

# 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 :  $I_{CC1} = 25$  mA TYP. @ $V_{CC} = 3.3$  V (LNA-mode)  
:  $I_{CC2} = 1$  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. @ $f_1 = 500$  MHz,  $f_2 = 505$  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 ( $1.5 \times 1.5 \times 0.37$  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	<ul style="list-style-type: none"> <li>• Embossed tape 8 mm wide</li> <li>• Pin 1, 6 face the perforation side of the tape</li> <li>• Qty 3 kpcs/reel</li> </ul>

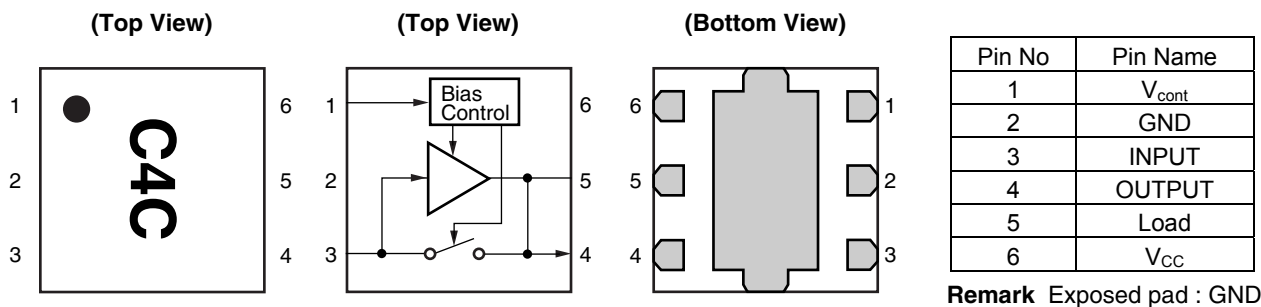
**Remark** To order evaluation samples, please contact your nearby sales office.

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



## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V <sub>CC</sub>	T <sub>A</sub> = +25°C	4.0	V
Mode Control Voltage	V <sub>cont</sub>	T <sub>A</sub> = +25°C	4.0	V
Total Power Dissipation	P <sub>tot</sub>	T <sub>A</sub> = +85°C <b>Note</b>	300	mW
Operating Ambient Temperature	T <sub>A</sub>		-40 to +85	°C
Storage Temperature	T <sub>stg</sub>		-55 to +150	°C
Input Power	P <sub>in</sub>	T <sub>A</sub> = +25°C, Z <sub>S</sub> = Z <sub>L</sub> = 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 <sub>CC</sub>	3.1	3.3	3.5	V
Mode Control Voltage (H)	V <sub>cont</sub> (H)	1.0	—	V <sub>CC</sub>	V
Mode Control Voltage (L)	V <sub>cont</sub> (L)	-0.1	—	0.4	V
Operating Frequency	f	40	—	1 000	MHz
Operating Ambient Temperature	T <sub>A</sub>	-40	+25	+85	°C
Input Power (LNA-mode) <b>Note</b>	P <sub>in</sub>	—	—	0	dBm
Input Power (Bypass-mode) <b>Note</b>	P <sub>in</sub>	—	—	+10	dBm

Note: T<sub>A</sub> = +25°C, Z<sub>S</sub> = Z<sub>L</sub> = 75 Ω

## ELECTRICAL CHARACTERISTICS 1 (DC Characteristics) (T<sub>A</sub> = +25°C, V<sub>CC</sub> = 3.3 V, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current 1	I <sub>CC1</sub>	V <sub>cont</sub> = 3.3 V, No Signal (LNA-mode)	16	25	34	mA
Circuit Current 2	I <sub>CC2</sub>	V <sub>cont</sub> = 0 V, No Signal (Bypass-mode)	—	0.01	1	μA
Mode Control Current 1	I <sub>cont1</sub>	V <sub>cont</sub> = 3.3 V, No Signal (LNA-mode)	—	50	100	μA
Mode Control Current 2	I <sub>cont2</sub>	V <sub>cont</sub> = 0 V, No Signal (Bypass-mode)	—	0.01	1	μA

**ELECTRICAL CHARACTERISTICS 2 (LNA-mode)**

( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = V_{cont} = 3.3\text{ V}$ ,  $Z_S = Z_L = 75\ \Omega$ , unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain 1	$G_{P1}$	$f = 40\text{ MHz}$ , $P_{in} = -20\text{ dBm}$	10.5	13	15.5	dB
Power Gain 2	$G_{P2}$	$f = 1\ 000\text{ MHz}$ , $P_{in} = -20\text{ dBm}$	10.5	13	15.5	dB
Noise Figure 1	NF1	$f = 40\text{ MHz}$ , $Z_S = Z_L = 50\ \Omega$ , excluded PCB and connector losses <b>Note</b>	–	3.2	4.2	dB
Noise Figure 2	NF2	$f = 1\ 000\text{ MHz}$ , $Z_S = Z_L = 50\ \Omega$ , excluded PCB and connector losses <b>Note</b>	–	3.2	4.2	dB
Input Return Loss 1	$RL_{in1}$	$f = 40\text{ MHz}$ , $P_{in} = -20\text{ dBm}$	7	9	–	dB
Input Return Loss 2	$RL_{in2}$	$f = 1\ 000\text{ MHz}$ , $P_{in} = -20\text{ dBm}$	7	10	–	dB
Output Return Loss 1	$RL_{out1}$	$f = 40\text{ MHz}$ , $P_{in} = -20\text{ dBm}$	7	10	–	dB
Output Return Loss 2	$RL_{out2}$	$f = 1\ 000\text{ MHz}$ , $P_{in} = -20\text{ dBm}$	7	12	–	dB
Input 3rd Order Intercept Point	$IIP_3$	$f1 = 500\text{ MHz}$ , $f2 = 505\text{ MHz}$ , $P_{in} = -20\text{ dBm}$	+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)**

( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 3.3\text{ V}$ ,  $V_{cont} = 0\text{ V}$ ,  $Z_S = Z_L = 75\ \Omega$ , unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss 1	$L_{ins1}$	$f = 40\text{ MHz}$ , $P_{in} = -10\text{ dBm}$ , excluded PCB and connector losses <b>Note</b>	–	0.5	1.5	dB
Insertion Loss 2	$L_{ins2}$	$f = 1\ 000\text{ MHz}$ , $P_{in} = -10\text{ dBm}$ , excluded PCB and connector losses <b>Note</b>	–	1.7	2.5	dB
Input Return Loss 1	$RL_{in1}$	$f = 40\text{ MHz}$ , $P_{in} = -10\text{ dBm}$	10	26	–	dB
Input Return Loss 2	$RL_{in2}$	$f = 1\ 000\text{ MHz}$ , $P_{in} = -10\text{ dBm}$	7	8	–	dB
Output Return Loss 1	$RL_{out1}$	$f = 40\text{ MHz}$ , $P_{in} = -10\text{ dBm}$	10	25	–	dB
Output Return Loss 2	$RL_{out2}$	$f = 1\ 000\text{ MHz}$ , $P_{in} = -10\text{ dBm}$	7	8	–	dB
Input 3rd Order Intercept Point	$IIP_3$	$f1 = 500\text{ MHz}$ , $f2 = 505\text{ MHz}$ , $P_{in} = -5\text{ dBm}$	+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)**

( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = V_{cont} = 3.3\text{ V}$ ,  $Z_S = Z_L = 75\ \Omega$ , unless otherwise specified)

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

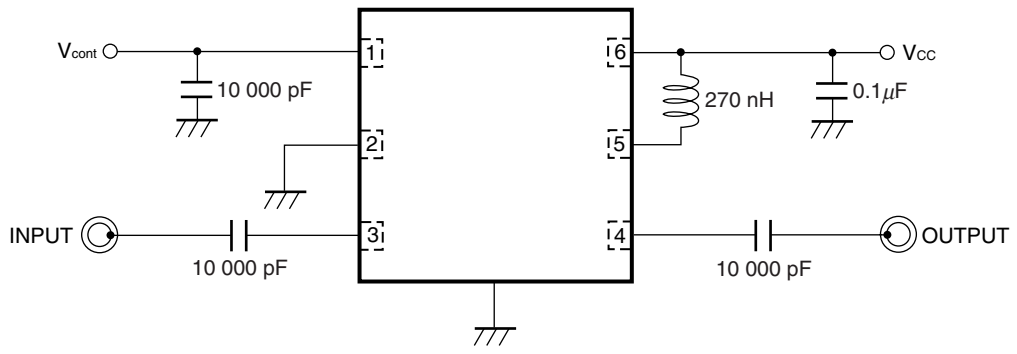
**STANDARD CHARACTERISTICS FOR REFERENCE 2 (Bypass-mode)**

( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 3.3\text{ V}$ ,  $V_{cont} = 0\text{ V}$ ,  $Z_S = Z_L = 75\ \Omega$ , unless otherwise specified)

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

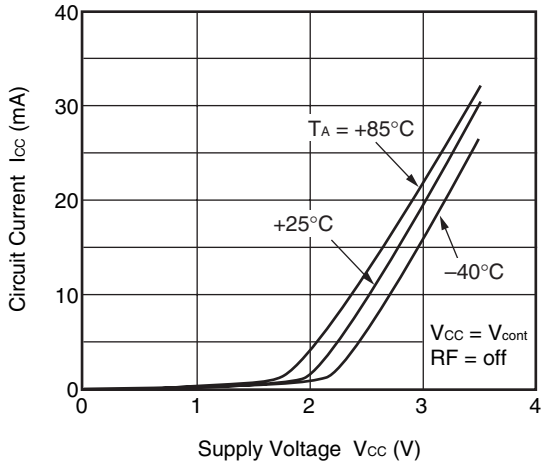
Note: The input-output power characteristic is not saturated up to +15 dBm of input power.

### TEST CIRCUIT

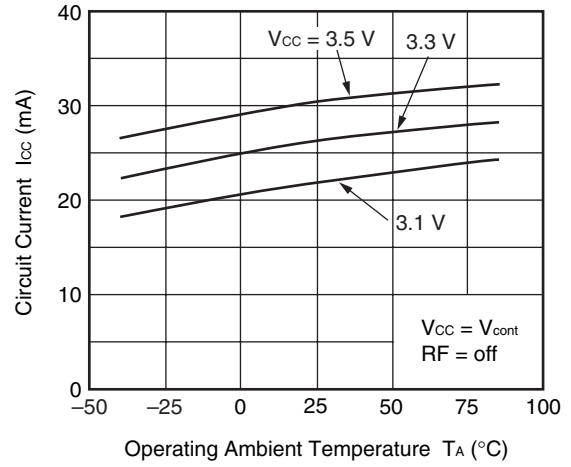


### TYPICAL CHARACTERISTICS 1 (DC Characteristics) ( $T_A = +25^\circ\text{C}$ , unless otherwise specified)

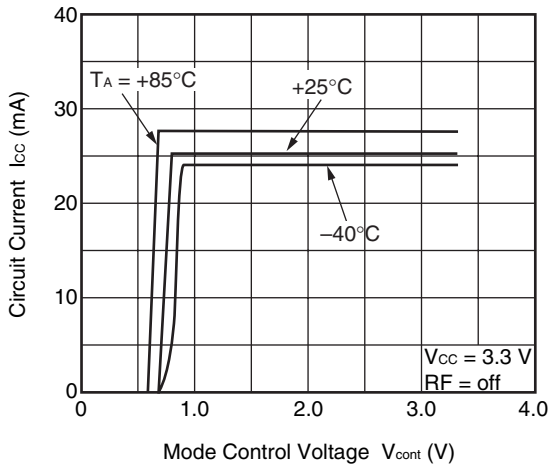
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



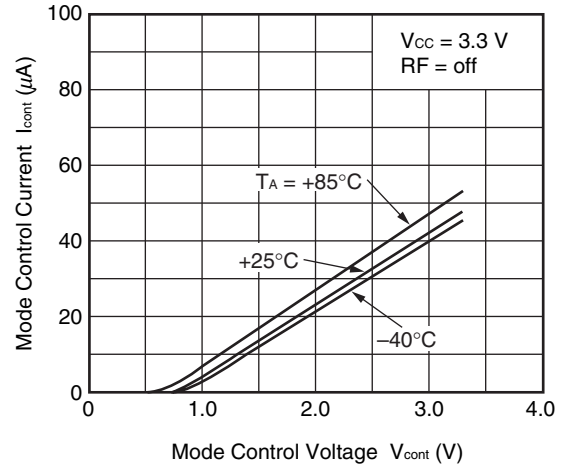
CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



CIRCUIT CURRENT vs. MODE CONTROL VOLTAGE



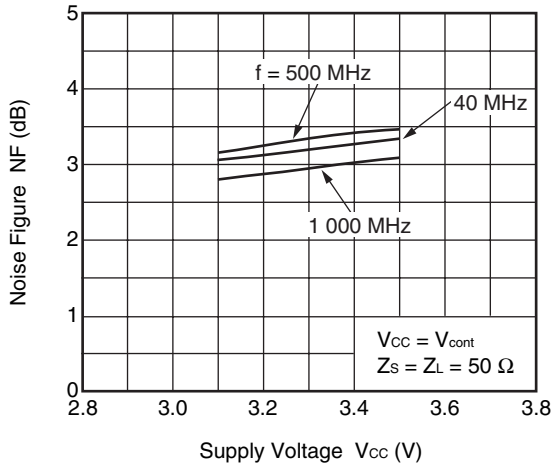
MODE CONTROL CURRENT vs. MODE CONTROL VOLTAGE



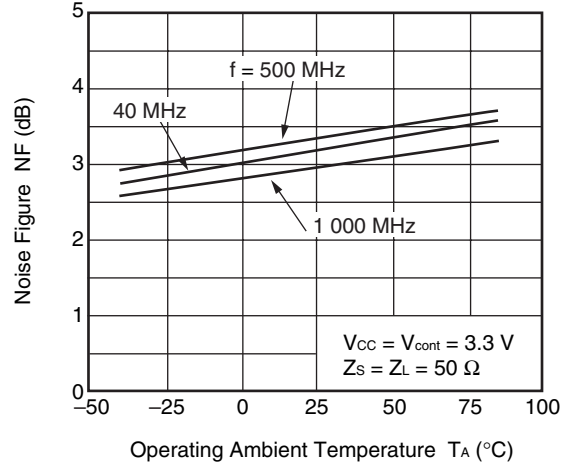
**Remark** The graphs indicate nominal characteristics.

