Data Sheet

μPC3244TB

Bipolar Analog Integrated Circuit
3.3 V, Silicon Germanium MMIC Medium Output Power Amplifier

R09DS0015EJ0100
Rev.1.00
Mar 28, 2011

DESCRIPTION

The μPC3244TB is a silicon germanium monolithic IC designed as IF amplifier for DBS tuners.
This IC is manufactured using our 50 GHz f_{MAX}. UHSK3 (Ultra High Speed Process) silicon germanium bipolar process.

FEATURES

- Low current : I_{CC} = 18 mA TYP.
- Power gain : G_P = 30 dB TYP. @ f = 1.0 GHz
  G_P = 31 dB TYP. @ f = 2.2 GHz
- Noise figure : NF = 3.1 dB TYP.@ f = 1.0 GHz
  NF = 3.1 dB TYP. @ f = 2.2 GHz
- High linearity : $P_{O (1 dB)}$ = +8 dBm TYP.@ f = 1.0 GHz
  $P_{O (1 dB)}$ = +6 dBm TYP. @ f = 2.2 GHz
- Supply voltage : V_{CC} = 3.0 to 3.6 V
- Port impedance : input/output 50 Ω

APPLICATIONS

- IF amplifier in DBS LNB, other L-band Amplifier, etc.

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPC3244TB-E3	μPC3244TB-E3-A	6-pin super minimold (Pb-Free)	C4B	• Embossed tape 8 mm wide • Pin 1, 2, 3 face the perforation side of the tape • Qty 3 kpcs/reel

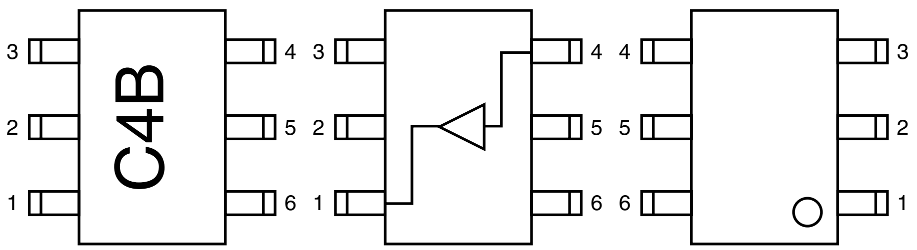
Remark To order evaluation samples, please contact your nearby sales office.
Part number for sample order: μPC3244TB

CAUTION

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

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM

(Top View) (Top View) (Bottom View)



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

PRODUCT LINE-UP OF 3 V or 3.3 V BIAS SILICON MMIC MEDIUM OUTPUT POWER 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)	$P_{O(1\ dB)}$ (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)	+10.0 (1.0 GHz) +8.0 (2.2 GHz)	+12.5 (1.0 GHz) +10.0 (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
μPC3244TB		18.0	30.0 (1.0 GHz) 31.0 (2.2 GHz)	3.1 (1.0 GHz) 3.1 (2.2 GHz)	+8.0 (1.0 GHz) +6.0 (2.2 GHz)	+13.0 (1.0 GHz) +9.0 (2.2 GHz)		C4B

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 3 and 1	4.0	V
Total Circuit Current	I_{CC}	T_A = +25°C, pin 3 and 1	35	mA
Power Dissipation	P_D	T_A = +85°C **Note**	166	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	–5	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 3 and 1.	3.0	3.3	3.6	V
Operating Ambient Temperature	T_A		–40	+25	+85	°C

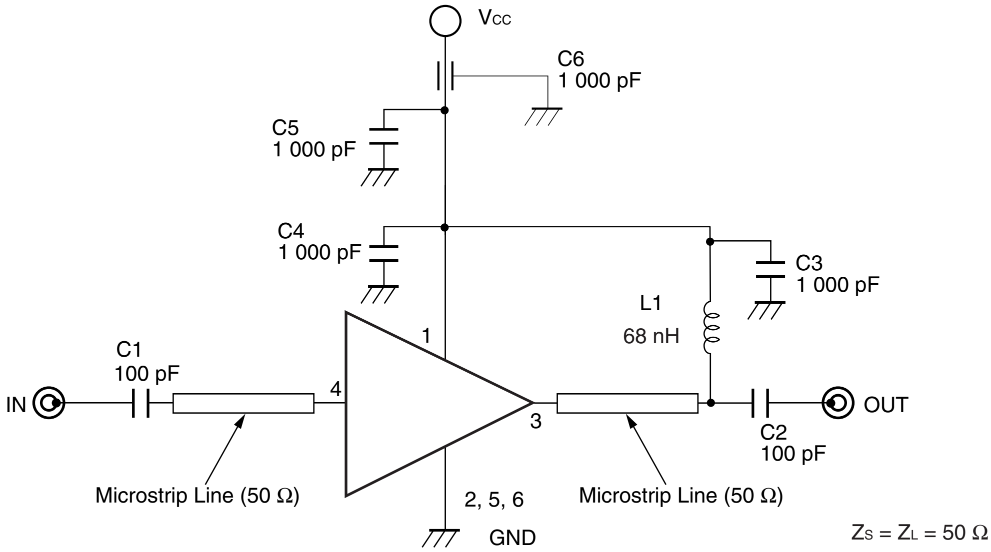
ELECTRICAL CHARACTERISTICS
(T_A = +25°C, V_{CC} = V_{out} = 3.3 V, Z_S = Z_L = 50 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No input signal	14.5	18	22	mA
Power Gain 1	G_P1	f = 0.25 GHz, P_{in} = –35 dBm	26.5	29.5	32.5	dB
Power Gain 2	G_P2	f = 1.0 GHz, P_{in} = –35 dBm	27	30	33	dB
Power Gain 3	G_P3	f = 1.8 GHz, P_{in} = –35 dBm	28	31	34	dB
Power Gain 4	G_P4	f = 2.2 GHz, P_{in} = –35 dBm	28	31	34	dB
Gain 1 dB Compression Output Power 1	$P_{O\ (1dB)}1$	f = 1.0 GHz	+5.0	+8.0	–	dBm
Gain 1dB Compression Output Power 2	$P_{O\ (1dB)}2$	f = 2.2 GHz	+3.0	+6.0	–	dBm
Noise Figure 1	NF1	f = 1.0 GHz	–	3.1	3.9	dB
Noise Figure 2	NF2	f = 2.2 GHz	–	3.1	3.9	dB
Isolation 1	ISL1	f = 1.0 GHz, P_{in} = –35 dBm	36	41	–	dB
Isolation 2	ISL2	f = 2.2 GHz, P_{in} = –35 dBm	34	39	–	dB
Input Return Loss 1	$RL_{in}1$	f = 1.0 GHz, P_{in} = –35 dBm	8.0	11	–	dB
Input Return Loss 2	$RL_{in}2$	f = 2.2 GHz, P_{in} = –35 dBm	8.5	12	–	dB
Output Return Loss 1	$RL_{out}1$	f = 1.0 GHz, P_{in} = –35 dBm	9.0	12	–	dB
Output Return Loss 2	$RL_{out}2$	f = 2.2 GHz, P_{in} = –35 dBm	8.5	12	–	dB

