To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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DATA SHEET

RENESAS

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3242TB

3.3 V, SILICON GERMANIUM MMIC WIDE BAND AMPLIFIER

DESCRIPTION

The μPC3242TB is a silicon germanium 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 UHSK3 (Ultra High Speed Process) silicon germanium bipolar process.

FEATURES

- Low current : I_{CC} = 4.3 mA TYP.
- Power gain : G_P = 22 dB TYP. @ f = 1.0 GHz
  : G_P = 22 dB TYP. @ f = 2.2 GHz
- Gain flatness : ΔG_P = 0.4 dB TYP. @ f = 1.0 to 2.2 GHz
- Noise figure : NF = 4.0 dB TYP. @ f = 1.0 GHz
  : NF = 4.0 dB TYP. @ f = 2.2 GHz
- High linearity : $P_{O (1 dB)}$ = −7.5 dBm TYP. @ f = 1.0 GHz
  : $P_{O (1 dB)}$ = −9.5 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
μPC3242TB-E3	μPC3242TB-E3-A	6-pin super minimold (Pb-Free)	C3Z	• 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: μPC3242TB

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

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Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.

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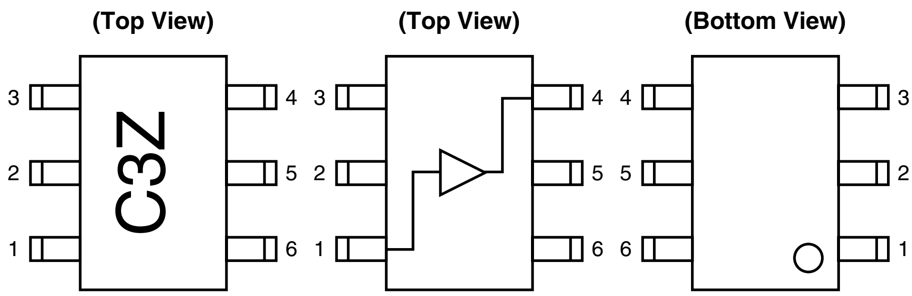
Date Published March 2010 NS
Printed in Japan

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 5 V or 3.3 V-BIAS SILICON MMIC WIDE BAND AMPLIFIER

(T_A = +25°C, V_{CC} = +5.0 V or +3.3 V, Z_S = Z_L = 50 Ω)

Part No.	V_{CC} (V)	I_{CC} (mA)	G_P (dB)	NF (dB)	$P_{O\,(sat)}$ (dBm)	$P_{O\,(1\,dB)}$ (dBm)	Package	Marking
μPC2711TB	+5.0	12.0	13.0 (1.0 GHz)	5.0 (1.0 GHz)	+1.0 (1.0 GHz)	–	6-pin super minimold	C1G
μPC2712TB		12.0	20.0 (1.0 GHz)	4.5 (1.0 GHz)	+3.0 (1.0 GHz)	–		C1H
μPC3215TB		14.0	20.5 (1.5 GHz)	2.3 (1.5 GHz)	+3.5 (1.5 GHz)	+1.5 (1.5 GHz)		C3H
μPC3224TB		9.0	21.5 (1.0 GHz)	4.3 (1.0 GHz)	+4.0 (1.0 GHz)	–3.5 (1.0 GHz)		C3K
			21.5 (2.2 GHz)	4.3 (2.2 GHz)	+1.5 (2.2 GHz)	–5.5 (2.2 GHz)		
μPC3227TB		4.8	22.0 (1.0 GHz)	4.7 (1.0 GHz)	–1.0 (1.0 GHz)	–6.5 (1.0 GHz)		C3P
			22.0 (2.2 GHz)	4.6 (2.2 GHz)	–3.5 (2.2 GHz)	–8.0 (2.2 GHz)		
μPC3240TB	+3.3	13.0	25.0 (1.0 GHz)	4.3 (1.0 GHz)	–	+1.0 (1.0 GHz)		C3W
			24.5 (2.2 GHz)	4.5 (2.2 GHz)	–	–4.0 (2.2 GHz)		
μPC3242TB		4.3	22.0 (1.0 GHz)	4.0 (1.0 GHz)	–0.5 (1.0 GHz)	–7.5 (1.0 GHz)		C3Z
			22.0 (2.2 GHz)	4.0 (2.2 GHz)	–4.0 (2.2 GHz)	–9.5 (2.2 GHz)		

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	4.0	V
Total Circuit Current	I_{CC}	T_A = +25°C	10	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}		+3.0	+3.3	+3.6	V
Operating Ambient Temperature	T_A		–40	+25	+85	°C

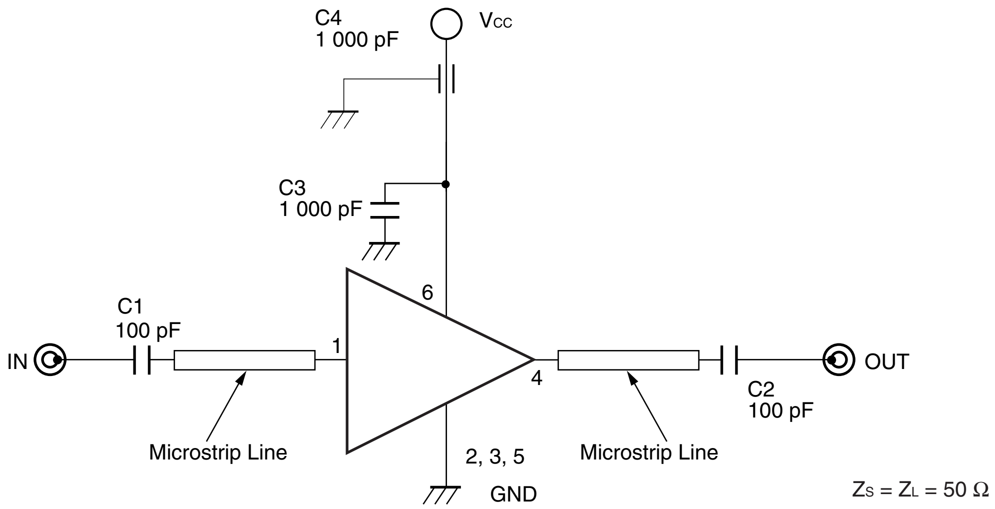
ELECTRICAL CHARACTERISTICS (T_A = +25°C, V_{CC} = +3.3 V, Z_S = Z_L = 50 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No input signal	3.6	4.3	5.0	mA
Power Gain 1	G_P1	f = 0.25 GHz, P_{in} = –40 dBm	19	22	25	dB
Power Gain 2	G_P2	f = 1.0 GHz, P_{in} = –40 dBm	19	22	25	
Power Gain 3	G_P3	f = 1.8 GHz, P_{in} = –40 dBm	19	22	25	
Power Gain 4	G_P4	f = 2.2 GHz, P_{in} = –40 dBm	19	22	25	
Gain 1 dB Compression Output Power 1	$P_{O (1 dB)}$ 1	f = 1.0 GHz	–10	–7.5	–	dBm
Gain 1 dB Compression Output Power 2	$P_{O (1 dB)}$ 2	f = 2.2 GHz	–12.5	–9.5	–	
Noise Figure 1	NF1	f = 1.0 GHz	–	4.0	4.8	dB
Noise Figure 2	NF2	f = 2.2 GHz	–	4.0	4.8	
Isolation 1	ISL1	f = 1.0 GHz, P_{in} = –40 dBm	31	36.5	–	dB
Isolation 2	ISL2	f = 2.2 GHz, P_{in} = –40 dBm	34	40.5	–	
Input Return Loss 1	$RL_{in}1$	f = 1.0 GHz, P_{in} = –40 dBm	10	14	–	dB
Input Return Loss 2	$RL_{in}2$	f = 2.2 GHz, P_{in} = –40 dBm	6	8.5	–	
Output Return Loss 1	$RL_{out}1$	f = 1.0 GHz, P_{in} = –40 dBm	8	11	–	dB
Output Return Loss 2	$RL_{out}2$	f = 2.2 GHz, P_{in} = –40 dBm	8	11	–	

