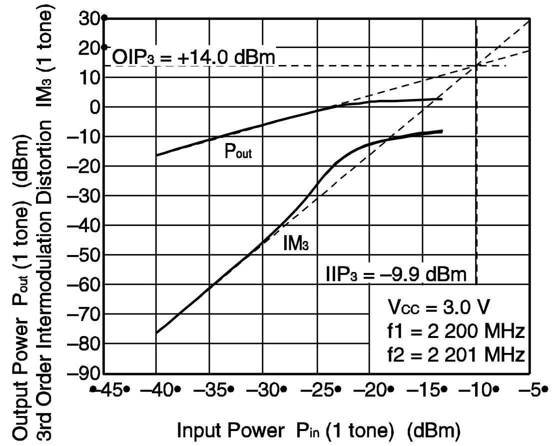


Remark The graphs indicate nominal characteristics.

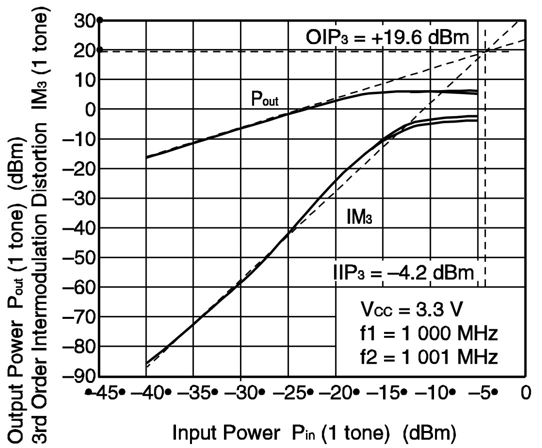
OUTPUT POWER, IM3 vs. INPUT POWER



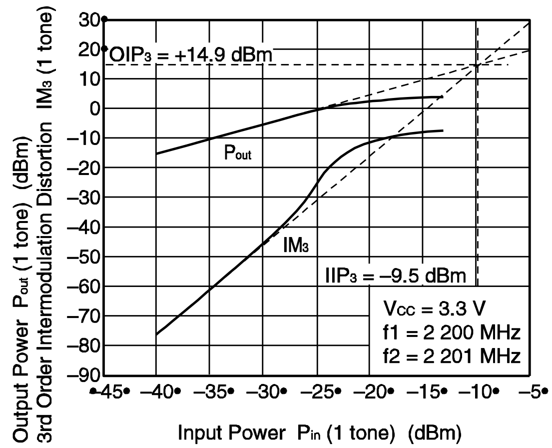
OUTPUT POWER, IM3 vs. INPUT POWER



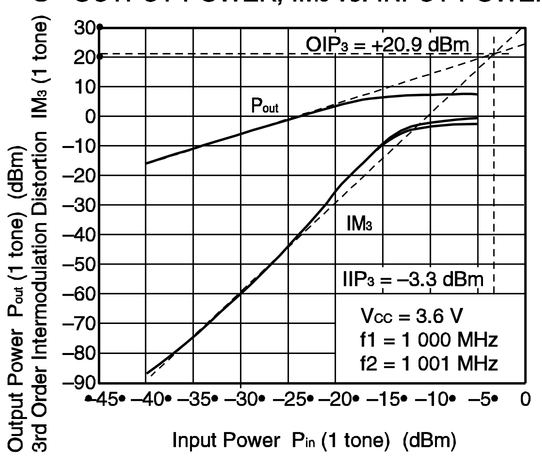
OUTPUT POWER, IM3 vs. INPUT POWER



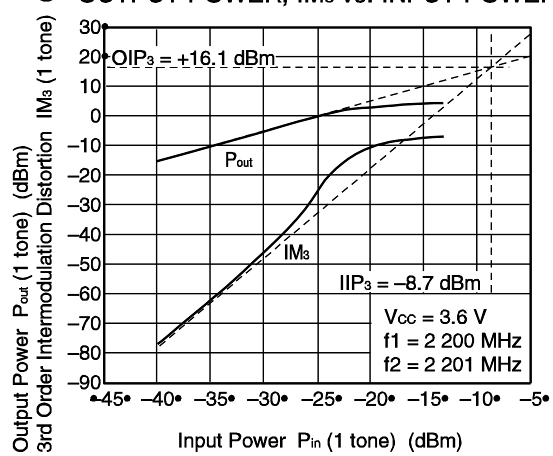