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

Parameter	Symbol	Test Conditions	Reference Value	Unit
Power Gain 5	G_P5	f = 2.6 GHz, P_{in} = –35 dBm	29.5	dB
Power Gain 6	G_P6	f = 3.0 GHz, P_{in} = –35 dBm	27.5	dB
Gain Flatness	ΔG_P	f = 1.0 GHz to 2.2 GHz, P_{in} = –35 dBm	1.0	dB
K factor 1	K1	f = 1.0 GHz, P_{in} = –35 dBm	1.6	–
K factor 2	K2	f = 2.2 GHz, P_{in} = –35 dBm	1.2	–
Output 3rd Order Distortion Intercept Point 1	OIP_3 1	f1 = 1 000 MHz, f2 = 1 001 MHz	18.5	dBm
Output 3rd Order Distortion Intercept Point 2	OIP_3 2	f1 = 2 200 MHz, f2 = 2 201 MHz	15.5	dBm
Input 3rd Order Distortion Intercept Point 1	IIP_3 1	f1 = 1 000 MHz, f2 = 1 001 MHz	–11.5	dBm
Input 3rd Order Distortion Intercept Point 2	IIP_3 2	f1 = 2 200 MHz, f2 = 2 201 MHz	–15.5	dBm
2nd Order Intermodulation Distortion	IM_2	f1 = 1 000 MHz, f2 = 1 001 MHz, P_{out} = –5 dBm/tone	40	dBc
2nd Harmonic	$2f_0$	f0 = 1.0 GHz, P_{out} = –15 dBm	55	dBc
Saturated Output Power 1	$P_{O\,(sat)}$ 1	f = 1.0 GHz, P_{in} = –10 dBm	+13.0	dBm
Saturated Output Power 2	$P_{O\,(sat)}$ 2	f = 2.2 GHz, P_{in} = –10 dBm	+9.0	dBm

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	Chip Inductor	68 nH
C1, C2	Chip Capacitor	100 pF
C3, C4, C5	Chip Capacitor	1 000 pF
C6	Feed-through Capacitor	1 000 pF

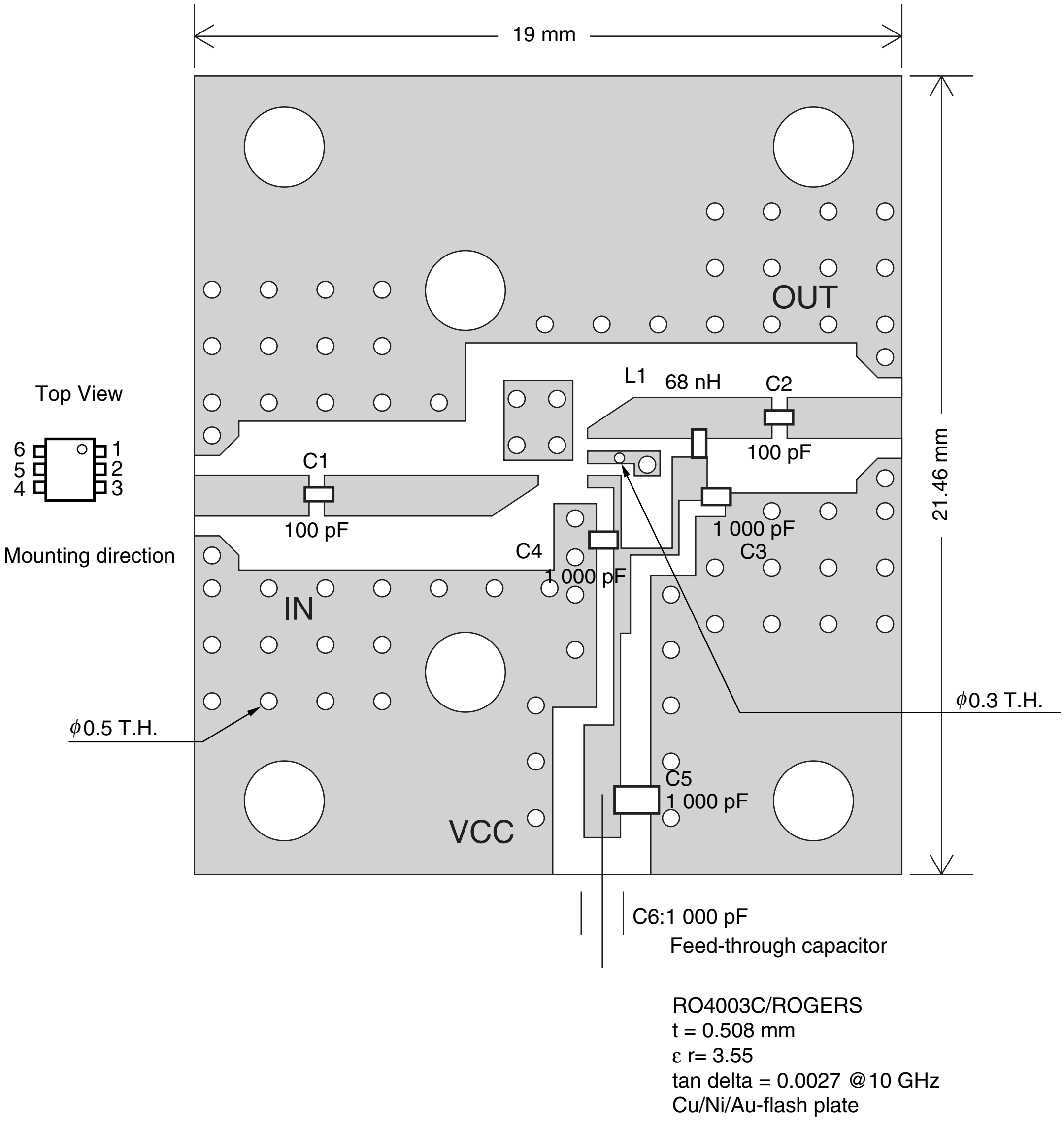
INDUCTOR FOR THE OUTPUT PIN

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 3) and output pin (pin 1).
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 of 100 pF are recommendable 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.

EVALUATION CIRCUIT



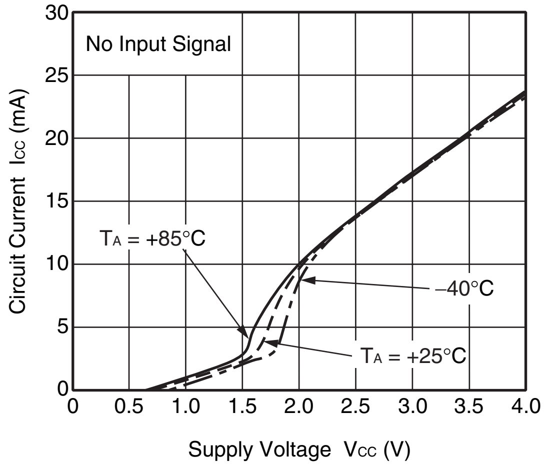
COMPONENT LIST

	Type	Value	size
L1	Chip Inductor	68 nH	1005
C1, C2	Chip Capacitor	100 pF	1005
C3, C4	Chip Capacitor	1 000 pF	1005
C5	Chip Capacitor	1 000 pF	1608
C6	Feed-through Capacitor	1 000 pF	–

