μPD5756T6N

SiGe BiCMOS Integrated Circuit
Wide Band LNA IC with Through Function

R09DS0026EJ0100
Rev.1.00
Oct 04, 2011

DESCRIPTION

The μPD5756T6N is a low noise wideband amplifier IC with the through function mainly designed for the digital TV application. This IC exhibits low noise figure and low distortion characteristics.
This IC is manufactured using our latest SiGe BiCMOS process that shows superior high frequency characteristics.

FEATURES

- Low voltage operation : V_{CC} = 3.1 to 3.5 V (3.3 V TYP.)
- Low current consumption : $I_{CC}1$ = 25 mA TYP. @V_{CC} = 3.3 V (LNA-mode)
  : $I_{CC}2$ = 1 μA MAX. @V_{CC} = 3.3 V (Bypass-mode)
- Operation frequency : f = 40 to 1 000 MHz
- Low noise : NF = 3.2 dB TYP. @f = 1 000 MHz (LNA-mode)
- Low distortion : IIP_3 = +9 dBm TYP. @f1 = 500 MHz, f2 = 505 MHz (LNA-mode)
- Low insertion loss : L_{ins} = 1.7 dB TYP. @f = 1 000 MHz (Bypass-mode)
- High-density surface mounting : 6-pin plastic TSON (T6N) package (1.5 × 1.5 × 0.37 mm)

APPLICATIONS

- Low noise amplifier for the digital TV system, etc.

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPD5756T6N-E2	μPD5756T6N-E2-A	6-pin plastic TSON (T6N) (Pb-Free)	C4C	• Embossed tape 8 mm wide • Pin 1, 6 face the perforation side of the tape • Qty 3 kpcs/reel

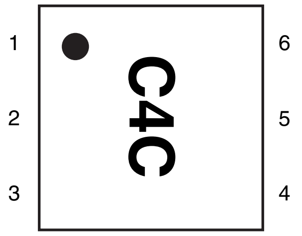
Remark To order evaluation samples, please contact your nearby sales office.
Part number for sample order: μPD5756T6N

CAUTION

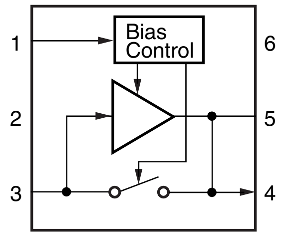
Observe precautions when handling because these devices are sensitive to electrostatic discharge.

PIN CONNECTIONS, MARKING AND INTERNAL BLOCK DIAGRAM

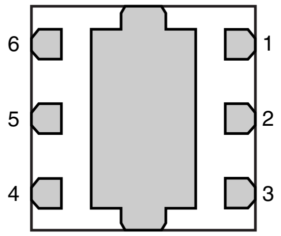
(Top View)



(Top View)



(Bottom View)



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

Remark Exposed pad : GND

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C	4.0	V
Mode Control Voltage	V_{cont}	T_A = +25°C	4.0	V
Total Power Dissipation	P_{tot}	T_A = +85°C **Note**	300	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, $Z_S = Z_L$ = 75 Ω	+15	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}	3.1	3.3	3.5	V
Mode Control Voltage (H)	$V_{cont (H)}$	1.0	–	V_{CC}	V
Mode Control Voltage (L)	$V_{cont (L)}$	–0.1	–	0.4	V
Operating Frequency	f	40	–	1 000	MHz
Operating Ambient Temperature	T_A	–40	+25	+85	°C
Input Power (LNA-mode) **Note**	P_{in}	–	–	0	dBm
Input Power (Bypass-mode) **Note**	P_{in}	–	–	+10	dBm

Note: T_A = +25°C, $Z_S = Z_L$ = 75 Ω

ELECTRICAL CHARACTERISTICS 1 (DC Characteristics) (T_A = +25°C, V_{CC} = 3.3 V, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current 1	$I_{CC}1$	V_{cont} = 3.3 V, No Signal (LNA-mode)	16	25	34	mA
Circuit Current 2	$I_{CC}2$	V_{cont} = 0 V, No Signal (Bypass-mode)	–	0.01	1	μA
Mode Control Current 1	$I_{cont}1$	V_{cont} = 3.3 V, No Signal (LNA-mode)	–	50	100	μA
Mode Control Current 2	$I_{cont}2$	V_{cont} = 0 V, No Signal (Bypass-mode)	–	0.01	1	μA

ELECTRICAL CHARACTERISTICS 2 (LNA-mode)
(T_A = +25°C, V_{CC} = V_{cont} = 3.3 V, Z_S = Z_L = 75 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain 1	G_P1	f = 40 MHz, P_{in} = –20 dBm	10.5	13	15.5	dB
Power Gain 2	G_P2	f = 1 000 MHz, P_{in} = –20 dBm	10.5	13	15.5	dB
Noise Figure 1	NF1	f = 40 MHz, Z_S = Z_L = 50 Ω, excluded PCB and connector losses **Note**	–	3.2	4.2	dB
Noise Figure 2	NF2	f = 1 000 MHz, Z_S = Z_L = 50 Ω, excluded PCB and connector losses **Note**	–	3.2	4.2	dB
Input Return Loss 1	$RL_{in}1$	f = 40 MHz, P_{in} = –20 dBm	7	9	–	dB
Input Return Loss 2	$RL_{in}2$	f = 1 000 MHz, P_{in} = –20 dBm	7	10	–	dB
Output Return Loss 1	$RL_{out}1$	f = 40 MHz, P_{in} = –20 dBm	7	10	–	dB
Output Return Loss 2	$RL_{out}2$	f = 1 000 MHz, P_{in} = –20 dBm	7	12	–	dB
Input 3rd Order Intercept Point	IIP_3	f1 = 500 MHz, f2 = 505 MHz, P_{in} = –20 dBm	+5	+9	–	dBm

Note: Input PCB and connector losses : 0.03 dB (at 40 MHz), 0.10 dB (at 1 000 MHz)

ELECTRICAL CHARACTERISTICS 3 (Bypass-mode)
(T_A = +25°C, V_{CC} = 3.3 V, V_{cont} = 0 V, Z_S = Z_L = 75 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss 1	$L_{ins}1$	f = 40 MHz, P_{in} = –10 dBm, excluded PCB and connector losses **Note**	–	0.5	1.5	dB
Insertion Loss 2	$L_{ins}2$	f = 1 000 MHz, P_{in} = –10 dBm, excluded PCB and connector losses **Note**	–	1.7	2.5	dB
Input Return Loss 1	$RL_{in}1$	f = 40 MHz, P_{in} = –10 dBm	10	26	–	dB
Input Return Loss 2	$RL_{in}2$	f = 1 000 MHz, P_{in} = –10 dBm	7	8	–	dB
Output Return Loss 1	$RL_{out}1$	f = 40 MHz, P_{in} = –10 dBm	10	25	–	dB
Output Return Loss 2	$RL_{out}2$	f = 1 000 MHz, P_{in} = –10 dBm	7	8	–	dB
Input 3rd Order Intercept Point	IIP_3	f1 = 500 MHz, f2 = 505 MHz, P_{in} = –5 dBm	+20	+29	–	dBm

Note: Input-output PCB and connector losses : 0.06 dB (at 40 MHz), 0.20 dB (at 1 000 MHz)