**TYPICAL CHARACTERISTICS 2 (LNA-mode)**  
 (T<sub>A</sub> = +25°C, Z<sub>S</sub> = Z<sub>L</sub> = 75 Ω, unless otherwise specified)

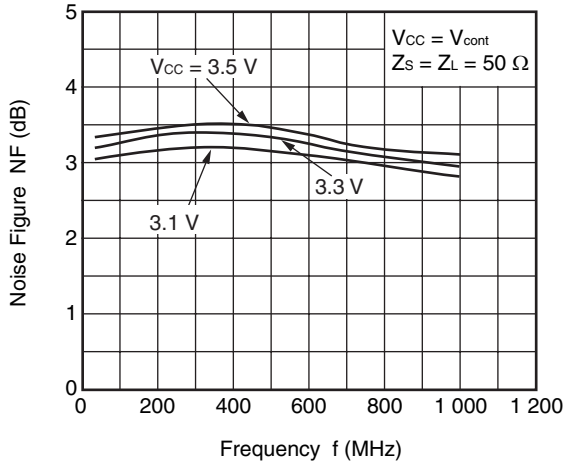
NOISE FIGURE vs. SUPPLY VOLTAGE



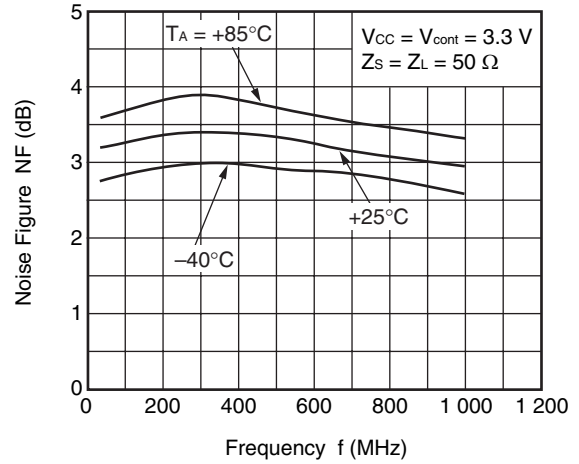
NOISE FIGURE vs. OPERATING AMBIENT TEMPERATURE



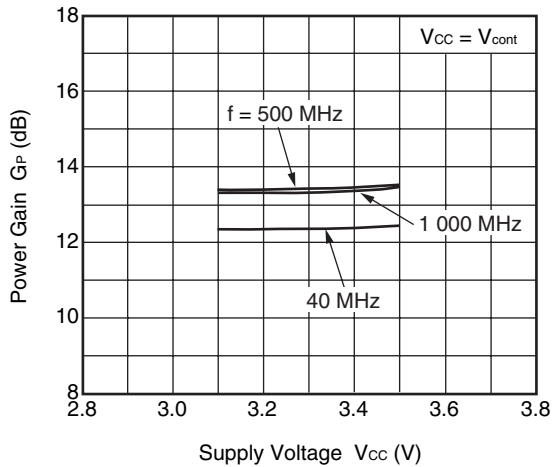
NOISE FIGURE vs. FREQUENCY



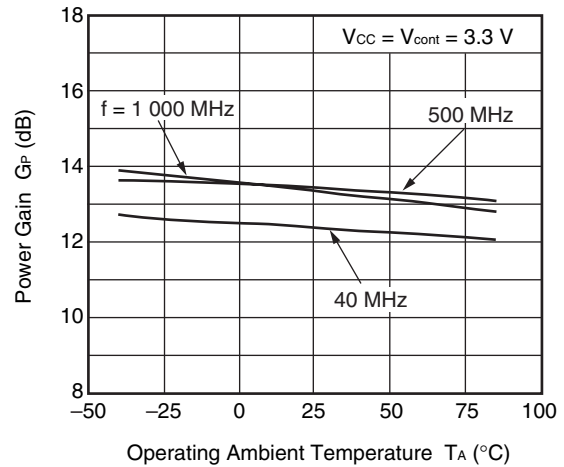
NOISE FIGURE vs. FREQUENCY



POWER GAIN vs. SUPPLY VOLTAGE

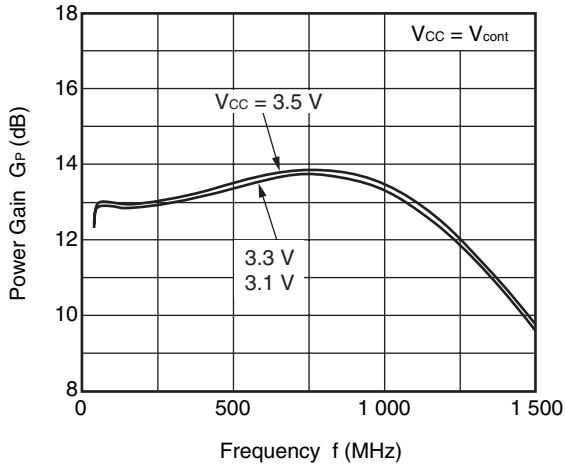


POWER GAIN vs. OPERATING AMBIENT TEMPERATURE

