μPC3245TB

SiGe BiCMOS Integrated Circuit
Wideband Amplifier IC with 3-Step Gain Selection Function

R09DS0027EJ0100
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DESCRIPTION

The μPC3245TB is a wideband amplifier IC mainly designed for SW Box and IF amplifier in DBS LNB application. This IC has 3-step gain selection function.

This IC is manufactured using our latest SiGe BiCMOS process that shows superior high frequency characteristics.

FEATURES

- Low voltage operation : V_{CC} = 3.0 to 3.6 V (3.3 V TYP.)
- Power gain
  - (High-gain mode) : G_P = 20.5 dB TYP. @ f = 1.0 GHz
  - : G_P = 22 dB TYP. @ f = 2.2 GHz
  - (Middle-gain mode) : G_P = 14.5 dB TYP. @ f = 1.0 GHz
  - : G_P = 15.5 dB TYP. @ f = 2.2 GHz
  - (Low-gain mode) : G_P = 8.5 dB TYP. @ f = 1.0 GHz
  - : G_P = 9.5 dB TYP. @ f = 2.2 GHz
- High linearity
  - (High-gain mode) : $P_{O\,(1\,dB)}$ = +10.5 dBm TYP. @ f = 1.0 GHz
  - : $P_{O\,(1\,dB)}$ = +8.5 dBm TYP. @ f = 2.2 GHz
  - (Middle-gain mode) : $P_{O\,(1\,dB)}$ = +11 dBm TYP. @ f = 1.0 GHz
  - : $P_{O\,(1\,dB)}$ = +9.5 dBm TYP. @ f = 2.2 GHz
  - (Low-gain mode) : $P_{O\,(1\,dB)}$ = +10.5 dBm TYP. @ f = 1.0 GHz
  - : $P_{O\,(1\,dB)}$ = +9.5 dBm TYP. @ f = 2.2 GHz

APPLICATIONS

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

ORDERING INFORMATION

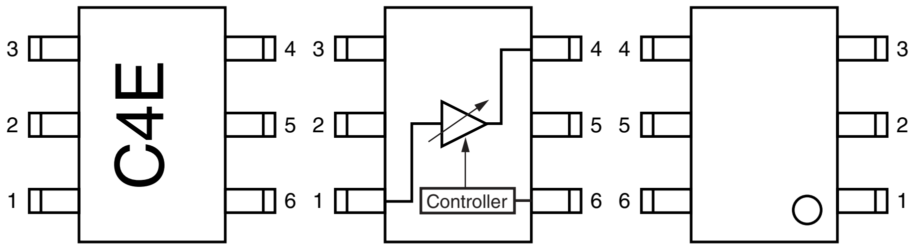
Part Number	Order Number	Package	Marking	Supplying Form
μPC3245TB-E3	μPC3245TB-E3-A	6-pin super minimold (Pb-Free)	C4E	• Embossed tape 8 mm wide • Pin 1, 2, 3 face the perforation side of the tape • Qty 3 kpcs/reel

Remark To order evaluation samples, please contact your nearby sales office.
Part number for sample order: μPC3245TB

CAUTION

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

PIN CONNECTIONS, MARKING AND INTERNAL BLOCK DIAGRAM



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

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C	4.0	V
Circuit Current	I_{CC}	T_A = +25°C	60	mA
Gain Selection Voltage	$V_{Gselect}$	T_A = +25°C	4.0	V
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	+10	dBm

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

RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}	3.0	3.3	3.6	V
Gain Selection Voltage 1 (High-Gain Mode)	$V_{Gselect}1$	–0.2	0	0.2	V
Gain Selection Voltage 2 (Low-Gain Mode) **Note**	$V_{Gselect}2$	3.0	3.3	3.6	V
Operating Frequency	f	0.25	–	3	GHz
Operating Ambient Temperature	T_A	–40	+25	+85	°C

Note: $V_{CC} – 0.2 V \le V_{Gselect}2 \le V_{CC} + 0.2 V$

ELECTRICAL CHARACTERISTICS 1 (HIGH-GAIN MODE)
(T_A = +25°C, V_{CC} = 3.3 V, Gselect = GND, $Z_S = Z_L$ = 50 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No input signal	22	27.5	33.5	mA
Power Gain 1	G_P1	f = 1.0 GHz, P_{in} = –30 dBm	18	20.5	23	dB
Power Gain 2	G_P2	f = 2.2 GHz, P_{in} = –30 dBm	19	22	25	dB
Gain 1 dB Compression Output Power 1	$P_{O (1 dB)}1$	f = 1.0 GHz	+7.5	+10.5	–	dBm
Gain 1 dB Compression Output Power 2	$P_{O (1 dB)}2$	f = 2.2 GHz	+5.5	+8.5	–	dBm
Input Return Loss 1	$RL_{in}1$	f = 1.0 GHz, P_{in} = –30 dBm	7	10.5	–	dB
Input Return Loss 2	$RL_{in}2$	f = 2.2 GHz, P_{in} = –30 dBm	10	17	–	dB
Output Return Loss 1	$RL_{out}1$	f = 1.0 GHz, P_{in} = –30 dBm	10	32	–	dB
Output Return Loss 2	$RL_{out}2$	f = 2.2 GHz, P_{in} = –30 dBm	7	11.5	–	dB

ELECTRICAL CHARACTERISTICS 2 (MIDDLE-GAIN MODE)
(T_A = +25°C, V_{CC} = 3.3 V, Gselect = Open, Z_S = Z_L = 50 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No input signal	22	27.5	33.5	mA
Power Gain 1	G_P1	f = 1.0 GHz, P_{in} = –30 dBm	12.5	14.5	16.5	dB
Power Gain 2	G_P2	f = 2.2 GHz, P_{in} = –30 dBm	13	15.5	18	dB
Gain 1 dB Compression Output Power 1	$P_{O\ (1\ dB)}\ 1$	f = 1.0 GHz	+8	+11	–	dBm
Gain 1 dB Compression Output Power 2	$P_{O\ (1\ dB)}\ 2$	f = 2.2 GHz	+6.5	+9.5	–	dBm
Input Return Loss 1	$RL_{in}1$	f = 1.0 GHz, P_{in} = –30 dBm	10	16.5	–	dB
Input Return Loss 2	$RL_{in}2$	f = 2.2 GHz, P_{in} = –30 dBm	7	12	–	dB
Output Return Loss 1	$RL_{out}1$	f = 1.0 GHz, P_{in} = –30 dBm	10	18.5	–	dB
Output Return Loss 2	$RL_{out}2$	f = 2.2 GHz, P_{in} = –30 dBm	7	15.5	–	dB

ELECTRICAL CHARACTERISTICS 3 (LOW-GAIN MODE)
(T_A = +25°C, V_{CC} = 3.3 V, Gselect = V_{CC}, Z_S = Z_L = 50 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No input signal	24	29	35	mA
Power Gain 1	G_P1	f = 1.0 GHz, P_{in} = –30 dBm	6.5	8.5	10.5	dB
Power Gain 2	G_P2	f = 2.2 GHz, P_{in} = –30 dBm	7	9.5	12	dB
Gain 1 dB Compression Output Power 1	$P_{O\ (1\ dB)}\ 1$	f = 1.0 GHz	+7.5	+10.5	–	dBm
Gain 1 dB Compression Output Power 2	$P_{O\ (1\ dB)}\ 2$	f = 2.2 GHz	+6.5	+9.5	–	dBm
Input Return Loss 1	$RL_{in}1$	f = 1.0 GHz, P_{in} = –30 dBm	10	19	–	dB
Input Return Loss 2	$RL_{in}2$	f = 2.2 GHz, P_{in} = –30 dBm	7	15.5	–	dB
Output Return Loss 1	$RL_{out}1$	f = 1.0 GHz, P_{in} = –30 dBm	10	24	–	dB
Output Return Loss 2	$RL_{out}2$	f = 2.2 GHz, P_{in} = –30 dBm	10	18	–	dB

STANDARD CHARACTERISTICS FOR REFERENCE 1 (HIGH-GAIN MODE)
(T_A = +25°C, V_{CC} = 3.3 V, Gselect = GND, Z_S = Z_L = 50 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	Reference Value	Unit
Power Gain 3	G_P3	f = 0.25 GHz, P_{in} = –30 dBm	18	dB
Power Gain 4	G_P4	f = 2.6 GHz, P_{in} = –30 dBm	20.5	dB
Power Gain 5	G_P5	f = 3.0 GHz, P_{in} = –30 dBm	18	dB
Gain Flatness	ΔG_P	f = 1.0 GHz to 2.2 GHz, P_{in} = –30 dBm	1.5	dB
Isolation 1	ISL1	f = 1.0 GHz, P_{in} = –30 dBm	31	dB
Isolation 2	ISL2	f = 2.2 GHz, P_{in} = –30 dBm	30	dB
Noise Figure 1	NF1	f = 1.0 GHz	4.0	dB
Noise Figure 2	NF2	f = 2.2 GHz	4.0	dB
Output 3rd Order Intercept Point 1	$OIP_3\ 1$	f1 = 1 000 MHz, f2 = 1 001 MHz	+22	dBm
Output 3rd Order Intercept Point 2	$OIP_3\ 2$	f1 = 2 200 MHz, f2 = 2 201 MHz	+20	dBm
2nd Order Intermodulation Distortion	IM_2	f1 = 1 000 MHz, f2 = 1 001 MHz, P_{out} = –5 dBm/tone	42	dBc
2nd Harmonic	$2f_0$	f0 = 1.0 GHz, P_{out} = –15 dBm	53	dBc

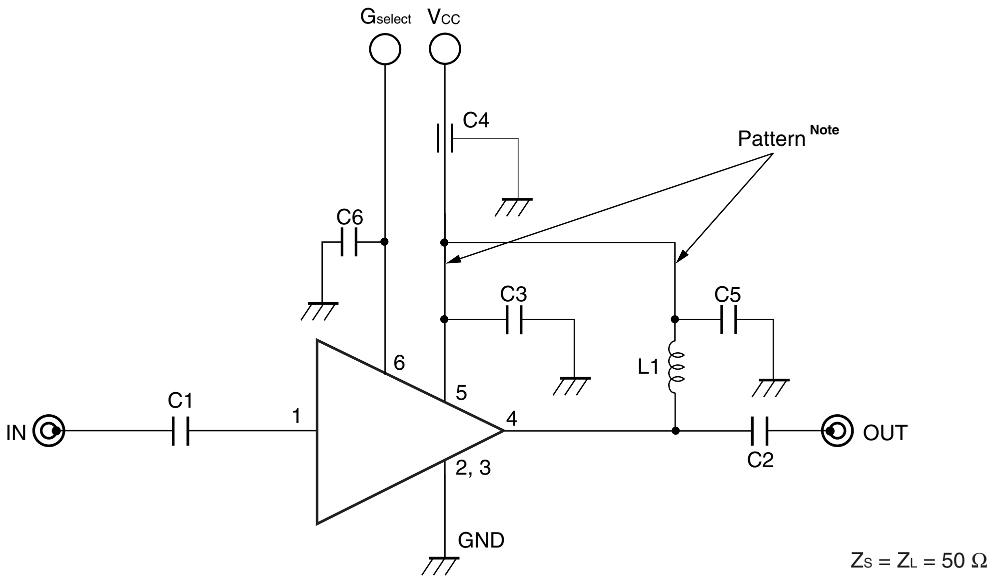
STANDARD CHARACTERISTICS FOR REFERENCE 2 (MIDDLE-GAIN MODE) (T_A = +25°C, V_{CC} = 3.3 V, Gselect = Open, Z_S = Z_L = 50 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	Reference Value	Unit
Power Gain 3	G_P3	f = 0.25 GHz, P_{in} = –30 dBm	14.5	dB
Power Gain 4	G_P4	f = 2.6 GHz, P_{in} = –30 dBm	15.5	dB
Power Gain 5	G_P5	f = 3.0 GHz, P_{in} = –30 dBm	14.5	dB
Gain Flatness	ΔG_P	f = 1.0 GHz to 2.2 GHz, P_{in} = –30 dBm	1.0	dB
Isolation 1	ISL1	f = 1.0 GHz, P_{in} = –30 dBm	24.5	dB
Isolation 2	ISL2	f = 2.2 GHz, P_{in} = –30 dBm	24.5	dB
Noise Figure 1	NF1	f = 1.0 GHz	6.0	dB
Noise Figure 2	NF2	f = 2.2 GHz	6.5	dB
Output 3rd Order Intercept Point 1	OIP_3 1	f1 = 1 000 MHz, f2 = 1 001 MHz	+24	dBm
Output 3rd Order Intercept Point 2	OIP_3 2	f1 = 2 200 MHz, f2 = 2 201 MHz	+21	dBm
2nd Order Intermodulation Distortion	IM_2	f1 = 1 000 MHz, f2 = 1 001 MHz, P_{out} = –5 dBm/tone	49	dBc
2nd Harmonic	$2f_0$	f0 = 1.0 GHz, P_{out} = –15 dBm	62	dBc

