DATA SHEET

CEL

SiGe BiCMOS INTEGRATED CIRCUIT

μPD5740T6N

LOW NOISE WIDEBAND AMPLIFIER IC WITH BYPASS / THROUGH FUNCTION

DESCRIPTION

The μPD5740T6N is a low noise wideband amplifier IC mainly designed for the portable digital TV application. This IC has achieved low noise figure and wideband operation. The μPD5740T6N has an LNA pass-through function (bypass function) to prevent the degradation of the received signal quality at the strong electric field, and achieve the high reception sensitivity and low power consumption.

The package is a 6-pin plastic TSON (Thin Small Out-line Non-leaded) (T6N) suitable for surface mount.

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

FEATURES

- Low voltage operation : V_{CC} = 2.3 to 3.3 V (2.8 V TYP.)
- Low mode control voltage : $V_{cont\,(H)}$ = 1.0 V to V_{CC}, $V_{cont\,(L)}$ = 0 to 0.5 V
- Low current consumption : $I_{CC}1$ = 5.0 mA TYP. @ V_{CC} = 2.8 V (LNA-mode)
  : $I_{CC}2$ = 1 μA MAX. @ V_{CC} = 2.8 V (Bypass-mode)
- Low noise (LNA-mode) : NF1 = 1.5 dB TYP. @ V_{CC} = 2.8 V, f = 470 MHz
  : NF2 = 1.5 dB TYP. @ V_{CC} = 2.8 V, f = 770 MHz
- High gain (LNA-mode) : G_P1 = 15.0 dB TYP. @ V_{CC} = 2.8 V, f = 470 MHz
  : G_P2 = 13.5 dB TYP. @ V_{CC} = 2.8 V, f = 770 MHz
- Low insertion loss (Bypass-mode) : $L_{ins}1$ = 1.1 dB TYP. @ V_{CC} = 2.8 V, f = 470 MHz
  : $L_{ins}2$ = 1.3 dB TYP. @ V_{CC} = 2.8 V, f = 770 MHz
- High-density surface mounting : 6-pin plastic TSON (T6N) package (1.5 × 1.5 × 0.37 mm)
- Included protection circuits for ESD

APPLICATION

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

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPD5740T6N-E2	μPD5740T6N-E2-A	6-pin plastic TSON (T6N) (Pb-Free)	C3U	• 8 mm wide embossed taping • 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: μPD5740T6N-A

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

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

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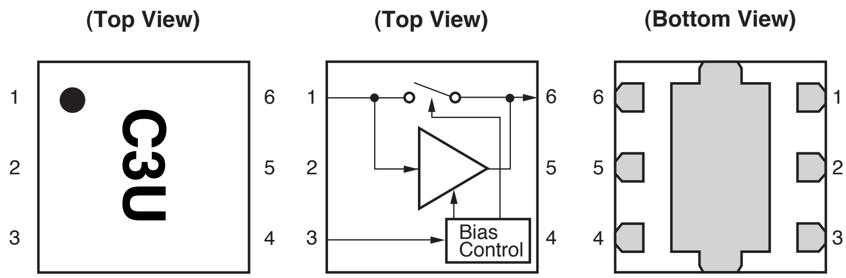
PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



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

Remark Exposed pad : GND

TRUTH TABLE

V_{cont}	Gain	Mode
H	High	LNA-mode
L	Low	Bypass-mode

Remark "H" = $V_{cont (H)}$, "L" = $V_{cont (L)}$

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Test Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C	3.6	V
Mode Control Voltage	V_{cont}	T_A = +25°C	3.6	V
Total Power Dissipation	P_{tot}		150	mW
Operating Ambient Temperature	T_A		–40 to +85	°C
Storage Temperature	T_{stg}		–55 to +150	°C
Input Power	P_{in}		+33	dBm

RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}	2.3	2.8	3.3	V
Mode Control Voltage (H)	$V_{cont (H)}$	1.0	–	V_{CC}	V
Mode Control Voltage (L)	$V_{cont (L)}$	0	–	0.5	V
Operating Frequency	f	50	–	1 800	MHz
Operating Ambient Temperature	T_A	–40	+25	+85	°C
Input Power (LNA-mode)	P_{in}	–	–	+7	dBm
Input Power (Bypass-mode)	P_{in}	–	–	+15	dBm