STANDARD CHARACTERISTICS FOR REFERENCE 1 (LNA-mode)
(T_A = +25°C, V_{CC} = V_{cont} = 3.3 V, Z_S = Z_L = 75 Ω, unless otherwise specified)

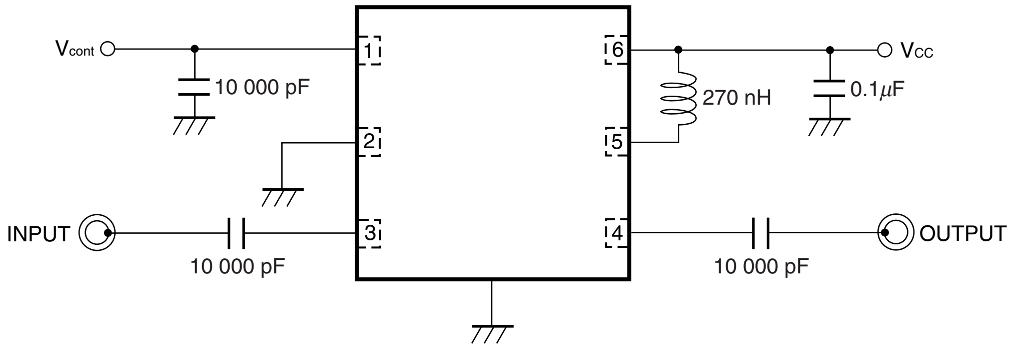
Parameter	Symbol	Test Conditions	Reference Value	Unit
Isolation 1	ISL1	f = 40 MHz, P_{in} = –20 dBm	20	dB
Isolation 2	ISL2	f = 1 000 MHz, P_{in} = –20 dBm	20	dB
Gain 1 dB Compression Output Power	$P_{O\ (1\ dB)}$	f = 500 MHz	+10	dBm

STANDARD CHARACTERISTICS FOR REFERENCE 2 (Bypass-mode)
(T_A = +25°C, V_{CC} = 3.3 V, V_{cont} = 0 V, Z_S = Z_L = 75 Ω, unless otherwise specified)

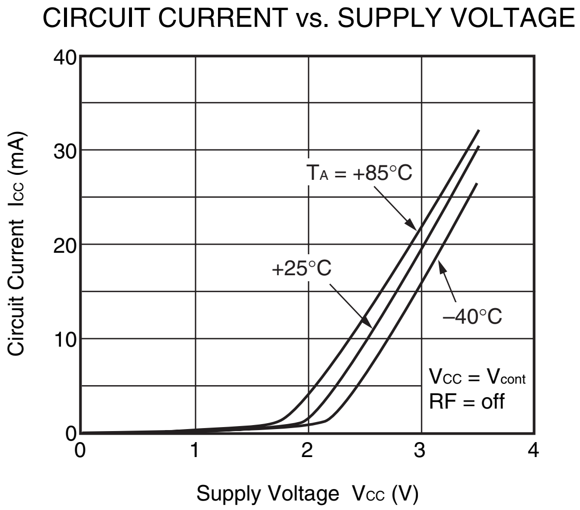
Parameter	Symbol	Test Conditions	Reference Value	Unit
Gain 1 dB Compression Output Power	$P_{O\ (1\ dB)}$	f = 500 MHz	**Note**	dBm

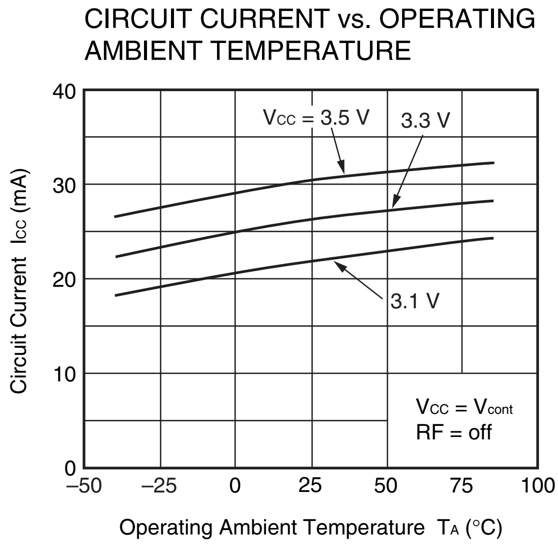
Note: The input-output power characteristic is not saturated up to +15 dBm of input power.

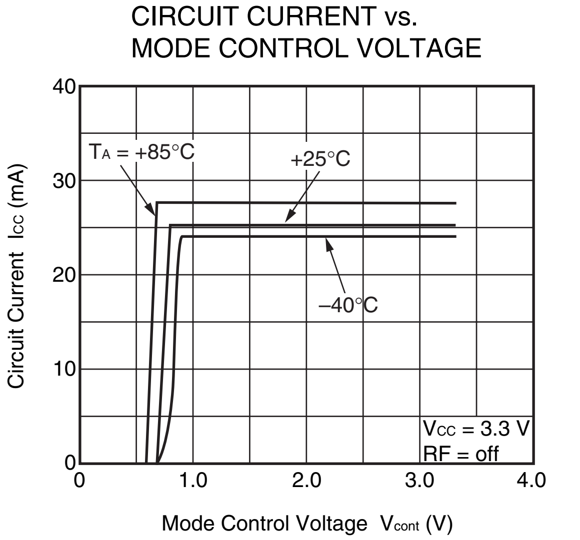
TEST CIRCUIT

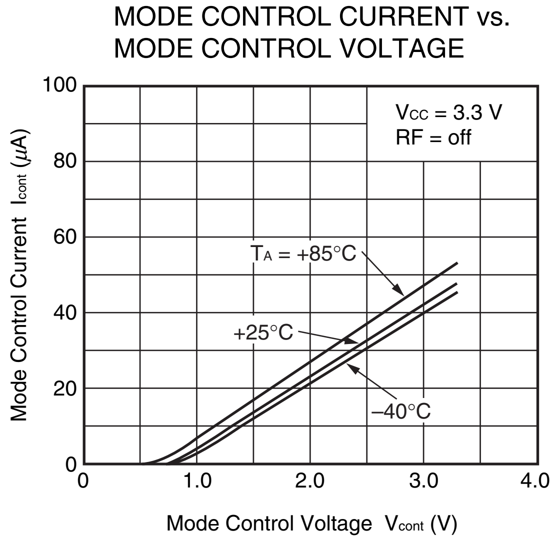


TYPICAL CHARACTERISTICS 1 (DC Characteristics)
(T_A = +25°C, unless otherwise specified)





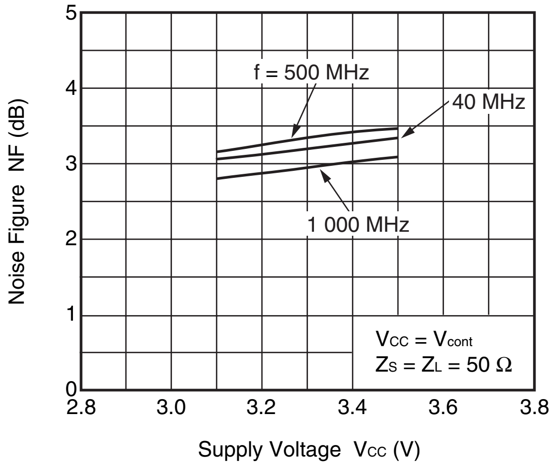




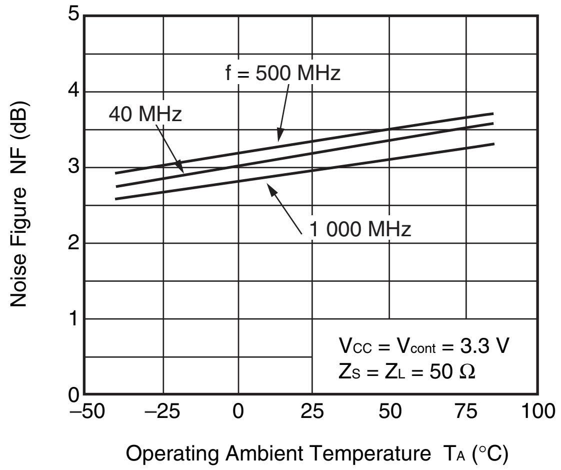
Remark The graphs indicate nominal characteristics.