OUTPUT POWER, IM3 vs. INPUT POWER



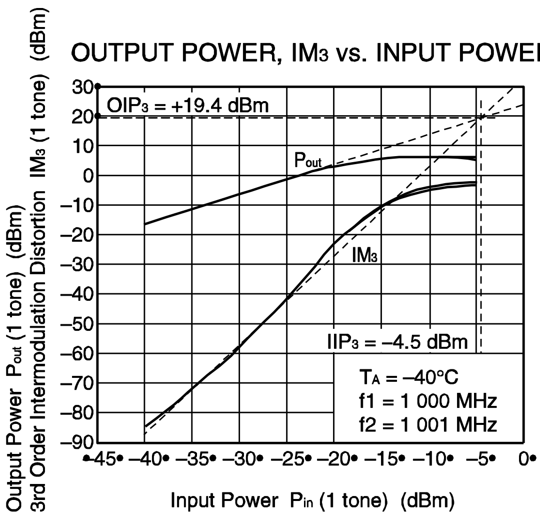
OUTPUT POWER, IM3 vs. INPUT POWER

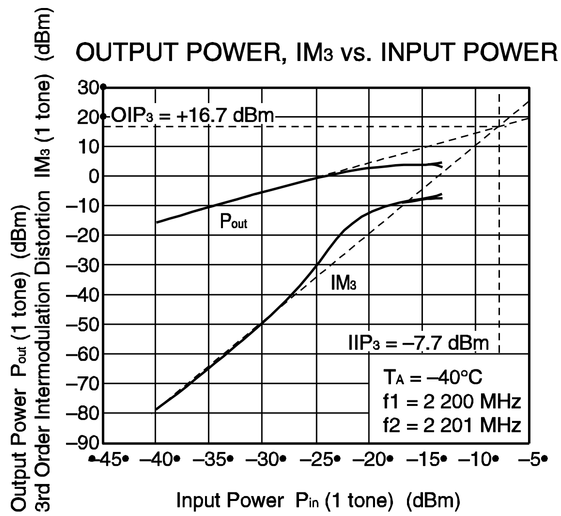


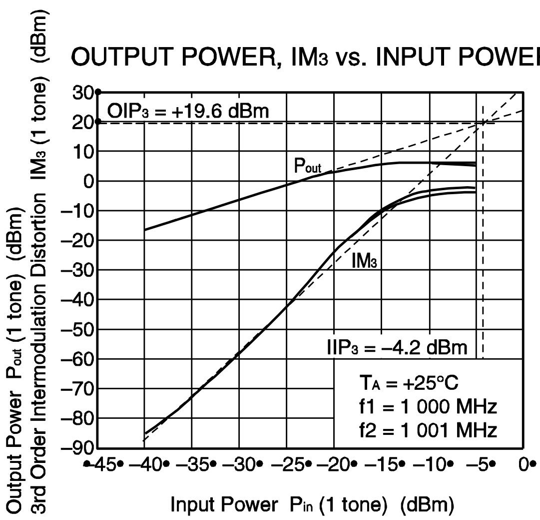
OUTPUT POWER, IM3 vs. INPUT POWER

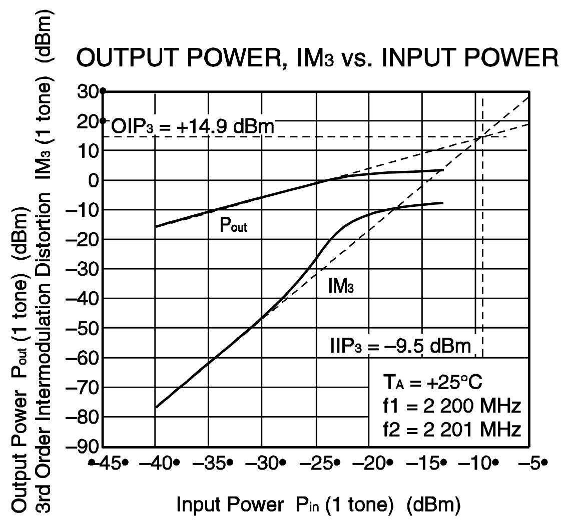


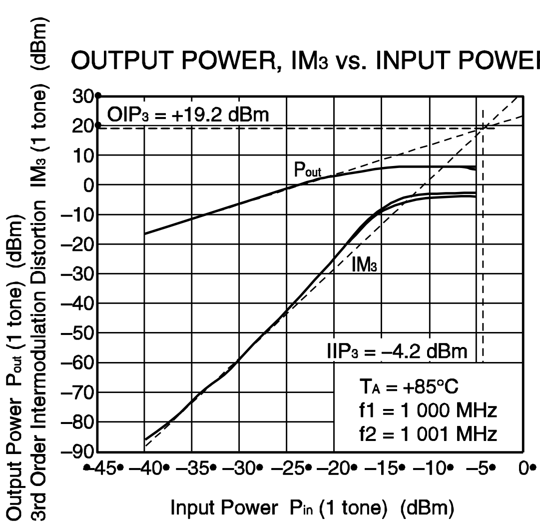
Remark The graphs indicate nominal characteristics.