ELECTRICAL CHARACTERISTICS 1 (DC Characteristics)
(T_A = +25°C, V_{CC} = 2.8 V, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current 1	$I_{CC}1$	V_{cont} = 2.8 V, No Signal (LNA-mode)	3.8	5.0	6.5	mA
Circuit Current 2	$I_{CC}2$	V_{cont} = 0 V, No Signal (Bypass-mode)	–	–	1	μA
Mode Control Current 1	$I_{cont}1$	V_{cont} = 2.8 V, No Signal (LNA-mode)	–	40	100	μA
Mode Control Current 2	$I_{cont}2$	V_{cont} = 0 V, No Signal (Bypass-mode)	–	–	1	μA

ELECTRICAL CHARACTERISTICS 2 (LNA-mode)
(T_A = +25°C, V_{CC} = V_{cont} = 2.8 V, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Power Gain 1	G_P1	f = 470 MHz, P_{in} = –30 dBm	13.0	15.0	17.0	dB
Power Gain 2	G_P2	f = 770 MHz, P_{in} = –30 dBm	11.5	13.5	15.5	dB
Noise Figure 1	NF1	f = 470 MHz, excluded PCB and connector losses **Note**	–	1.5	2.0	dB
Noise Figure 2	NF2	f = 770 MHz, excluded PCB and connector losses **Note**	–	1.5	2.0	dB
Input Return Loss 1	$RL_{in}1$	f = 470 MHz, P_{in} = –30 dBm	7	12	–	dB
Input Return Loss 2	$RL_{in}2$	f = 770 MHz, P_{in} = –30 dBm	7	10	–	dB
Output Return Loss 1	$RL_{out}1$	f = 470 MHz, P_{in} = –30 dBm	7	14	–	dB
Output Return Loss 2	$RL_{out}1$	f = 770 MHz, P_{in} = –30 dBm	7	11	–	dB
Input 3rd Order Intercept Point 1	IIP_31	f1 = 470 MHz, f2 = 471 MHz, P_{in} = –30 dBm	–4.0	–1.0	–	dBm
Input 3rd Order Intercept Point 2	IIP_32	f1 = 770 MHz, f2 = 771 MHz, P_{in} = –30 dBm	–1.0	+2.0	–	dBm

Note Input PCB and connector losses: 0.05 dB (at 470 MHz), 0.08 dB (at 770 MHz)

ELECTRICAL CHARACTERISTICS 3 (Bypass-mode)
(T_A = +25°C, V_{CC} = 2.8 V, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss 1	$L_{ins}1$	f = 470 MHz, P_{in} = −10 dBm, excluded PCB and connector losses **Note**	–	1.1	2	dB
Insertion Loss 2	$L_{ins}2$	f = 770 MHz, P_{in} = −10 dBm, excluded PCB and connector losses **Note**	–	1.3	2	dB
Input Return Loss 1	$RL_{in}1$	f = 470 MHz, P_{in} = −10 dBm	10	20	–	dB
Input Return Loss 2	$RL_{in}2$	f = 770 MHz, P_{in} = −10 dBm	10	17	–	dB
Output Return Loss 1	$RL_{out}1$	f = 470 MHz, P_{in} = −10 dBm	10	20	–	dB
Output Return Loss 2	$RL_{out}1$	f = 770 MHz, P_{in} = −10 dBm	10	17	–	dB
Input 3rd Order Intercept Point	IIP_3	f1 = 770 MHz, f2 = 771 MHz, P_{in} = −2.5 dBm	+20	+30	–	dBm

Note Input-output PCB and connector losses: 0.10 dB (at 470 MHz), 0.16 dB (at 770 MHz)

