

μPC3244TB

Data Sheet

Bipolar Analog Integrated Circuit

R09DS0015EJ0100

3.3 V, Silicon Germanium MMIC Medium Output Power Amplifier

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 : $P_{O(1\text{ dB})} = +8$ dBm TYP. @ $f = 1.0$ GHz
 $P_{O(1\text{ dB})} = +6$ dBm TYP. @ $f = 2.2$ GHz
- Supply voltage : $V_{CC} = 3.0$ to 3.6 V
- Port impedance : input/output $50\ \Omega$

APPLICATIONS

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

ORDERING INFORMATION

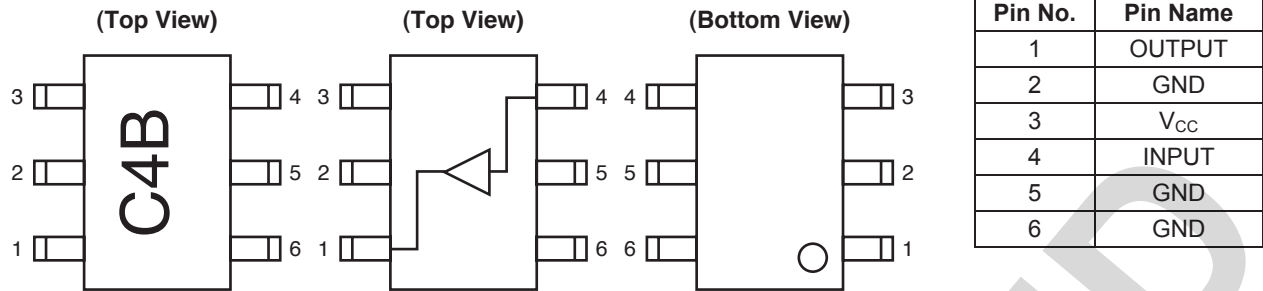
Part Number	Order Number	Package	Marking	Supplying Form
μPC3244TB-E3	μPC3244TB-E3-A	6-pin super minimold (Pb-Free)	C4B	• Embossed tape 8 mm wide • Pin 1, 2, 3 face the perforation side of the tape • Qty 3 kpcs/reel

Remark To order evaluation samples, please contact your nearby sales office.

Part number for sample order: μPC3244TB-A

CAUTION

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

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM
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)	6.5 (0.9 GHz)	+8.0 (0.9 GHz)	+9.0 (0.9 GHz)	6-pin super minimold	C1Z
			15.5 (1.9 GHz)	7.0 (1.9 GHz)	+7.0 (1.9 GHz)	+8.5 (1.9 GHz)		
μPC2763TB		27.0	20.0 (0.9 GHz)	5.5 (0.9 GHz)	+9.5 (0.9 GHz)	+11.0 (0.9 GHz)		C2A
			21.0 (1.9 GHz)	5.5 (1.9 GHz)	+6.5 (1.9 GHz)	+8.0 (1.9 GHz)		
μPC2771TB		36.0	21.0 (0.9 GHz)	6.0 (0.9 GHz)	+11.5 (0.9 GHz)	+12.5 (0.9 GHz)		C2H
			21.0 (1.5 GHz)	6.0 (1.5 GHz)	+9.5 (1.5 GHz)	+11.0 (1.5 GHz)		
μPC8181TB	3.3	23.0	19.0 (0.9 GHz)	4.5 (0.9 GHz)	+8.0 (0.9 GHz)	+9.5 (0.9 GHz)		C3E
			21.0 (1.9 GHz)	4.5 (1.9 GHz)	+7.0 (1.9 GHz)	+9.0 (1.9 GHz)		
			22.0 (2.4 GHz)	4.5 (2.4 GHz)	+7.0 (2.4 GHz)	+9.0 (2.4 GHz)		
μPC8182TB		30.0	21.5 (0.9 GHz)	4.5 (0.9 GHz)	+9.5 (0.9 GHz)	+11.0 (0.9 GHz)		C3F
			20.5 (1.9 GHz)	4.5 (1.9 GHz)	+9.0 (1.9 GHz)	+10.5 (1.9 GHz)		
			20.5 (2.4 GHz)	5.0 (2.4 GHz)	+8.0 (2.4 GHz)	+10.0 (2.4 GHz)		
μPC3239TB		29.0	25.0 (1.0 GHz)	4.0 (1.0 GHz)	+10.0 (1.0 GHz)	+12.5 (1.0 GHz)		C3V
			25.5 (2.2 GHz)	4.3 (2.2 GHz)	+8.0 (2.2 GHz)	+10.0 (2.2 GHz)		
μPC3241TB		19.8	23.5 (1.0 GHz)	4.0 (1.0 GHz)	+7.5 (1.0 GHz)	–		C3Y
			24.0 (2.2 GHz)	4.3 (2.2 GHz)	+6.0 (2.2 GHz)			
μPC3244TB		18.0	30.0 (1.0 GHz)	3.1 (1.0 GHz)	+8.0 (1.0 GHz)	+13.0 (1.0 GHz)		C4B
			31.0 (2.2 GHz)	3.1 (2.2 GHz)	+6.0 (2.2 GHz)	+9.0 (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}	$T_A = +25^{\circ}\text{C}$, pin 3 and 1	4.0	V
Total Circuit Current	I_{CC}	$T_A = +25^{\circ}\text{C}$, pin 3 and 1	35	mA
Power Dissipation	P_D	$T_A = +85^{\circ}\text{C}$ Note	166	mW
Operating Ambient Temperature	T_A		-40 to +85	$^{\circ}\text{C}$
Storage Temperature	T_{stg}		-55 to +150	$^{\circ}\text{C}$
Input Power	P_{in}	$T_A = +25^{\circ}\text{C}$	-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	$^{\circ}\text{C}$

ELECTRICAL CHARACTERISTICS

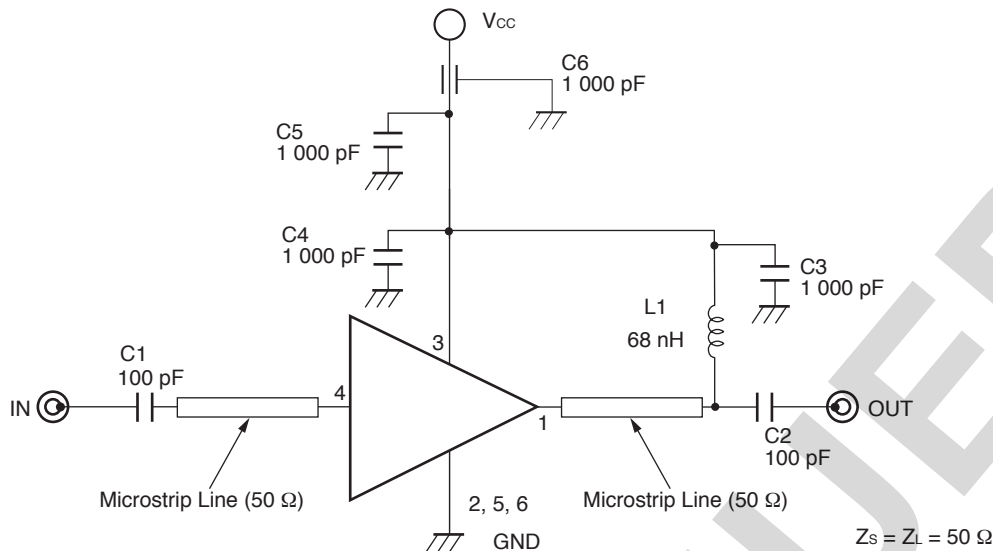
($T_A = +25^{\circ}\text{C}$, $V_{CC} = V_{out} = 3.3\text{ V}$, $Z_S = Z_L = 50\ \Omega$, unless otherwise specified)