STANDARD CHARACTERISTICS FOR REFERENCE
(T_A = +25°C, V_{CC} = +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} = –40 dBm	20.5	dB
Power Gain 6	G_P6	f = 3.0 GHz, P_{in} = –40 dBm	19	
Gain Flatness	ΔG_P	f = 1.0 to 2.2 GHz, P_{in} = –40 dBm	0.4	dB
Saturated Output Power 1	$P_{O (sat)}$ 1	f = 1.0 GHz, P_{in} = –15 dBm	–0.5	dBm
Saturated Output Power 2	$P_{O (sat)}$ 2	f = 2.2 GHz, P_{in} = –15 dBm	–4.0	
K factor 1	K1	f = 1.0 GHz, P_{in} = –40 dBm	2.5	–
K factor 2	K2	f = 2.2 GHz, P_{in} = –40 dBm	3.4	–
Output 3rd Order Intercept Point 1	OIP_31	f1 = 1 000 MHz, f2 = 1 001 MHz	1.5	dBm
Output 3rd Order Intercept Point 2	OIP_32	f1 = 2 200 MHz, f2 = 2 201 MHz	–0.5	
Input 3rd Order Intercept Point 1	IIP_31	f1 = 1 000 MHz, f2 = 1 001 MHz	–20	dBm
Input 3rd Order Intercept Point 2	IIP_32	f1 = 2 200 MHz, f2 = 2 201 MHz	–22	
2nd Order Intermodulation Distortion	IM_2	f1 = 1 000 MHz, f2 = 1 001 MHz, P_{in} = –40 dBm/tone	22	dBc
2nd Harmonics	$2f_0$	f_0 = 1.0 GHz, P_{in} = –40 dBm	28.5	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
C1, C2	Chip Capacitor	100 pF
C3	Chip Capacitor	1 000 pF
C4	Feed-through Capacitor	1 000 pF

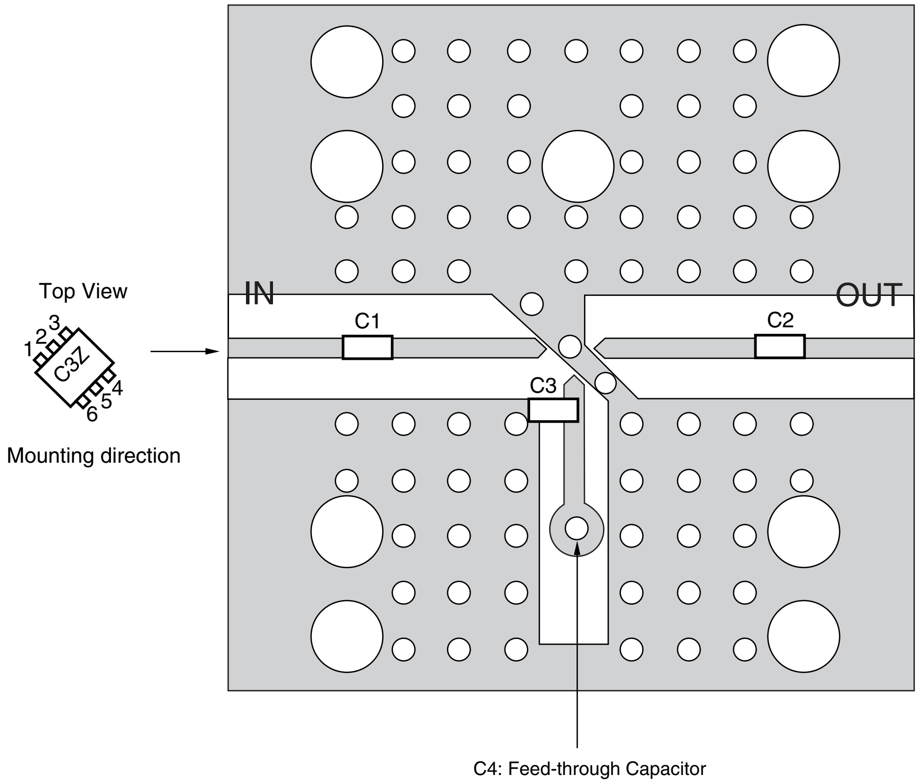
CAPACITORS FOR THE V_{CC}, INPUT AND OUTPUT PINS

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



(Unit: mm)

Notes

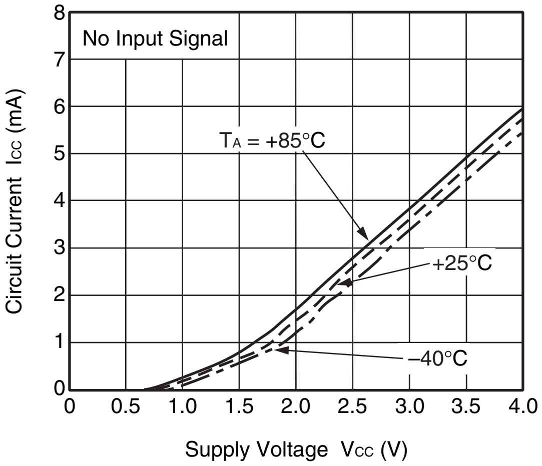
1. 30 × 30 × 0.4 mm double sided 35 μm copper clad polyimide board.
2. Back side: GND pattern
3. Au plated on pattern
4. ○◯: Through holes

COMPONENT LIST

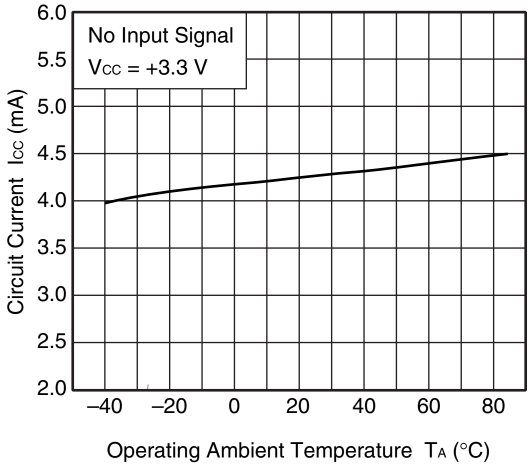
	Type	Value	Size
C1, C2	Chip Capacitor	100 pF	1608
C3	Chip Capacitor	1 000 pF	1608
C4	Feed-through Capacitor	1 000 pF	–

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

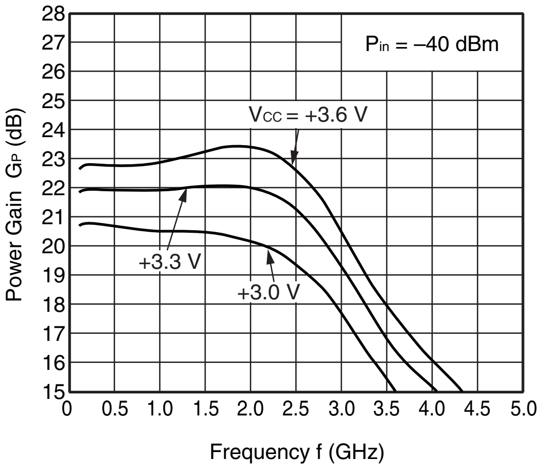
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



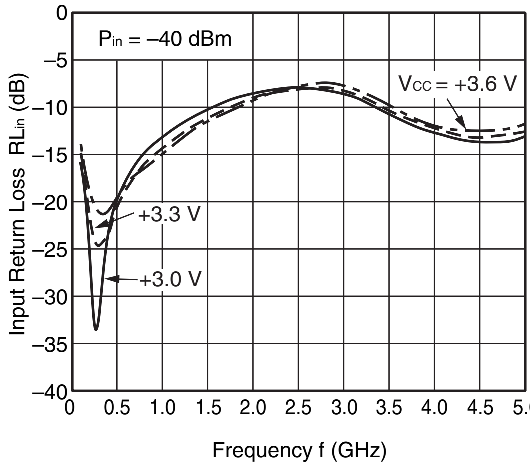
CURCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