STANDARD CHARACTERISTICS FOR REFERENCE 3 (LOW-GAIN MODE) (T_A = +25°C, V_{CC} = 3.3 V, Gselect = V_{CC}, Z_S = Z_L = 50 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	Reference Value	Unit
Power Gain 3	G_P3	f = 0.25 GHz, P_{in} = –30 dBm	8	dB
Power Gain 4	G_P4	f = 2.6 GHz, P_{in} = –30 dBm	10	dB
Power Gain 5	G_P5	f = 3.0 GHz, P_{in} = –30 dBm	10	dB
Gain Flatness	ΔG_P	f = 1.0 GHz to 2.2 GHz, P_{in} = –30 dBm	1.0	dB
Isolation 1	ISL1	f = 1.0 GHz, P_{in} = –30 dBm	21	dB
Isolation 2	ISL2	f = 2.2 GHz, P_{in} = –30 dBm	24	dB
Noise Figure 1	NF1	f = 1.0 GHz	9.0	dB
Noise Figure 2	NF2	f = 2.2 GHz	9.0	dB
Output 3rd Order Intercept Point 1	OIP_3 1	f1 = 1 000 MHz, f2 = 1 001 MHz	+23	dBm
Output 3rd Order Intercept Point 2	OIP_3 2	f1 = 2 200 MHz, f2 = 2 201 MHz	+21	dBm
2nd Order Intermodulation Distortion	IM_2	f1 = 1 000 MHz, f2 = 1 001 MHz, P_{out} = –5 dBm/tone	50	dBc
2nd Harmonic	$2f_0$	f0 = 1.0 GHz, P_{out} = –15 dBm	64	dBc

TEST CIRCUIT



Note: The power supply to 4 pin and 5 pin is separated and supplied by the pattern.

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

Gselect PIN CONNECTION

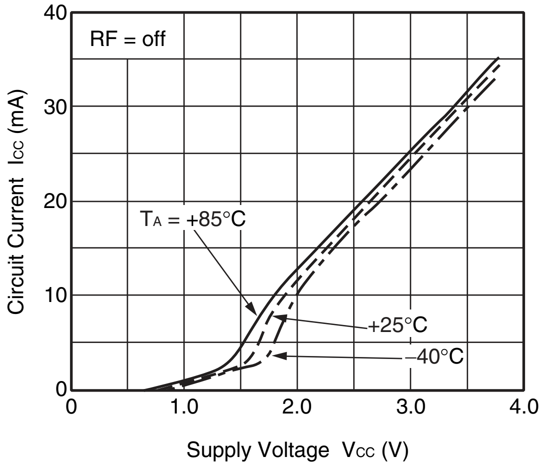
Gselect	Mode
GND	High-Gain Mode
OPEN	Middle-Gain Mode
V_{CC}	Low-Gain Mode

COMPONENTS LIST

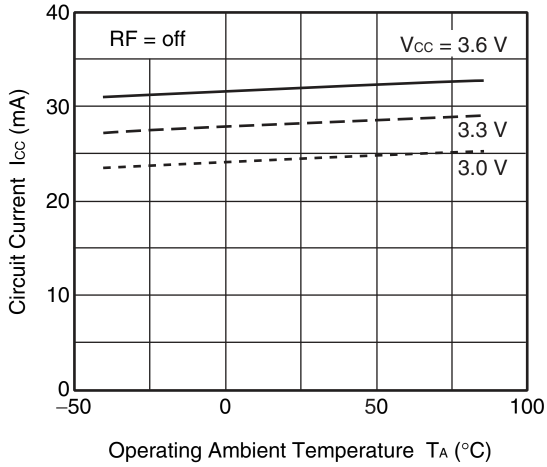
Symbol	Type	Value	Unit
L1	Chip Inductor	47	nH
C1, C2	Chip Capacitor	100	pF
C3	Chip Capacitor	1 000	pF
C4	Feed-through Capacitor	1 000	pF
C5, C6	Chip Capacitor	1 000	pF

TYPICAL CHARACTERISTICS 1 (HIGH-GAIN MODE)
(T_A = +25°C, V_{CC} = 3.3 V, Gselect = GND, Z_S = Z_L = 50 Ω, unless otherwise specified)

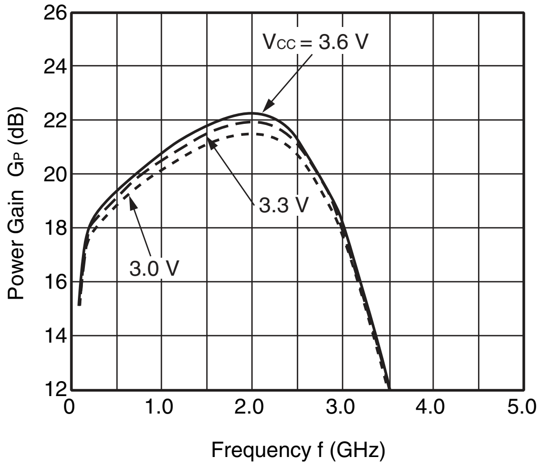
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



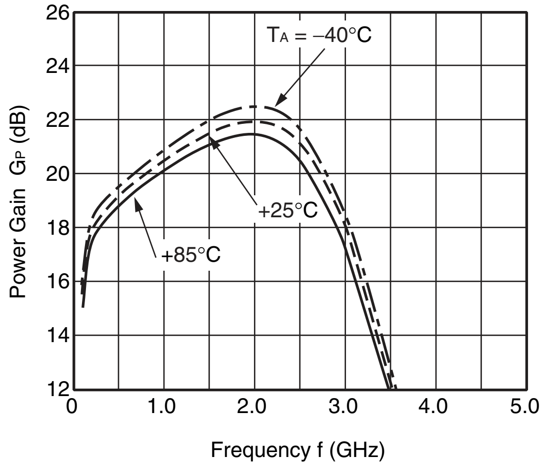
CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



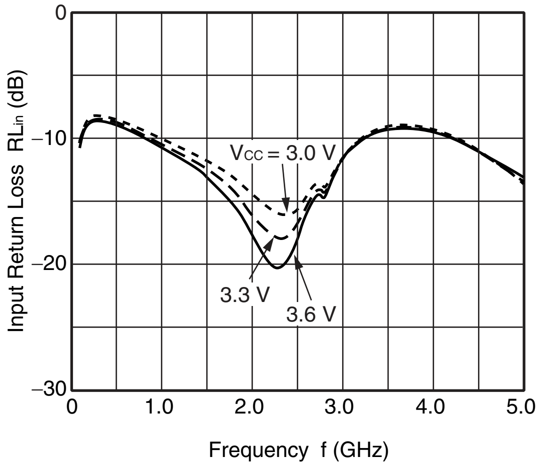
POWER GAIN vs. FREQUENCY



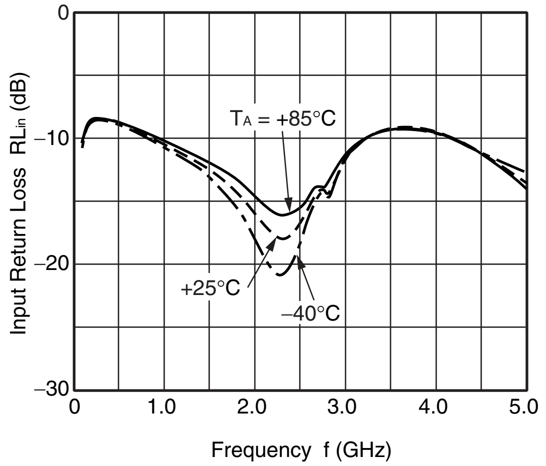
POWER GAIN vs. FREQUENCY



INPUT RETURN LOSS vs. FREQUENCY

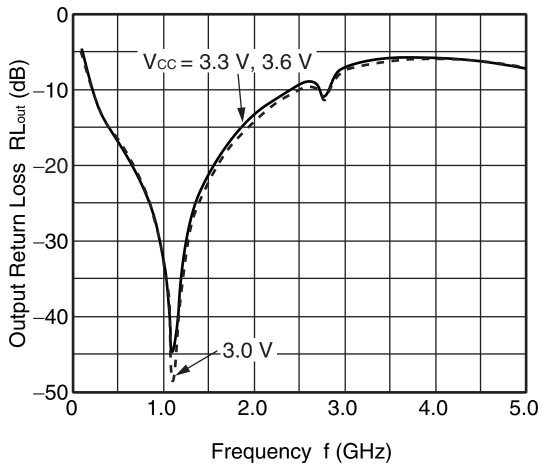


INPUT RETURN LOSS vs. FREQUENCY

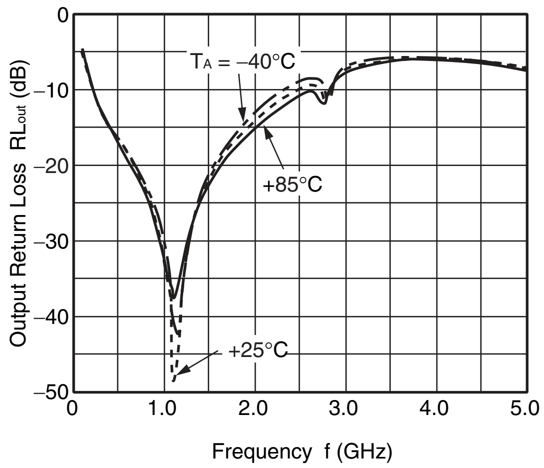


Remark The graphs indicate nominal characteristics.