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}	$f = 0.25\text{ GHz}$, $P_{in} = -35\text{ dBm}$	26.5	29.5	32.5	dB
Power Gain 2	G_{p2}	$f = 1.0\text{ GHz}$, $P_{in} = -35\text{ dBm}$	27	30	33	dB
Power Gain 3	G_{p3}	$f = 1.8\text{ GHz}$, $P_{in} = -35\text{ dBm}$	28	31	34	dB
Power Gain 4	G_{p4}	$f = 2.2\text{ GHz}$, $P_{in} = -35\text{ dBm}$	28	31	34	dB
Gain 1 dB Compression Output Power 1	$P_{O(1dB)1}$	$f = 1.0\text{ GHz}$	+5.0	+8.0	–	dBm
Gain 1dB Compression Output Power 2	$P_{O(1dB)2}$	$f = 2.2\text{ GHz}$	+3.0	+6.0	–	dBm
Noise Figure 1	NF1	$f = 1.0\text{ GHz}$	–	3.1	3.9	dB
Noise Figure 2	NF2	$f = 2.2\text{ GHz}$	–	3.1	3.9	dB
Isolation 1	ISL1	$f = 1.0\text{ GHz}$, $P_{in} = -35\text{ dBm}$	36	41	–	dB
Isolation 2	ISL2	$f = 2.2\text{ GHz}$, $P_{in} = -35\text{ dBm}$	34	39	–	dB
Input Return Loss 1	RL_{in1}	$f = 1.0\text{ GHz}$, $P_{in} = -35\text{ dBm}$	8.0	11	–	dB
Input Return Loss 2	RL_{in2}	$f = 2.2\text{ GHz}$, $P_{in} = -35\text{ dBm}$	8.5	12	–	dB
Output Return Loss 1	RL_{out1}	$f = 1.0\text{ GHz}$, $P_{in} = -35\text{ dBm}$	9.0	12	–	dB
Output Return Loss 2	RL_{out2}	$f = 2.2\text{ GHz}$, $P_{in} = -35\text{ dBm}$	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.

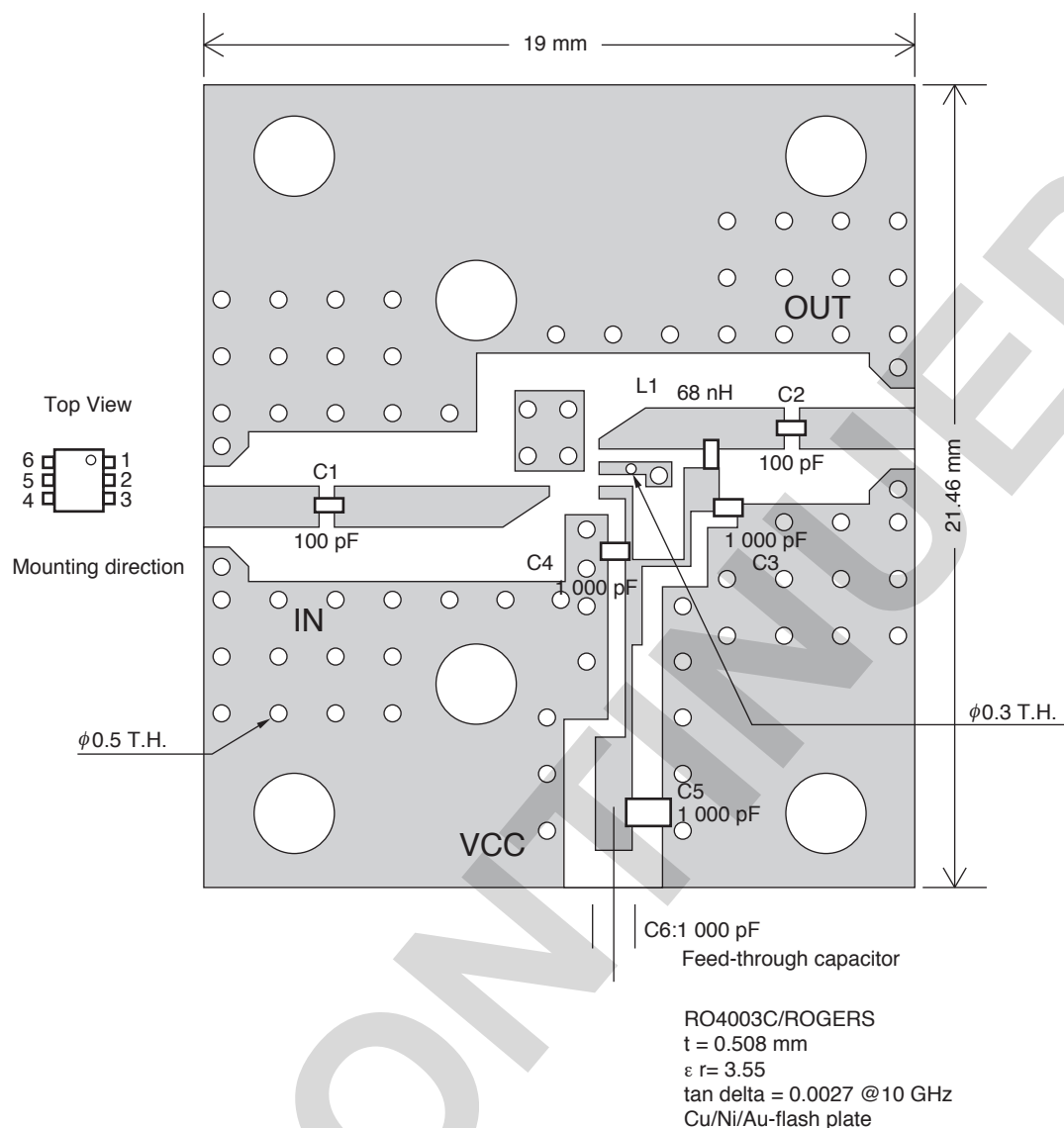
In terms of DC, the inductor biases the output transistor with minimum voltage drop to output enable high level. In terms of AC, the inductor makes output-port impedance higher to get enough gain. In this case, large inductance and Q is suitable (Refer to the following page).

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.