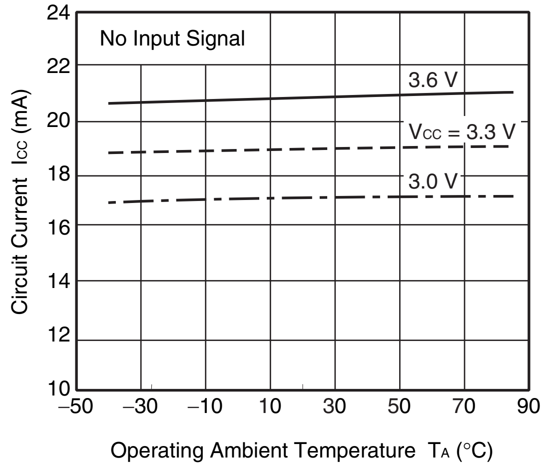
Notes:
1. 21.46 × 19 × 0.508 mm double sided 18μm copper clad polyimide board.
2. Back side: GND pattern.
3. Solder plated on pattern.
4. ∘○: Through holes

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

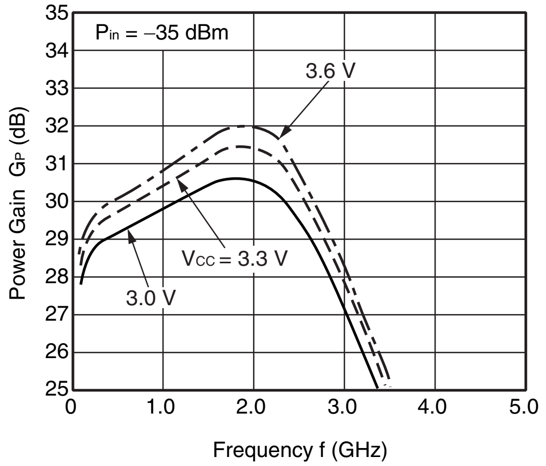
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



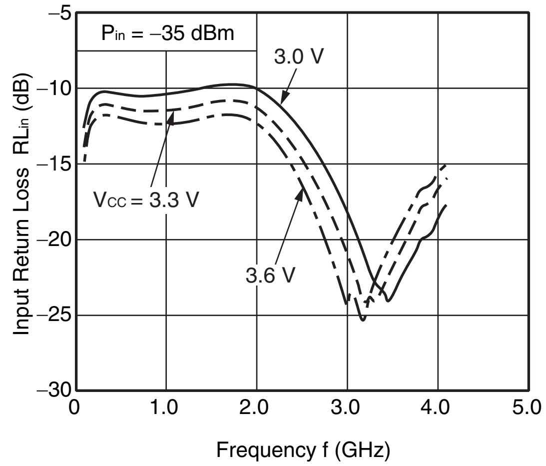
CURCUIT CURRENT vs.
OPERATING AMBIENT TEMPERATURE



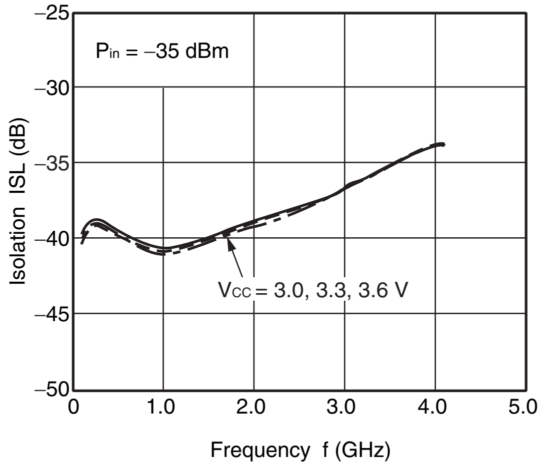
POWER GAIN vs. FREQUENCY



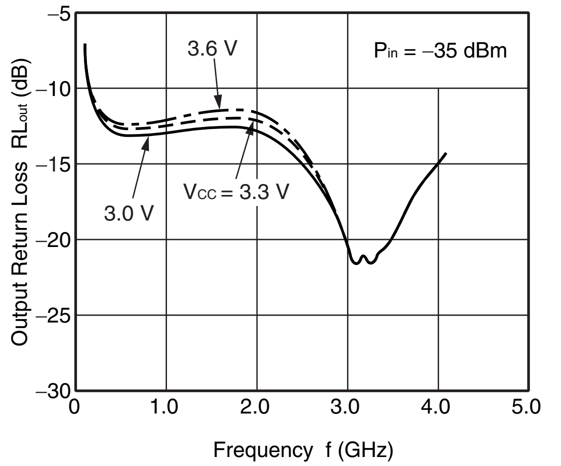
INPUT RETURN LOSS vs. FREQUENCY



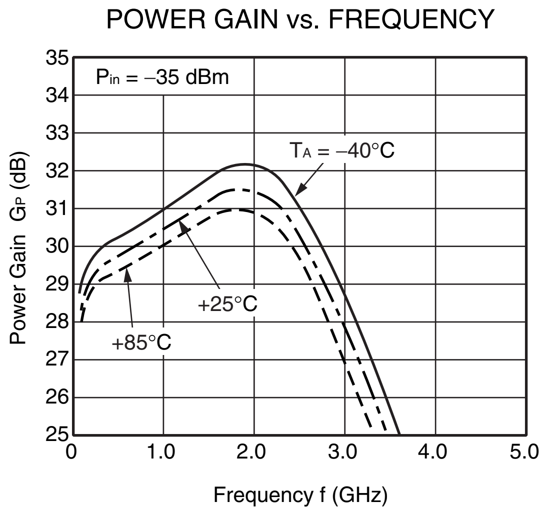
ISOLATION vs. FREQUENCY

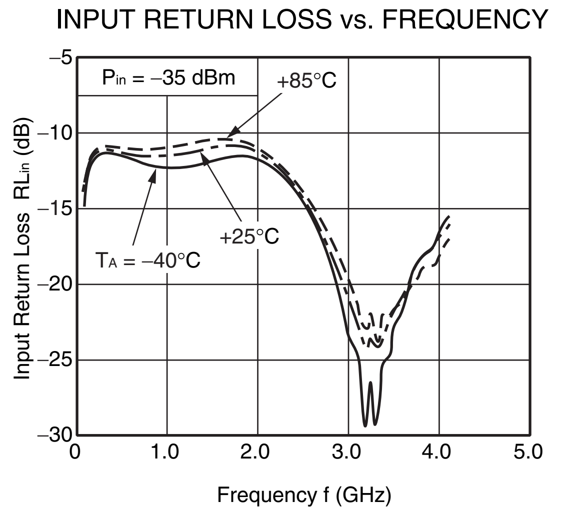


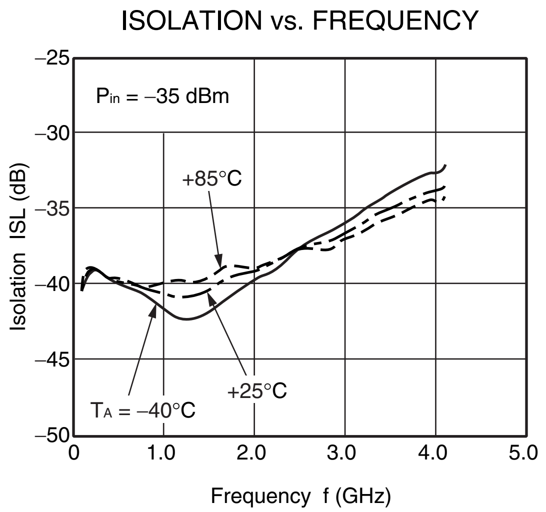
OUTPUT RETURN LOSS vs. FREQUENCY

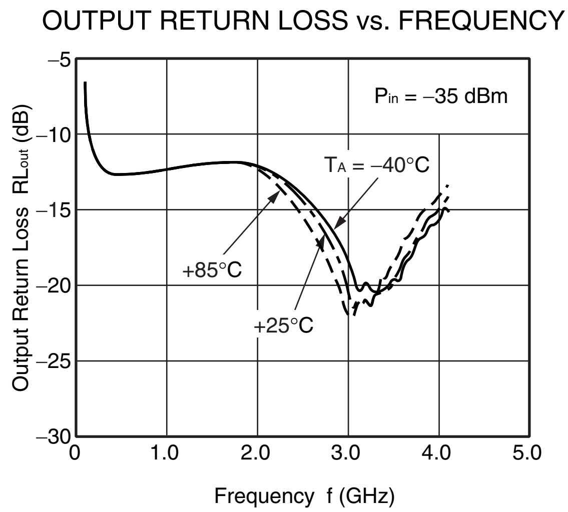


Remark The graphs indicate nominal characteristics.