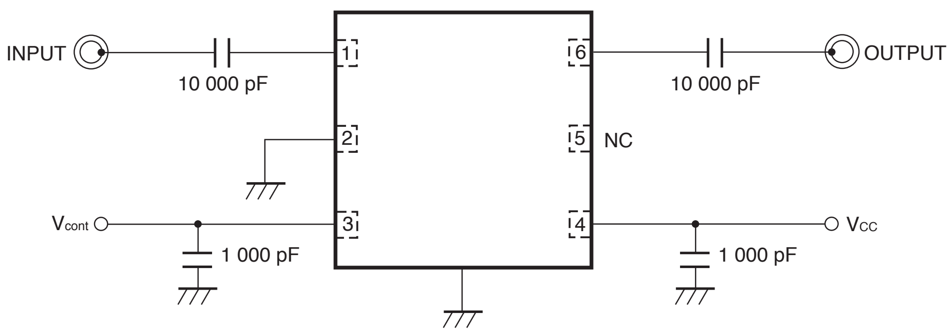
STANDARD CHARACTERISTICS FOR REFERENCE 1 (LNA-mode)
(T_A = +25°C, V_{CC} = V_{cont} = 2.8 V, unless otherwise specified)

Parameter	Symbol	Test Conditions	Reference	Unit
Isolation 1	ISL1	f = 470 MHz, P_{in} = –30 dBm	20	dB
Isolation 2	ISL2	f = 770 MHz, P_{in} = –30 dBm	20	dB
Gain 1 dB Compression Output Power 1	$P_{O\ (1\ dB)}$ 1	f = 470 MHz	–5.5	dBm
Gain 1 dB Compression Output Power 2	$P_{O\ (1\ dB)}$ 2	f = 770 MHz	–5.0	dBm

STANDARD CHARACTERISTICS FOR REFERENCE 2 (Bypass-mode)
(T_A = +25°C, V_{CC} = 2.8 V, V_{cont} = 0 V, unless otherwise specified)

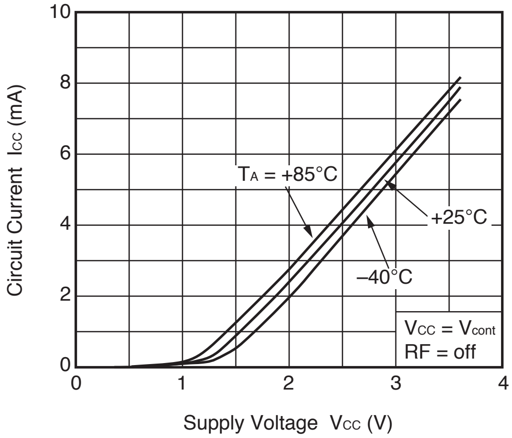
Parameter	Symbol	Test Conditions	Reference	Unit
Gain 1 dB Compression Output Power	$P_{O\ (1\ dB)}$	f = 770 MHz	+8	dBm

TEST CIRCUIT

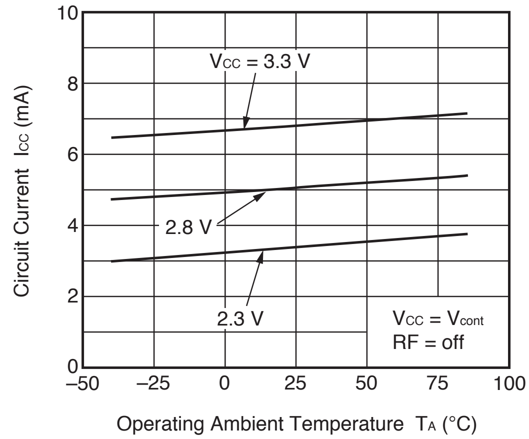


TYPICAL CHARACTERISTICS 1 (DC Characteristics) (T_A = +25°C, unless otherwise specified)

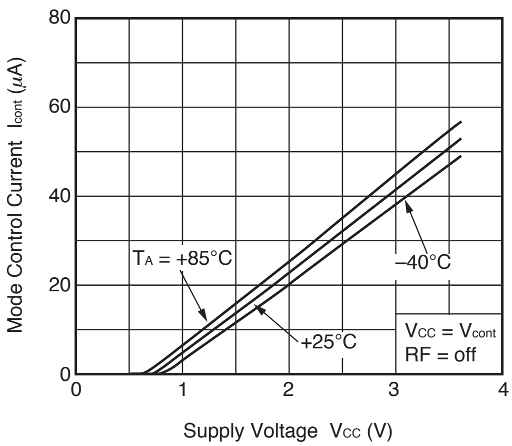
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