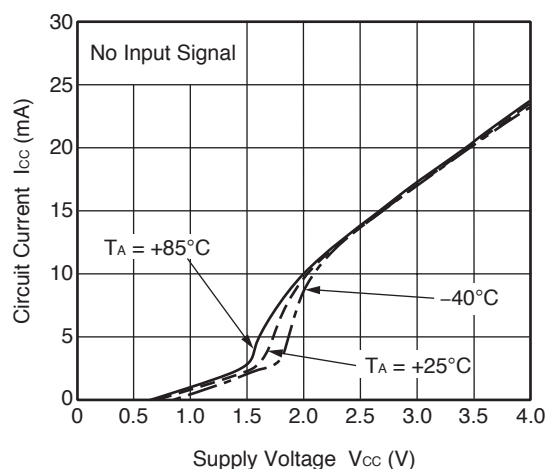
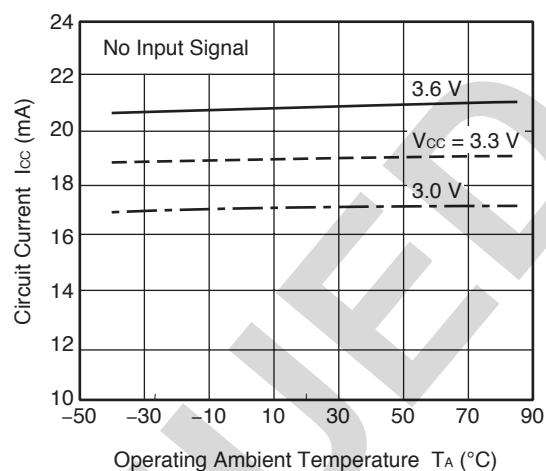
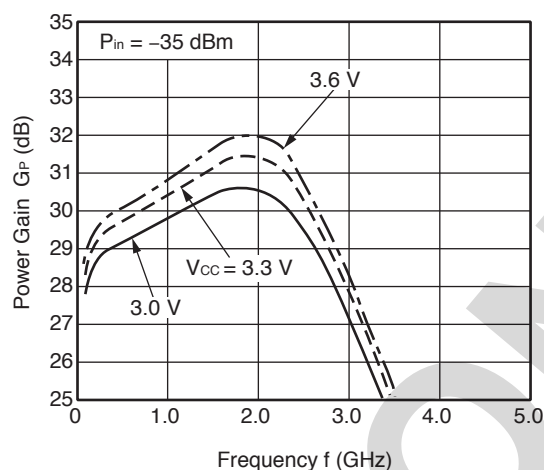
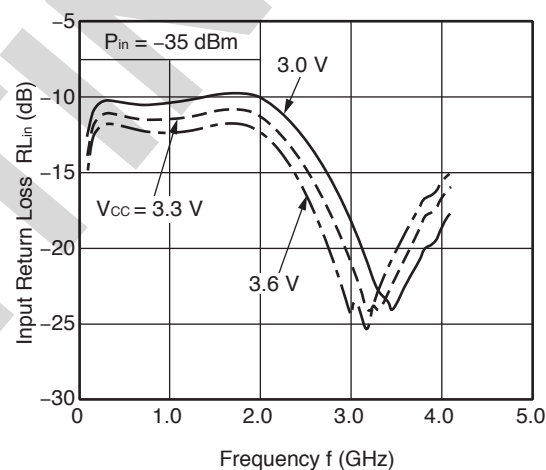
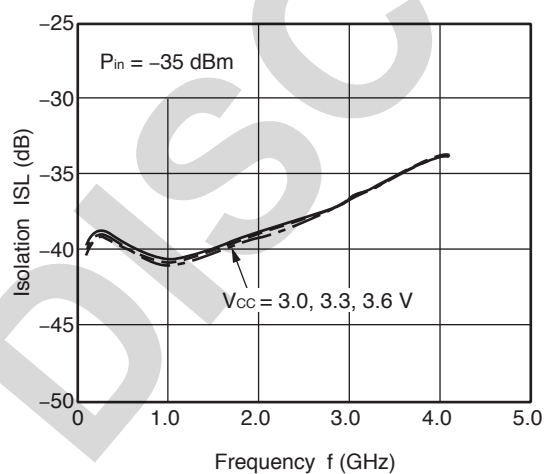
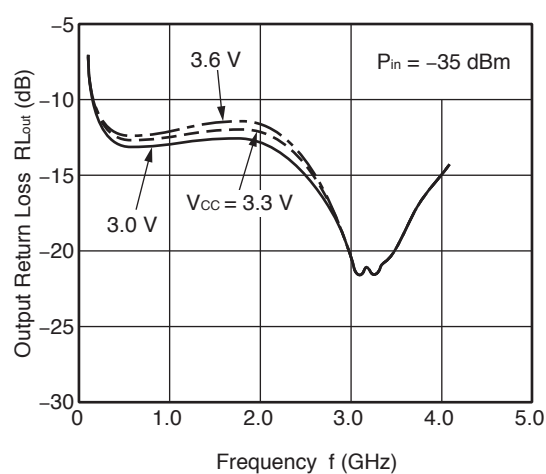
The coupling capacitors, connected to the input and output pins, are used to cut the DC and minimize RF serial impedance. Their capacitances are therefore selected as lower impedance against a 50 Ω load. The capacitors thus perform as high pass filters, suppressing low frequencies to DC.

EVALUATION CIRCUIT**COMPONENT LIST**

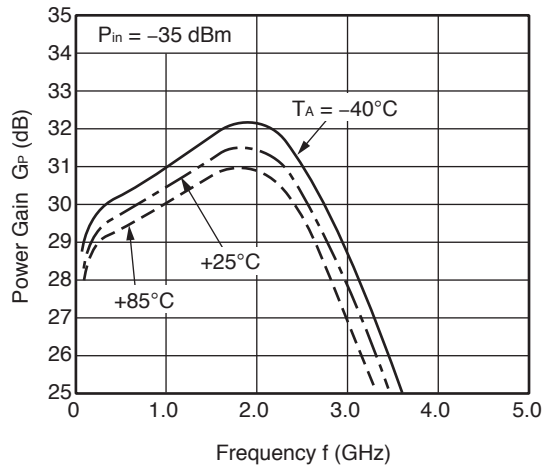
	Type	Value	size
L1	Chip Inductor	68 nH	1005
C1, C2	Chip Capacitor	100 pF	1005
C3, C4	Chip Capacitor	1 000 pF	1005
C5	Chip Capacitor	1 000 pF	1608
C6	Feed-through Capacitor	1 000 pF	–

Notes:

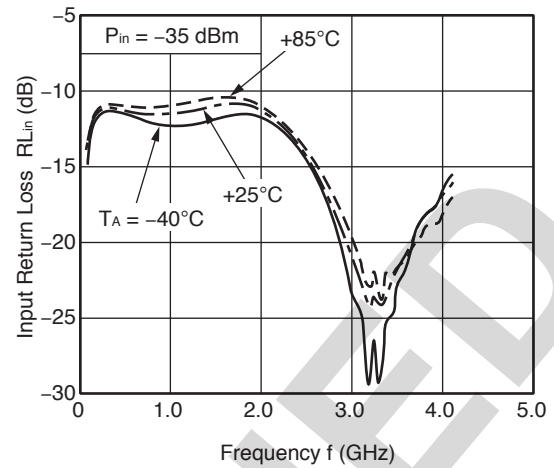
1. 21.46 × 19 × 0.508 mm double sided 18 μm copper clad polyimide board.
2. Back side: GND pattern.
3. Solder plated on pattern.
4. ○○: Through holes

TYPICAL CHARACTERISTICS**($T_A = +25^\circ\text{C}$, $V_{CC} = V_{out} = 3.3\text{ V}$, $Z_S = Z_L = 50\ \Omega$, unless otherwise specified)****CIRCUIT CURRENT vs. SUPPLY VOLTAGE****CIRCUIT 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.