TYPICAL CHARACTERISTICS 2 (LNA-mode)
(T_A = +25°C, Z_S = Z_L = 75 Ω, unless otherwise specified)

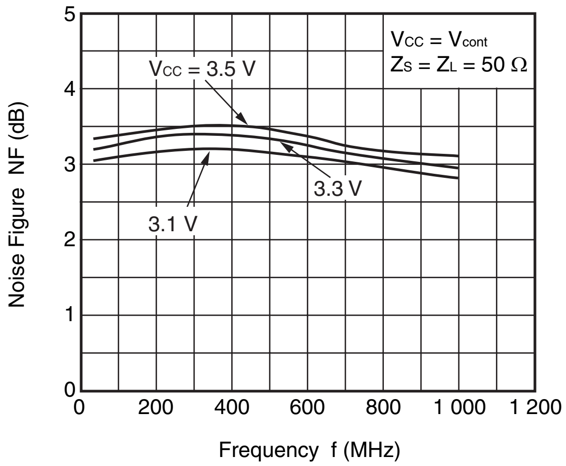
NOISE FIGURE vs. SUPPLY VOLTAGE



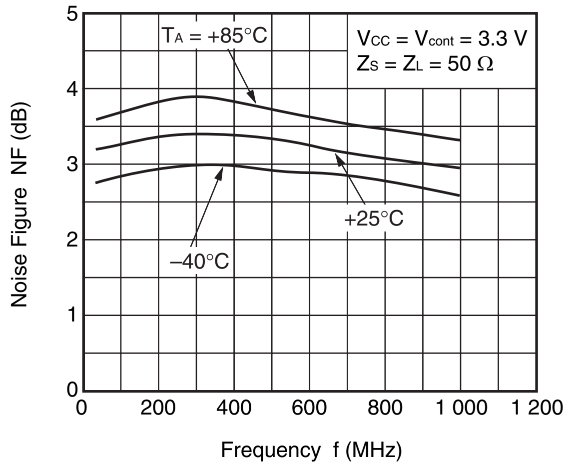
NOISE FIGURE vs. OPERATING AMBIENT TEMPERATURE



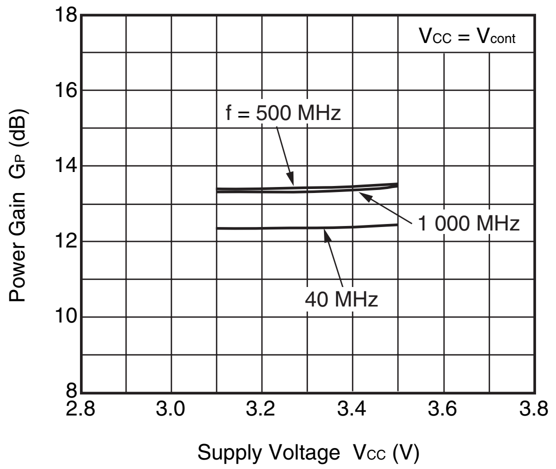
NOISE FIGURE vs. FREQUENCY



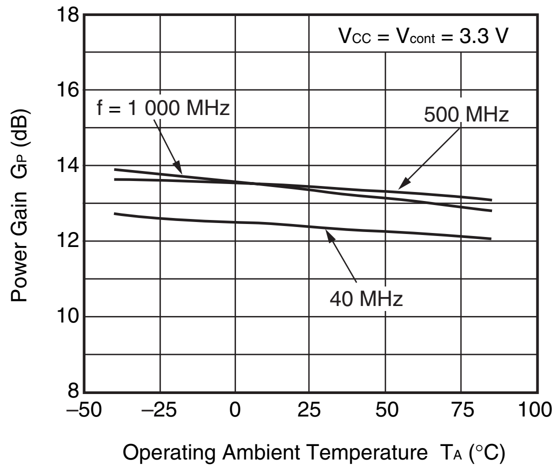
NOISE FIGURE vs. FREQUENCY



POWER GAIN vs. SUPPLY VOLTAGE

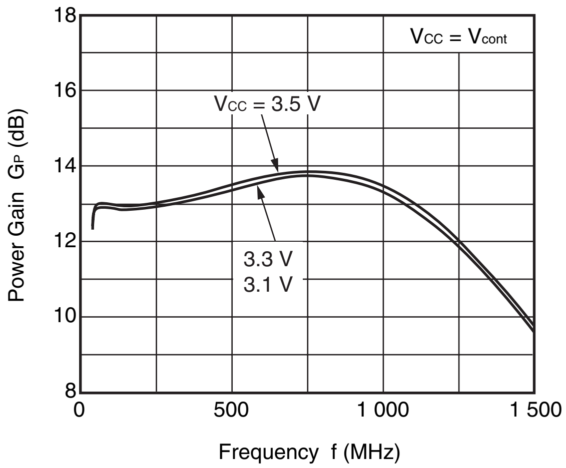


POWER GAIN vs. OPERATING AMBIENT TEMPERATURE

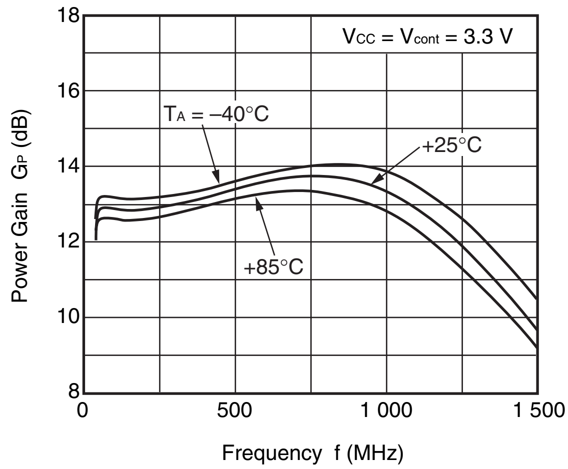


Remark The graphs indicate nominal characteristics.