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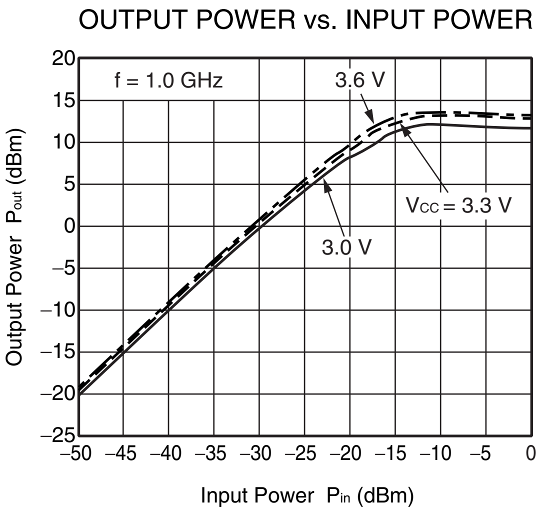

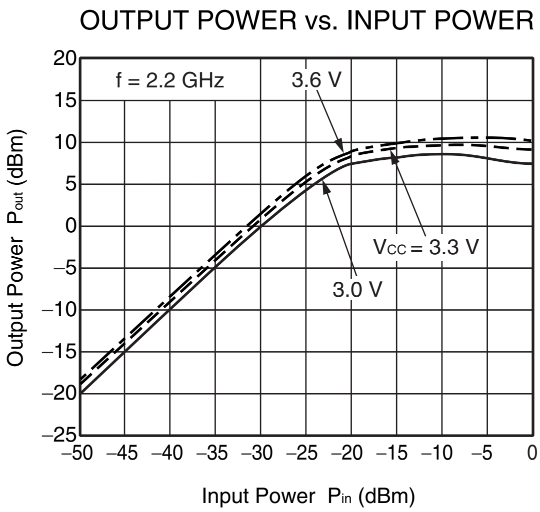

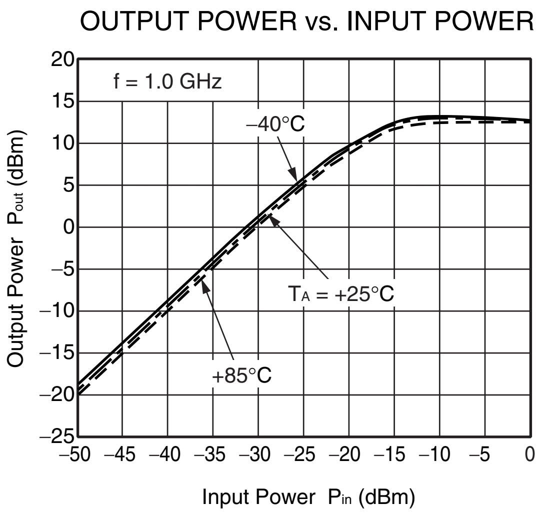

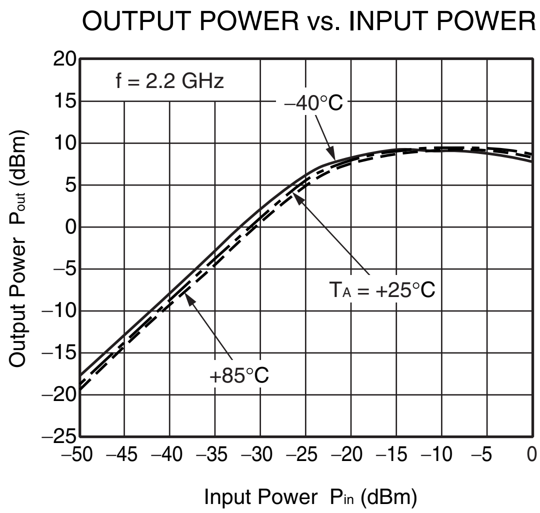

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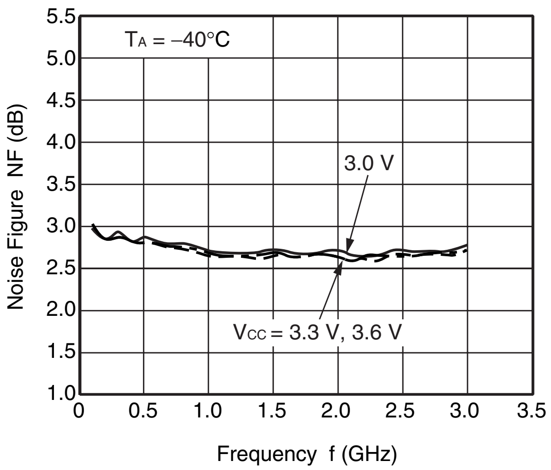
NOISE FIGURE vs. FREQUENCY



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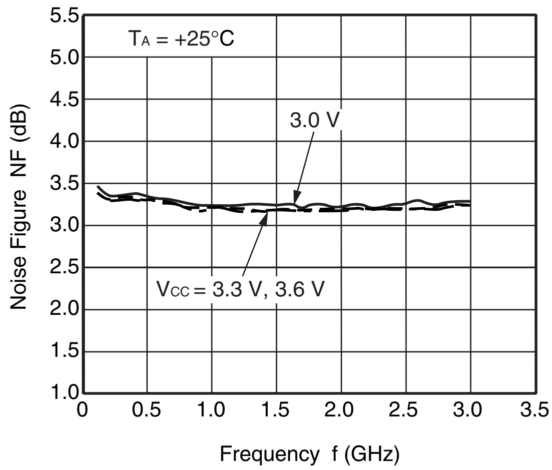

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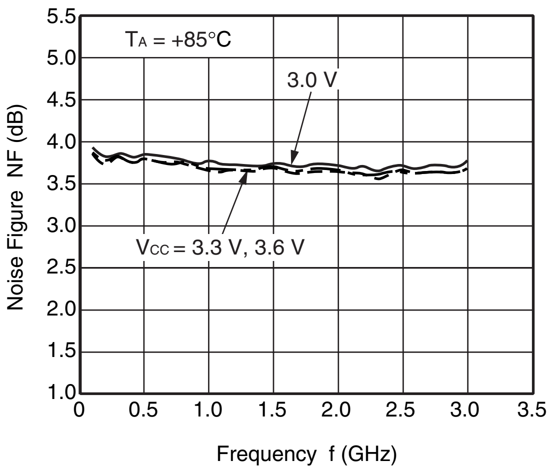