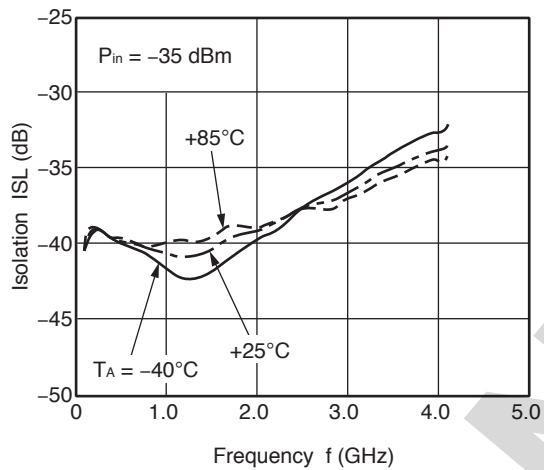
POWER GAIN vs. FREQUENCY



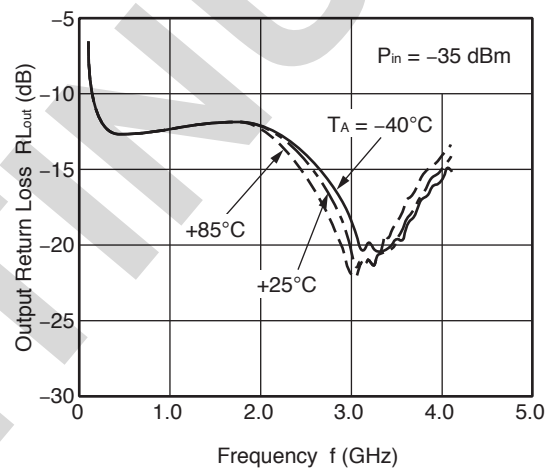
INPUT RETURN LOSS vs. FREQUENCY



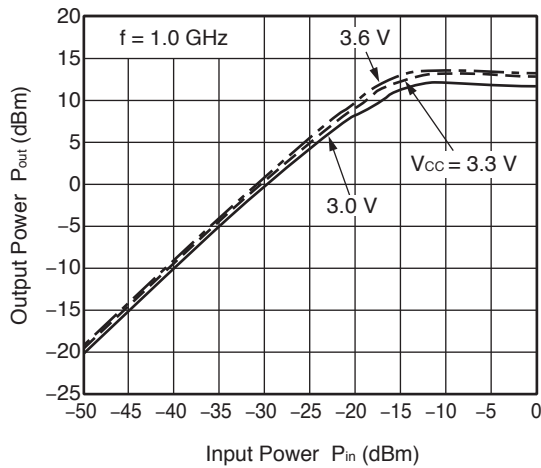
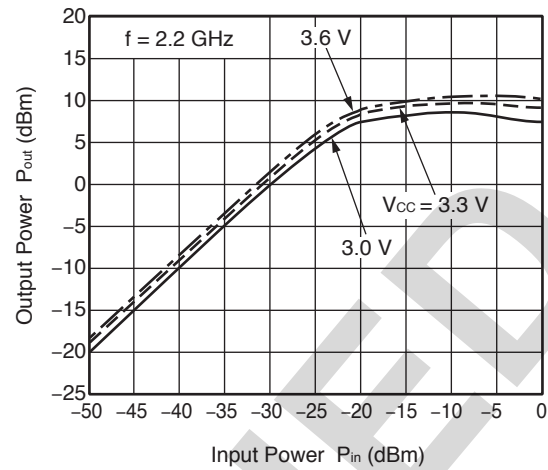
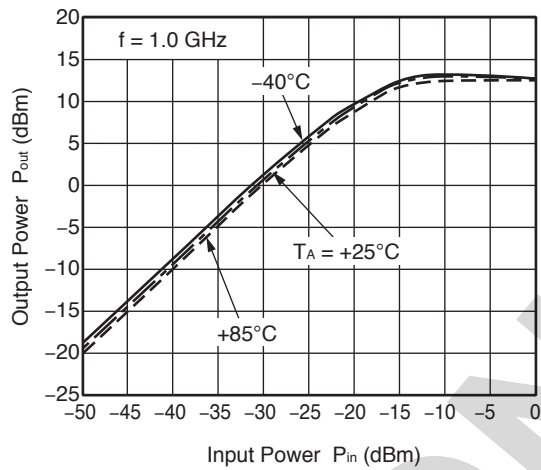
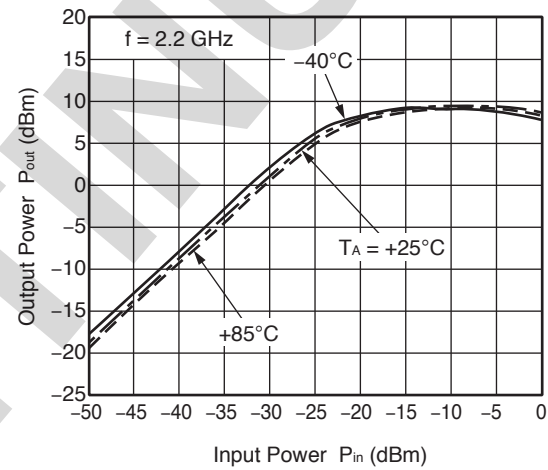
ISOLATION vs. FREQUENCY



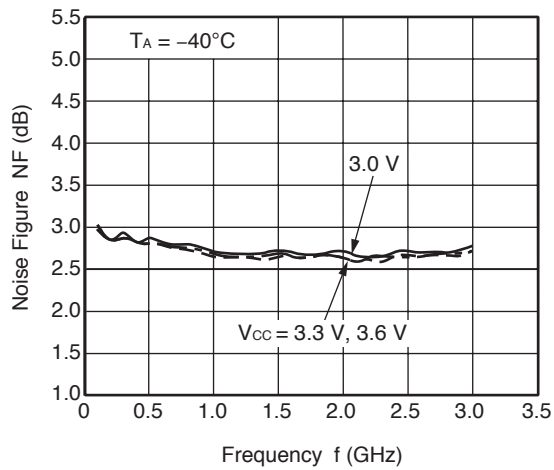
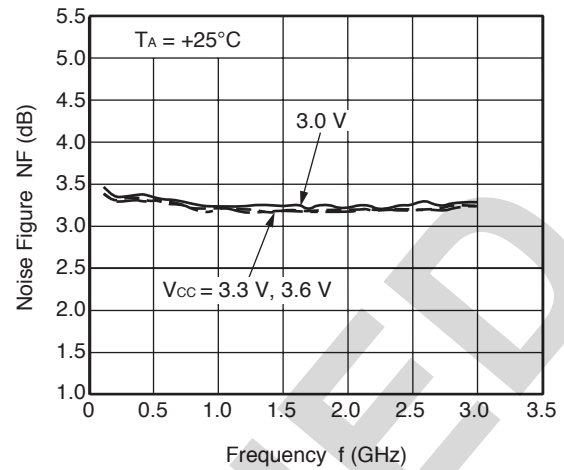
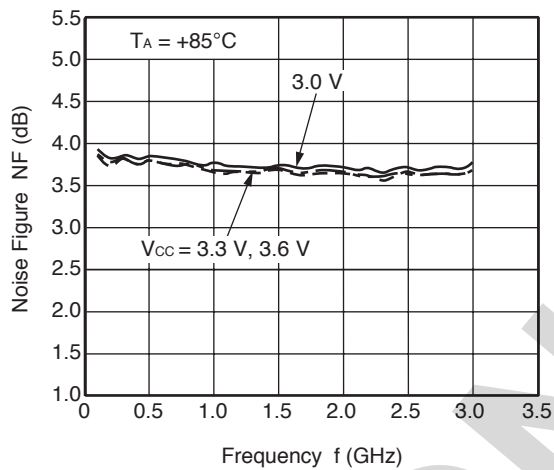
OUTPUT RETURN LOSS vs. FREQUENCY