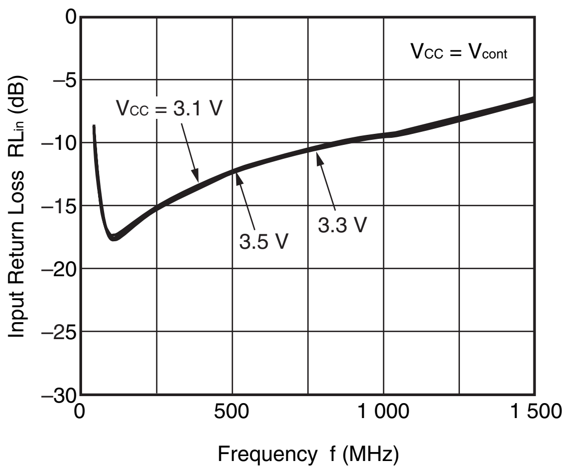
POWER GAIN vs. FREQUENCY



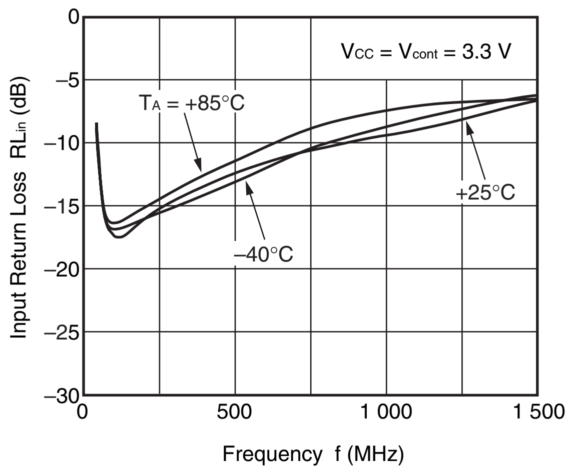
POWER GAIN vs. FREQUENCY



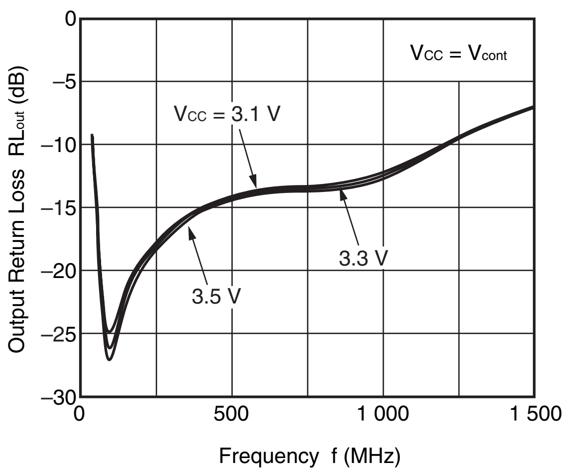
INPUT RETURN LOSS vs. FREQUENCY



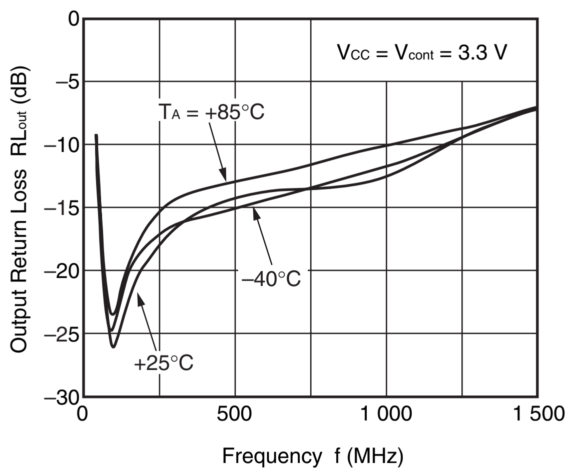
INPUT RETURN LOSS vs. FREQUENCY



OUTPUT RETURN LOSS vs. FREQUENCY

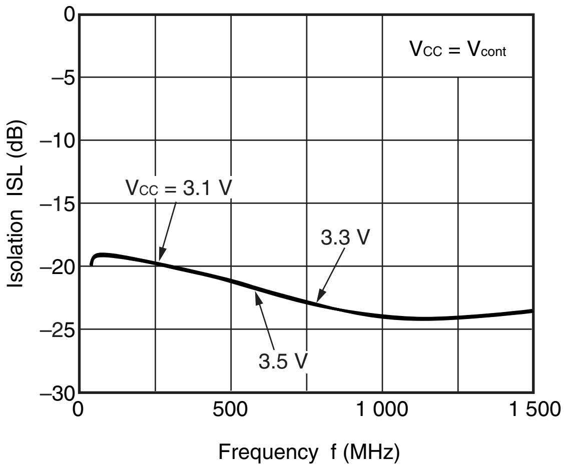


OUTPUT RETURN LOSS vs. FREQUENCY

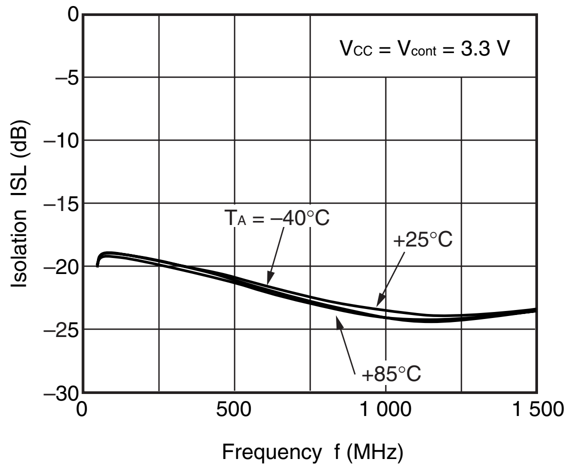


Remark The graphs indicate nominal characteristics.