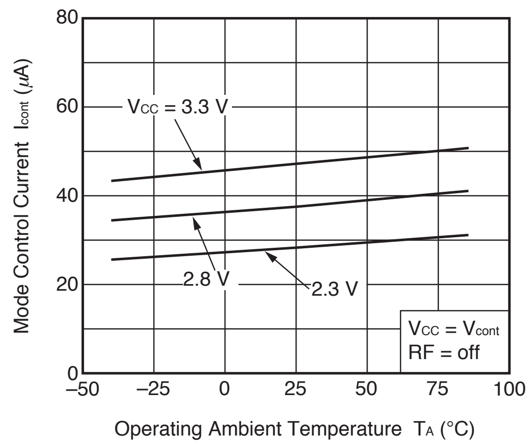
CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



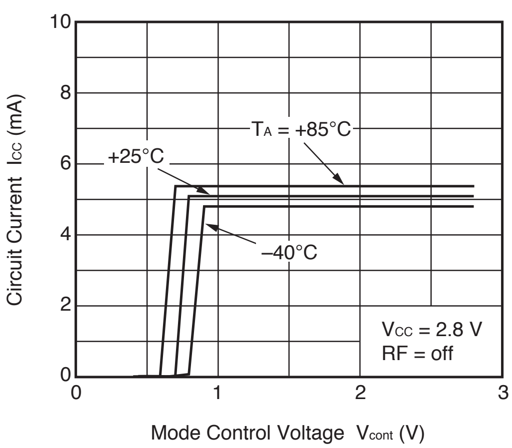
MODE CONTROL CURRENT vs. SUPPLY VOLTAGE



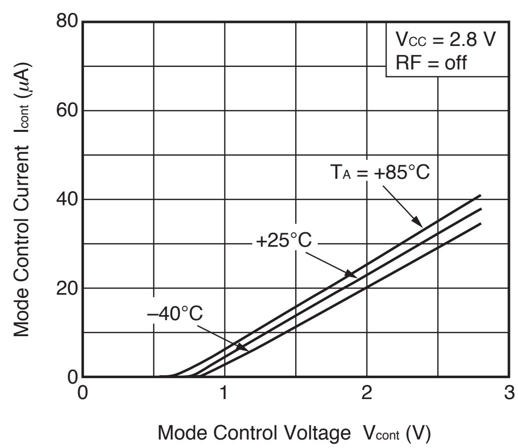
MODE CONTROL CURRENT vs. OPERATING AMBIENT TEMPERATURE



CIRCUIT CURRENT vs. MODE CONTROL VOLTAGE



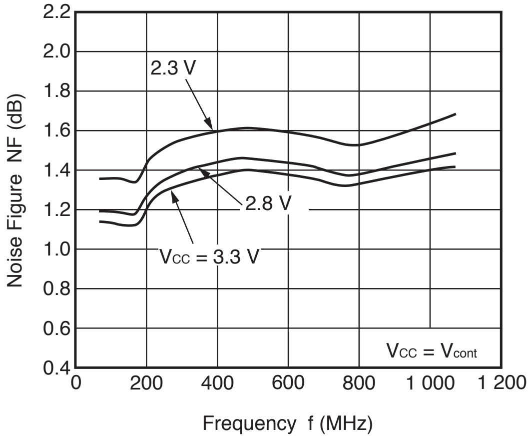
MODE CONTROL CURRENT vs. MODE CONTROL VOLTAGE



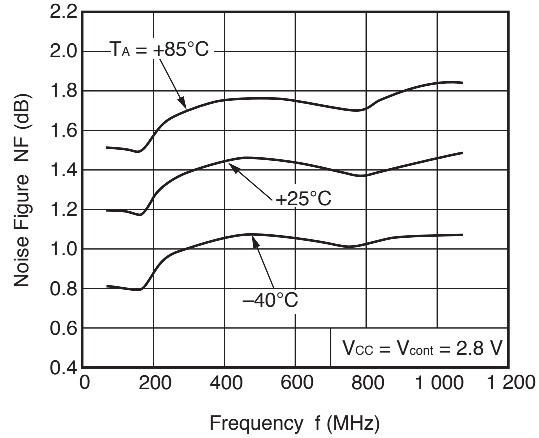
Remark The graphs indicate nominal characteristics.