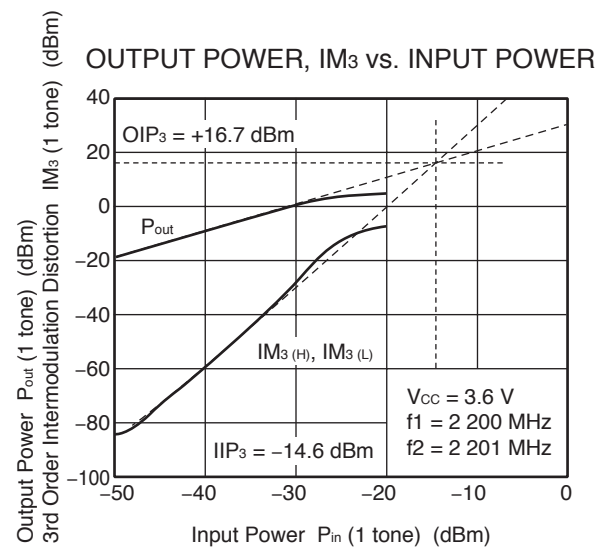
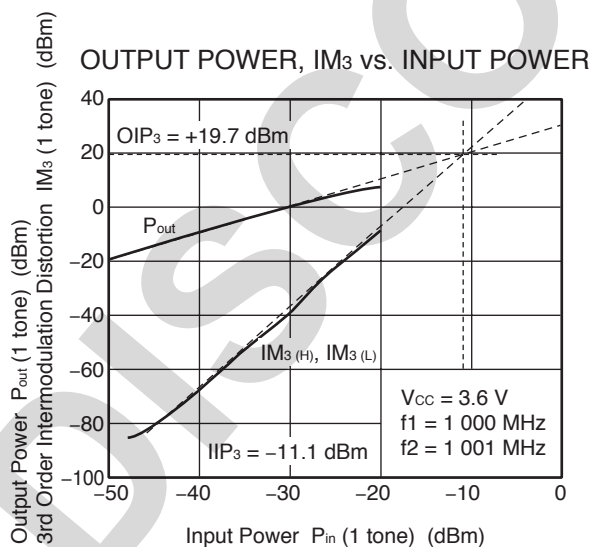
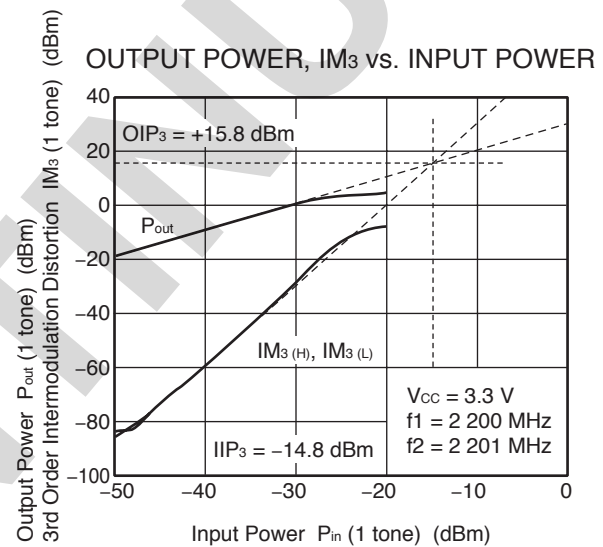
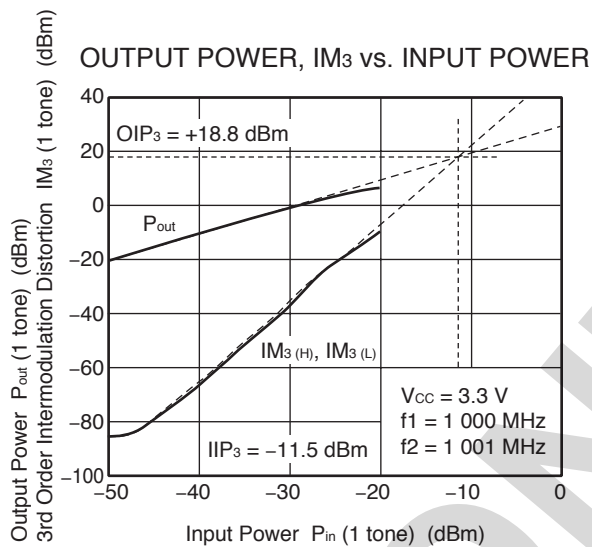
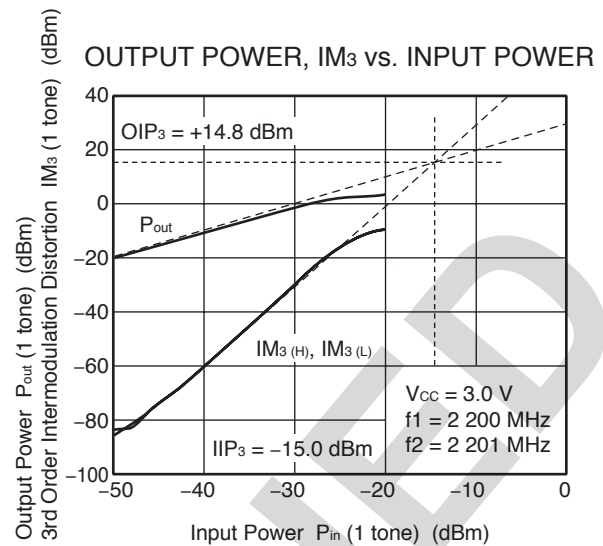
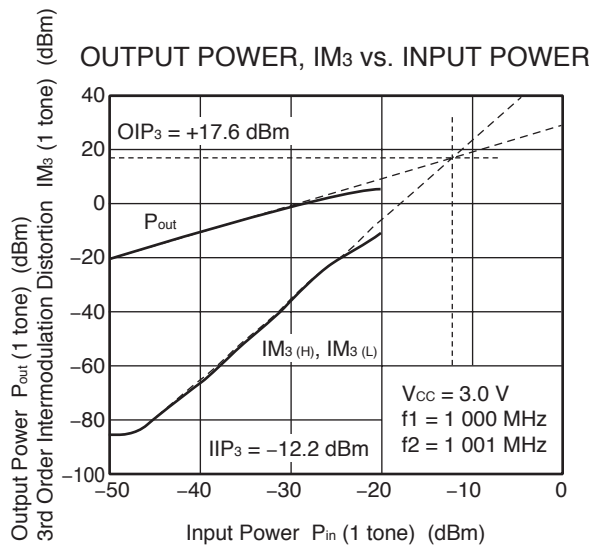
Remark The graphs indicate nominal characteristics.