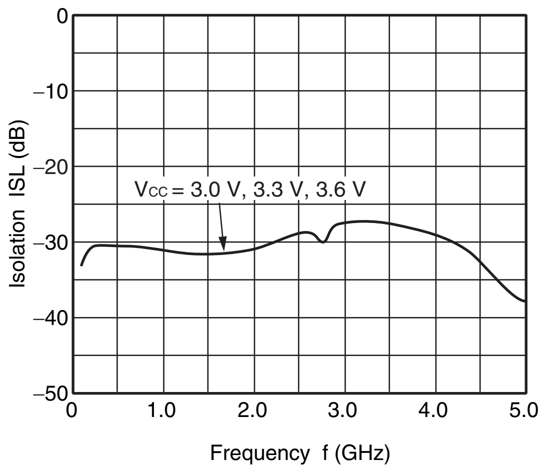
OUTPUT RETURN LOSS vs. FREQUENCY



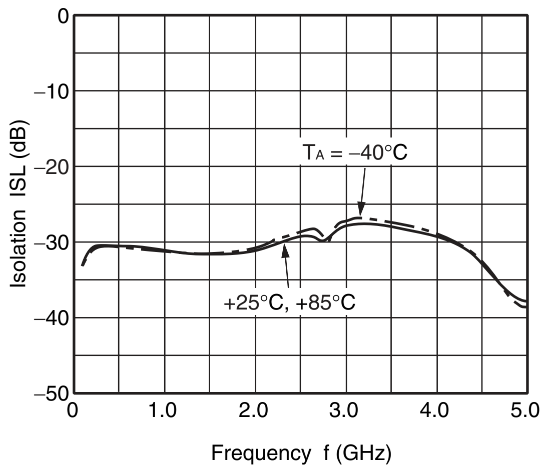
OUTPUT RETURN LOSS vs. FREQUENCY



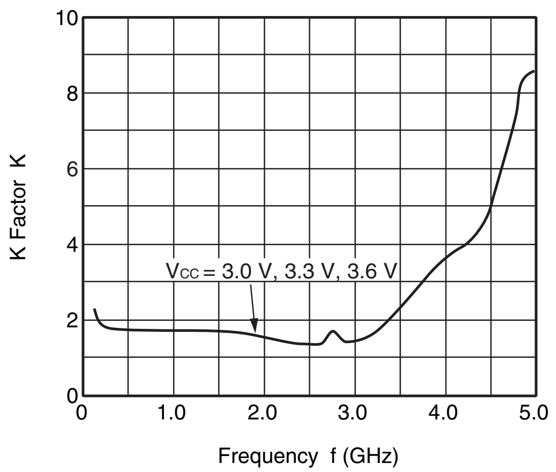
ISOLATION vs. FREQUENCY



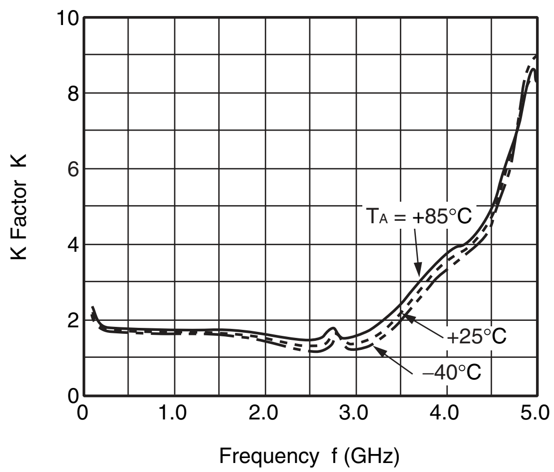
ISOLATION vs. FREQUENCY



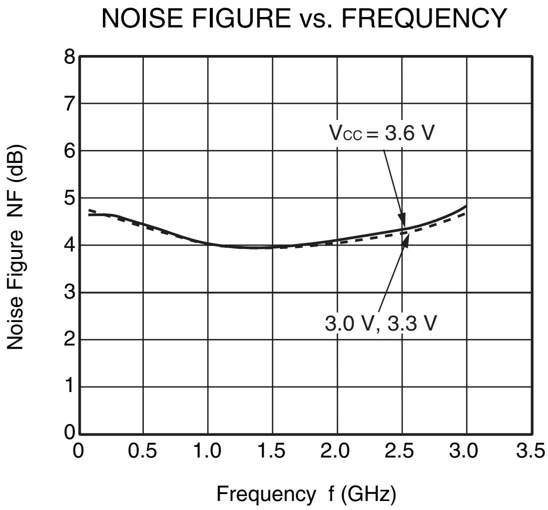
K FACTOR vs. FREQUENCY

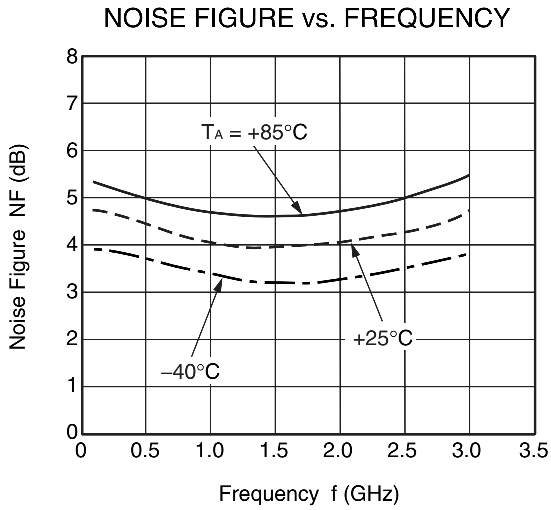


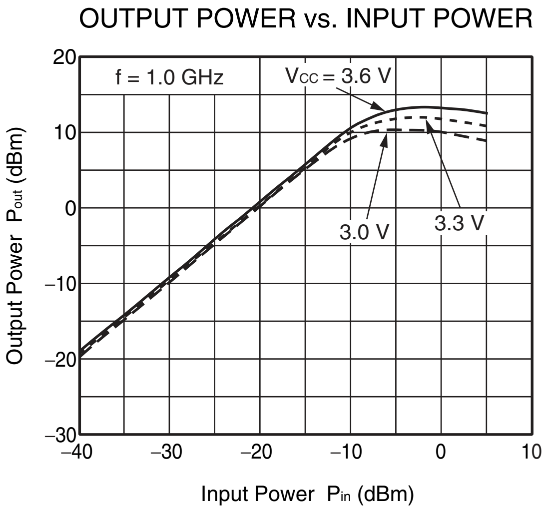
K FACTOR vs. FREQUENCY

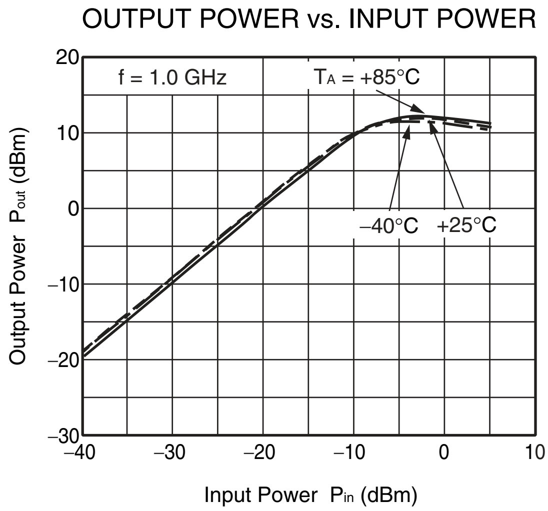


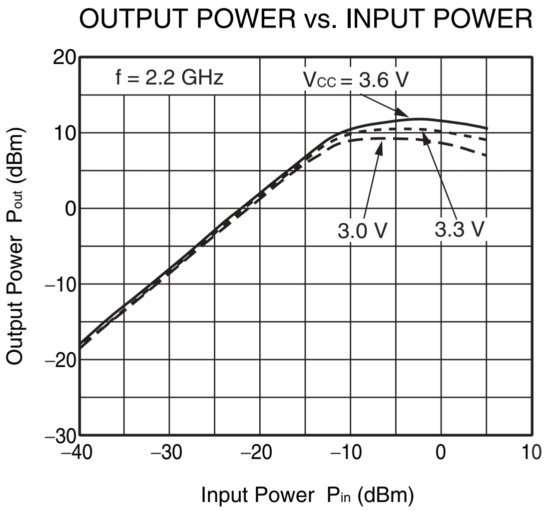
Remark The graphs indicate nominal characteristics.

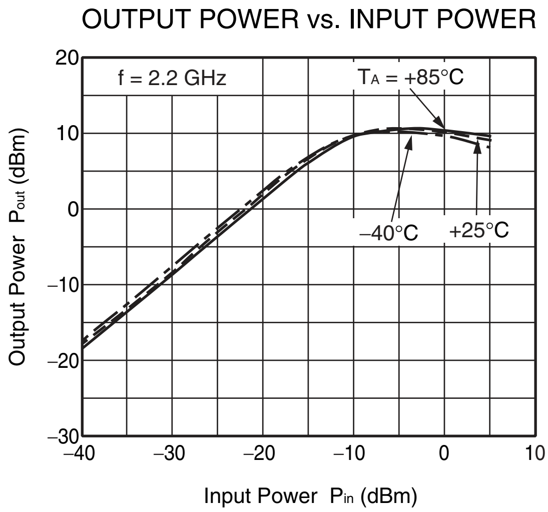






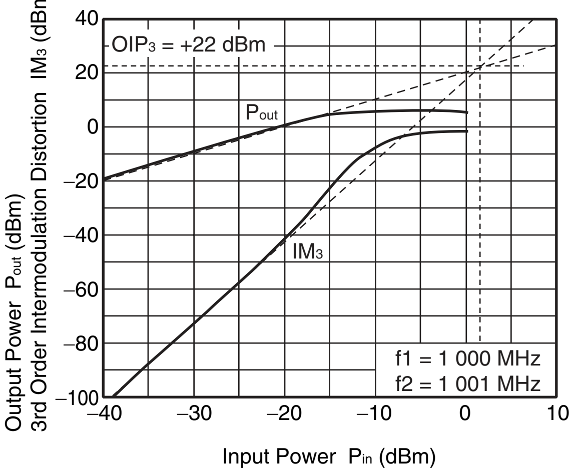




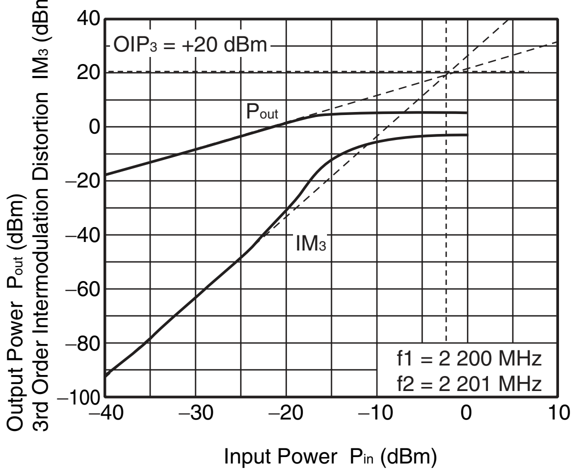


Remark The graphs indicate nominal characteristics.