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

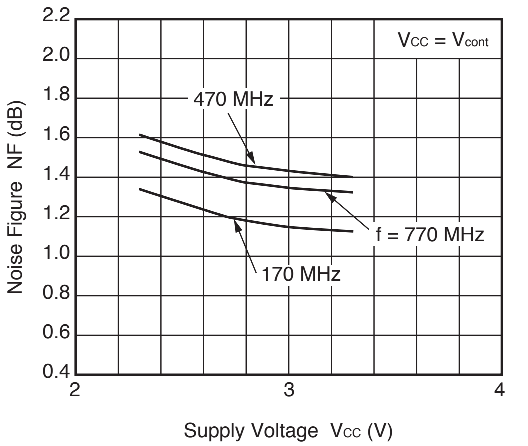
NOISE FIGURE vs. FREQUENCY



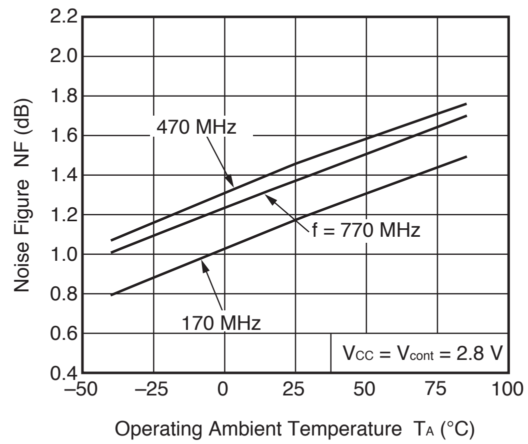
NOISE FIGURE vs. FREQUENCY



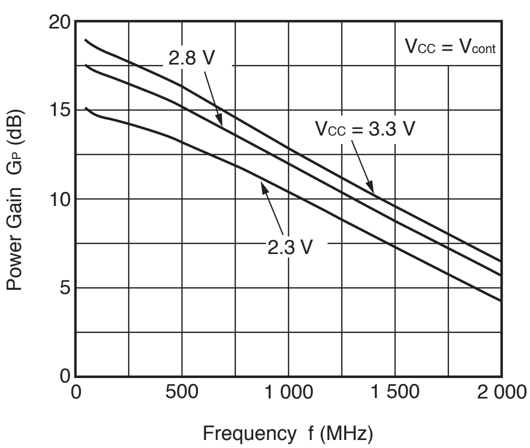
NOISE FIGURE vs. SUPPLY VOLTAGE



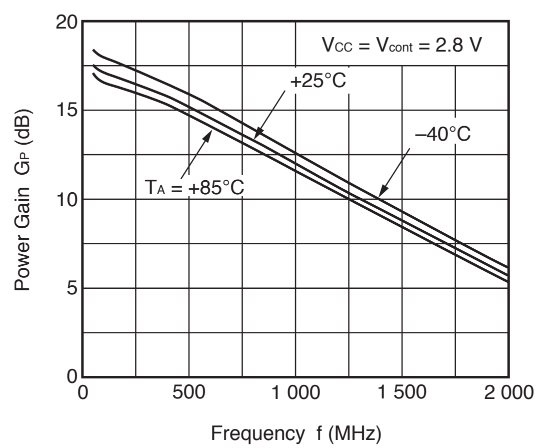
NOISE FIGURE vs. OPERATING AMBIENT TEMPERATURE



POWER GAIN vs. FREQUENCY

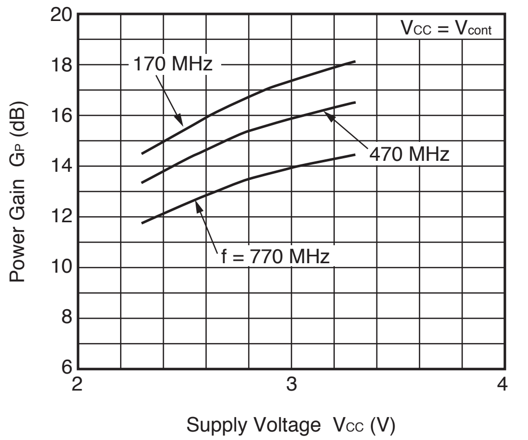


POWER GAIN vs. FREQUENCY