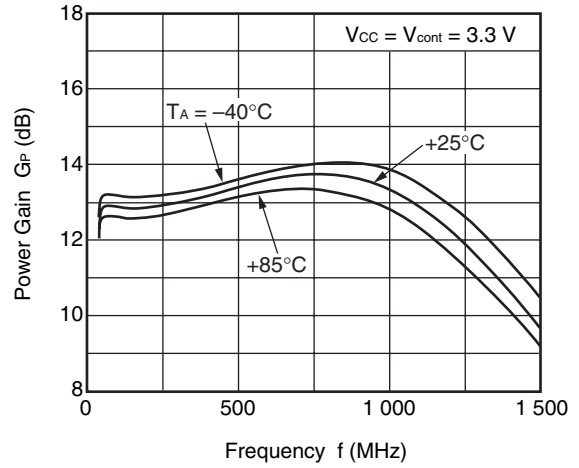


**Remark** The graphs indicate nominal characteristics.

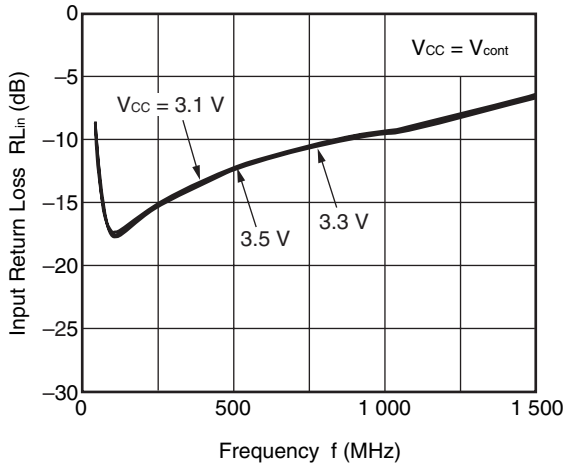
POWER GAIN vs. FREQUENCY



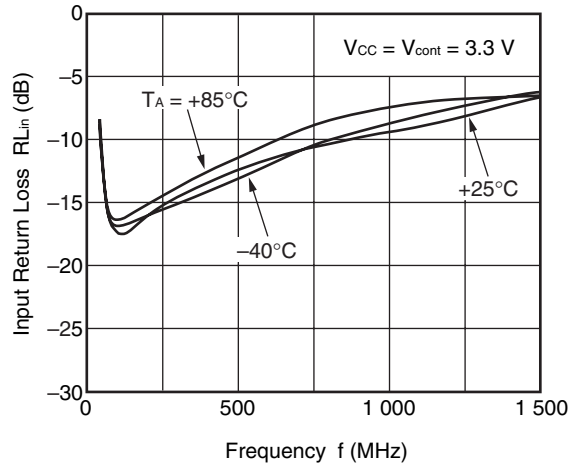
POWER GAIN vs. FREQUENCY



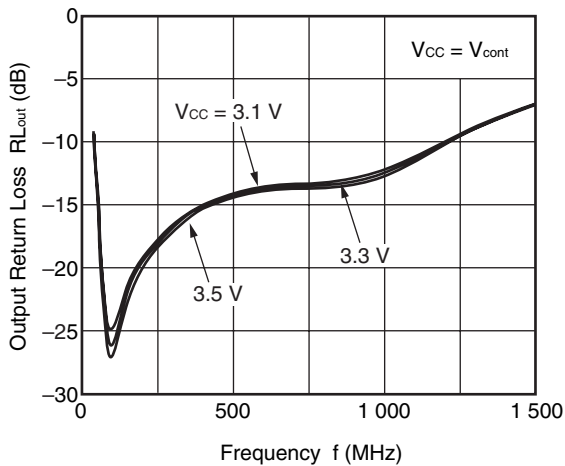
INPUT RETURN LOSS vs. FREQUENCY



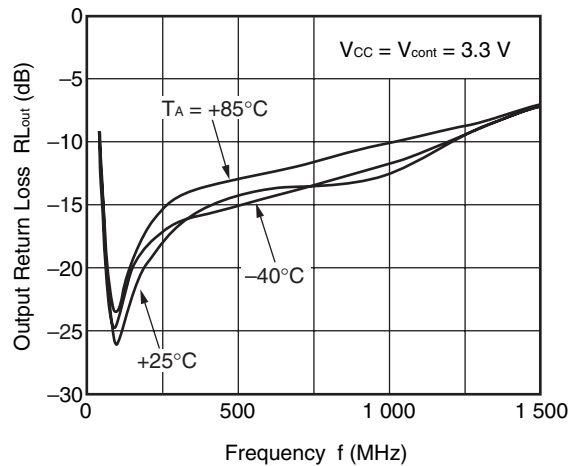
INPUT RETURN LOSS vs. FREQUENCY



OUTPUT RETURN LOSS vs. FREQUENCY

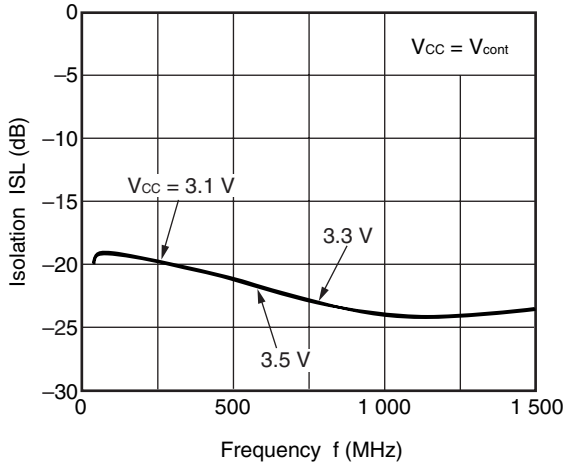


OUTPUT RETURN LOSS vs. FREQUENCY

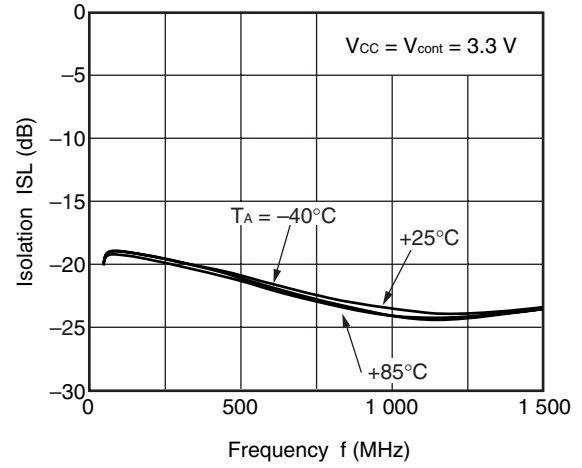