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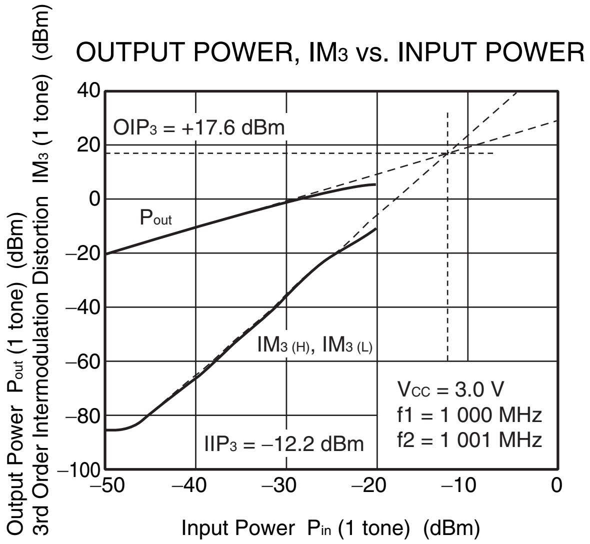

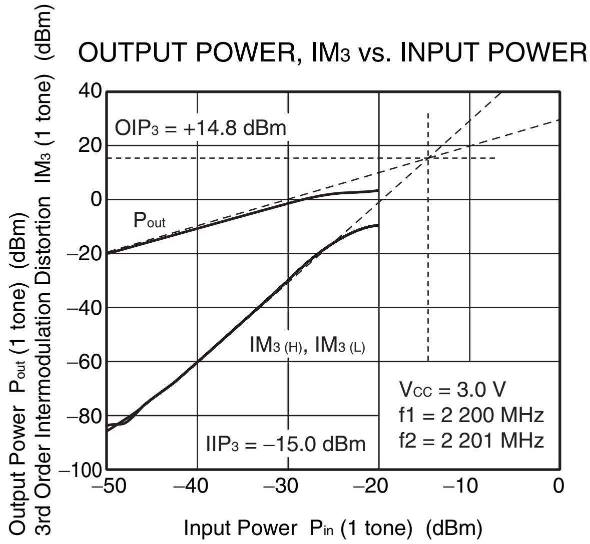

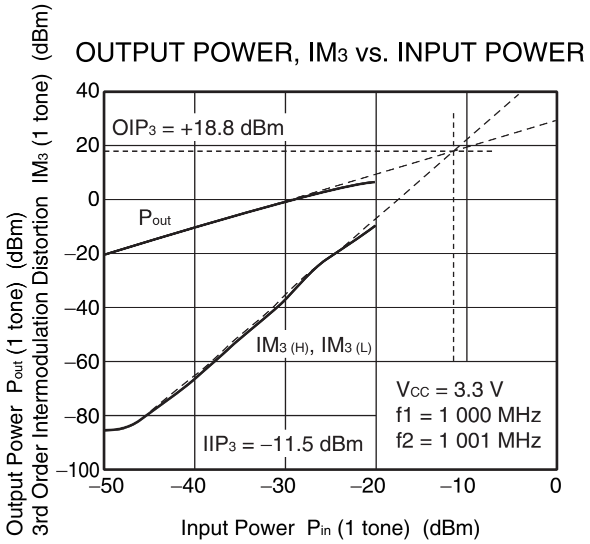

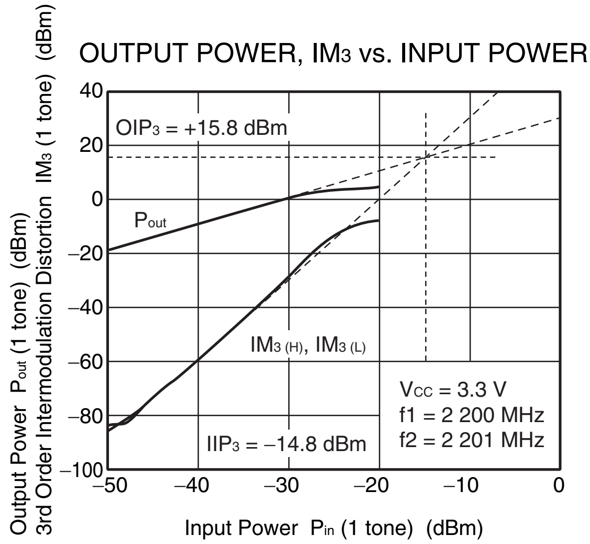

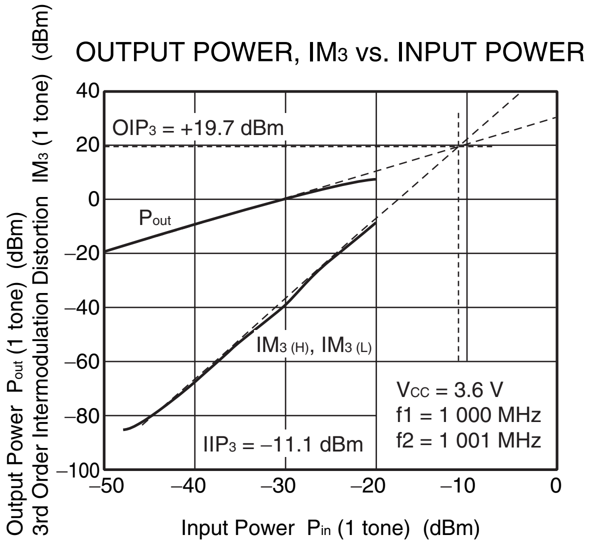

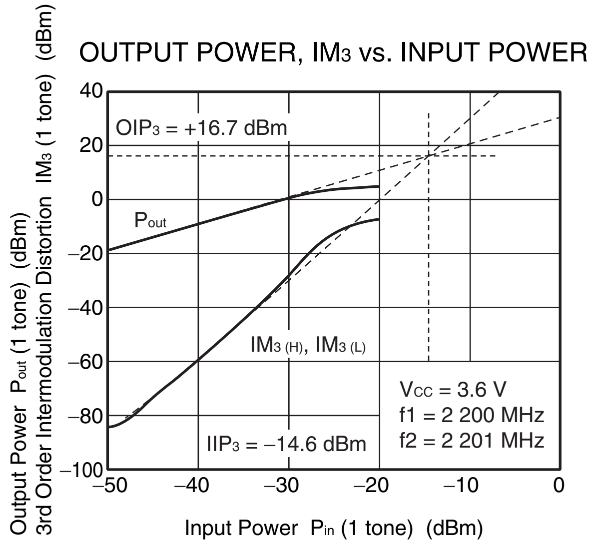

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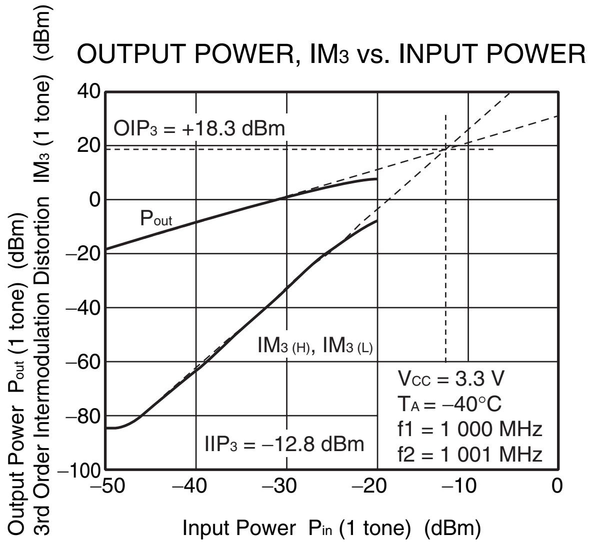