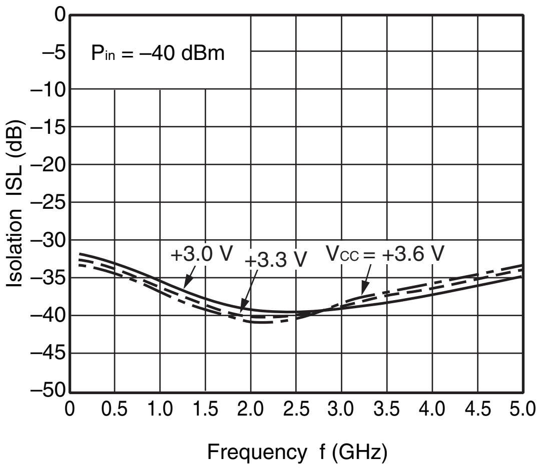
POWER GAIN vs. FREQUENCY



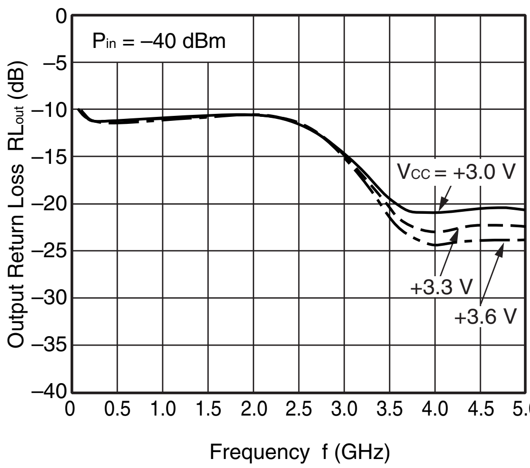
INPUT RETURN LOSS vs. FREQUENCY



ISOLATION vs. FREQUENCY

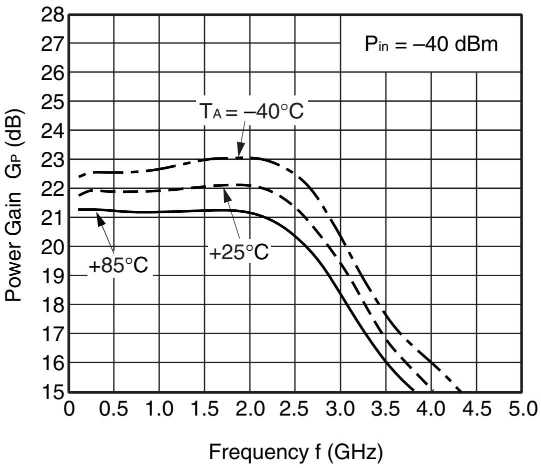


OUTPUT RETURN LOSS vs. FREQUENCY

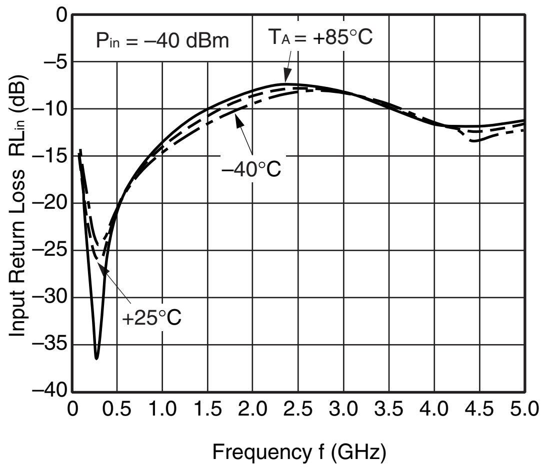


Remark The graphs indicate nominal characteristics.