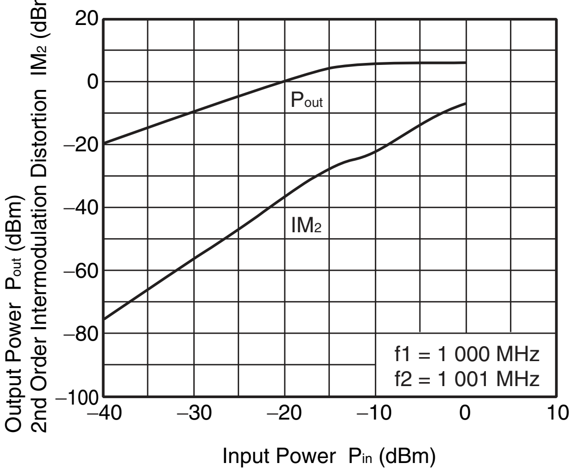
OUTPUT POWER, IM3 vs. INPUT POWER



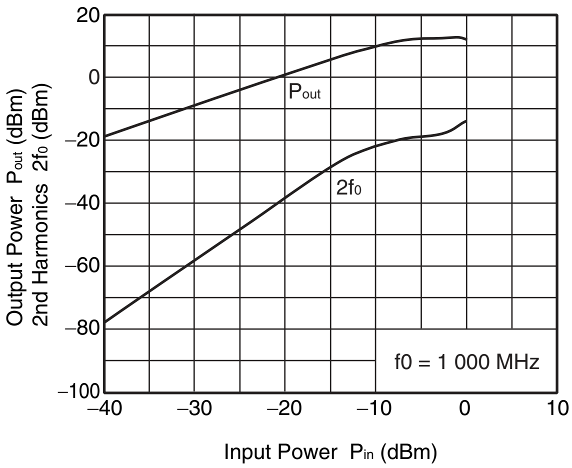
OUTPUT POWER, IM3 vs. INPUT POWER



OUTPUT POWER, IM2 vs. INPUT POWER



OUTPUT POWER, 2f0 vs. INPUT POWER

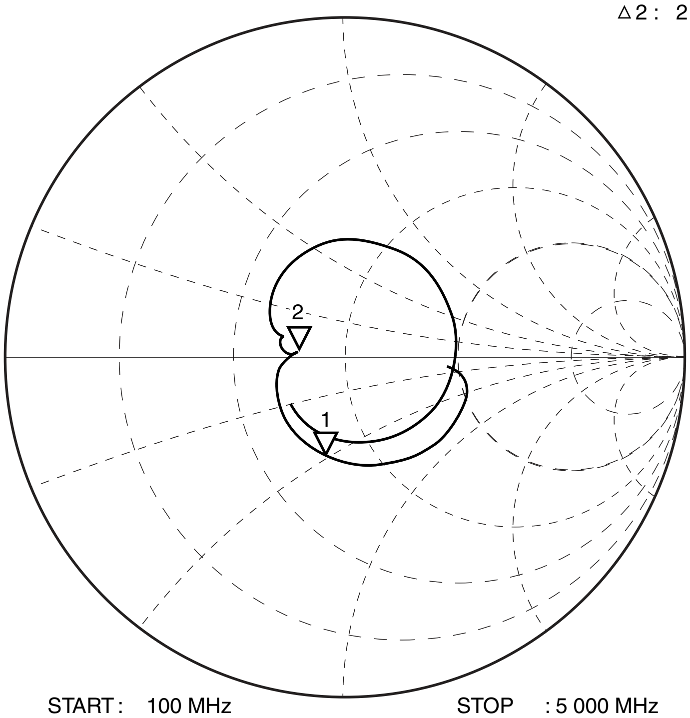


Remark The graphs indicate nominal characteristics.

S-PARAMETERS 1 (HIGH-GAIN MODE)
(T_A = +25°C, V_{CC} = 3.3 V, Gselect = GND, monitored at connector on board)

S_{11}-FREQUENCY

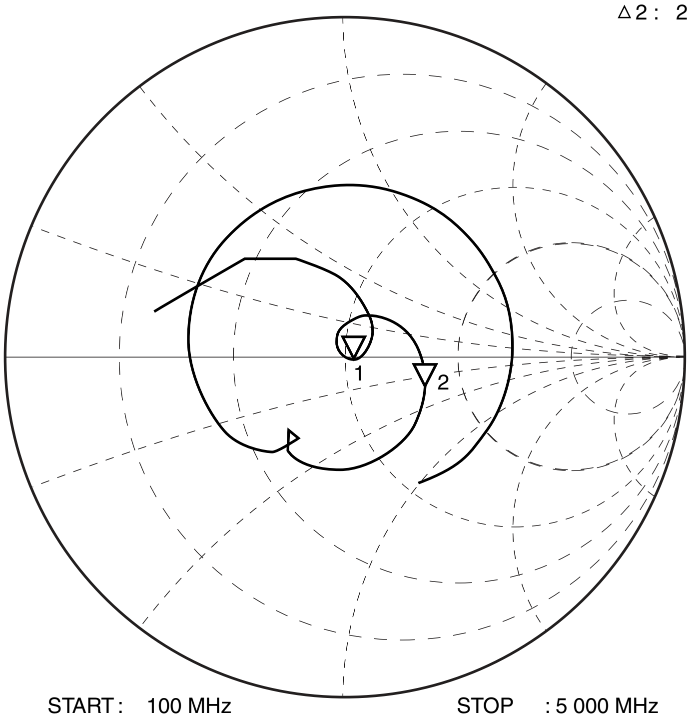
△1 : 1 000 MHz 38.10 Ω –24.75 Ω
△2 : 2 200 MHz 38.35 Ω 1.05 Ω



START : 100 MHz STOP : 5 000 MHz

S_{22}-FREQUENCY

△1 : 1 000 MHz 52.22 Ω –0.80 Ω
△2 : 2 200 MHz 79.35 Ω –14.30 Ω

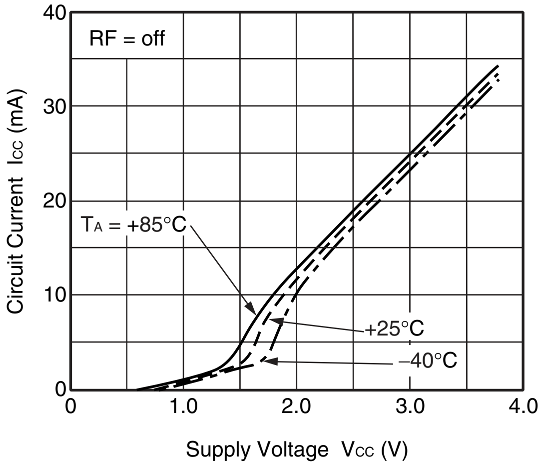


START : 100 MHz STOP : 5 000 MHz

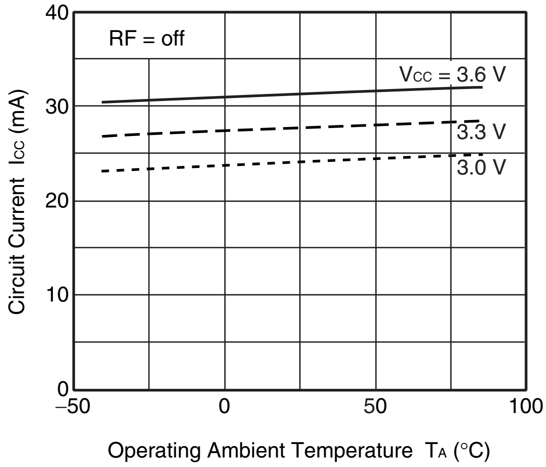
Remark The graphs indicate nominal characteristics.

TYPICAL CHARACTERISTICS 2 (MIDDLE-GAIN MODE)
(T_A = +25°C, V_{CC} = 3.3 V, Gselect = Open, Z_S = Z_L = 50 Ω, unless otherwise specified)

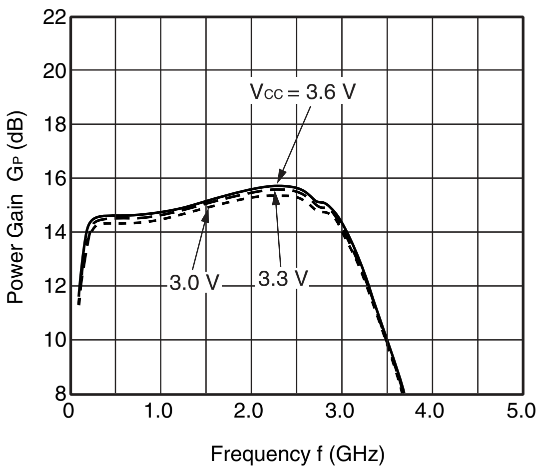
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



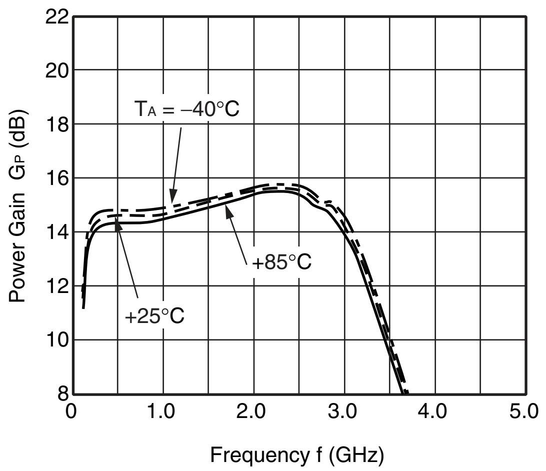
CIRCUIT CURRENT vs.
OPERATING AMBIENT TEMPERATURE



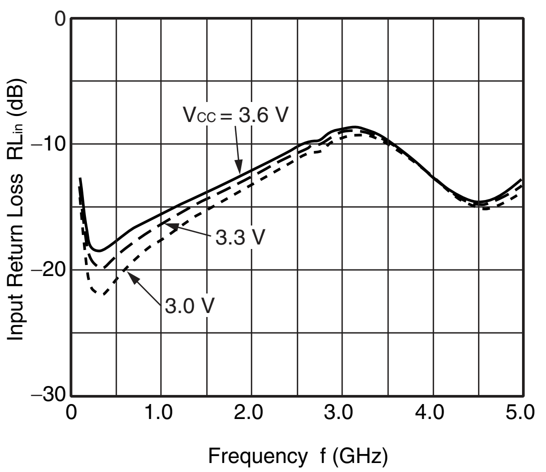
POWER GAIN vs. FREQUENCY



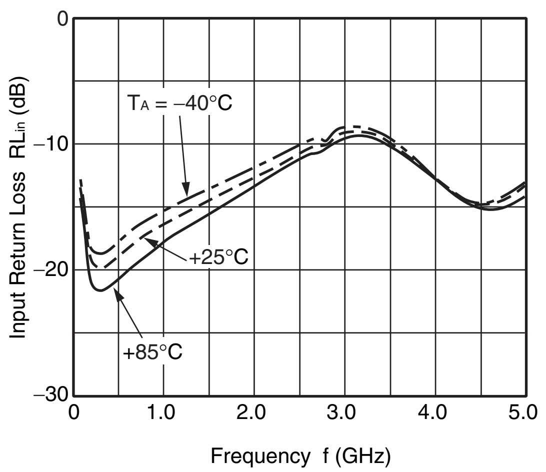
POWER GAIN vs. FREQUENCY



INPUT RETURN LOSS vs. FREQUENCY

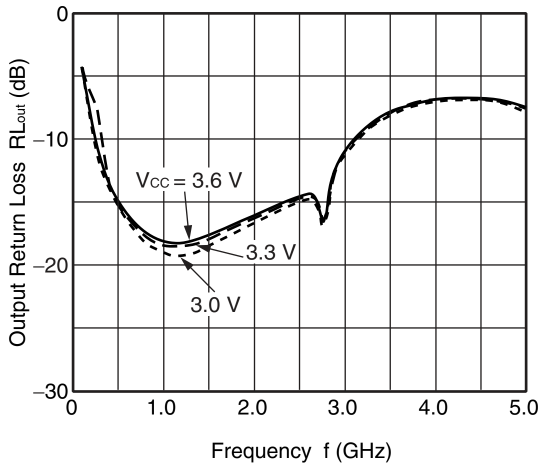


INPUT RETURN LOSS vs. FREQUENCY

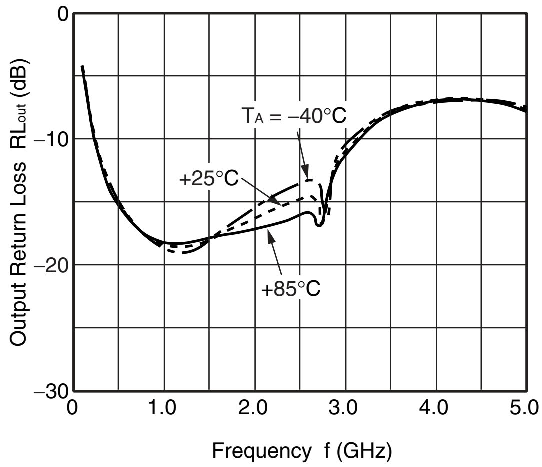


Remark The graphs indicate nominal characteristics.