OUTPUT POWER vs. INPUT POWER**OUTPUT POWER vs. INPUT POWER****OUTPUT POWER vs. INPUT POWER****OUTPUT POWER vs. INPUT POWER**

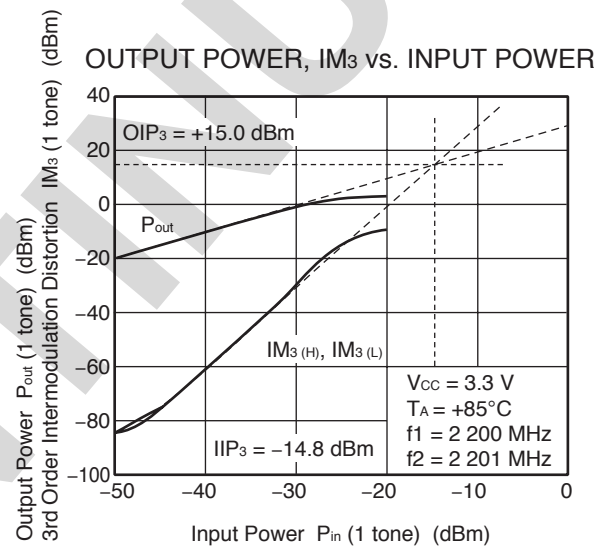
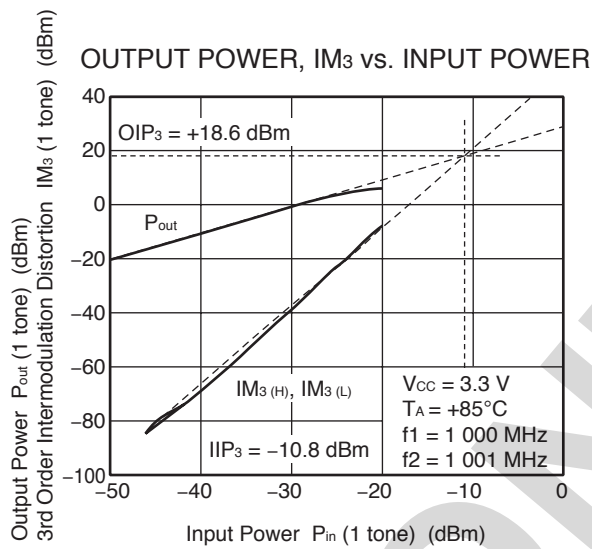
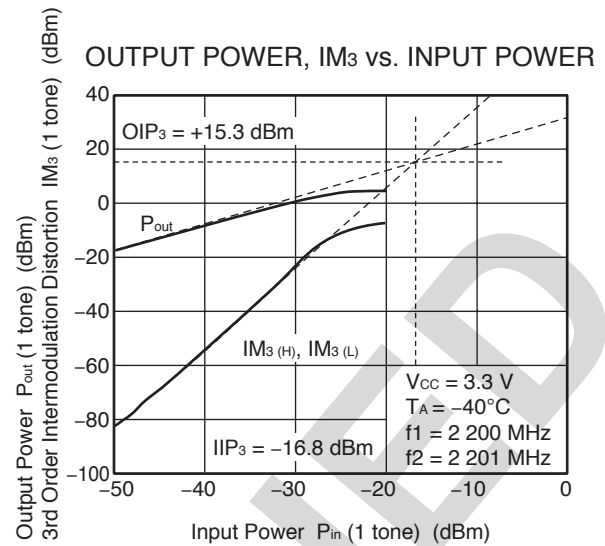
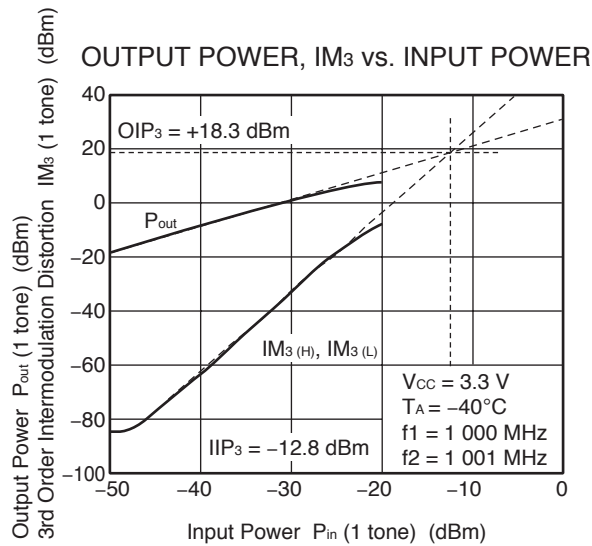
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NOISE FIGURE vs. FREQUENCY**NOISE FIGURE vs. FREQUENCY****NOISE FIGURE vs. FREQUENCY**