**Remark** The graphs indicate nominal characteristics.

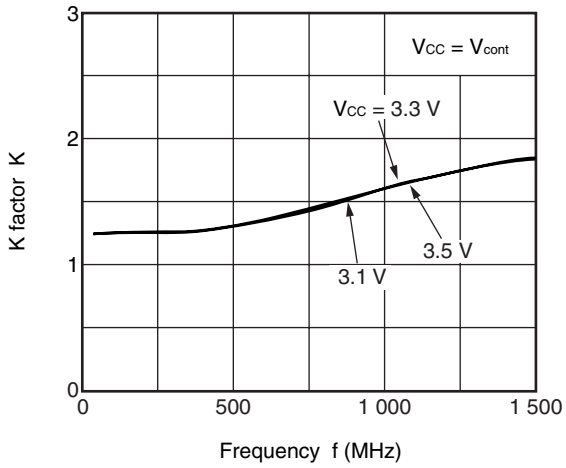
ISOLATION vs. FREQUENCY



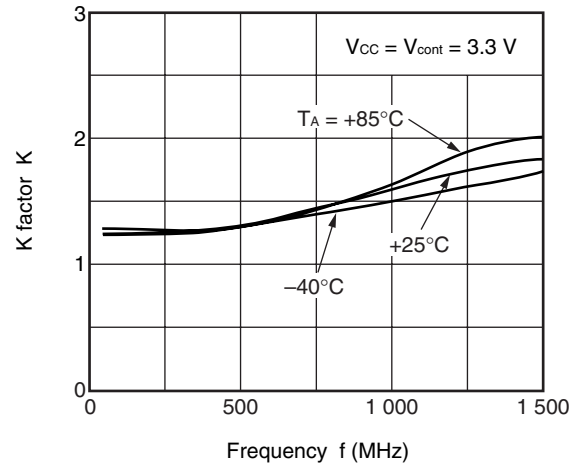
ISOLATION vs. FREQUENCY



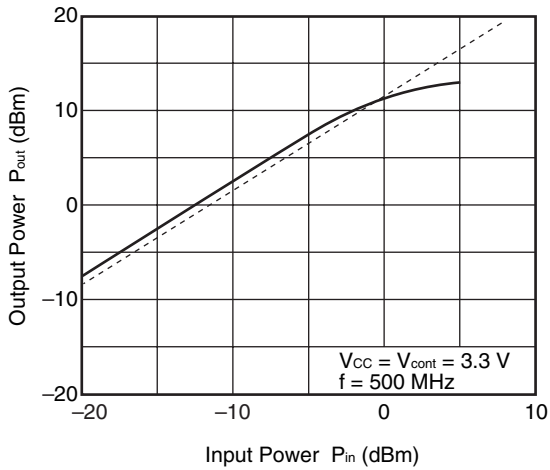
K FACTOR vs. FREQUENCY



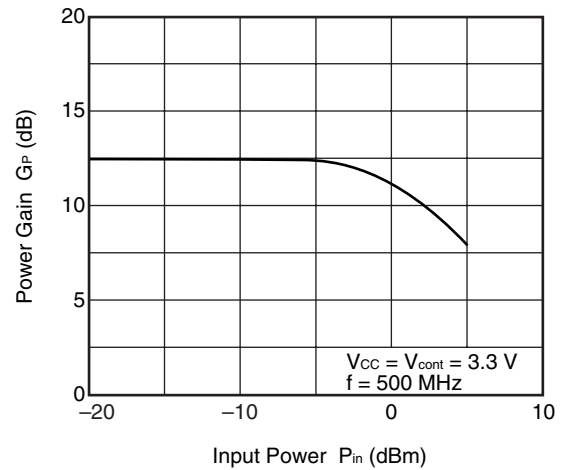
K FACTOR vs. FREQUENCY



OUTPUT POWER vs. INPUT POWER

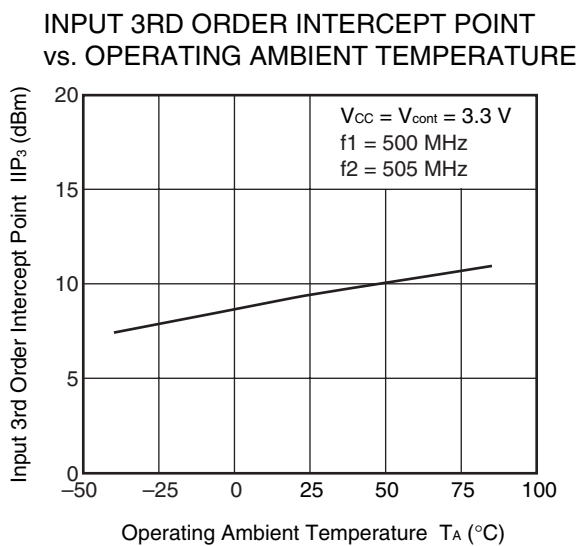
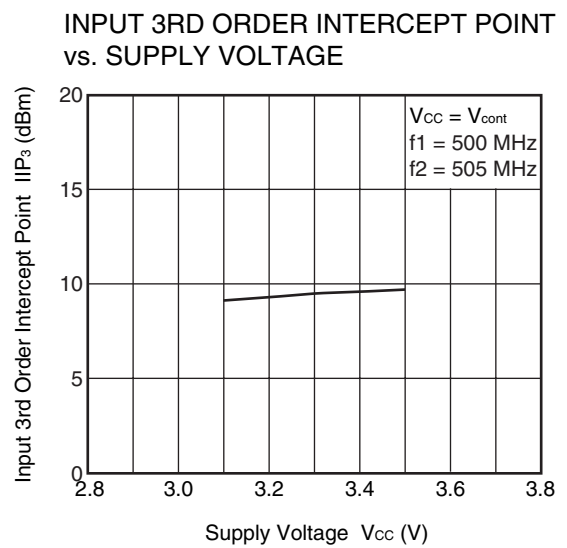
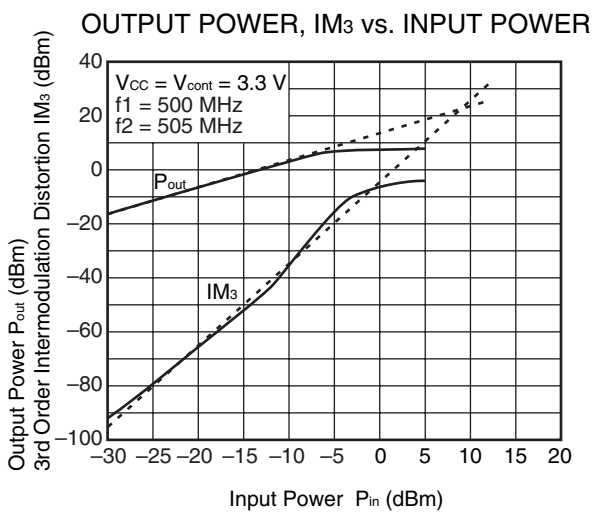
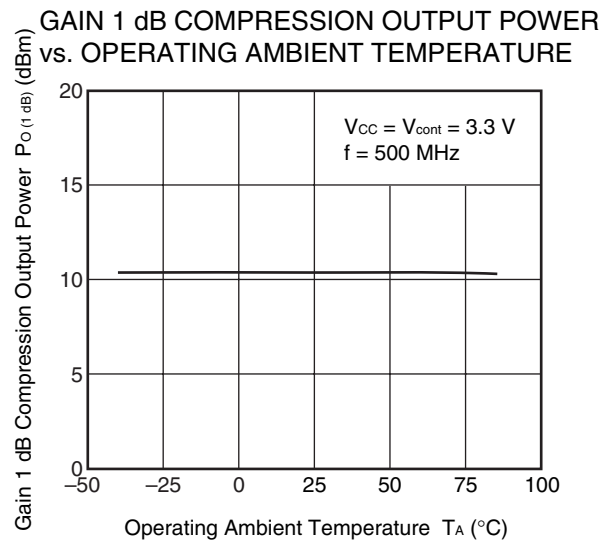
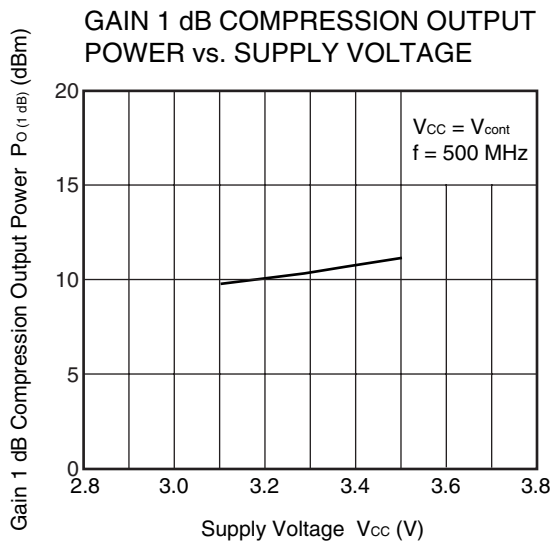