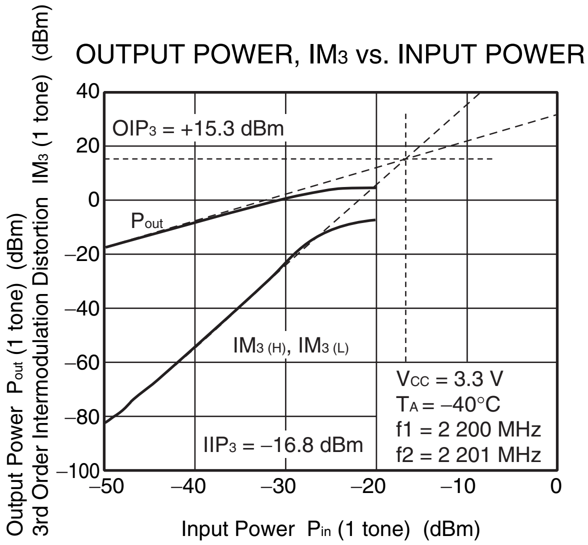

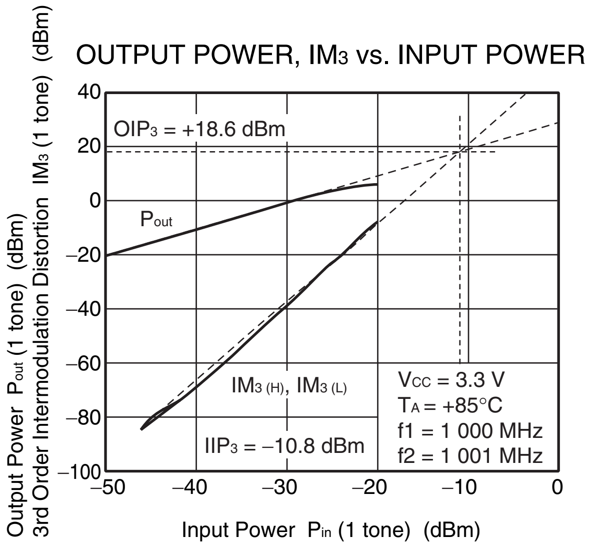

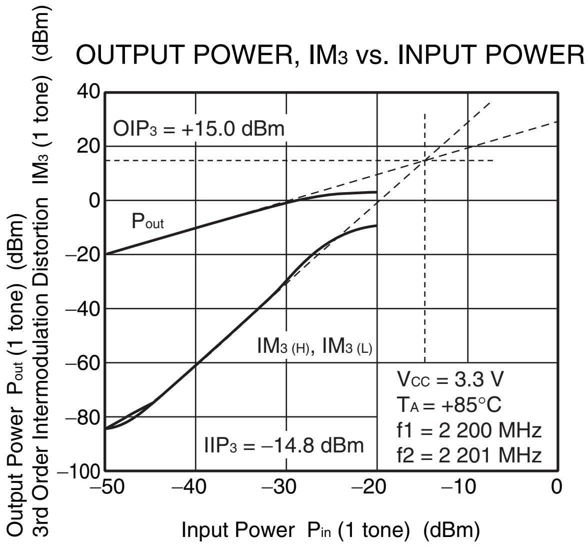

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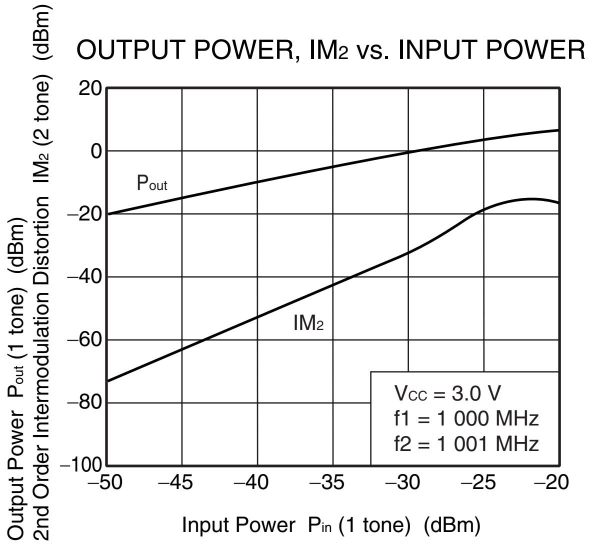