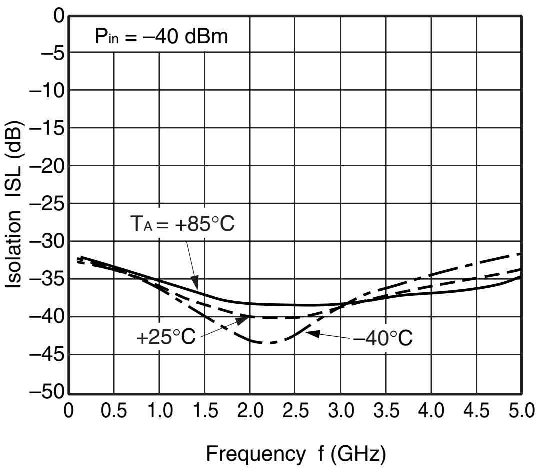
POWER GAIN vs. FREQUENCY



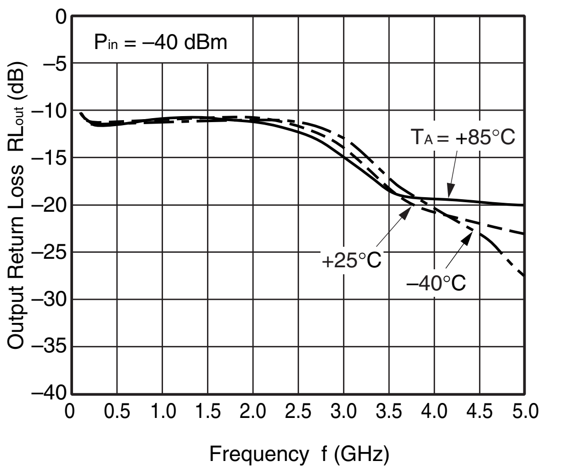
INPUT RETURN LOSS vs. FREQUENCY



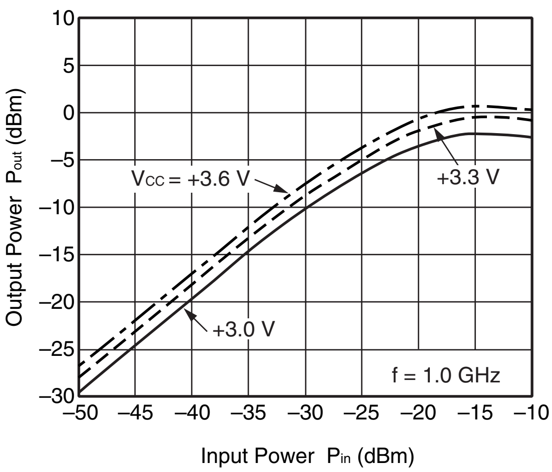
ISOLATION vs. FREQUENCY



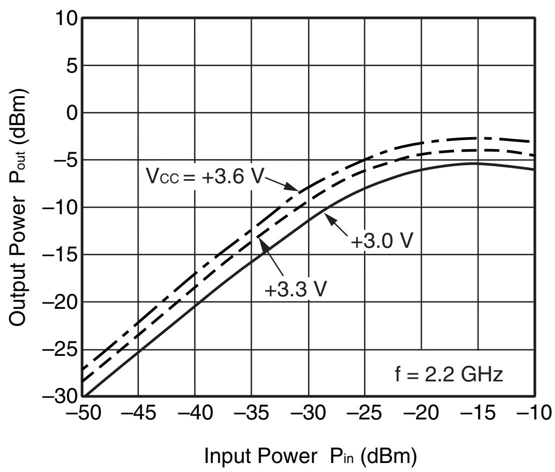
OUTPUT RETURN LOSS vs. FREQUENCY



OUTPUT POWER vs. INPUT POWER



OUTPUT POWER vs. INPUT POWER



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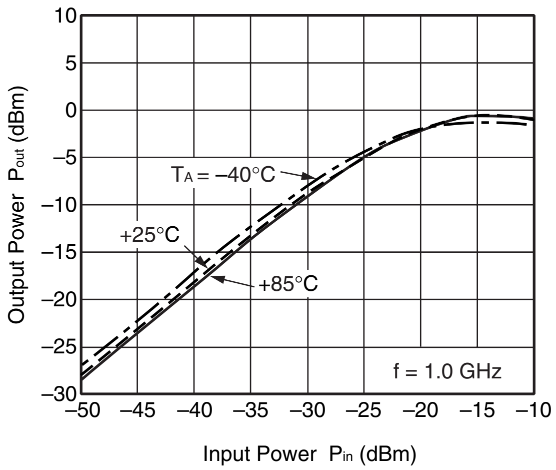
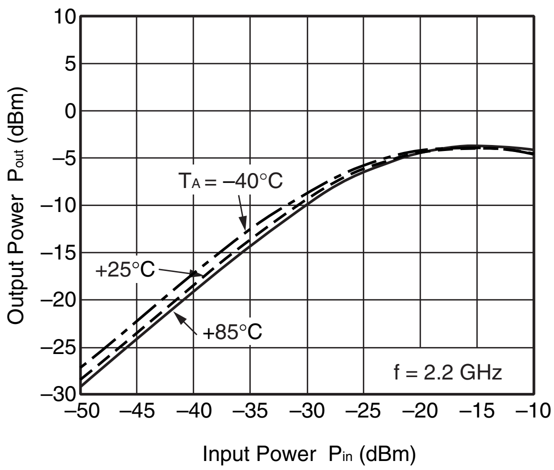
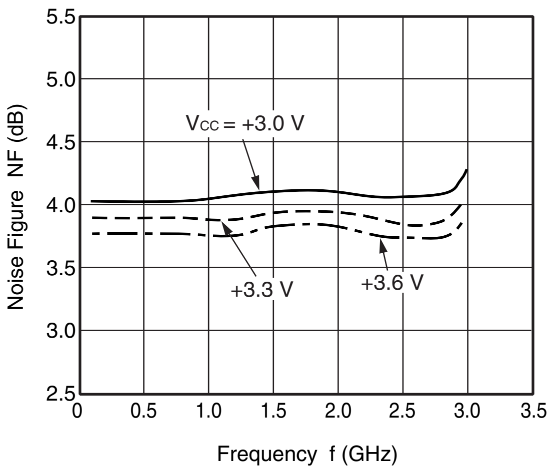
OUTPUT POWER vs. INPUT POWER



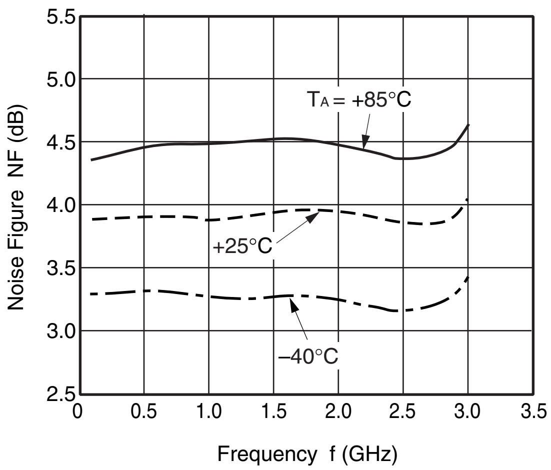
OUTPUT POWER vs. INPUT POWER



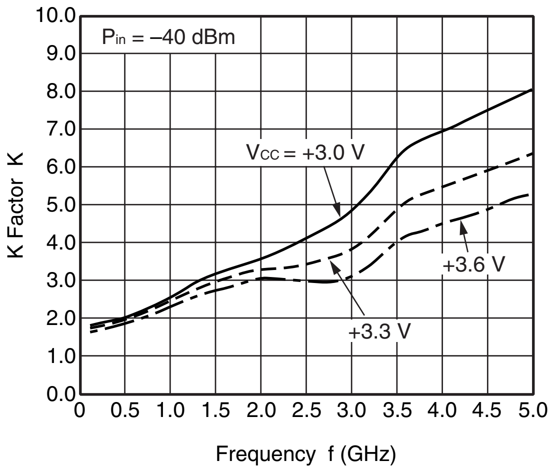
NOISE FIGURE vs. FREQUENCY



NOISE FIGURE vs. FREQUENCY



K FACTOR vs. FREQUENCY



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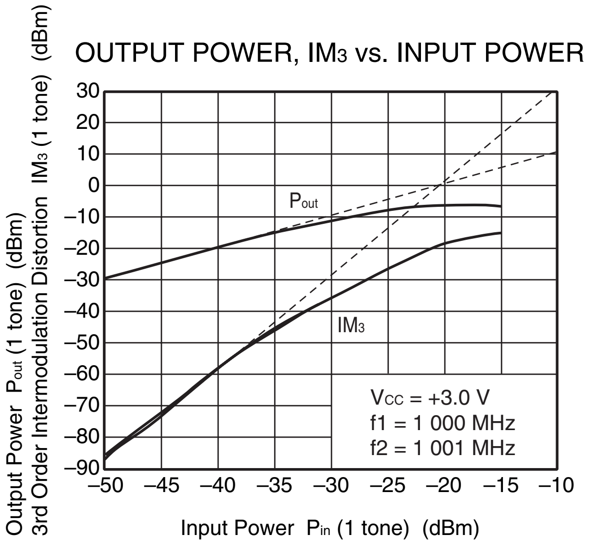
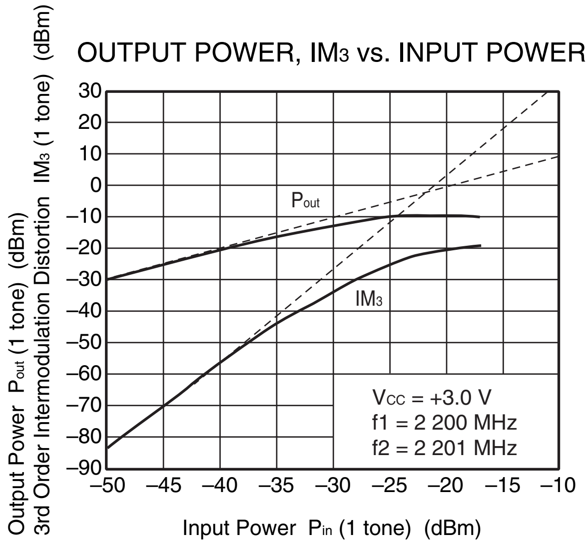
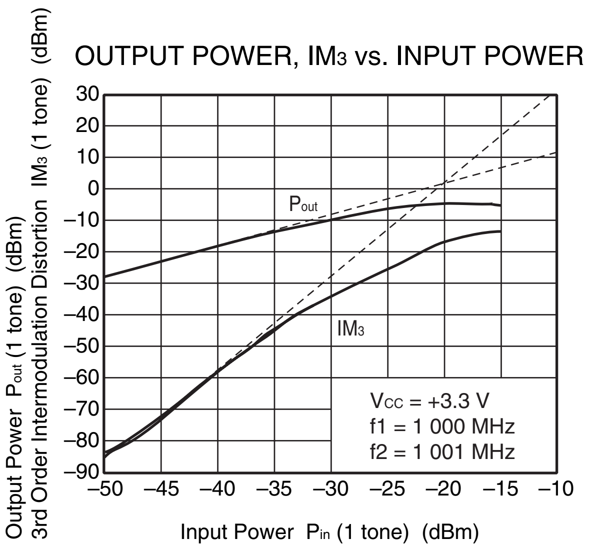
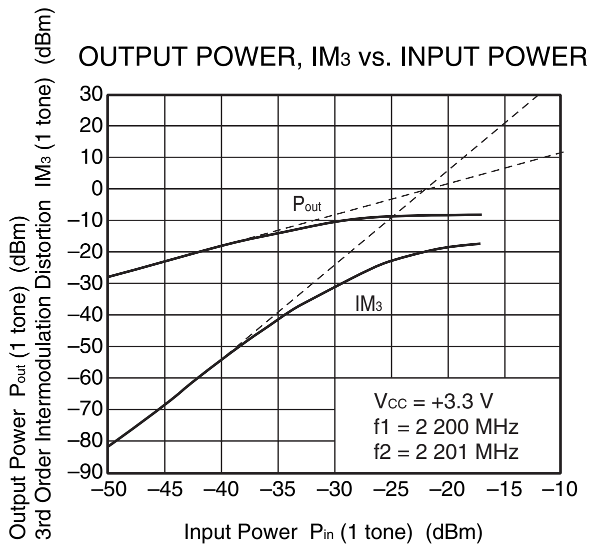
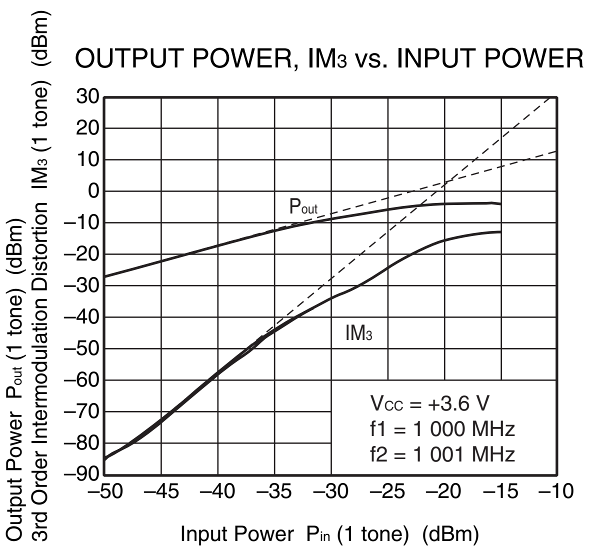
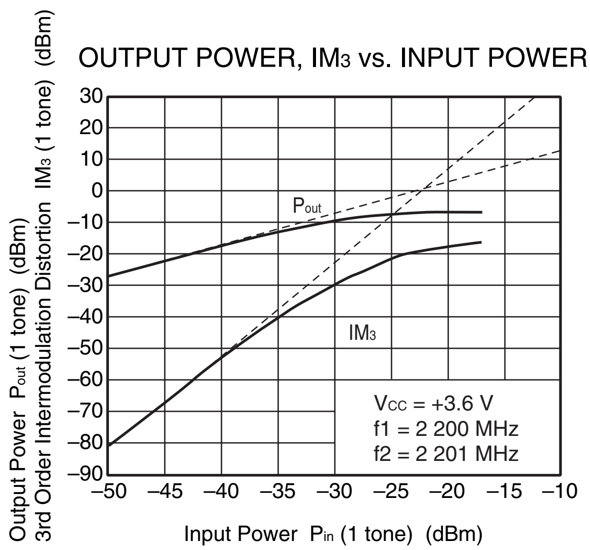