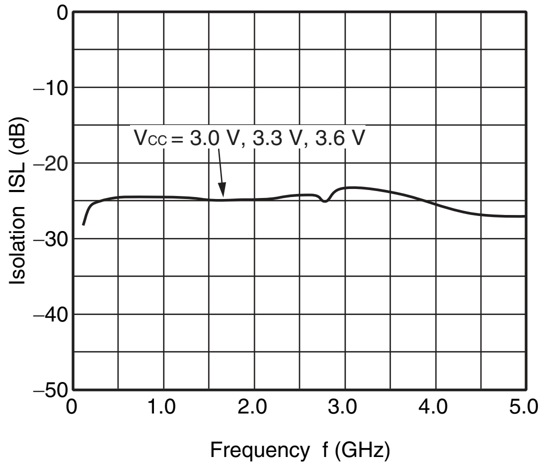
OUTPUT RETURN LOSS vs. FREQUENCY



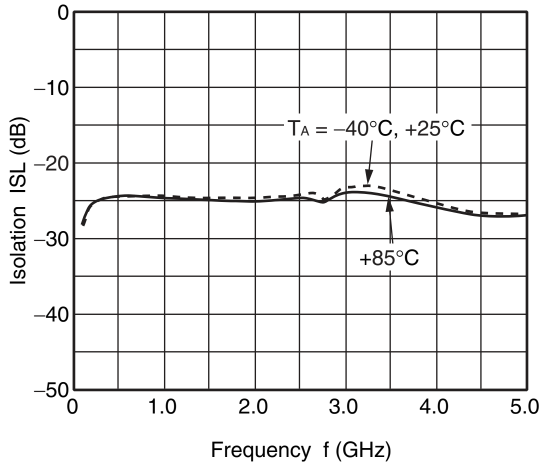
OUTPUT RETURN LOSS vs. FREQUENCY



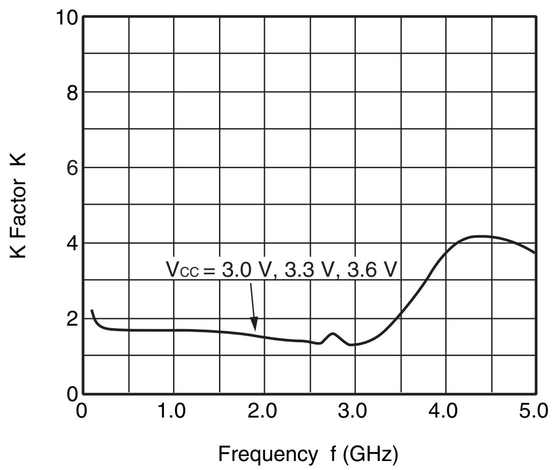
ISOLATION vs. FREQUENCY



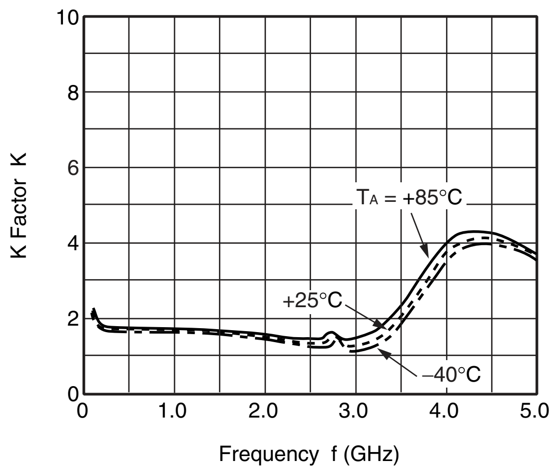
ISOLATION vs. FREQUENCY



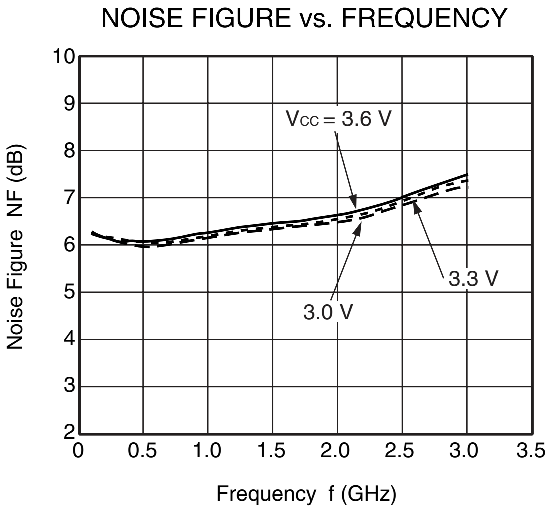
K FACTOR vs. FREQUENCY

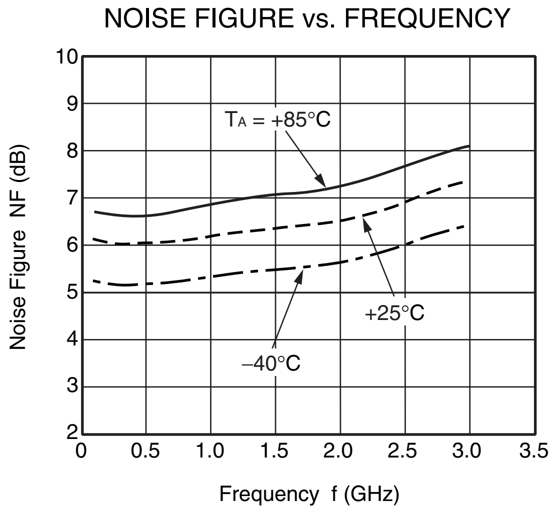


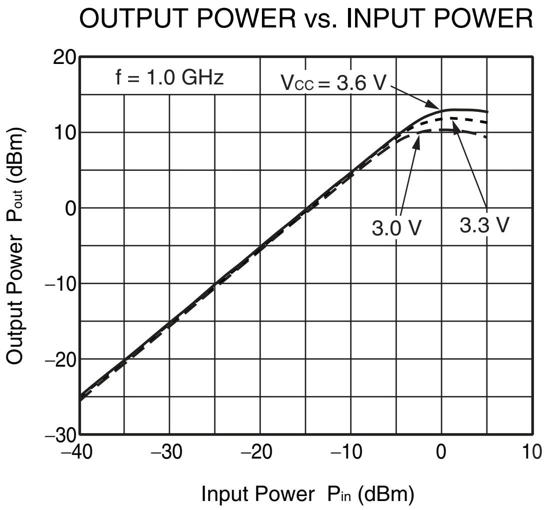
K FACTOR vs. FREQUENCY

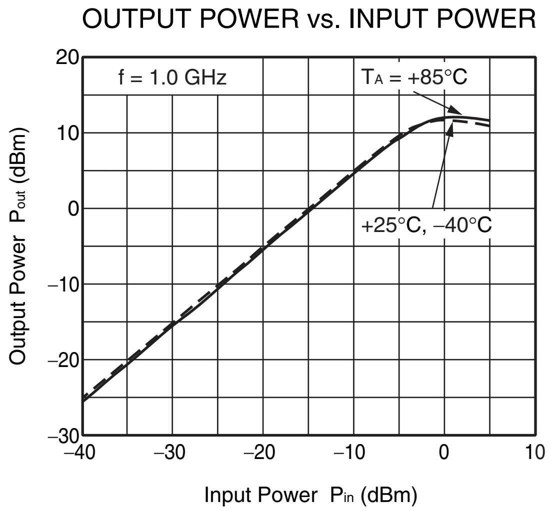


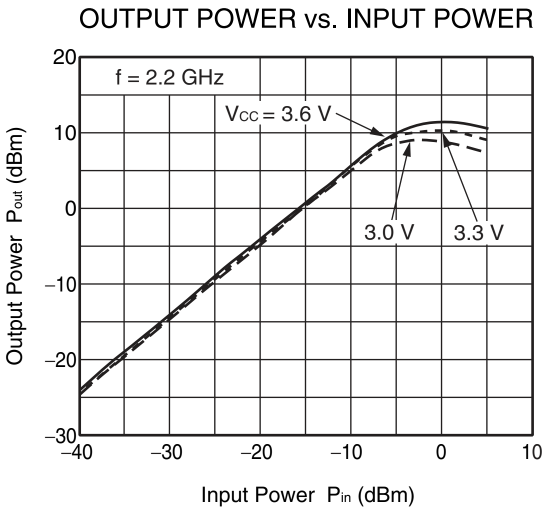
Remark The graphs indicate nominal characteristics.

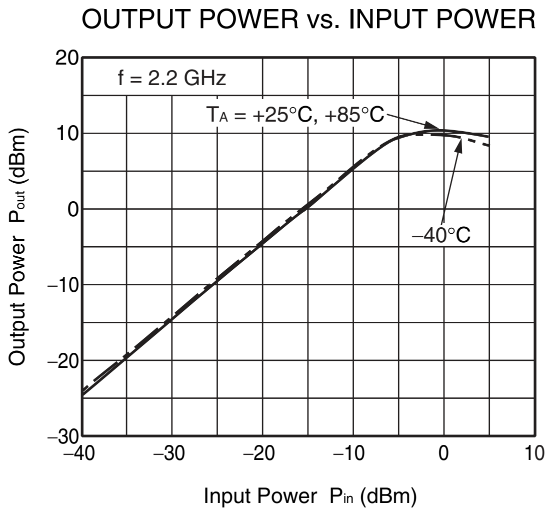






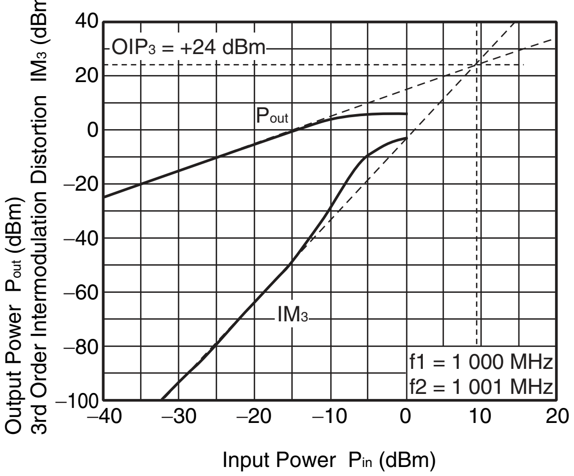




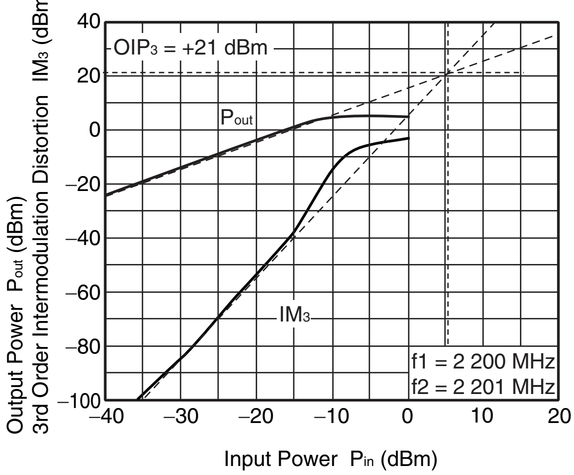


Remark The graphs indicate nominal characteristics.