POWER GAIN vs. INPUT POWER



**Remark** The graphs indicate nominal characteristics.



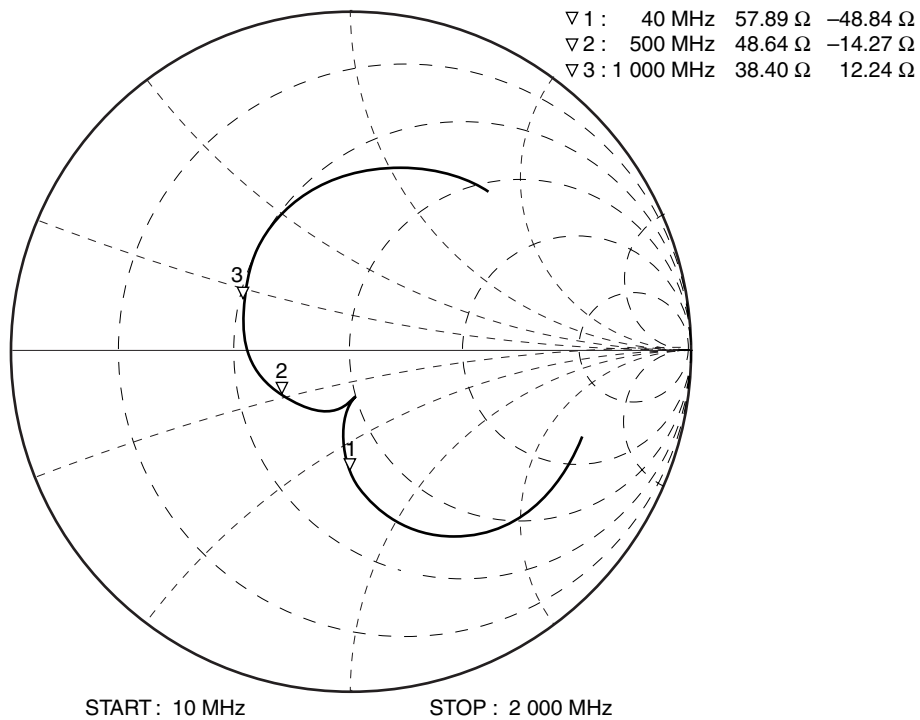


**Remark** The graphs indicate nominal characteristics.

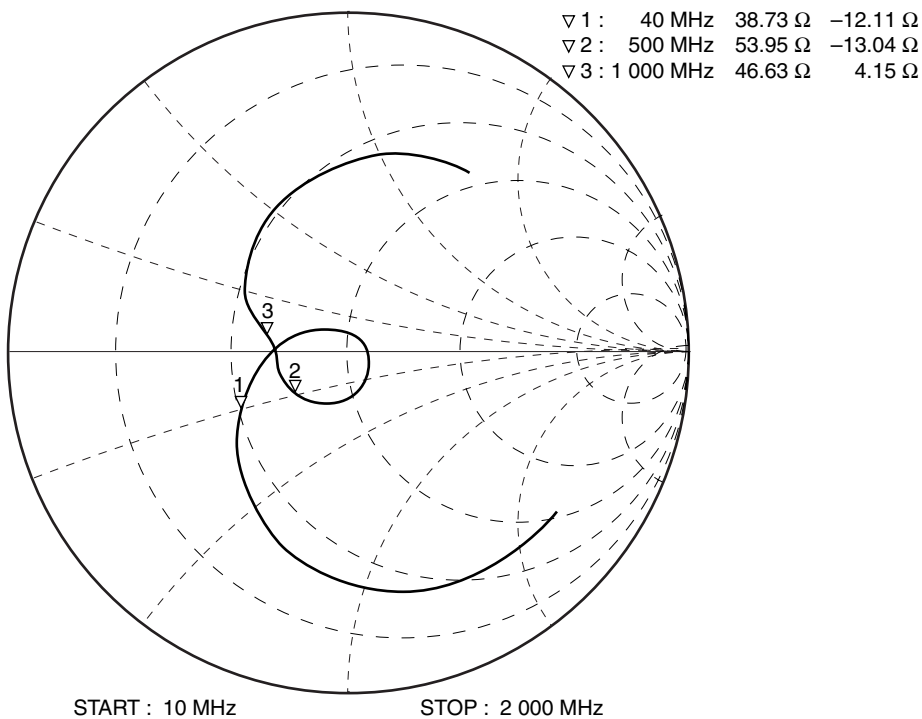
### S-PARAMETERS 1 (LNA-mode)

( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = V_{cont} = 3.3\text{ V}$ ,  $Z_S = Z_L = 75\ \Omega$ , monitored at connector on board)

#### S<sub>11</sub>-FREQUENCY



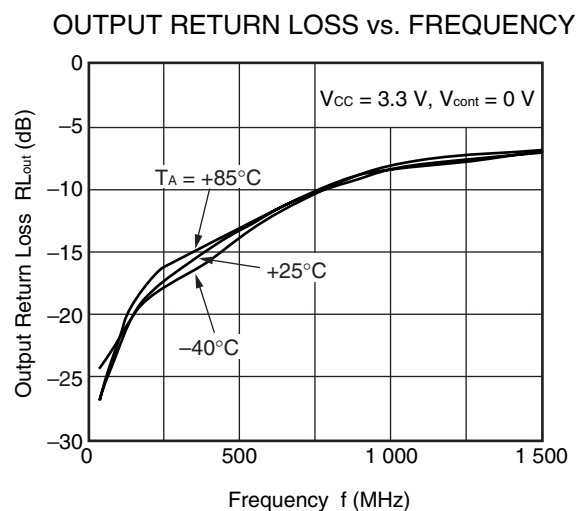
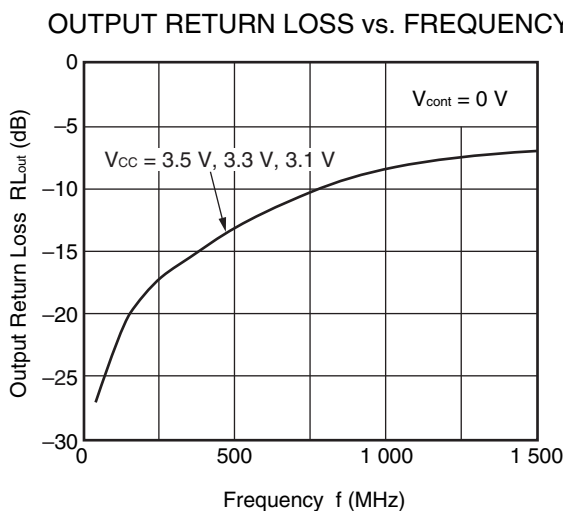
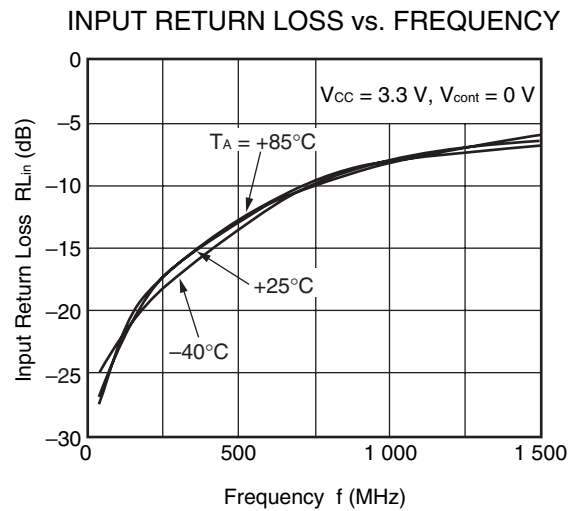
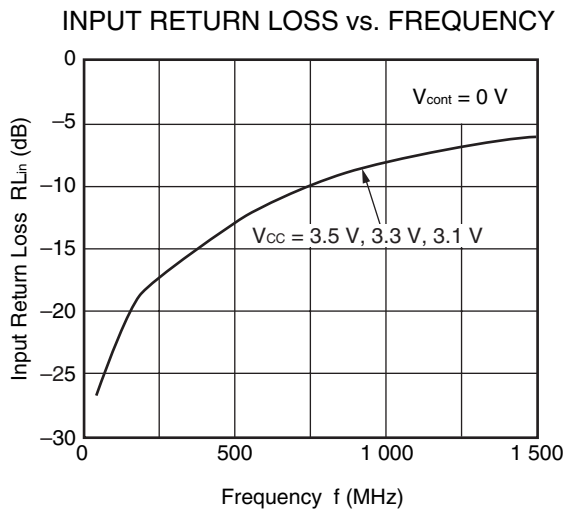
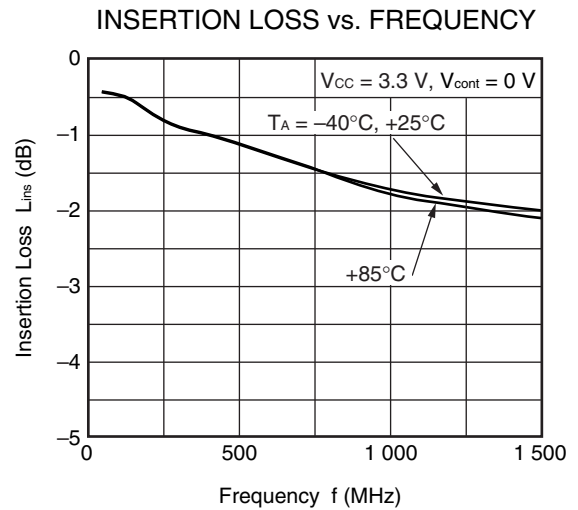
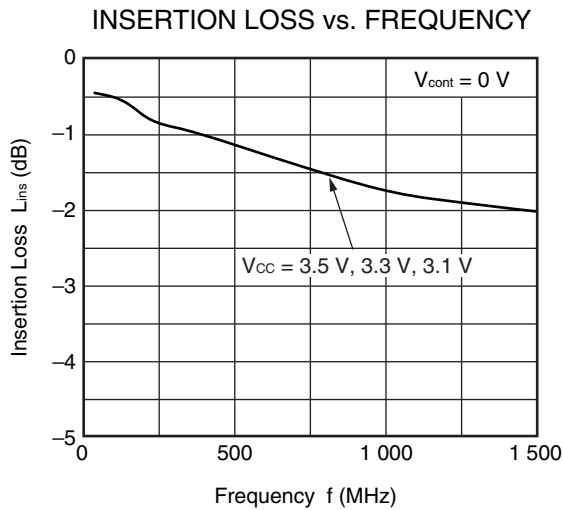
#### S<sub>22</sub>-FREQUENCY