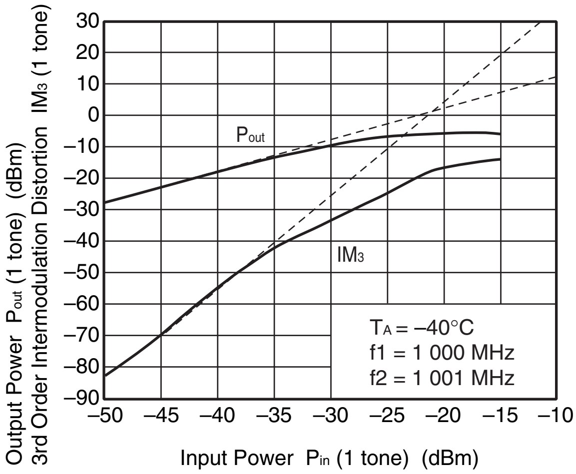






Remark The graphs indicate nominal characteristics.

OUTPUT POWER, IM3 vs. INPUT POWER



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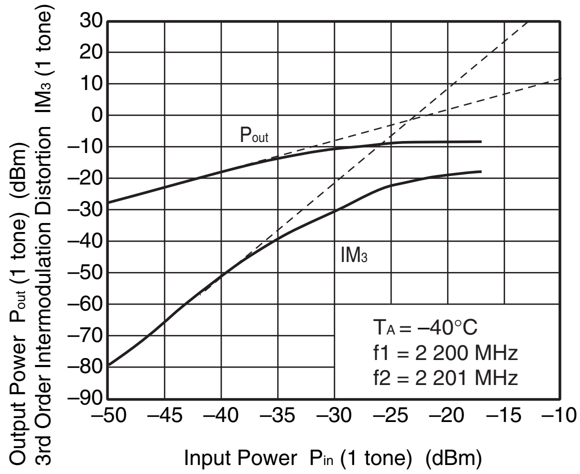

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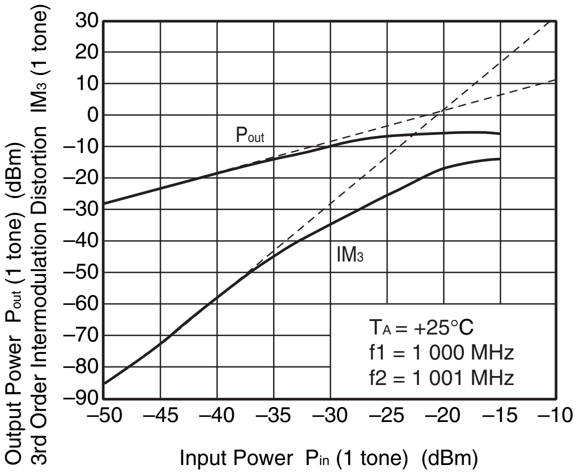
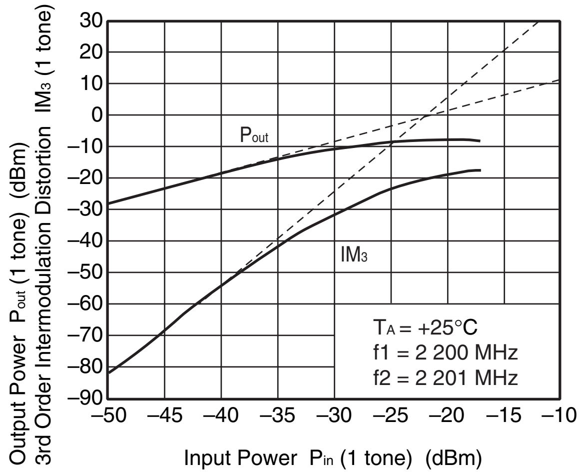
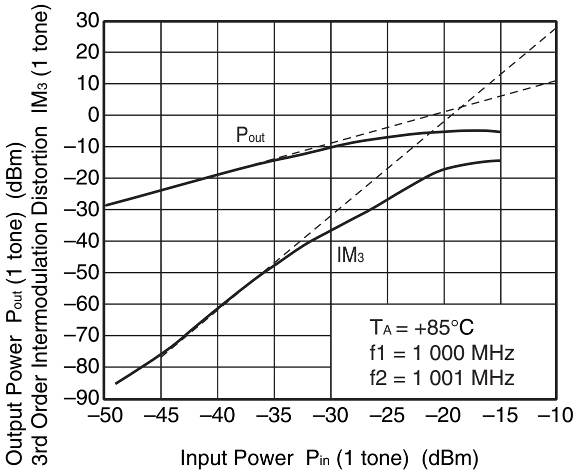