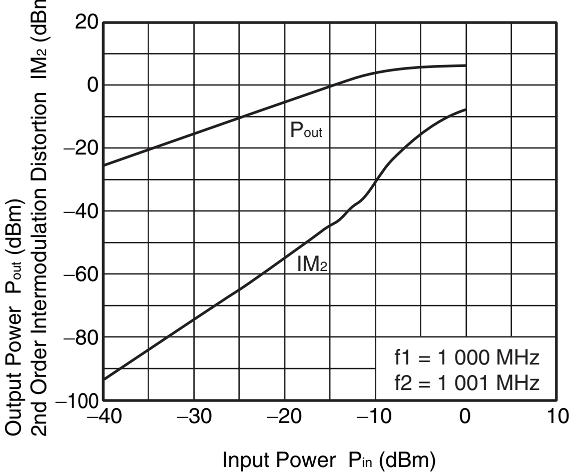
OUTPUT POWER, IM3 vs. INPUT POWER



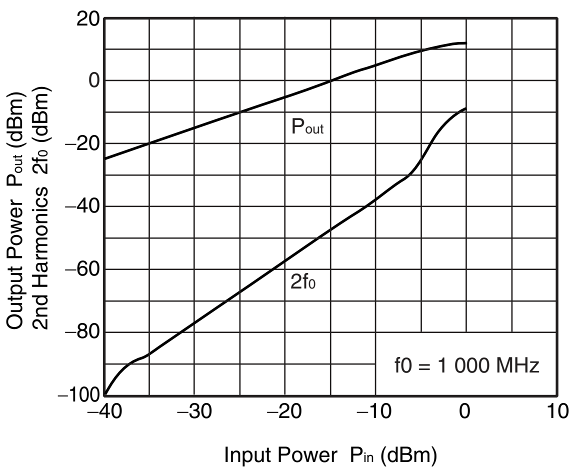
OUTPUT POWER, IM3 vs. INPUT POWER



OUTPUT POWER, IM2 vs. INPUT POWER



OUTPUT POWER, 2f0 vs. INPUT POWER

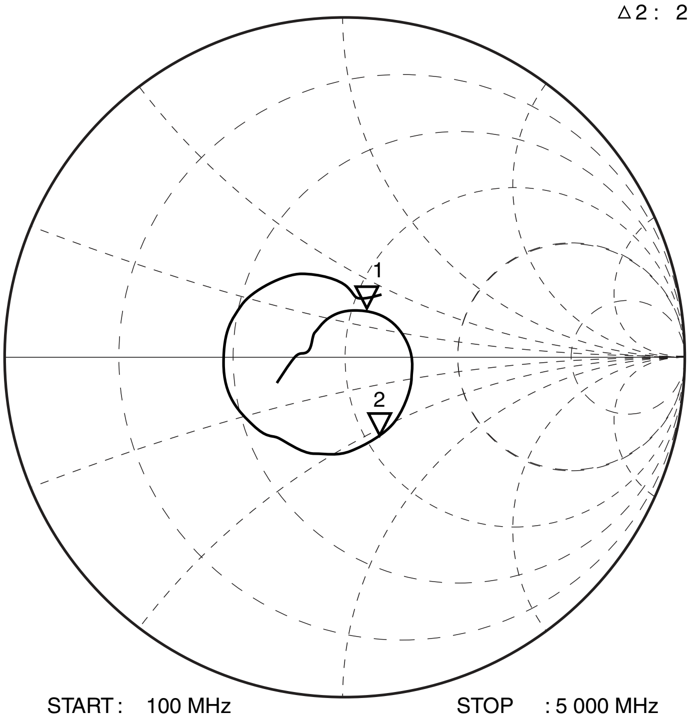


Remark The graphs indicate nominal characteristics.

S-PARAMETERS 2 (MIDDLE-GAIN MODE)
(T_A = +25°C, V_{CC} = 3.3 V, Gselect = Open, monitored at connector on board)

S_{11}-FREQUENCY

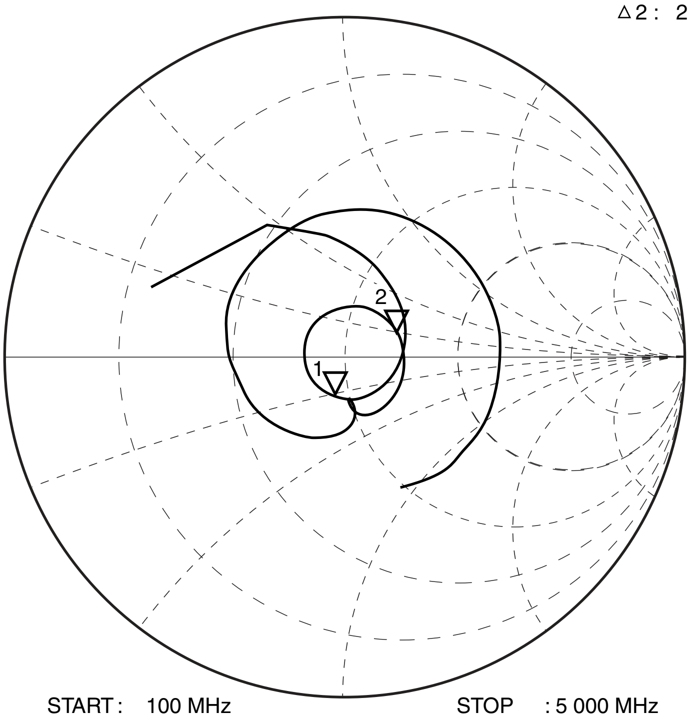
Δ1 : 1 000 MHz 54.35 Ω 15.40 Ω
Δ2 : 2 200 MHz 54.10 Ω –26.80 Ω



START : 100 MHz STOP : 5 000 MHz

S_{22}-FREQUENCY

Δ1 : 1 000 MHz 45.95 Ω –10.80 Ω
Δ2 : 2 200 MHz 66.50 Ω 9.75 Ω

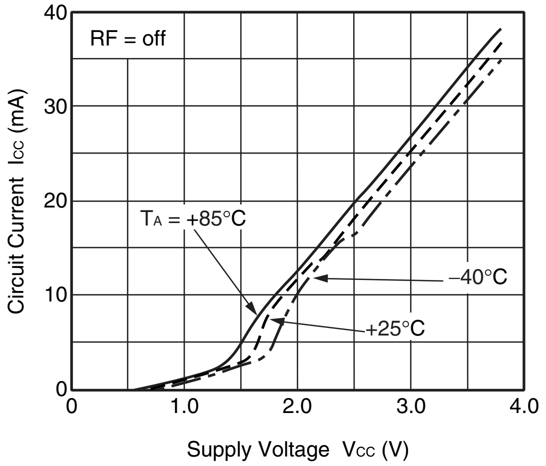


START : 100 MHz STOP : 5 000 MHz

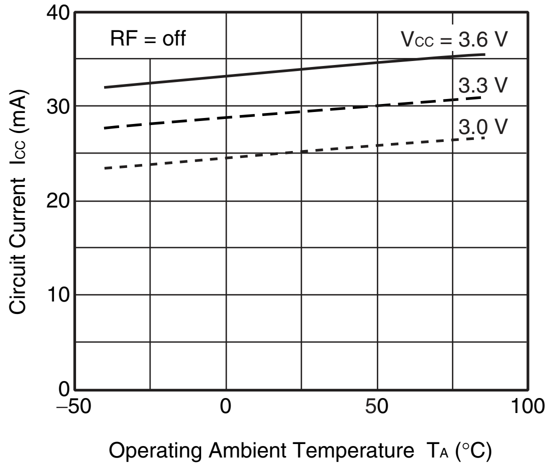
Remark The graphs indicate nominal characteristics.

TYPICAL CHARACTERISTICS 3 (LOW-GAIN MODE)
(T_A = +25°C, V_{CC} = 3.3 V, Gselect = V_{CC}, Z_S = Z_L = 50 Ω, unless otherwise specified)

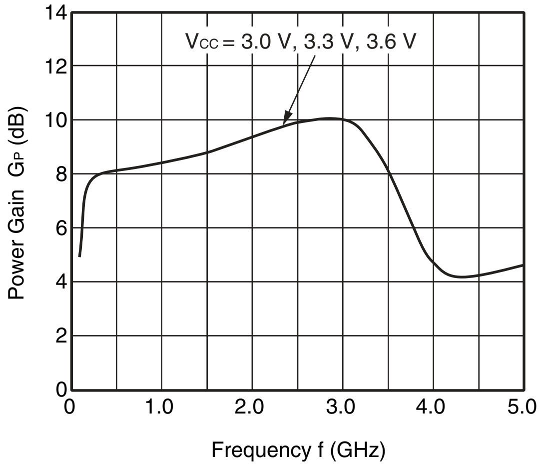
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