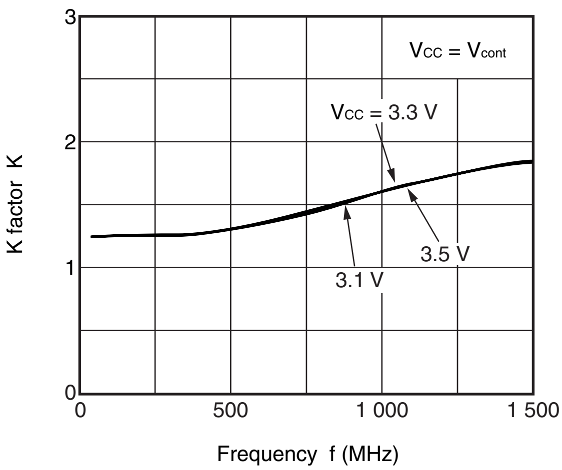
ISOLATION vs. FREQUENCY



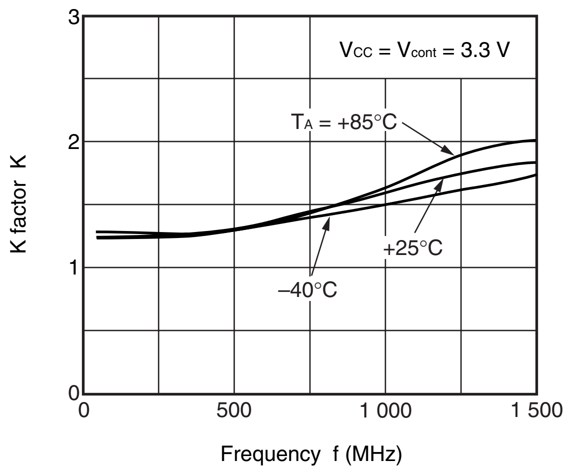
ISOLATION vs. FREQUENCY



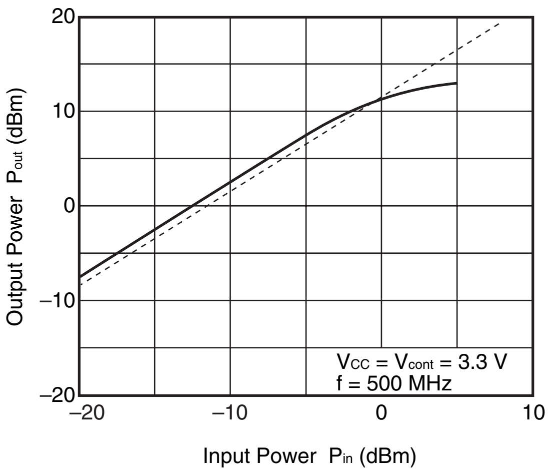
K FACTOR vs. FREQUENCY



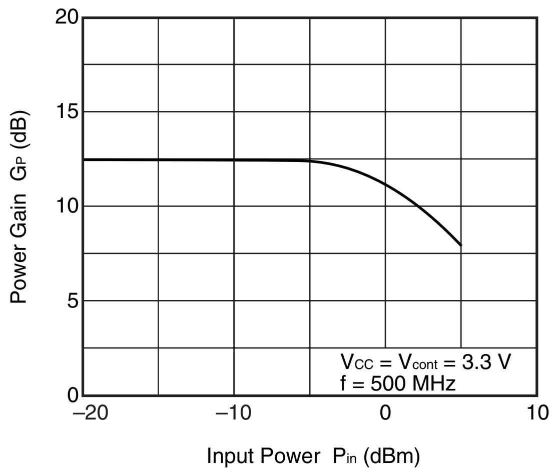
K FACTOR vs. FREQUENCY



OUTPUT POWER vs. INPUT POWER

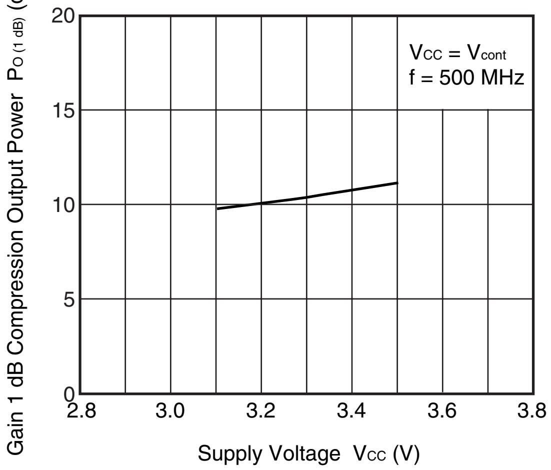


POWER GAIN vs. INPUT POWER

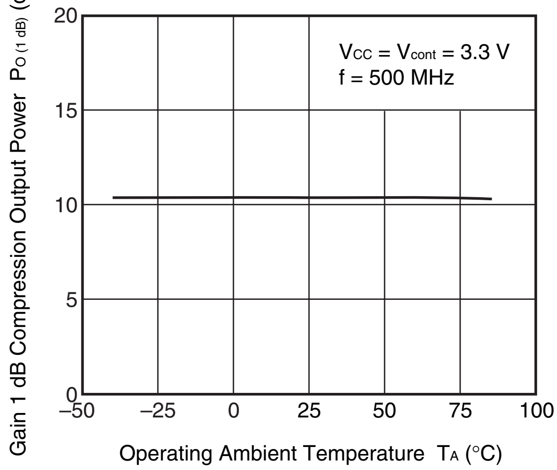


Remark The graphs indicate nominal characteristics.