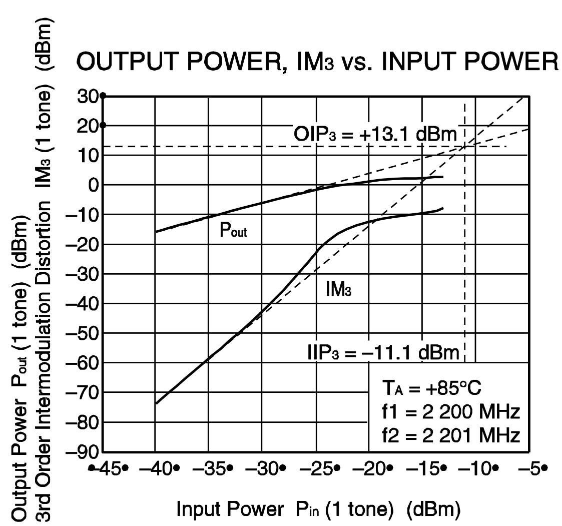




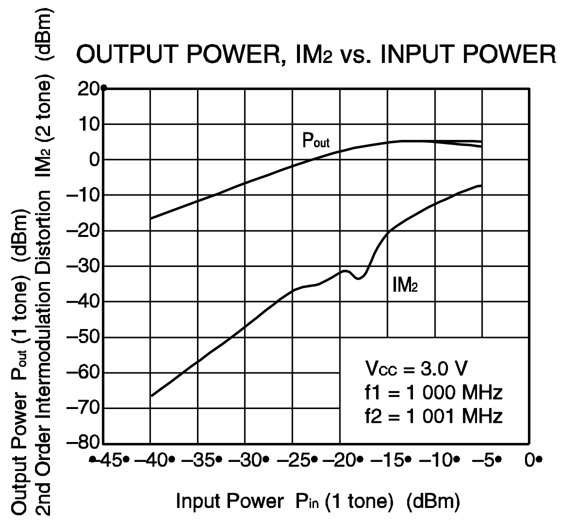


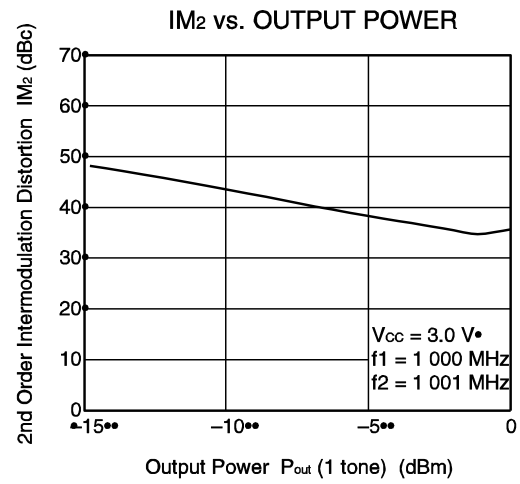


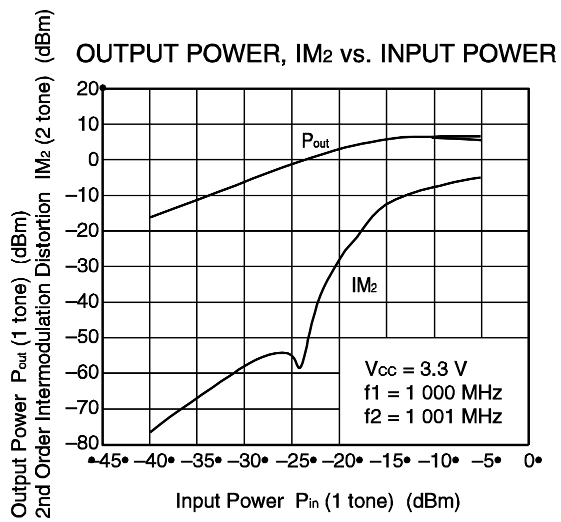