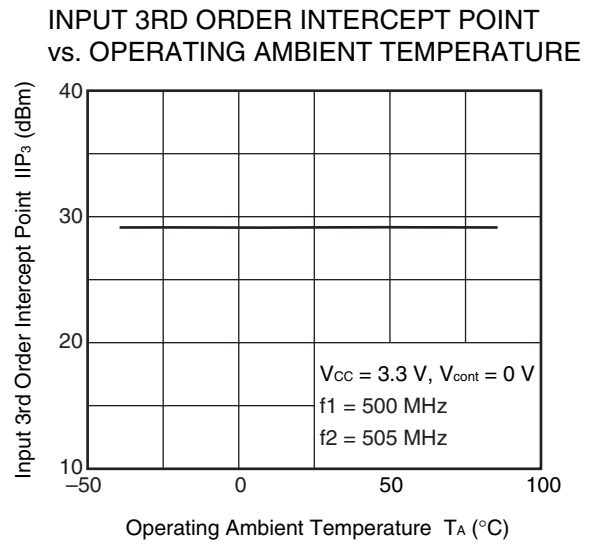
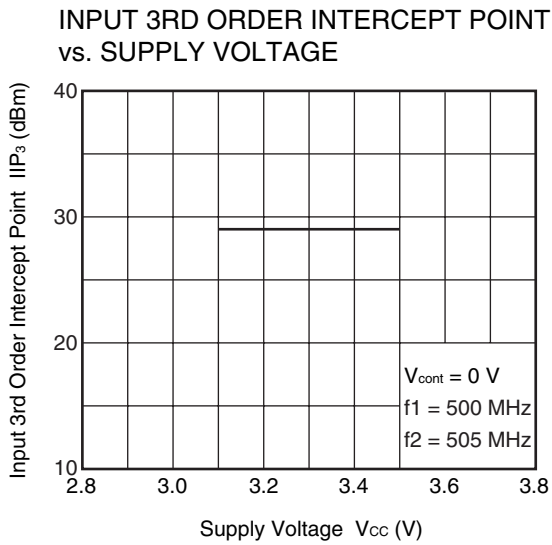
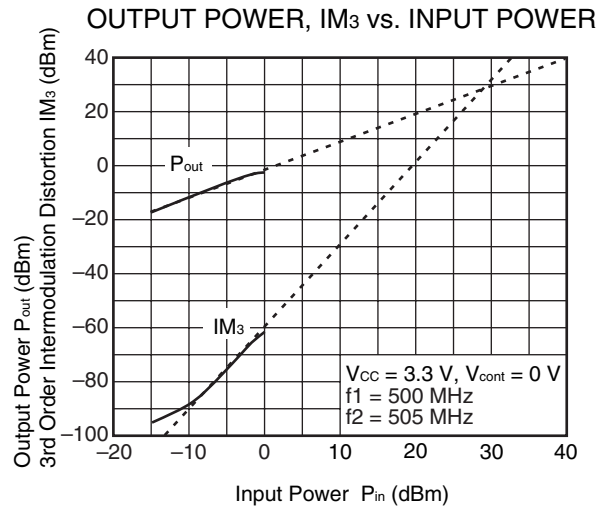
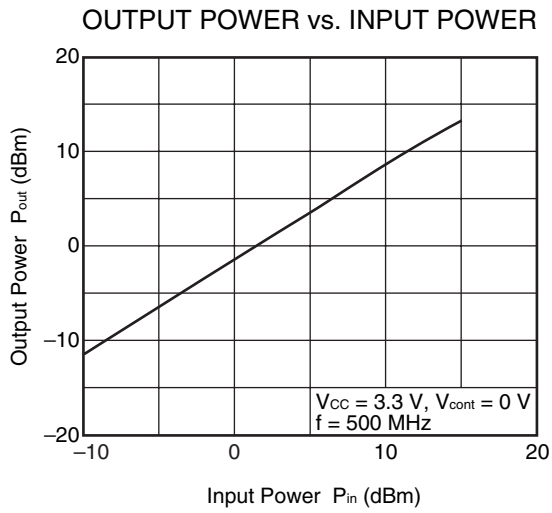
**Remark** The graphs indicate nominal characteristics.