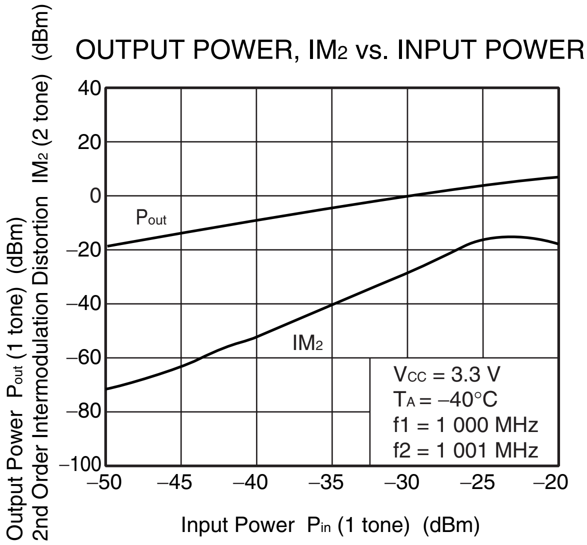

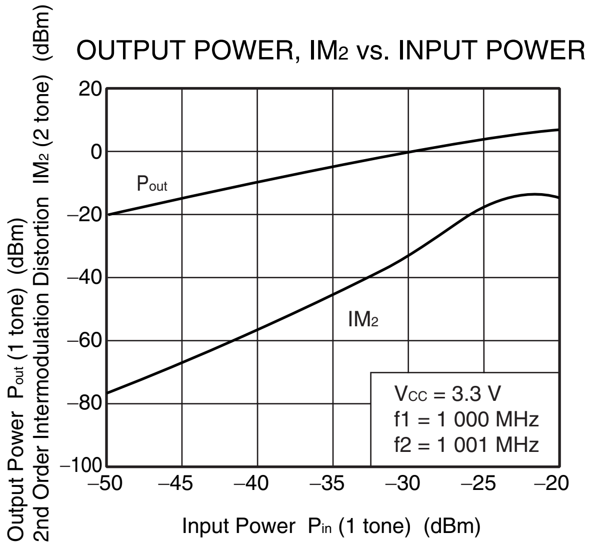

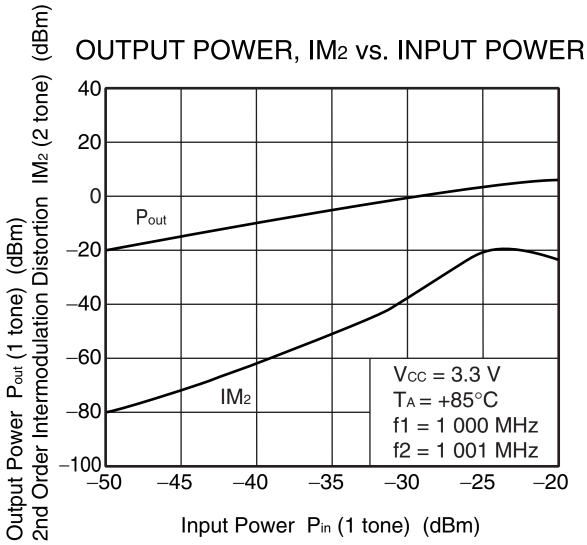

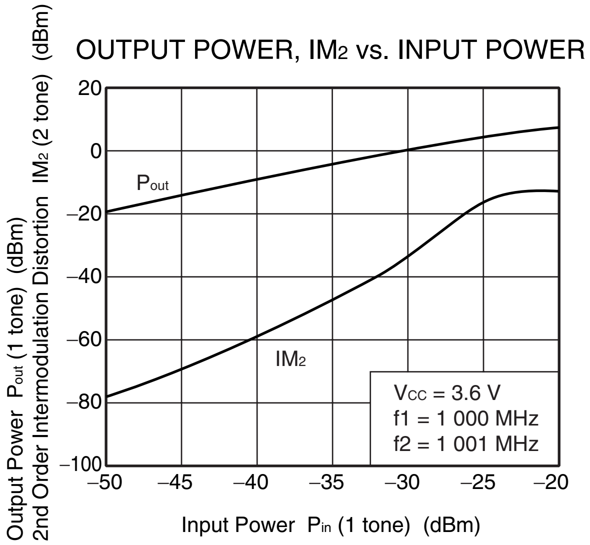

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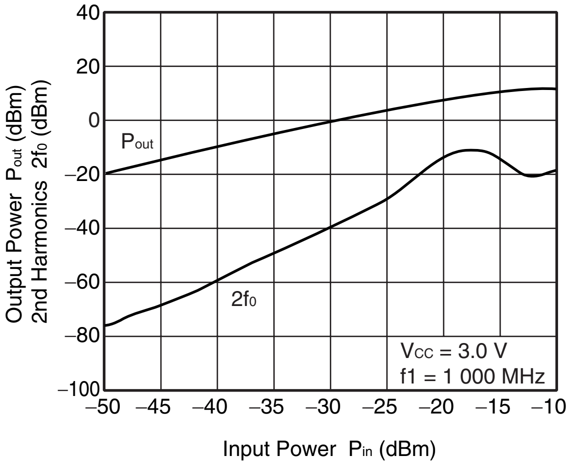
OUTPUT POWER, 2f0 vs. INPUT POWER



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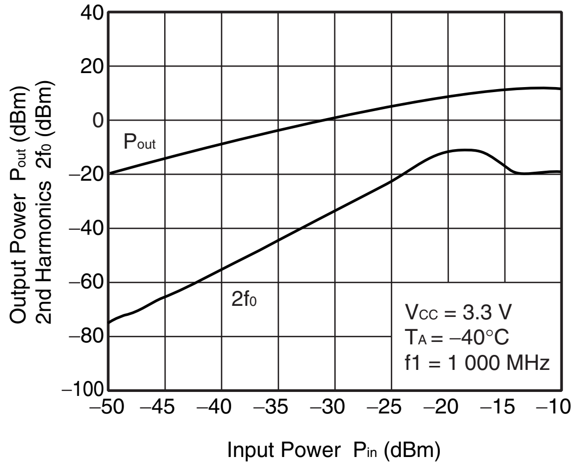

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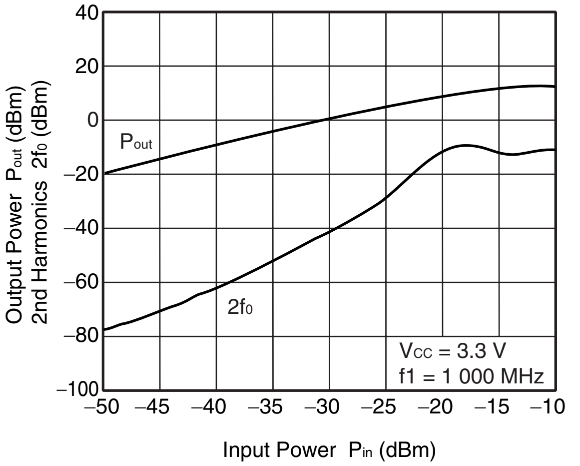

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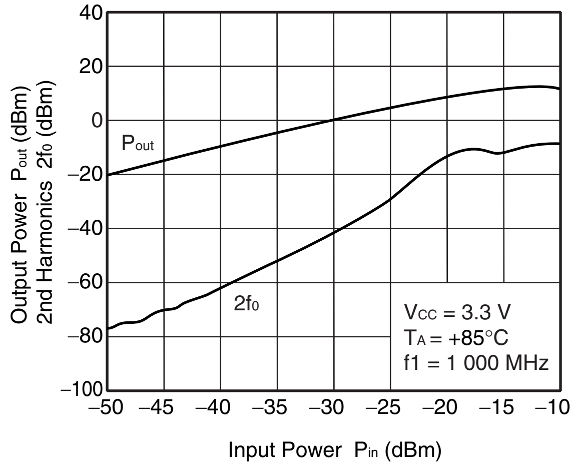

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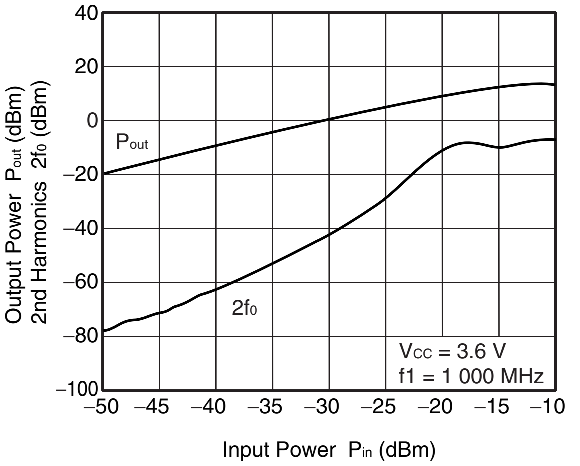
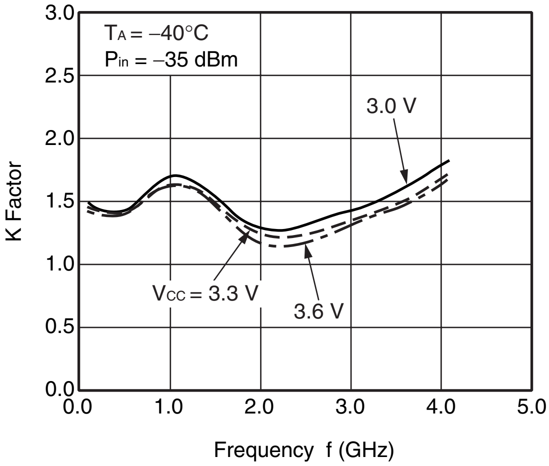
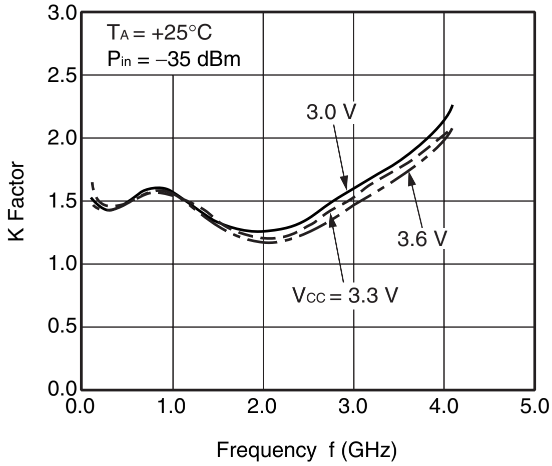


Remark The graphs indicate nominal characteristics.