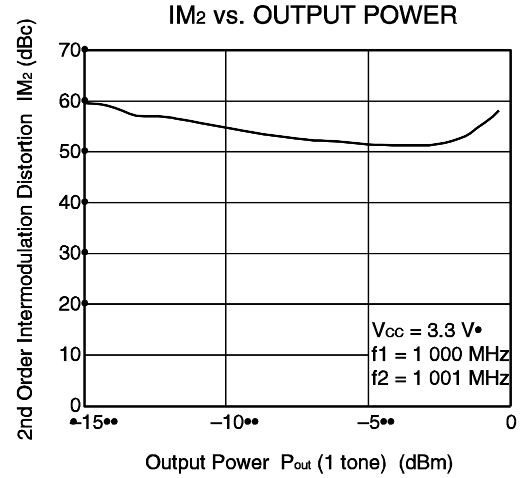


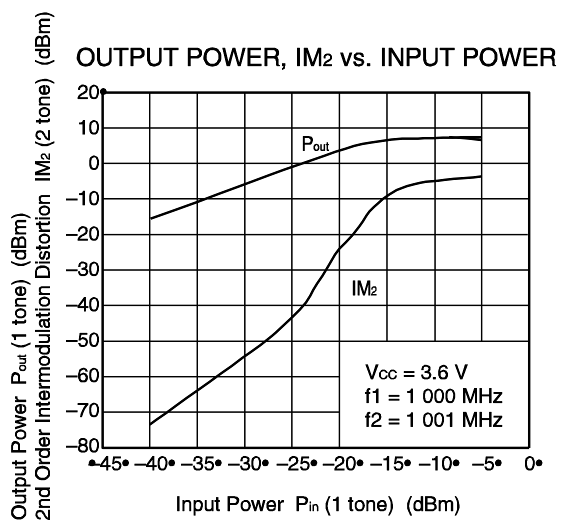
Remark The graphs indicate nominal characteristics.