**TYPICAL CHARACTERISTICS 3 (Bypass-mode)**

( $T_A = +25^\circ\text{C}$ ,  $Z_S = Z_L = 75 \Omega$ , unless otherwise specified)



**Remark** The graphs indicate nominal characteristics.

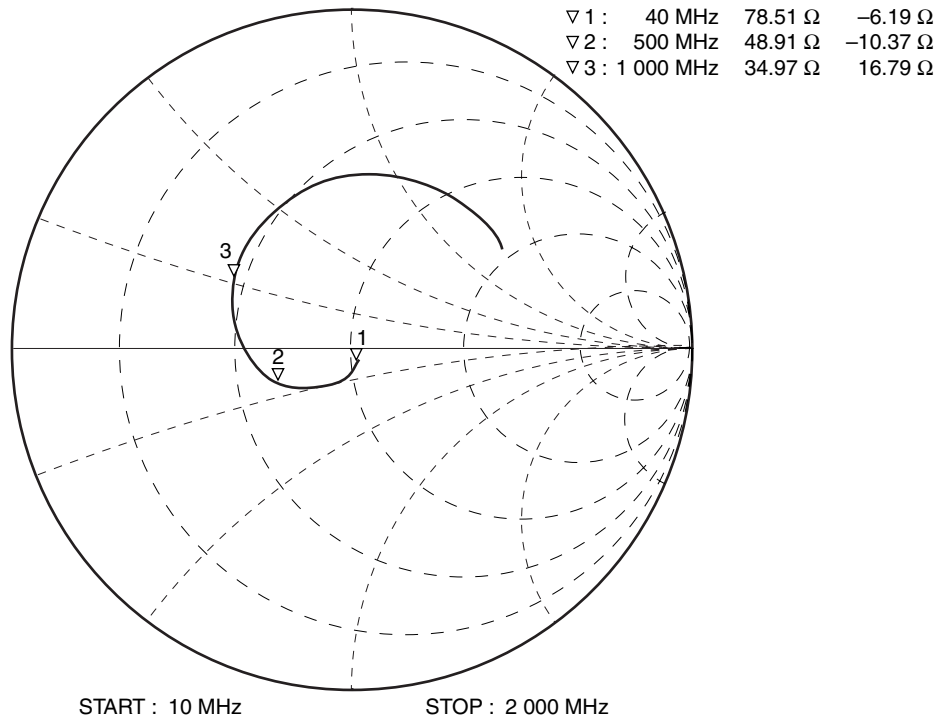


**Remark** The graphs indicate nominal characteristics.

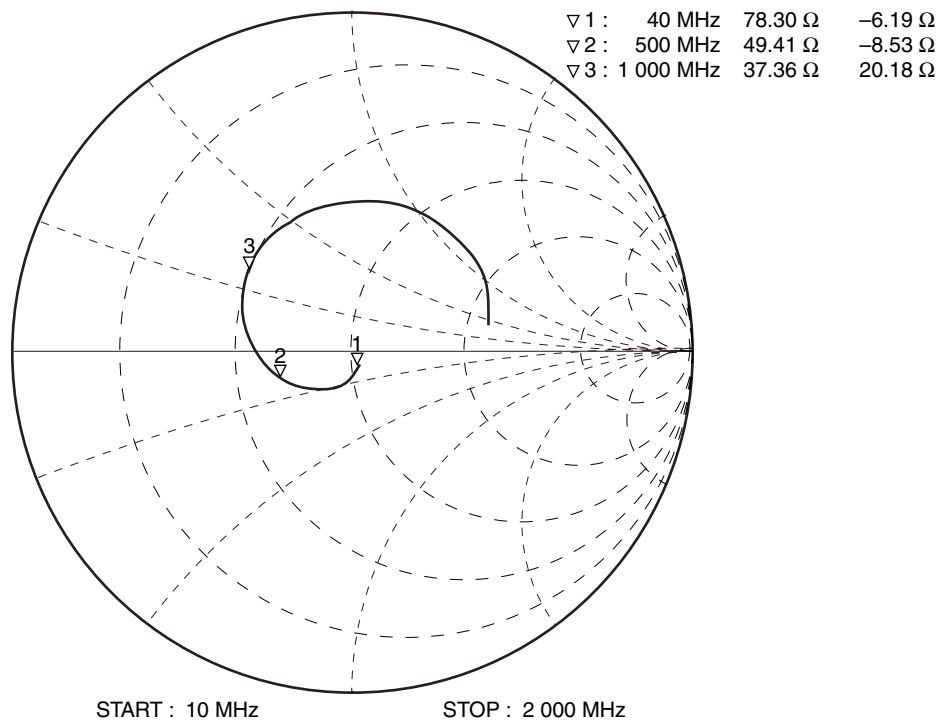
### S-PARAMETERS 2 (Bypass-mode)

( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 3.3\text{ V}$ ,  $V_{cont} = 0\text{ V}$ ,  $Z_S = Z_L = 75\ \Omega$ , monitored at connector on board)

#### S<sub>11</sub>-FREQUENCY



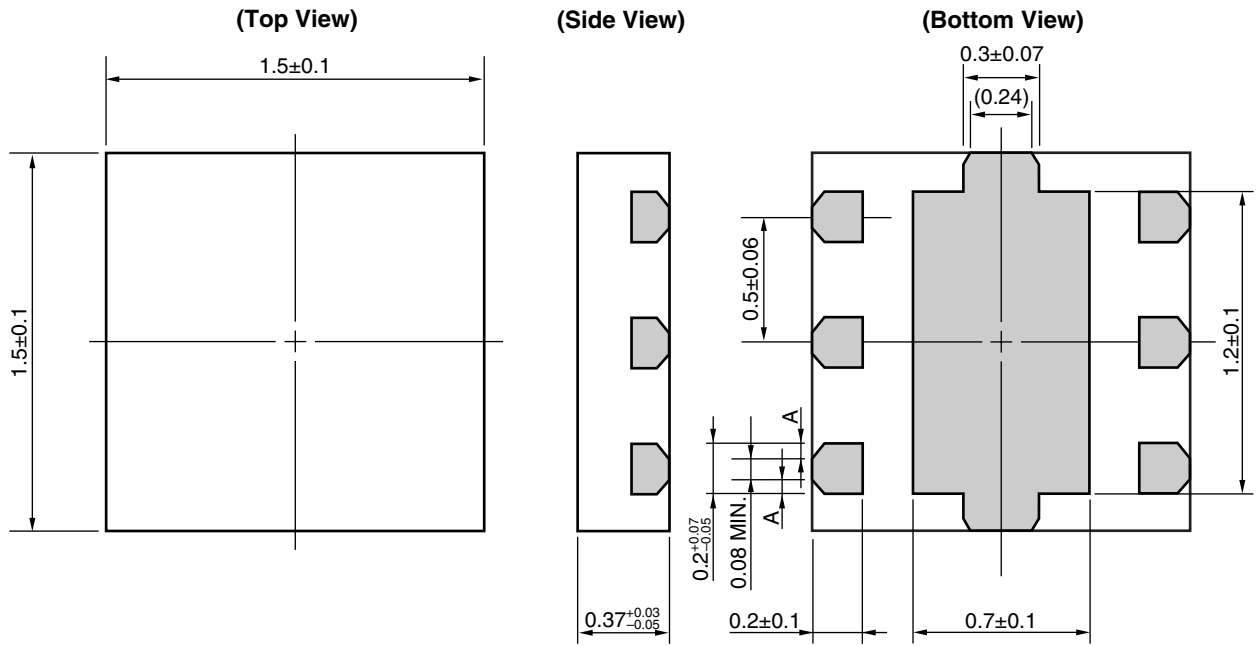
#### S<sub>22</sub>-FREQUENCY



**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<sub>CC</sub> 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 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
Partial Heating	Peak temperature (terminal 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.

<b>Revision History</b>	<b><math>\mu</math>PD5756T6N Data Sheet</b>
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Rev.	Date	Description	
		Page	Summary
1.00	Oct 04, 2011	—	First edition issued

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