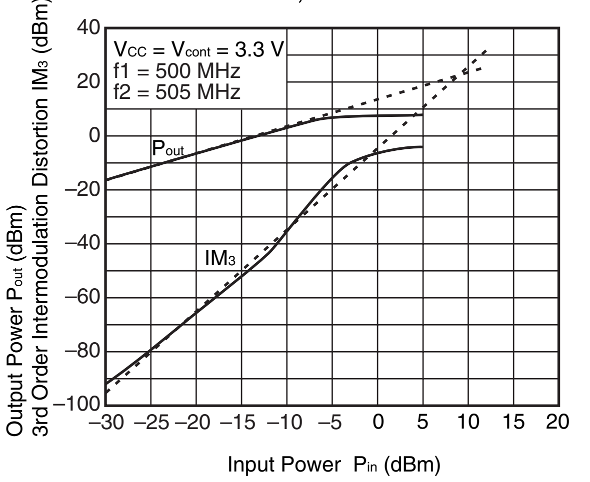
GAIN 1 dB COMPRESSION OUTPUT POWER vs. SUPPLY VOLTAGE



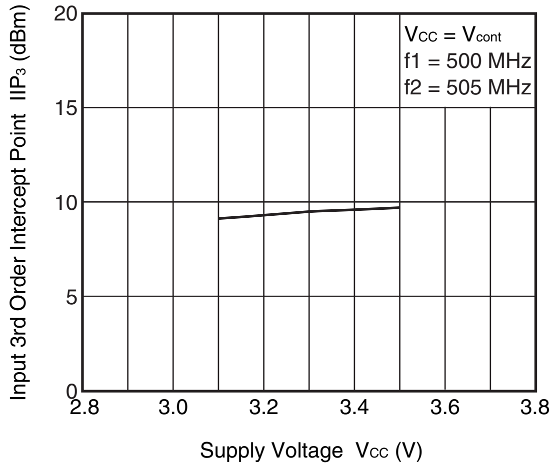
GAIN 1 dB COMPRESSION OUTPUT POWER vs. OPERATING AMBIENT TEMPERATURE



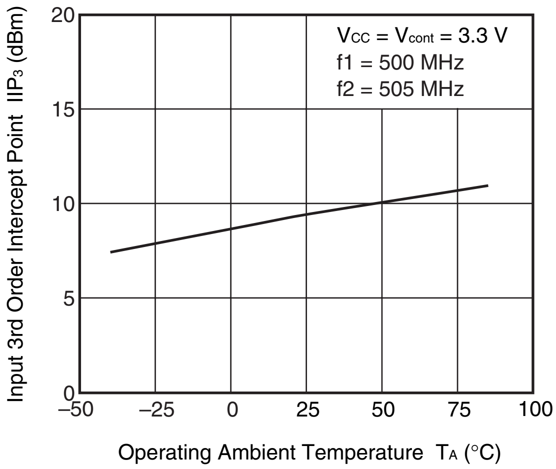
OUTPUT POWER, IM3 vs. INPUT POWER



INPUT 3RD ORDER INTERCEPT POINT vs. SUPPLY VOLTAGE



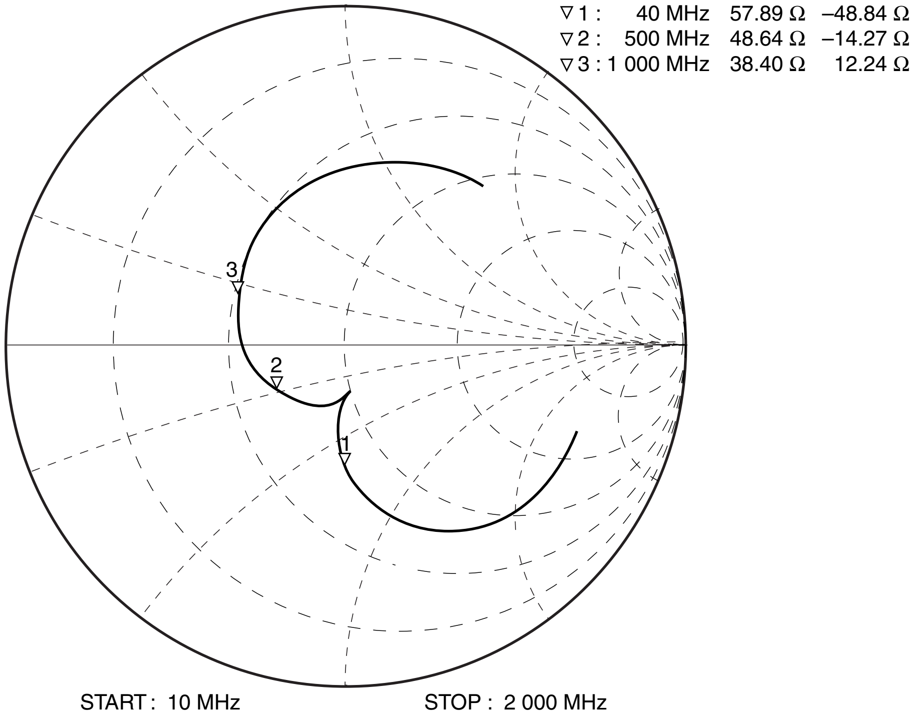
INPUT 3RD ORDER INTERCEPT POINT vs. OPERATING AMBIENT TEMPERATURE



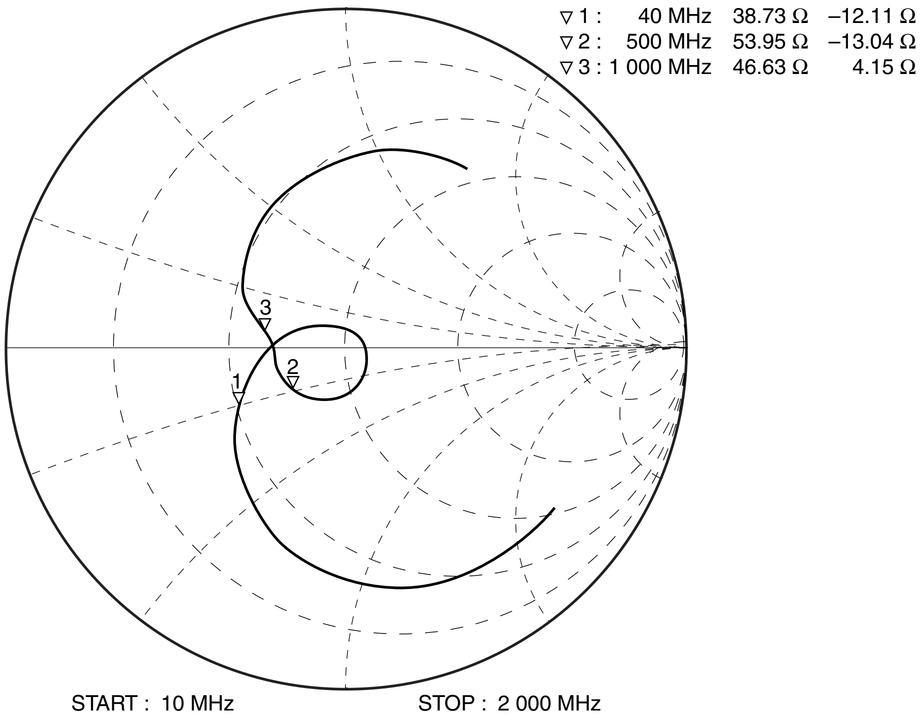
Remark The graphs indicate nominal characteristics.

S-PARAMETERS 1 (LNA-mode)
(T_A = +25°C, V_{CC} = V_{cont} = 3.3 V, Z_S = Z_L = 75 Ω, monitored at connector on board)

S_{11}-FREQUENCY



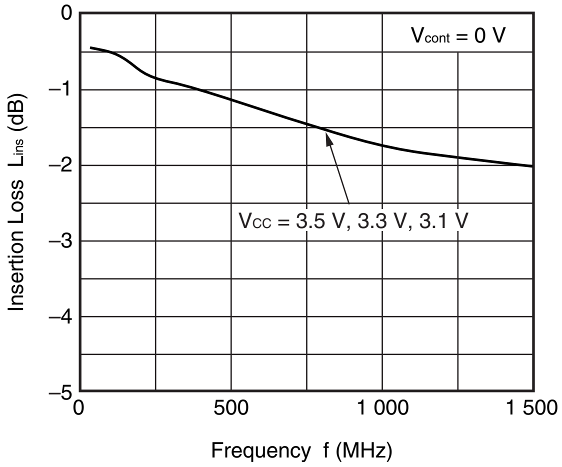
S_{22}-FREQUENCY



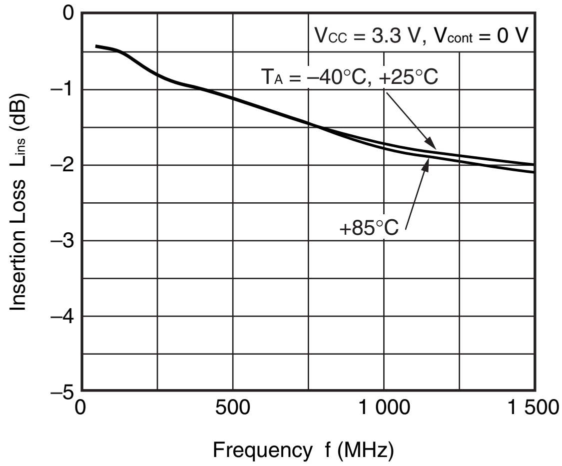
Remark The graphs indicate nominal characteristics.

TYPICAL CHARACTERISTICS 3 (Bypass-mode)
(T_A = +25°C, Z_S = Z_L = 75 Ω, unless otherwise specified)