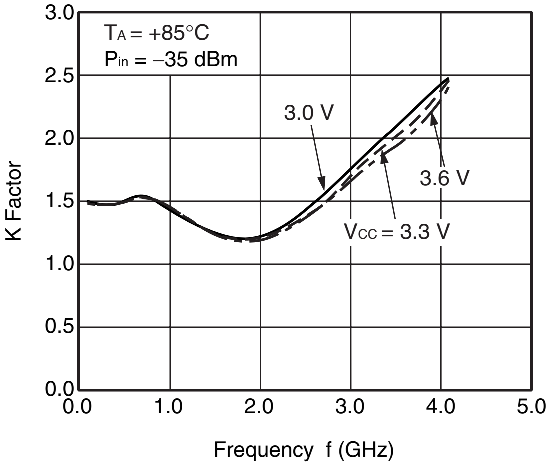
K FACTOR vs. FREQUENCY



K FACTOR vs. FREQUENCY



K FACTOR vs. FREQUENCY

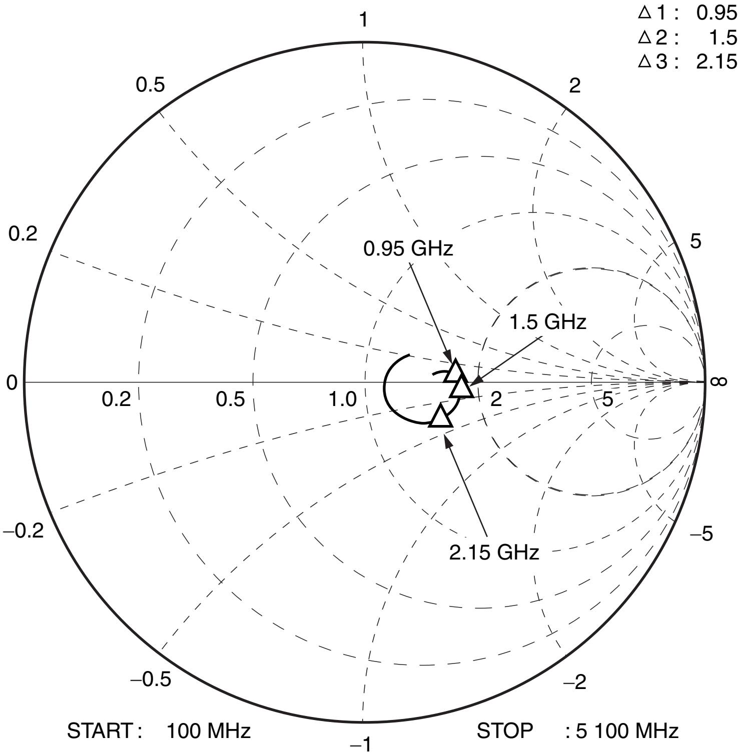


Remark The graphs indicate nominal characteristics.

S-PARAMETERS (T_A = +25°C, V_{CC} = V_{out} = 3.3 V, P_{in} = –35 dBm, Z_O = 50 Ω)

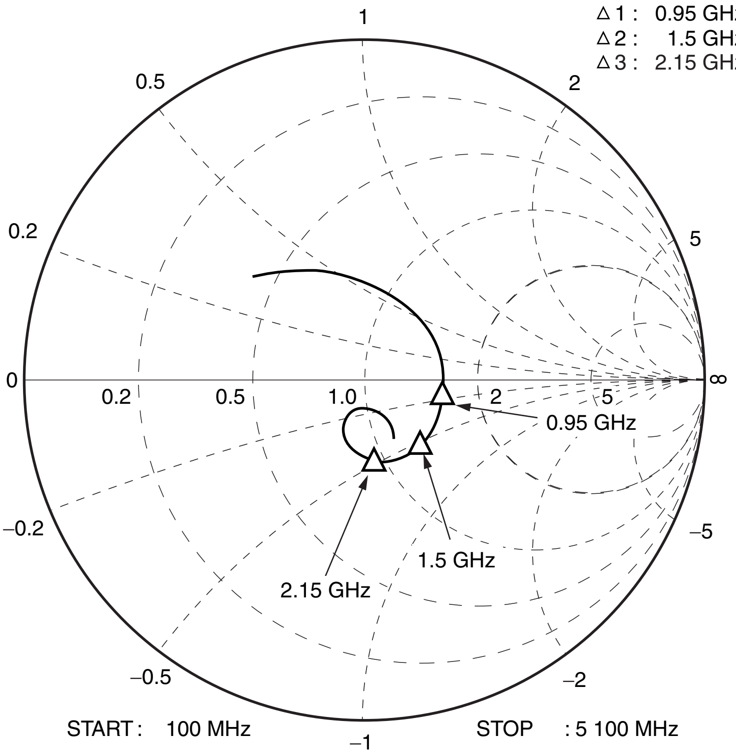
S_{11}-FREQUENCY

△1 : 0.95 GHz 0.26 ∠ 2.7 deg.
△2 : 1.5 GHz 0.28 ∠ –1.6 deg.
△3 : 2.15 GHz 0.25 ∠ –24.6 deg.

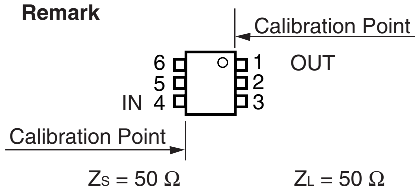


S_{22}-FREQUENCY

△1 : 0.95 GHz 0.24 ∠ –12.5 deg.
△2 : 1.5 GHz 0.25 ∠ –45.7 deg.
△3 : 2.15 GHz 0.23 ∠ –86.8 deg.



Remark



Remark The graphs indicate nominal characteristics.

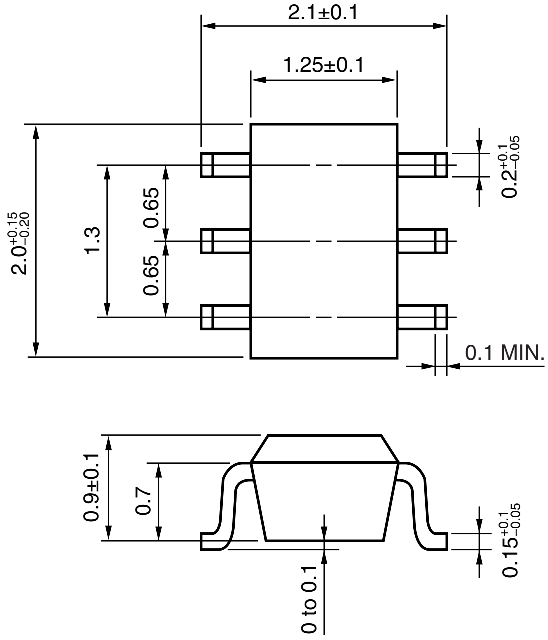
S-Parameters

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://www2.renesas.com/microwave/en/download.html

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

CAUTION

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

Revision History	μPC3244TB Data Sheet

Rev.	Date	Description	
		Page	Summary
1.00	Mar 28, 2011	–	First edition issued

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Refer to "http://www.renesas.com/" for the latest and detailed information.

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