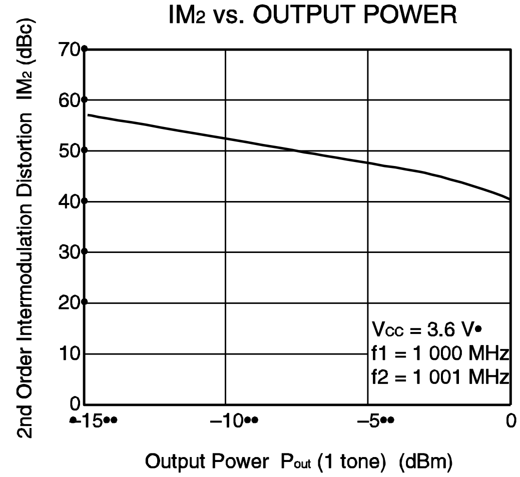




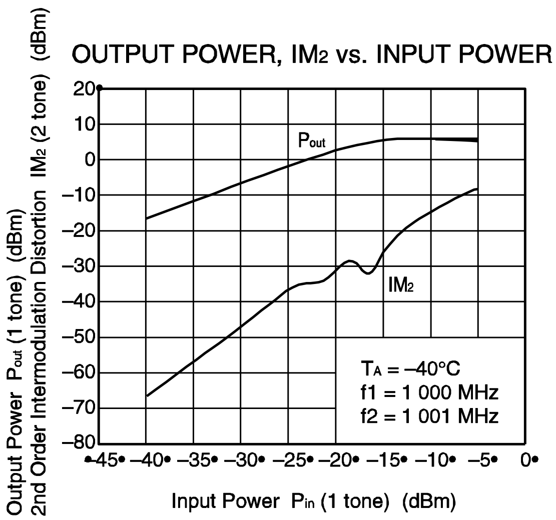


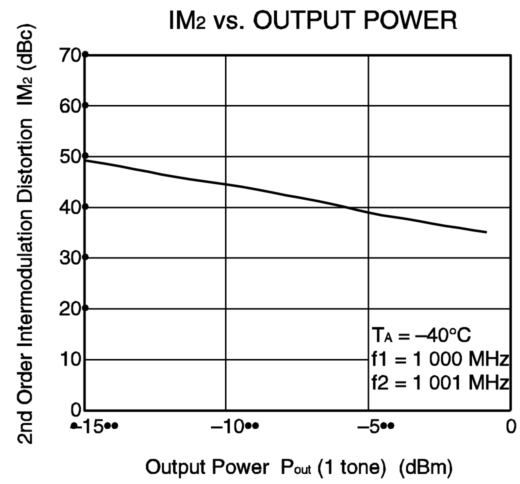


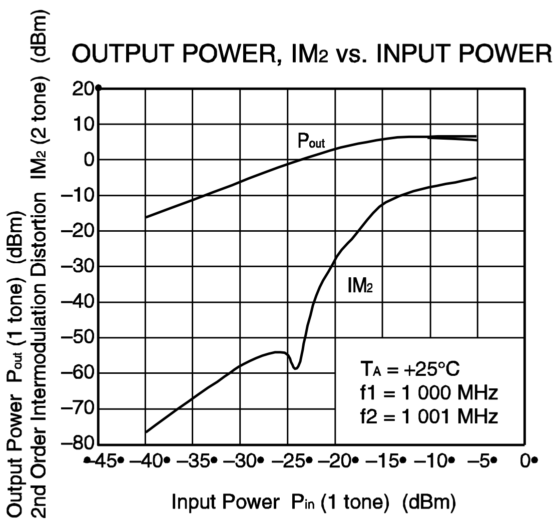


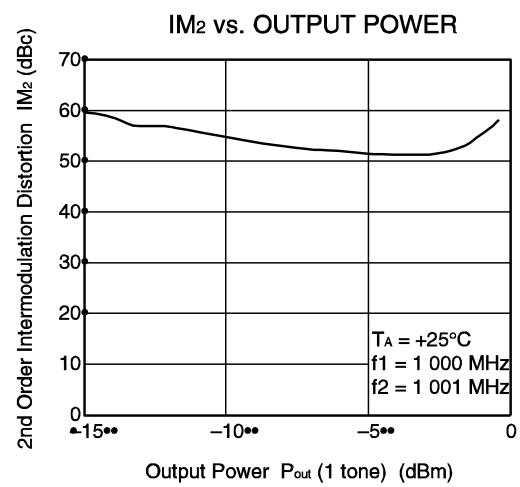


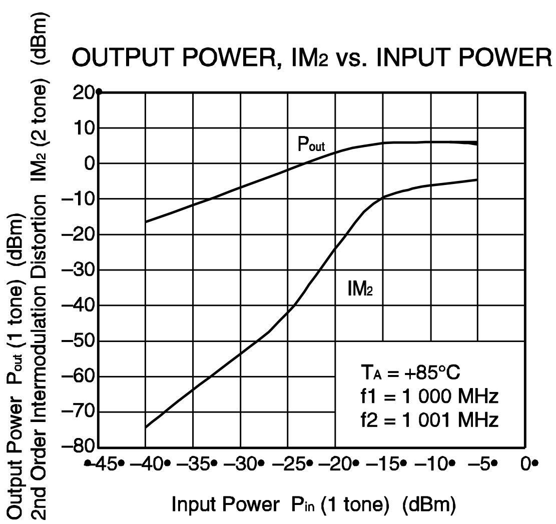
Remark The graphs indicate nominal characteristics.