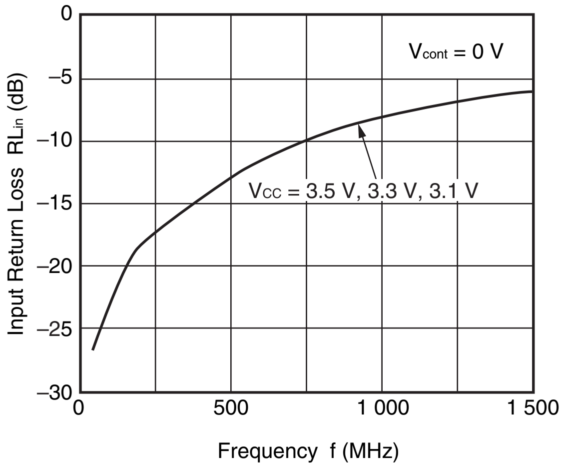
INSERTION LOSS vs. FREQUENCY



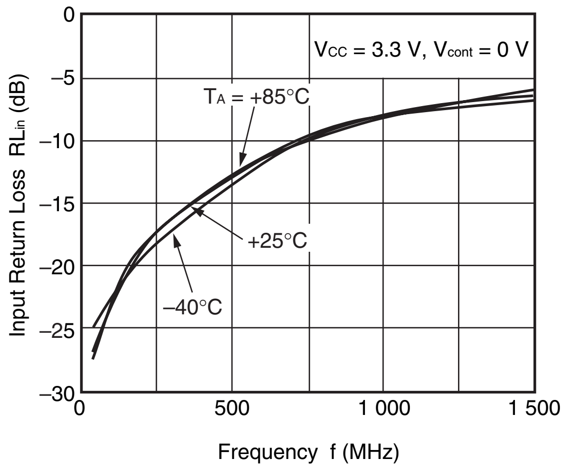
INSERTION LOSS vs. FREQUENCY



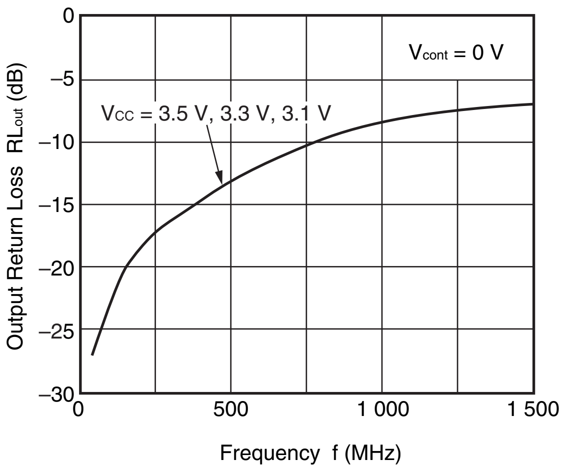
INPUT RETURN LOSS vs. FREQUENCY



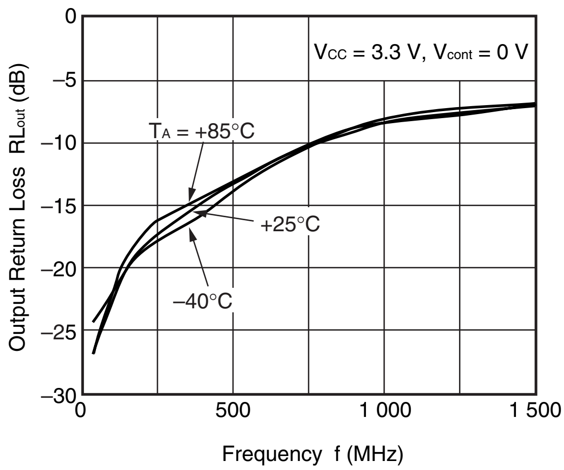
INPUT RETURN LOSS vs. FREQUENCY



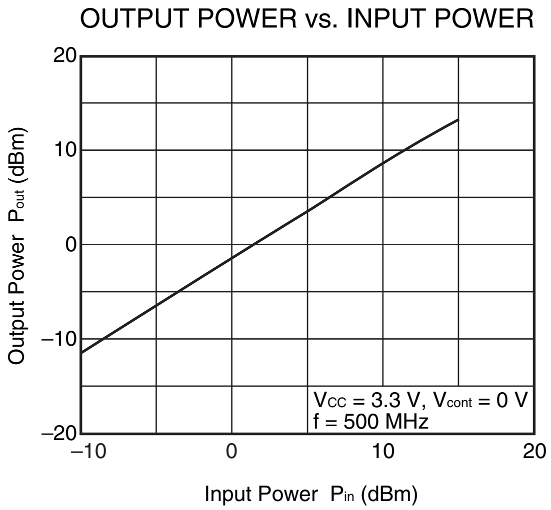
OUTPUT RETURN LOSS vs. FREQUENCY

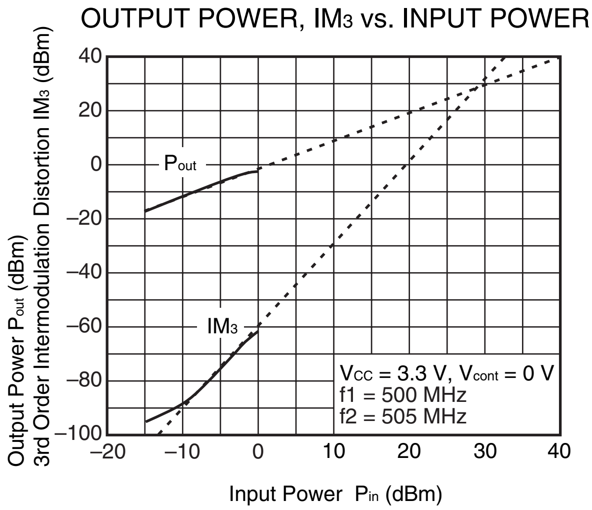


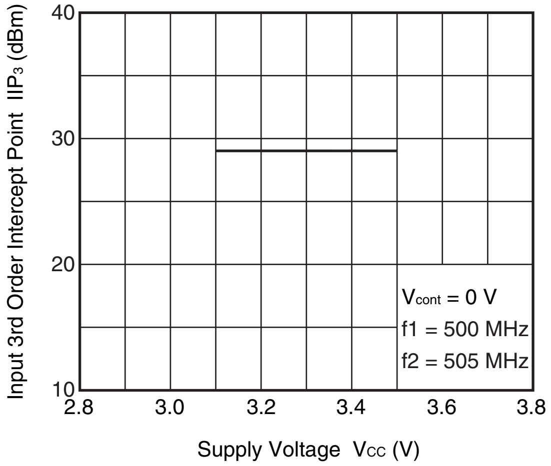
OUTPUT RETURN LOSS vs. FREQUENCY

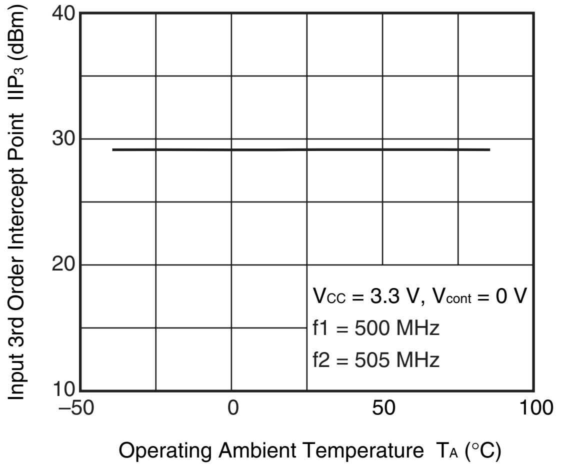


Remark The graphs indicate nominal characteristics.