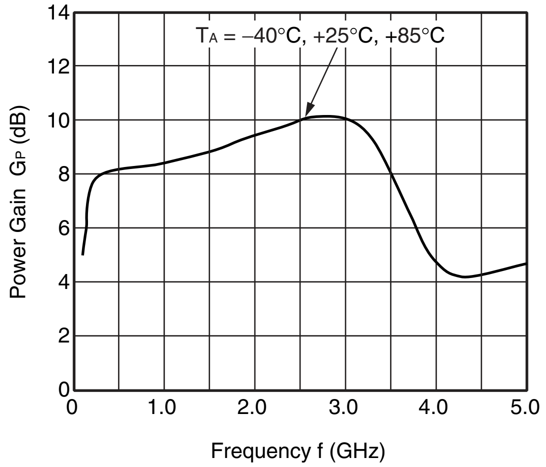
CIRCUIT CURRENT vs.
OPERATING AMBIENT TEMPERATURE



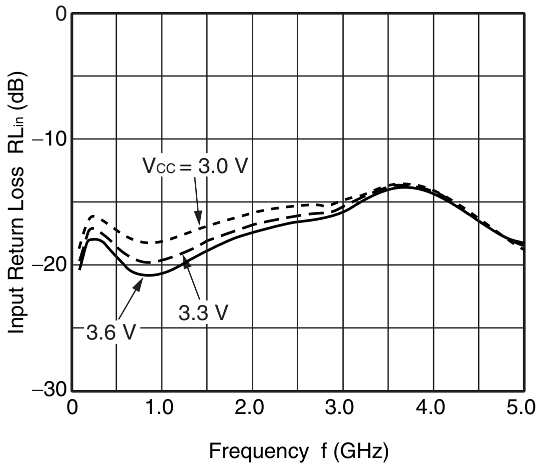
POWER GAIN vs. FREQUENCY



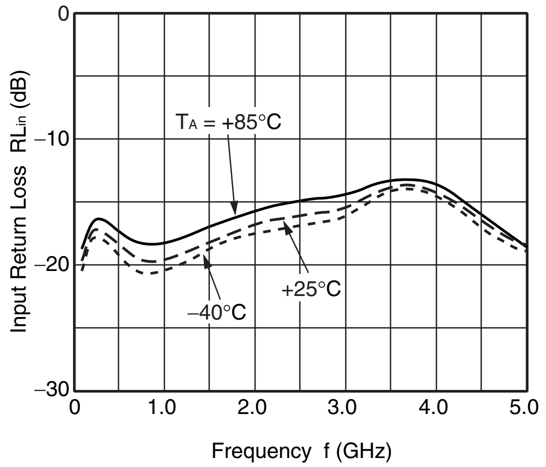
POWER GAIN vs. FREQUENCY



INPUT RETURN LOSS vs. FREQUENCY

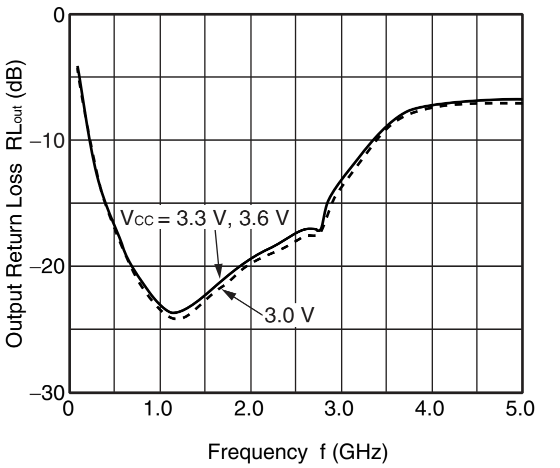


INPUT RETURN LOSS vs. FREQUENCY

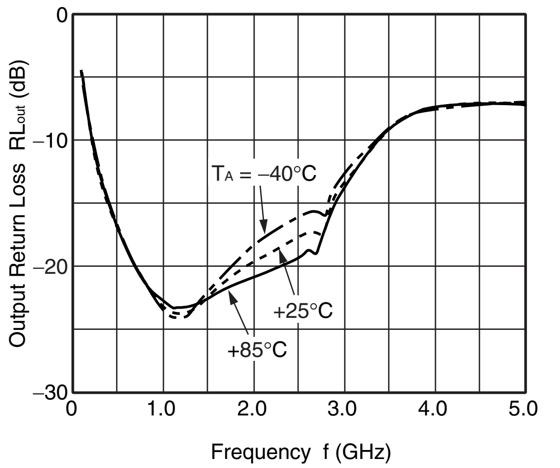


Remark The graphs indicate nominal characteristics.

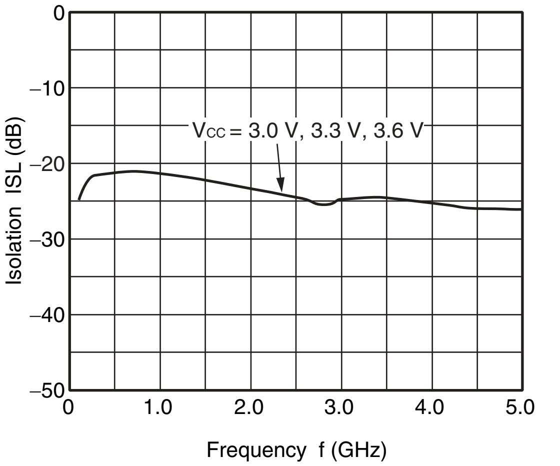
OUTPUT RETURN LOSS vs. FREQUENCY



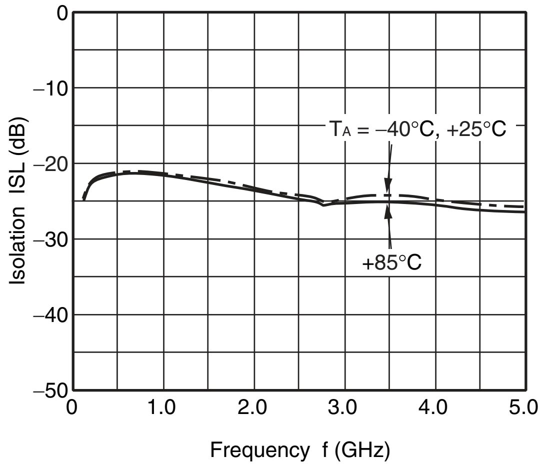
OUTPUT RETURN LOSS vs. FREQUENCY



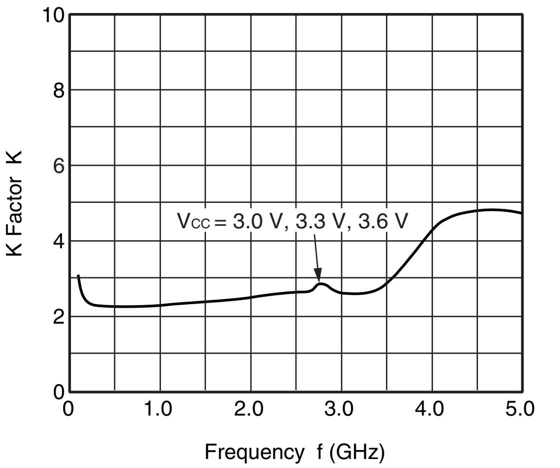
ISOLATION vs. FREQUENCY



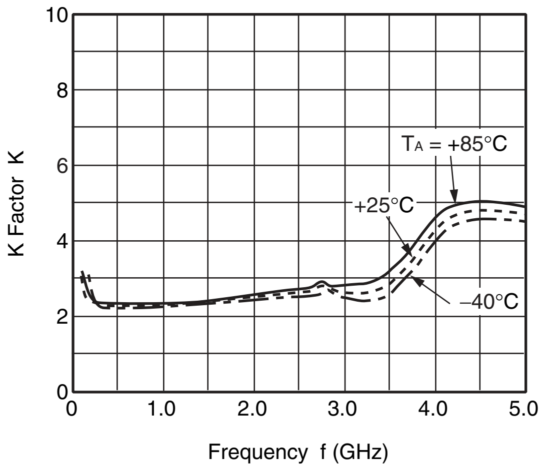
ISOLATION vs. FREQUENCY



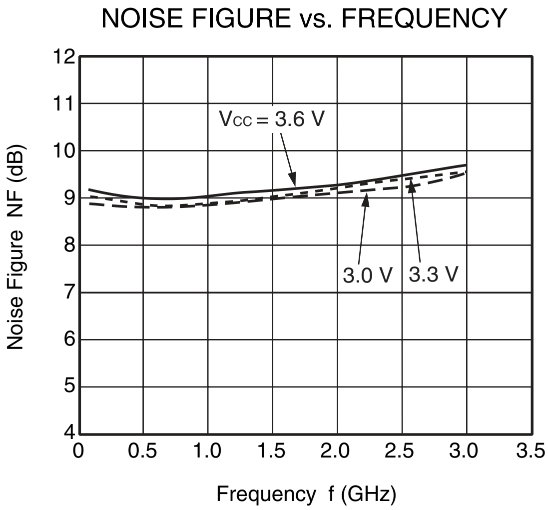
K FACTOR vs. FREQUENCY

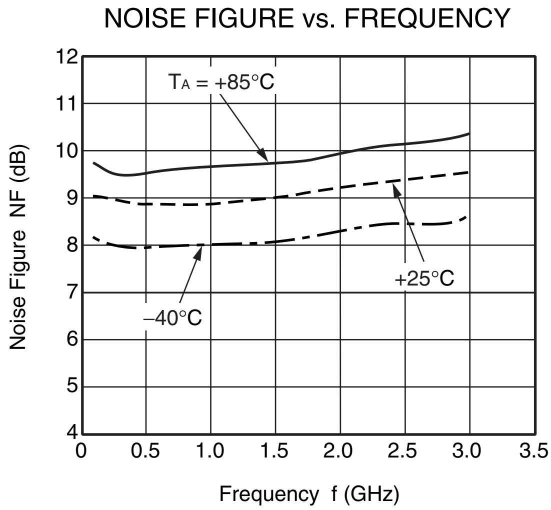


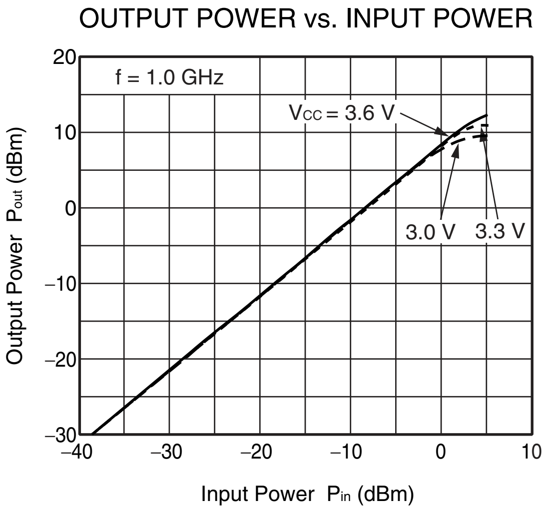
K FACTOR vs. FREQUENCY

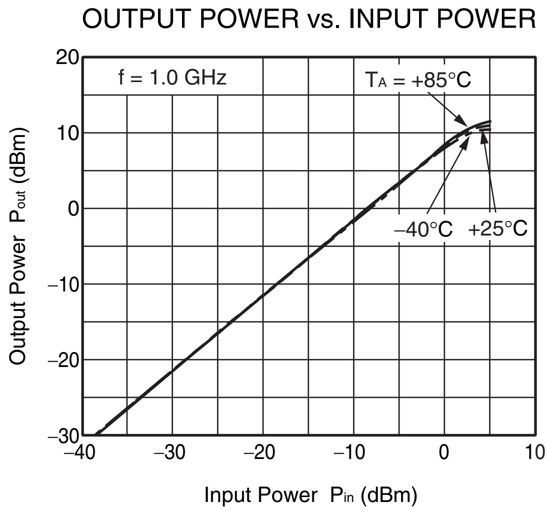


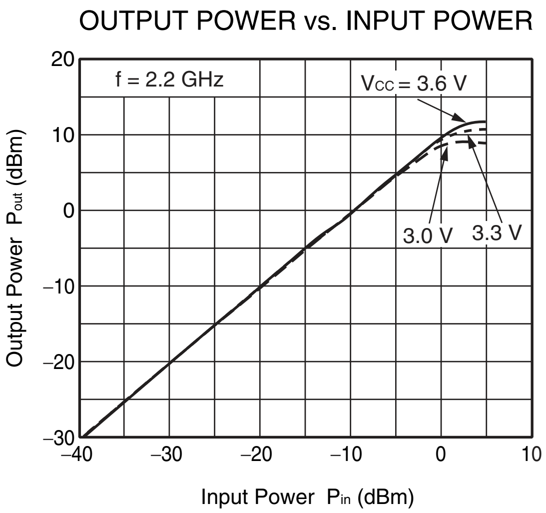
Remark The graphs indicate nominal characteristics.