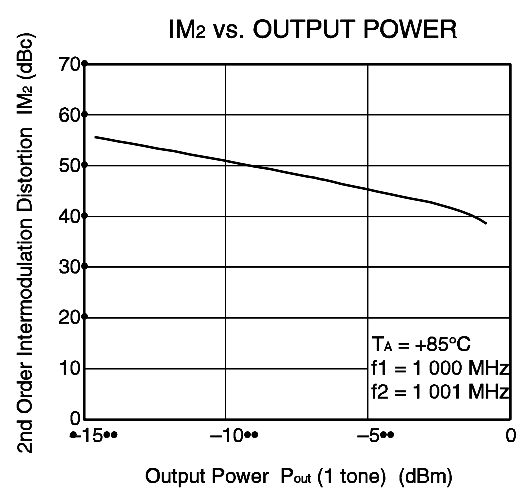




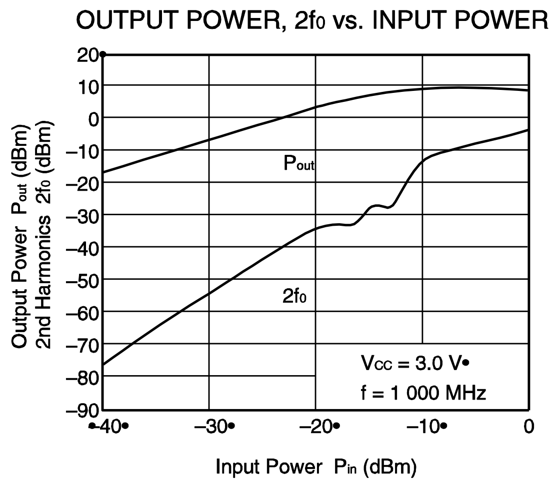


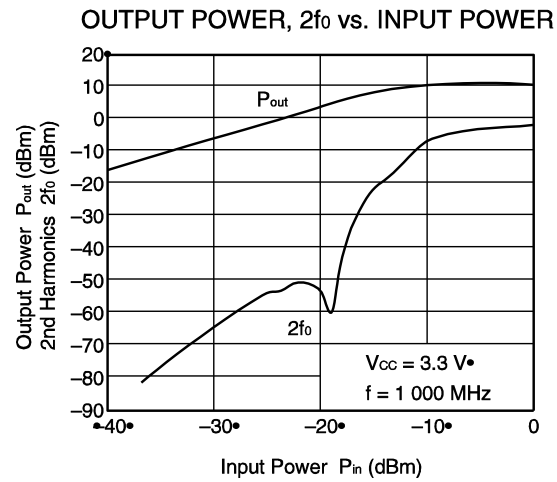


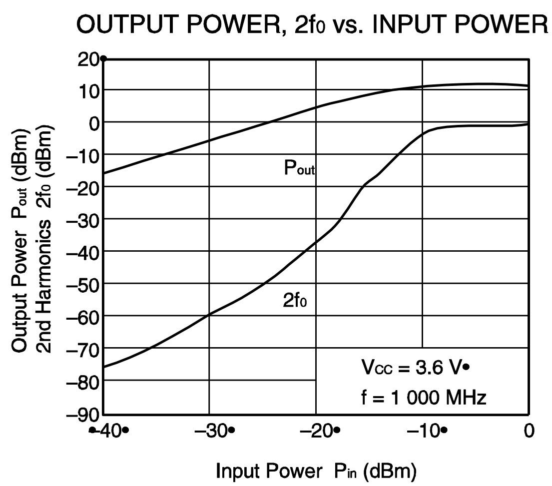


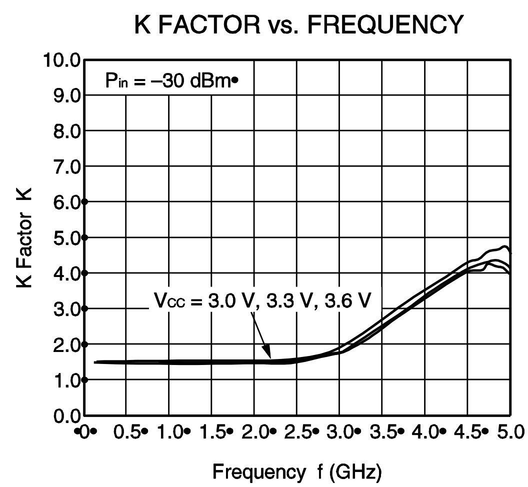