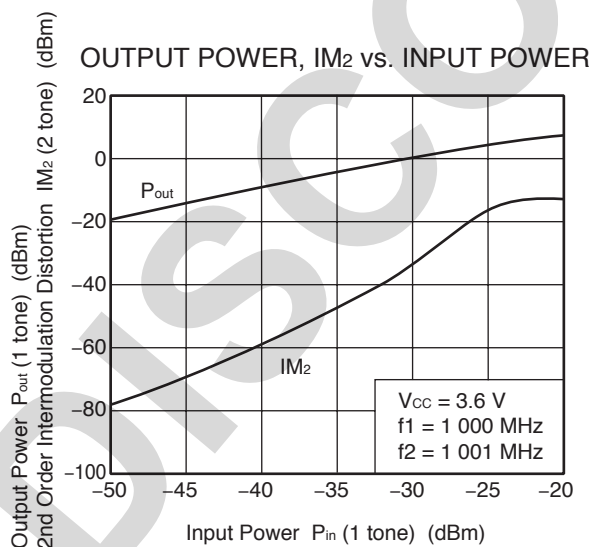
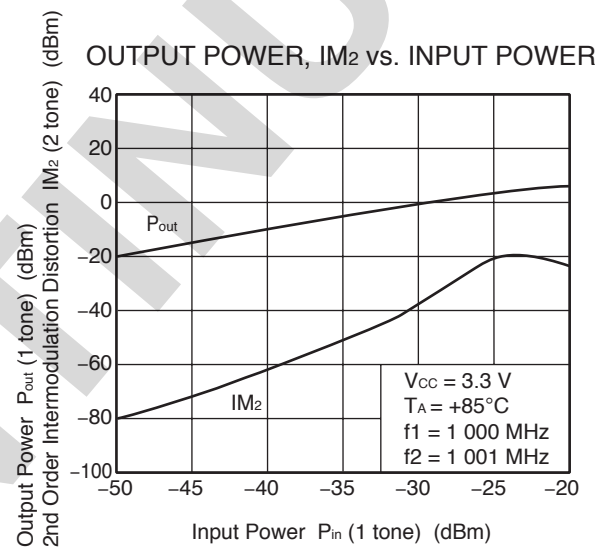
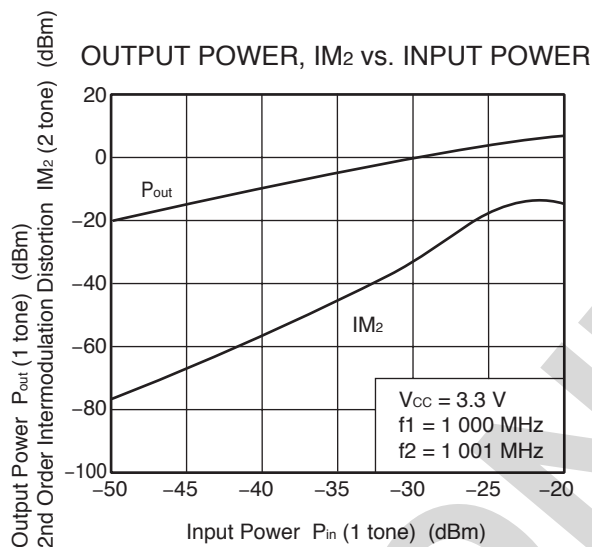
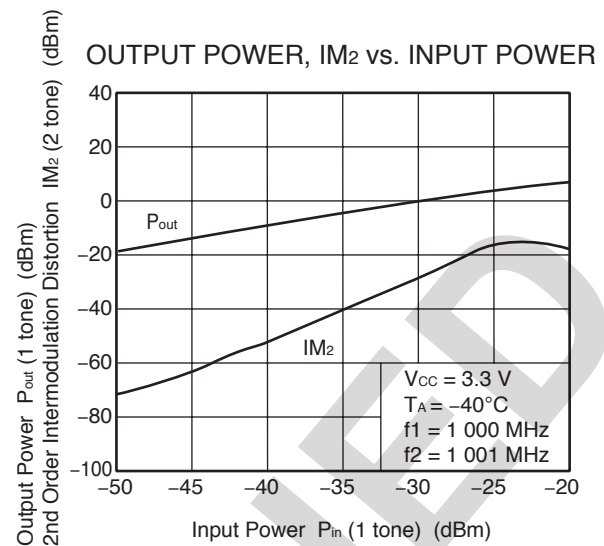
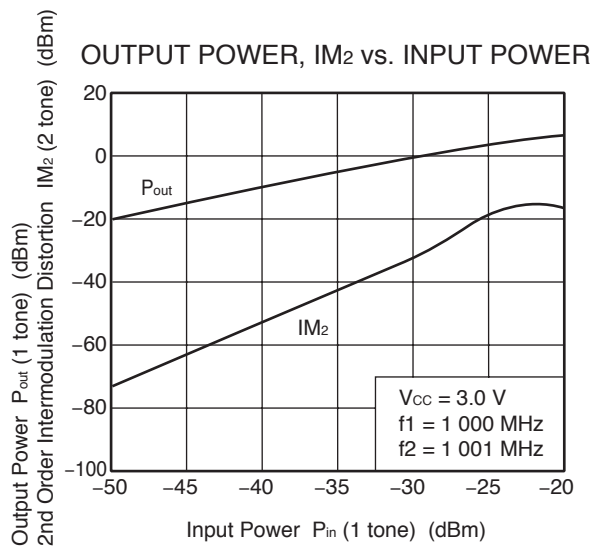
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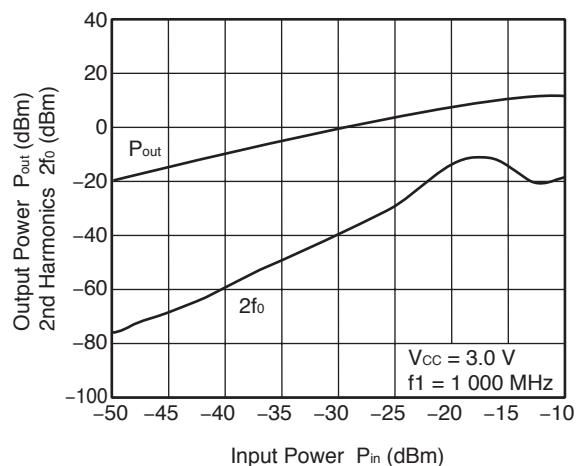
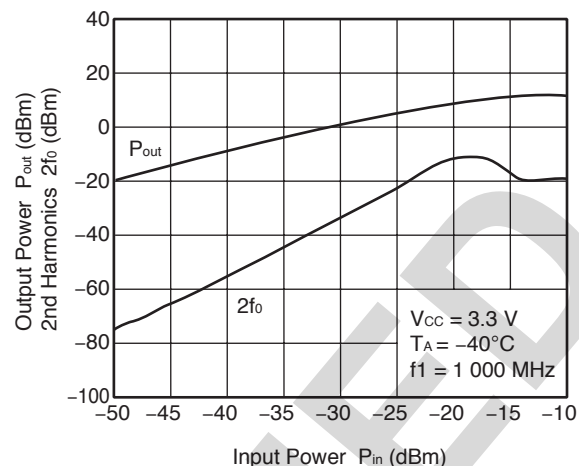
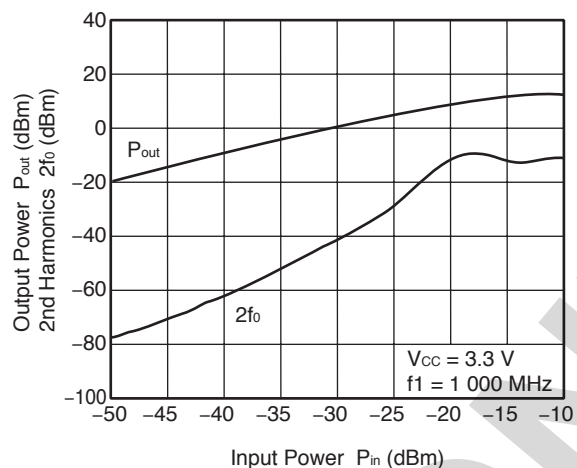
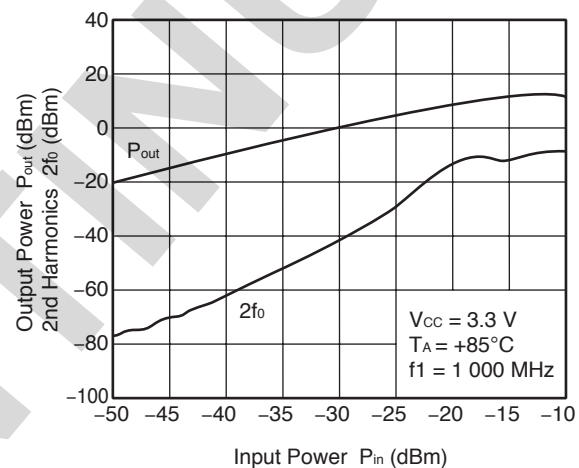
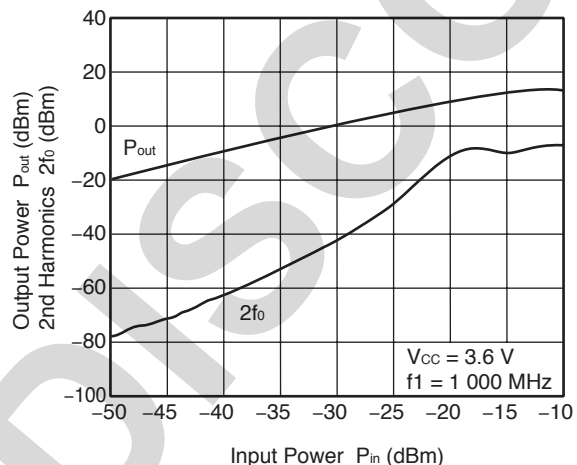
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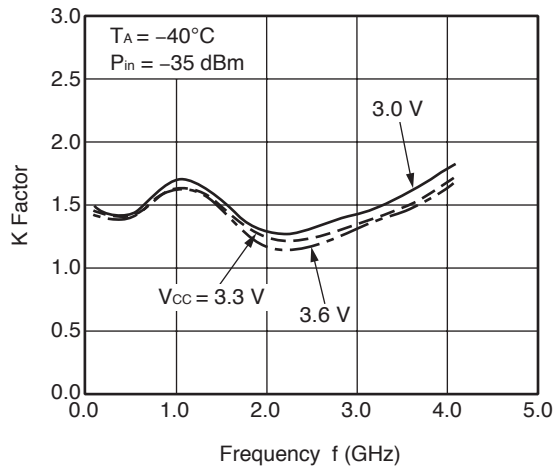
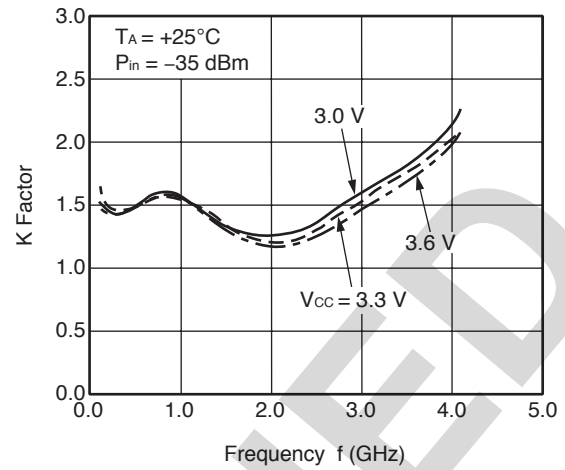
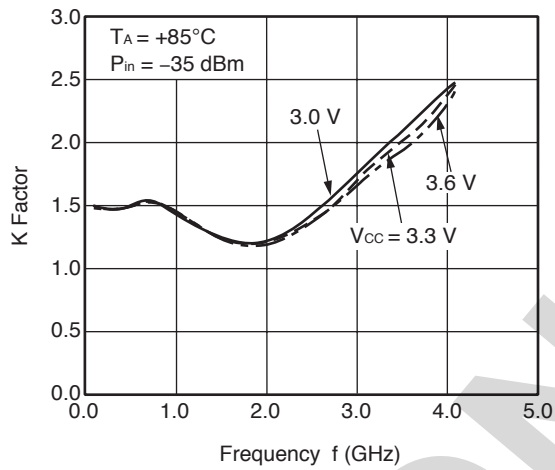
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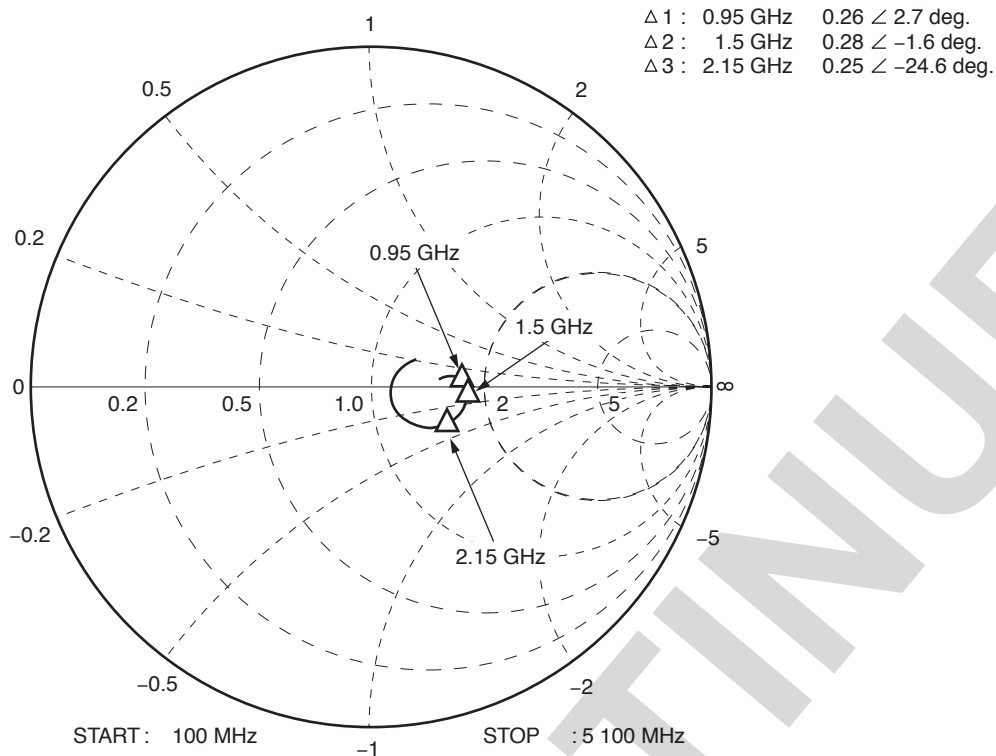
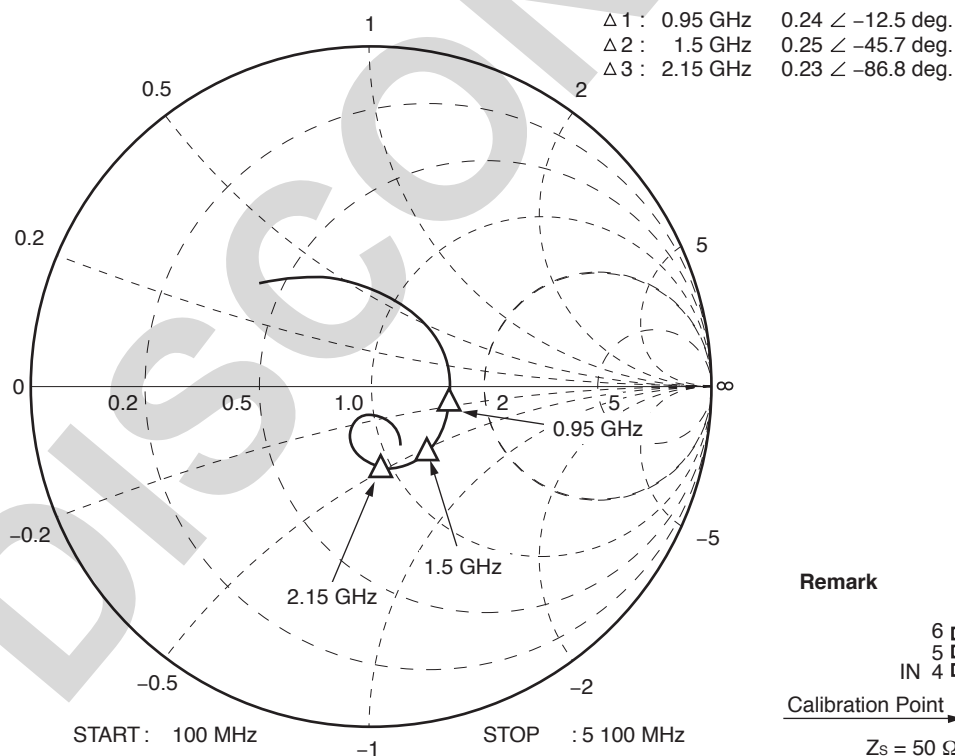
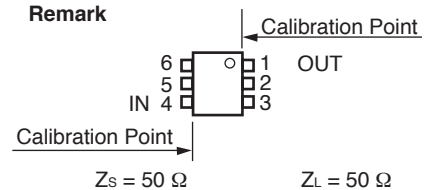
Remark The graphs indicate nominal characteristics.

OUTPUT POWER, $2f_0$ vs. INPUT POWEROUTPUT POWER, $2f_0$ vs. INPUT POWEROUTPUT POWER, $2f_0$ vs. INPUT POWEROUTPUT POWER, $2f_0$ vs. INPUT POWEROUTPUT POWER, $2f_0$ vs. INPUT POWER

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 ($T_A = +25^\circ\text{C}$, $V_{CC} = V_{out} = 3.3\text{ V}$, $P_{in} = -35\text{ dBm}$, $Z_O = 50\ \Omega$) **S_{11} -FREQUENCY** **S_{22} -FREQUENCY****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>

DISCONTINUED

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 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	IR260
Wave Soldering	Peak temperature (molten solder temperature) : 260°C or below 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	WS260
Partial Heating	Peak temperature (package surface temperature) : 350°C or below Soldering time (per side of device) : 3 seconds or less Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	HS350

CAUTION

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

Revision History	μPC3244TB Data Sheet
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Rev.	Date	Description	
		Page	Summary
1.00	Mar 28, 2011	—	First edition issued

DISCONTINUED

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