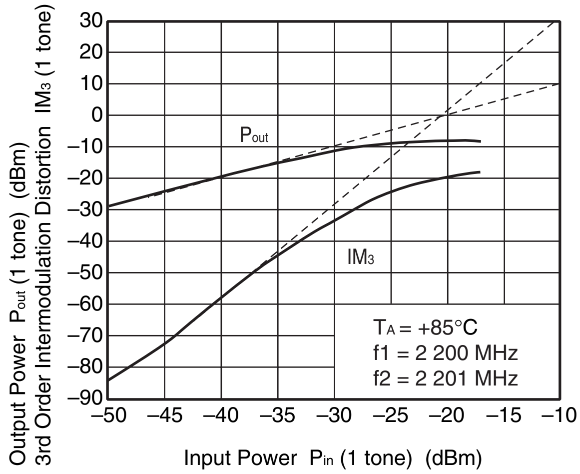
OUTPUT POWER, IM3 vs. INPUT POWER



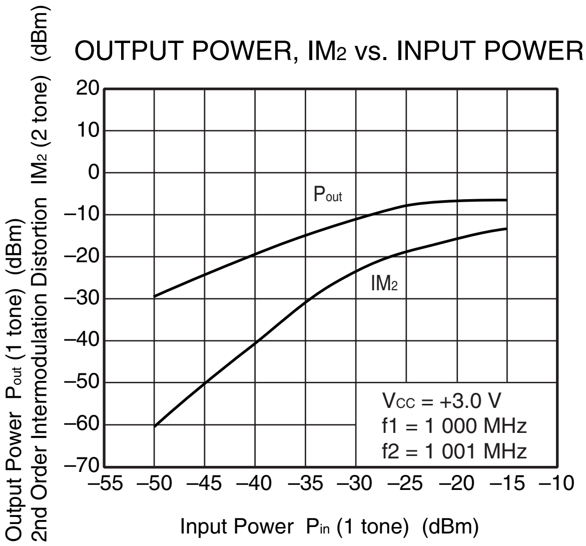
OUTPUT POWER, IM3 vs. INPUT POWER

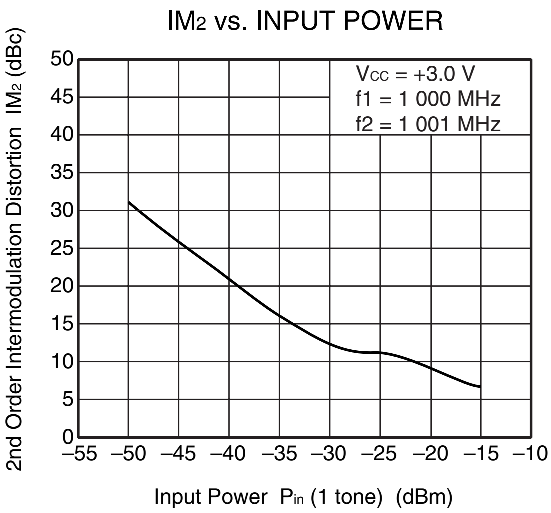


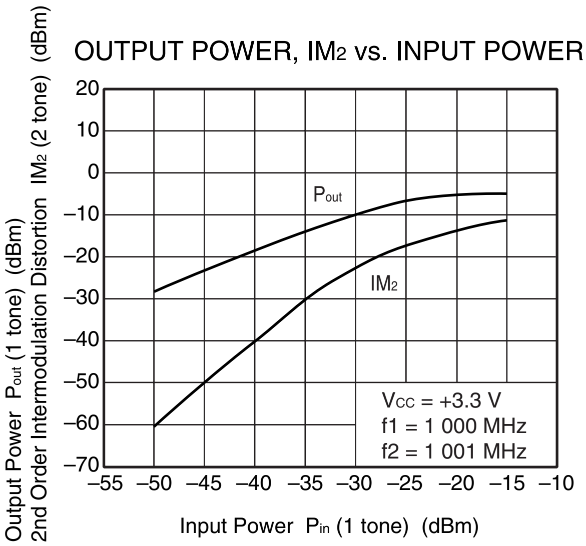
OUTPUT POWER, IM3 vs. INPUT POWER

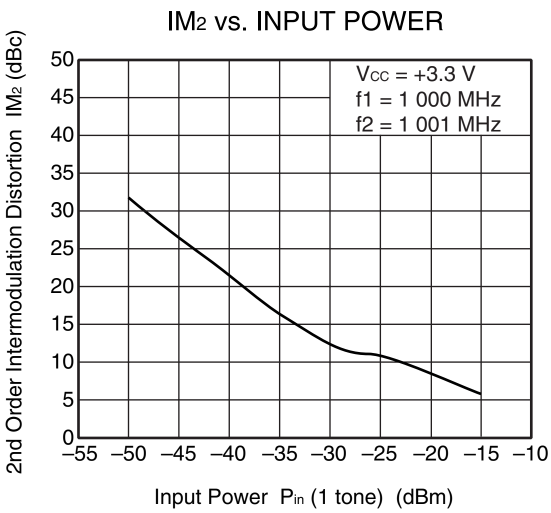


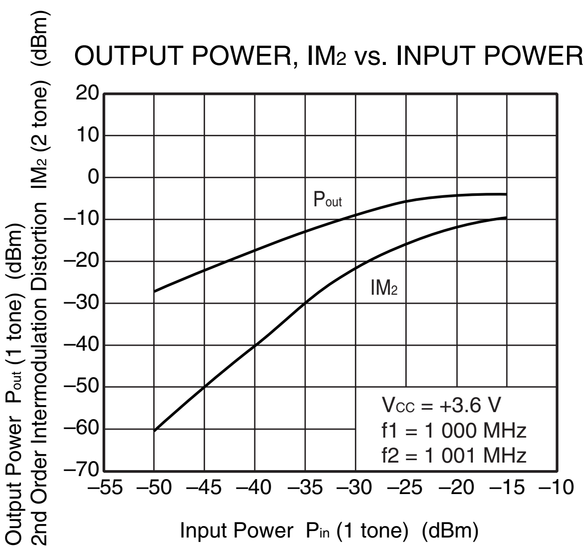
Remark The graphs indicate nominal characteristics.