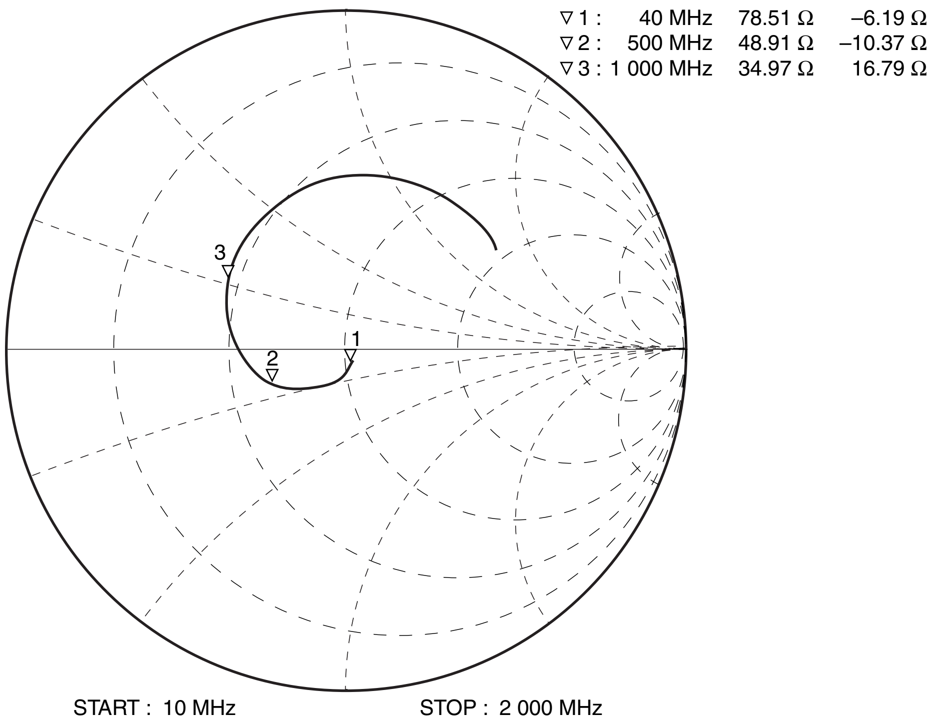




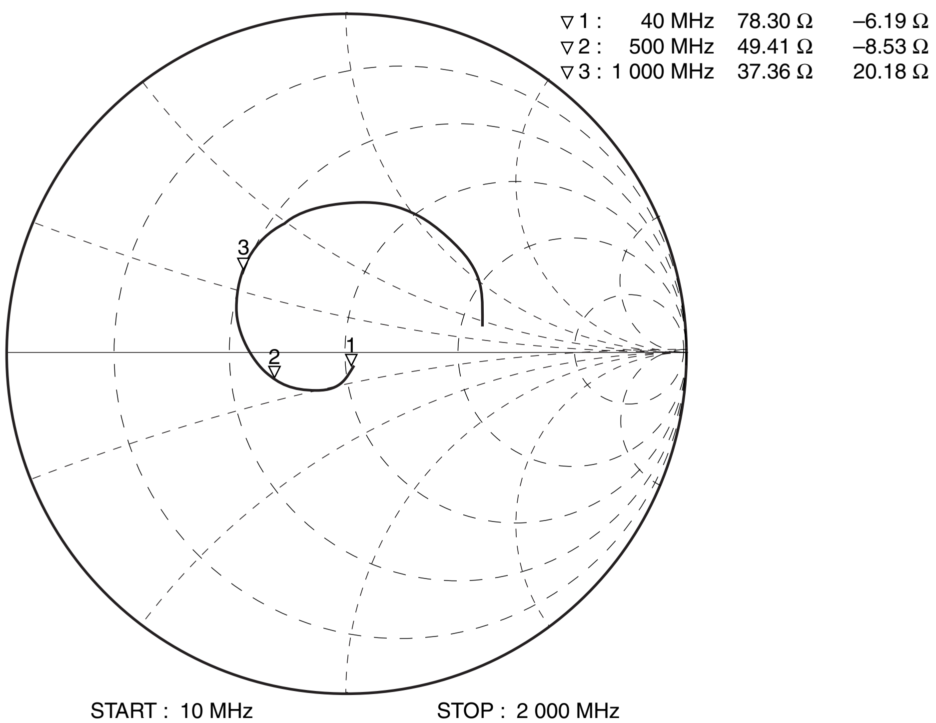
Remark The graphs indicate nominal characteristics.

S-PARAMETERS 2 (Bypass-mode)
(T_A = +25°C, V_{CC} = 3.3 V, V_{cont} = 0 V, Z_S = Z_L = 75 Ω, monitored at connector on board)

S_{11}-FREQUENCY



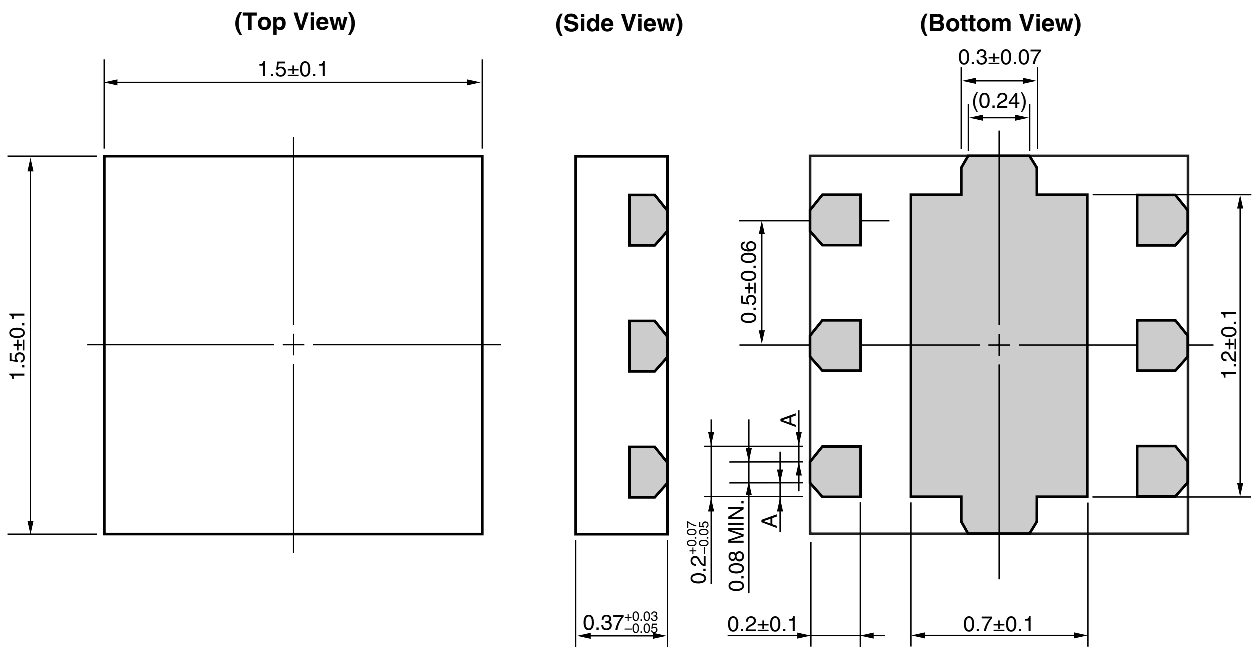
S_{22}-FREQUENCY



Remark The graphs indicate nominal characteristics.

PACKAGE DIMENSIONS

6-PIN PLASTIC TSON (T6N) (UNIT: mm)



Remark A>0

( ) : Reference value

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).
(3) All the ground terminals should be connected to the ground plane as close as possible.
(4) The bypass capacitor should be attached to V_{CC} line.
(5) Do not supply DC voltage to INPUT 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	
Partial Heating	Peak temperature (terminal 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.

Rev.	Date	Description	
		Page	Summary
1.00	Oct 04, 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.

Renesas Electronics America Inc.
2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
1 harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632
Tel: +65-6213-0200, Fax: +65-6278-8001

Renesas Electronics Malaysia Sdn.Bhd.
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics Korea Co., Ltd.
11F., Samik Lavied' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

Colophon 1.1