Remark The graphs indicate nominal characteristics.





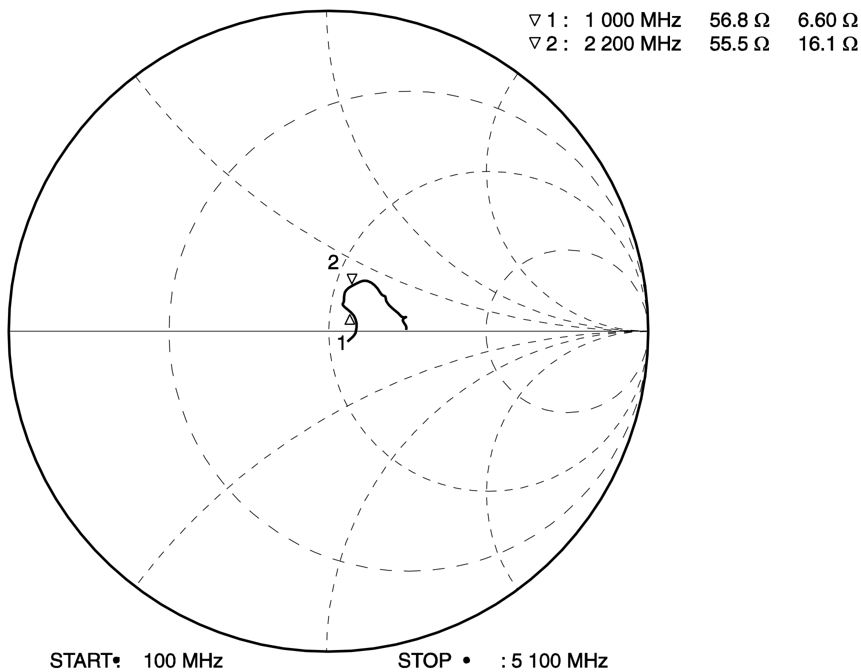




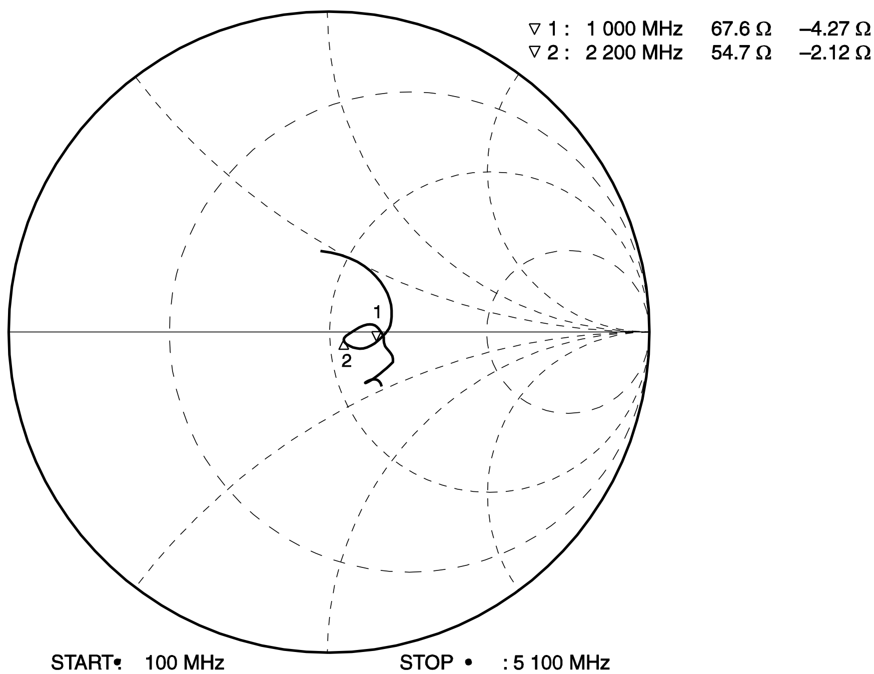
Remark The graphs indicate nominal characteristics.