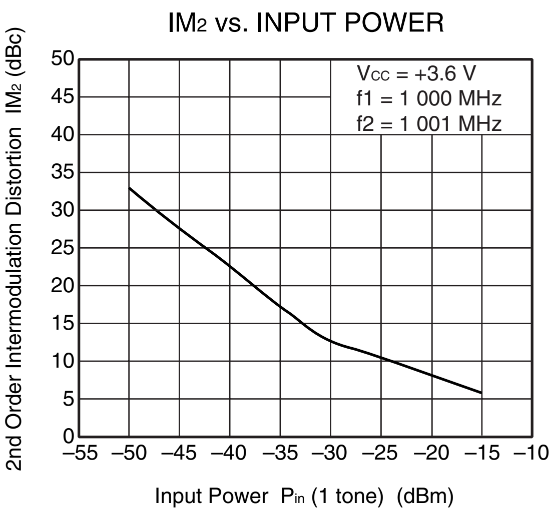




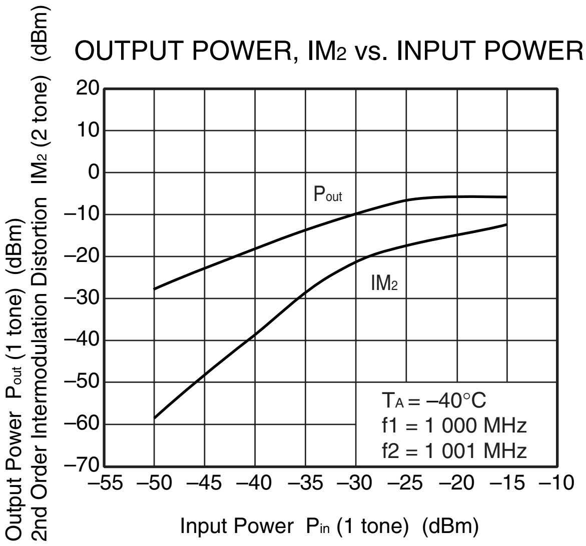


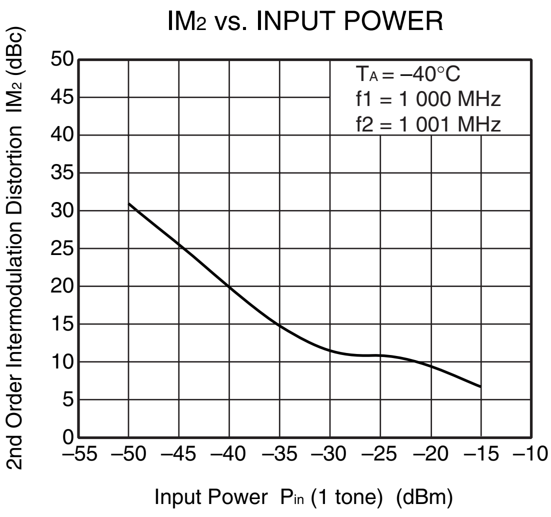


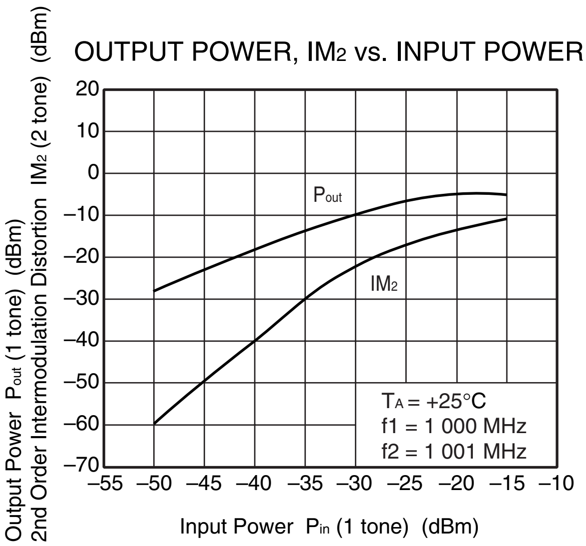


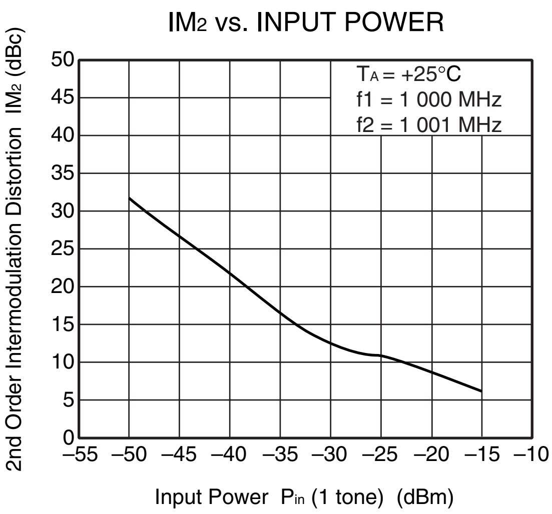


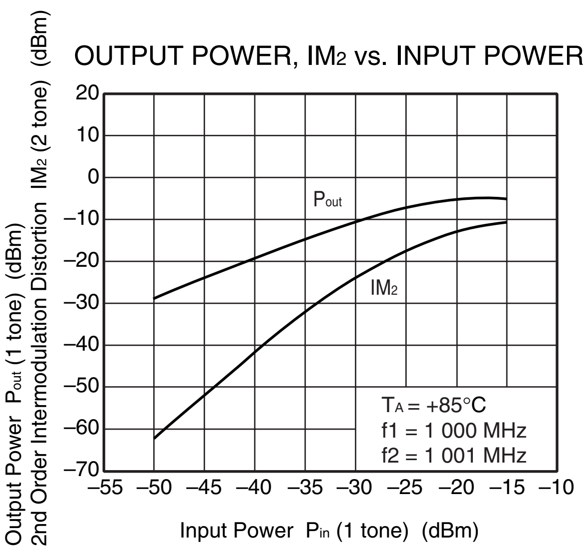
Remark The graphs indicate nominal characteristics.

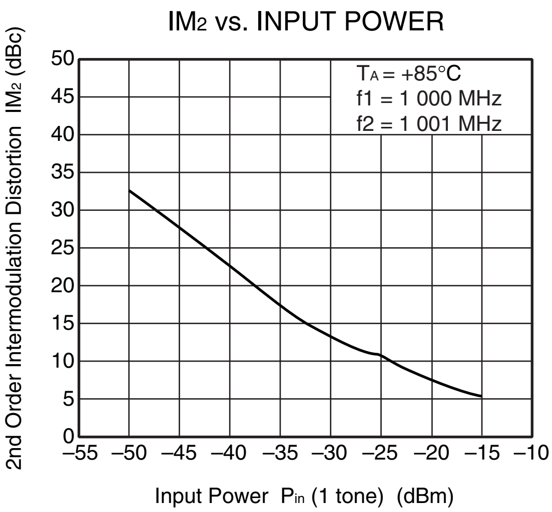






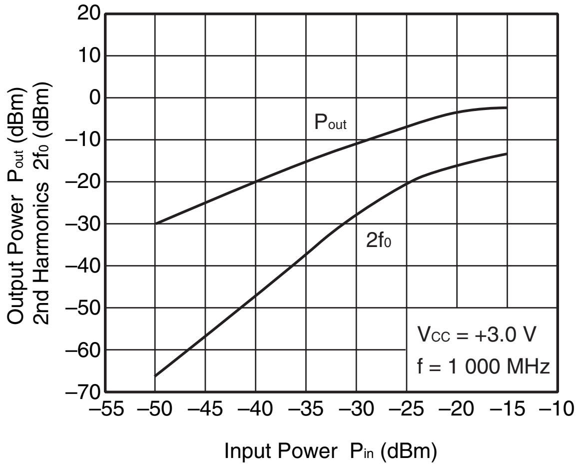




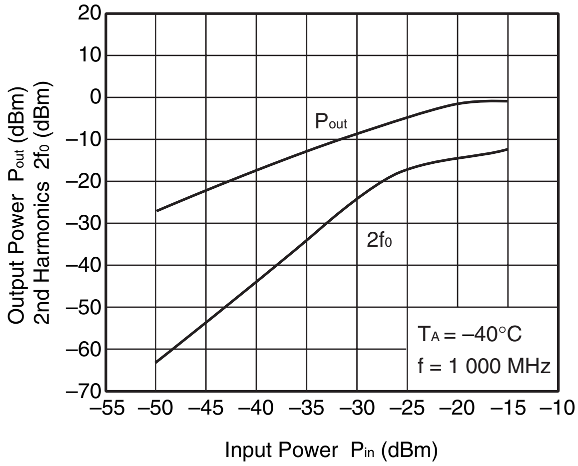


Remark The graphs indicate nominal characteristics.