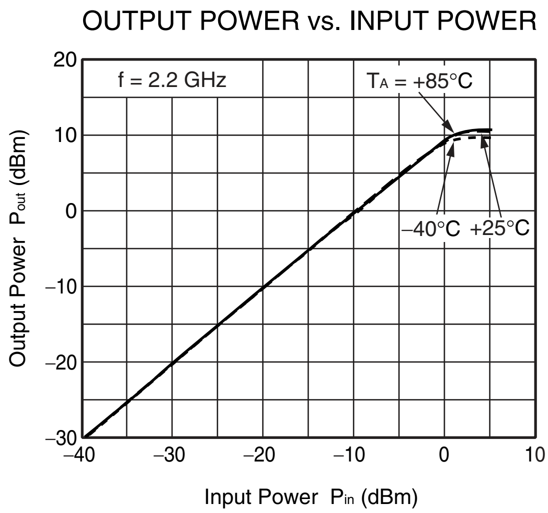






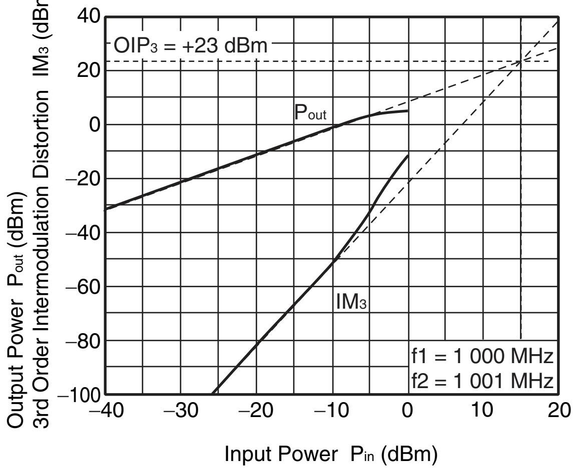




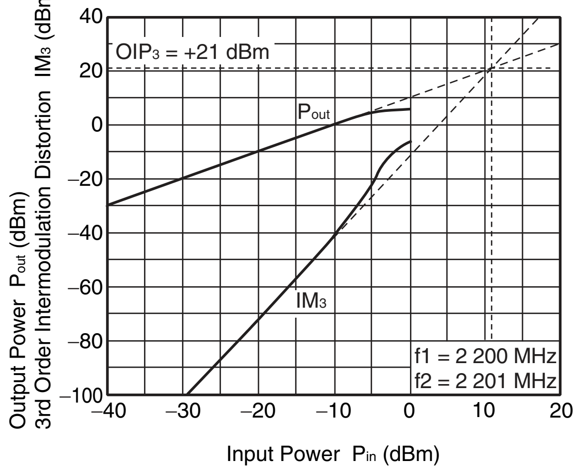


Remark The graphs indicate nominal characteristics.

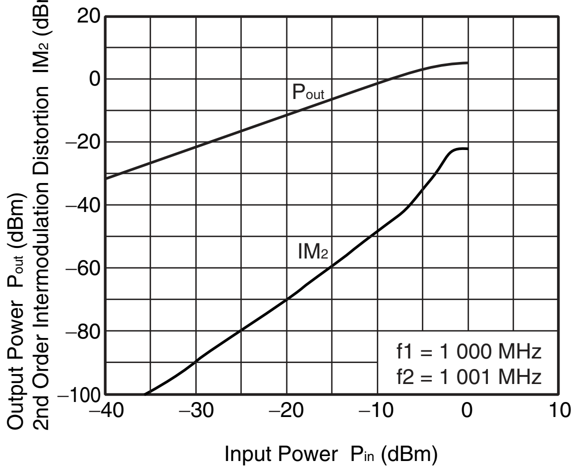
OUTPUT POWER, IM3 vs. INPUT POWER



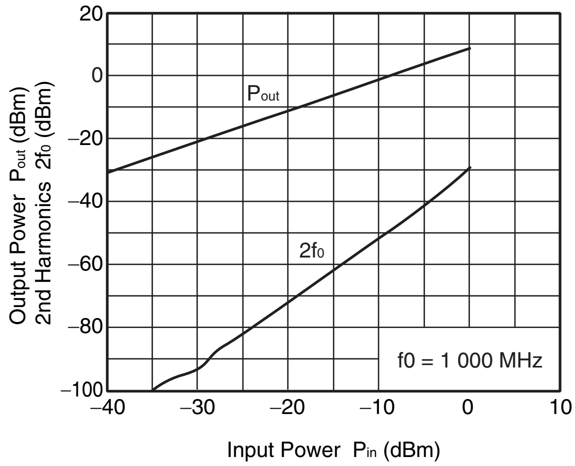
OUTPUT POWER, IM3 vs. INPUT POWER



OUTPUT POWER, IM2 vs. INPUT POWER



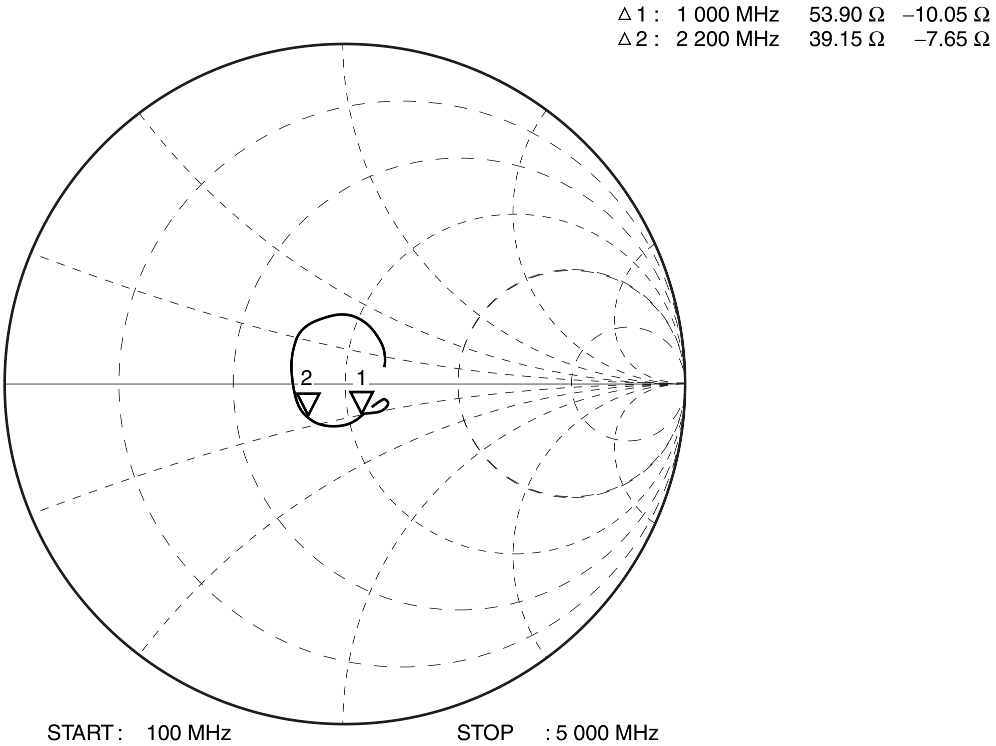
OUTPUT POWER, 2f0 vs. INPUT POWER



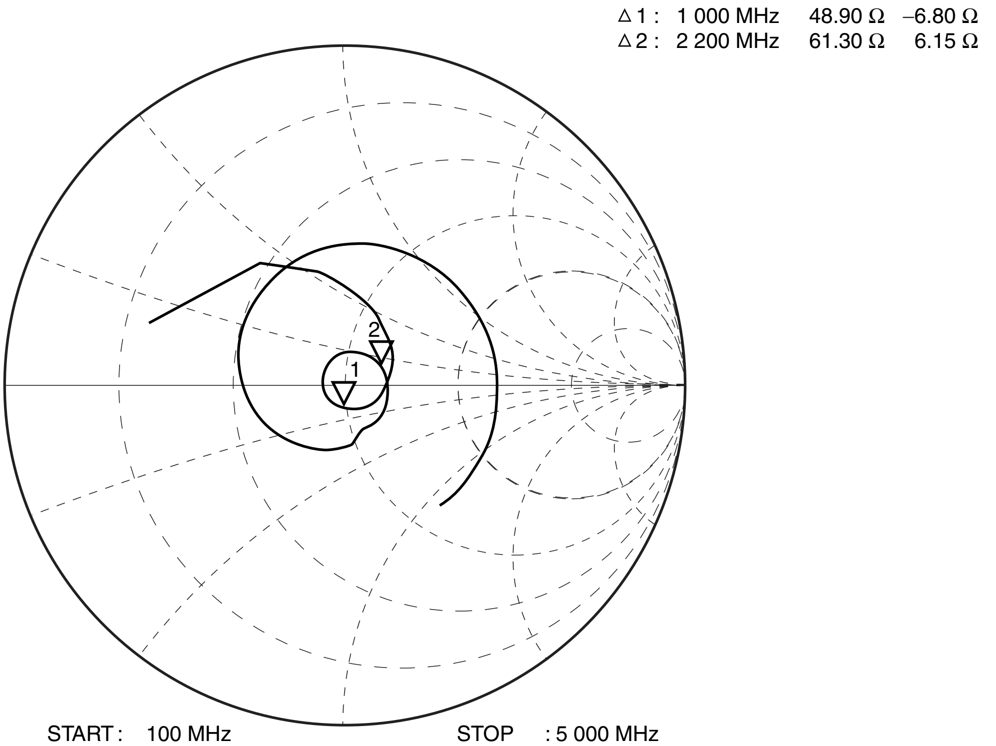
Remark The graphs indicate nominal characteristics.

S-PARAMETERS 3 (LOW-GAIN MODE)
(T_A = +25°C, V_{CC} = 3.3 V, Gselect = V_{CC}, monitored at connector on board)

S_{11}-FREQUENCY



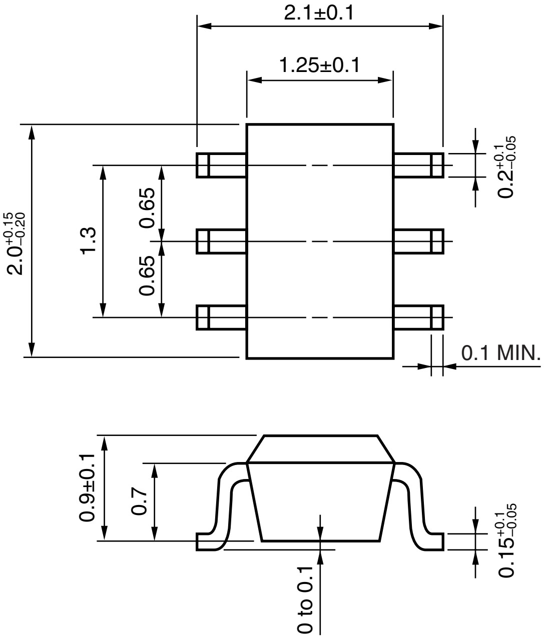
S_{22}-FREQUENCY



Remark The graphs indicate nominal characteristics.

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 (package surface 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).

Revision History	μPC3245TB Data Sheet

Rev.	Date	Description	
		Page	Summary
1.00	Sep 26, 2011	–	First edition issued

SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

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

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Colophon 1.1