S-PARAMETERS (T_A = +25°C, V_{CC} = V_{out} = 3.3 V, P_{in} = –30 dBm)

S_{11}–FREQUENCY



S_{22}–FREQUENCY



Remarks 1. Measured on the test circuit of evaluation board.

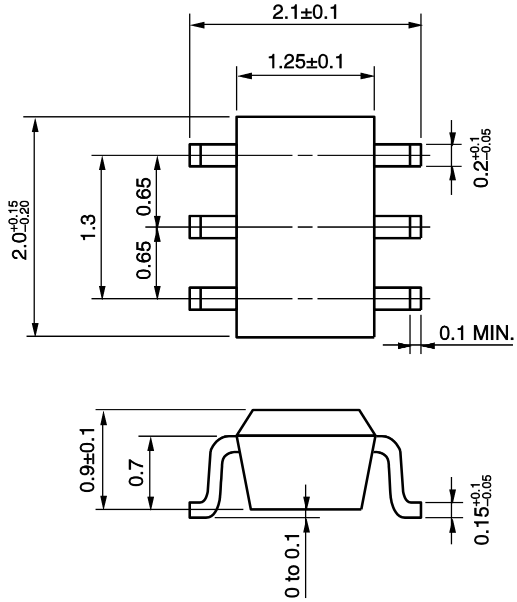
2. The graphs indicate nominal characteristics.

S-PARAMETERS

- S-parameters and noise parameters are provided on our Web site in a format (S2P) that enables the direct import of the parameters to microwave circuit simulators without the need for keyboard inputs.
- Click here to download S-parameters.
- [RF and Microwave] → [Device Parameters]
- URL http://www.necel.com/microwave/en/

PACKAGE DIMENSIONS

6-PIN SUPER MINIMOLD (UNIT: mm)



NOTES ON CORRECT USE

(1) Observe precautions for handling because of electro-static sensitive devices.
(2) Form a ground pattern as widely as possible to minimize ground impedance (to prevent undesired oscillation).
All the ground terminals must be connected together with wide ground pattern to decrease impedance difference.
(3) The bypass capacitor should be attached to the V_{CC} line.
(4) The inductor (L) must be attached between V_{CC} and output pins. The inductance value should be determined in accordance with desired frequency.
(5) The DC cut capacitor must be attached to input and output pin.

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered and mounted under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your nearby sales office.

Soldering Method	Soldering Conditions		Condition Symbol
Infrared Reflow	Peak temperature (package surface temperature) Time at peak temperature Time at temperature of 220°C or higher Preheating time at 120 to 180°C Maximum number of reflow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 60 seconds or less : 120±30 seconds : 3 times : 0.2%(Wt.) or below	IR260
Wave Soldering	Peak temperature (molten solder temperature) Time at peak temperature Preheating temperature (package surface temperature) Maximum number of flow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 120°C or below : 1 time : 0.2%(Wt.) or below	WS260
Partial Heating	Peak temperature (terminal temperature) Soldering time (per side of device) Maximum chlorine content of rosin flux (% mass)	: 350°C or below : 3 seconds or less : 0.2%(Wt.) or below	HS350

Caution Do not use different soldering methods together (except for partial heating).