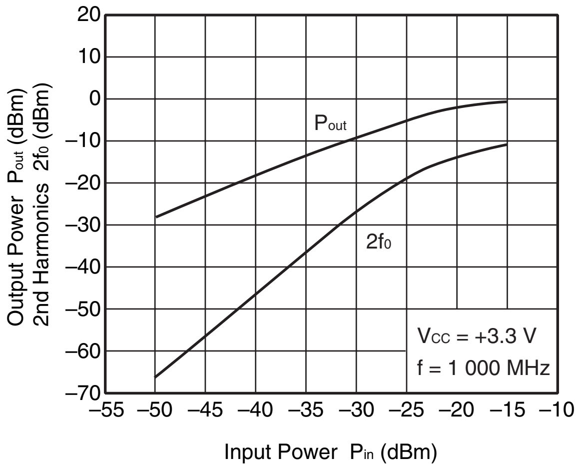
OUTPUT POWER, 2f0 vs. INPUT POWER



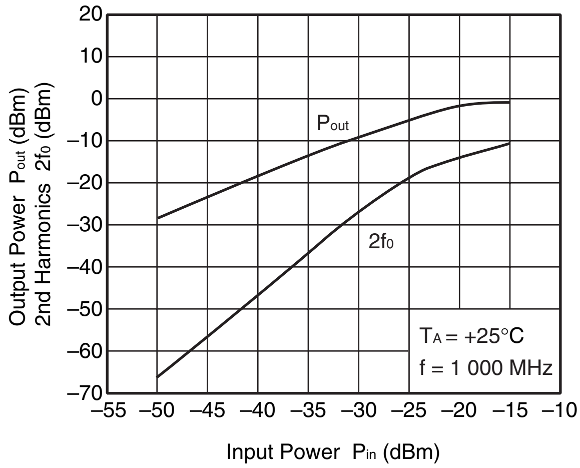
OUTPUT POWER, 2f0 vs. INPUT POWER



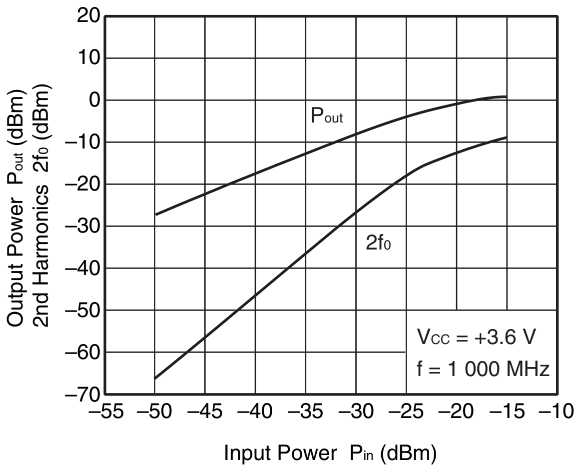
OUTPUT POWER, 2f0 vs. INPUT POWER



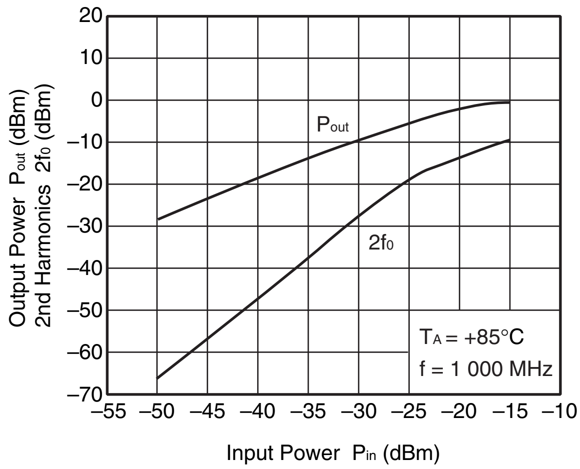
OUTPUT POWER, 2f0 vs. INPUT POWER



OUTPUT POWER, 2f0 vs. INPUT POWER



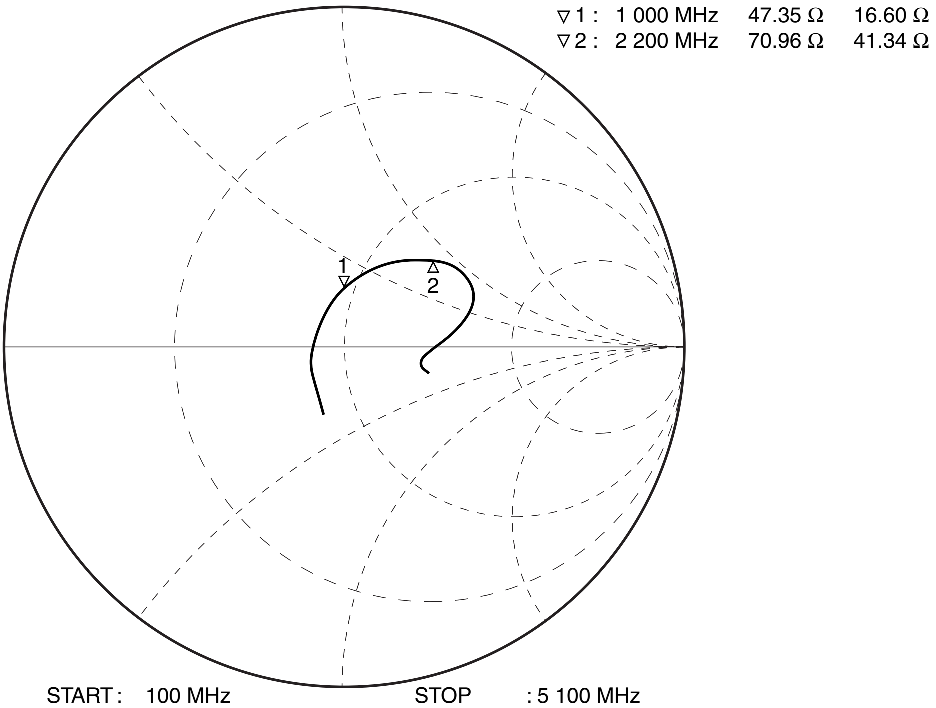
OUTPUT POWER, 2f0 vs. INPUT POWER



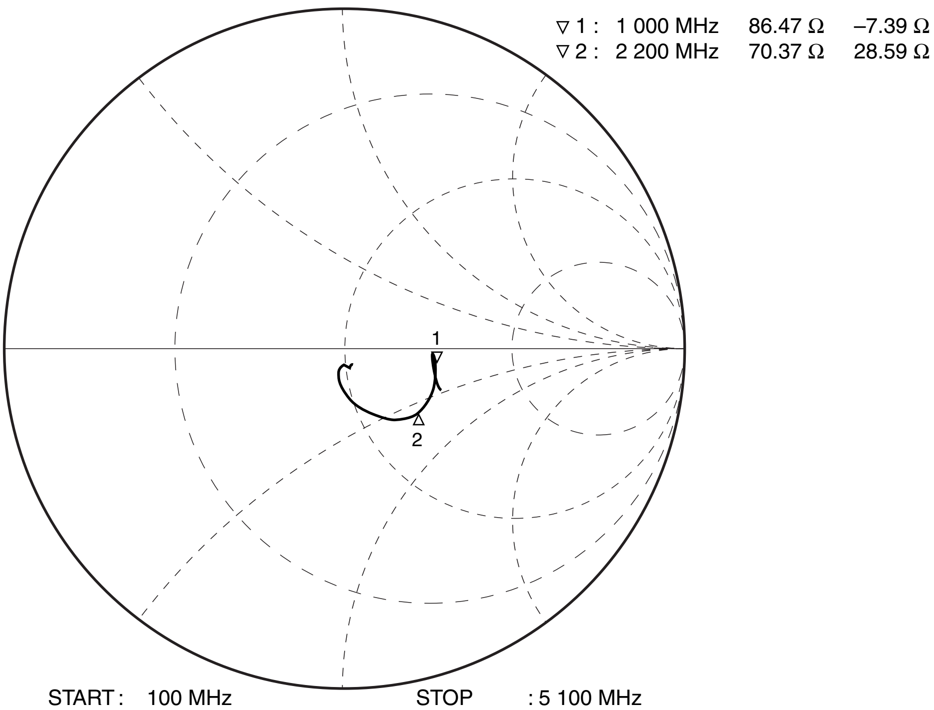
Remark The graphs indicate nominal characteristics.

S-PARAMETERS (T_A = +25°C, V_{CC} = 3.3 V, P_{in} = −40 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.

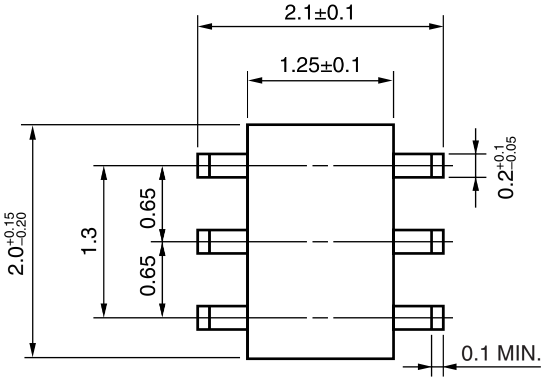
Click here to download S-parameters.

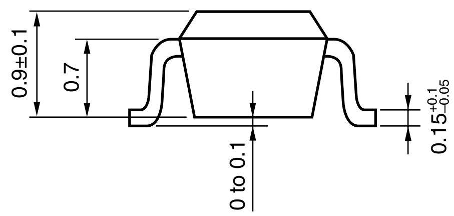
[RF and Microwave] → [Device Parameters]

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 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).