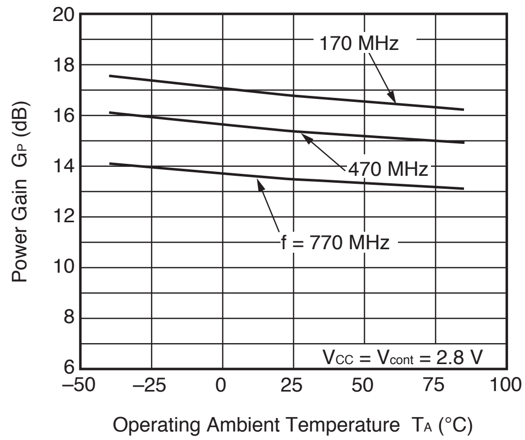


Remark The graphs indicate nominal characteristics.

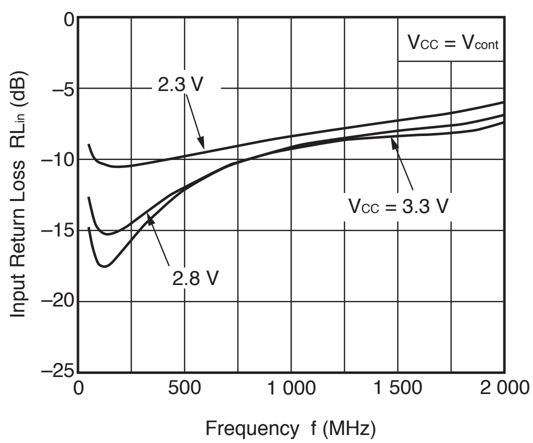
POWER GAIN vs. SUPPLY VOLTAGE



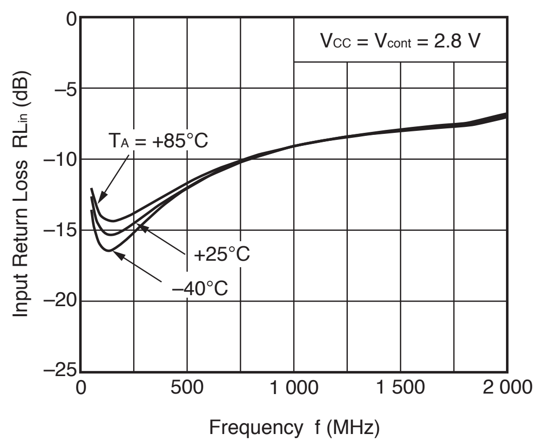
POWER GAIN vs. OPERATING AMBIENT TEMPERATURE



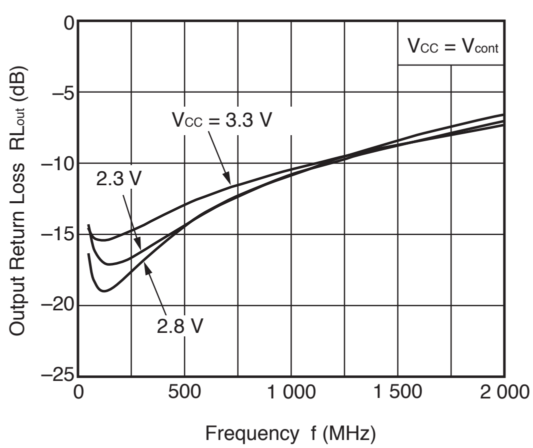
INPUT RETURN LOSS vs. FREQUENCY



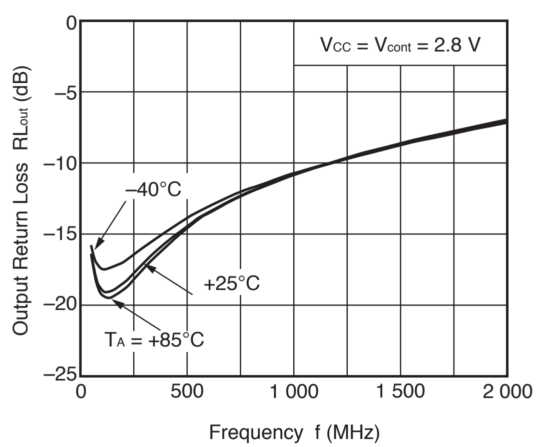
INPUT RETURN LOSS vs. FREQUENCY



OUTPUT RETURN LOSS vs. FREQUENCY

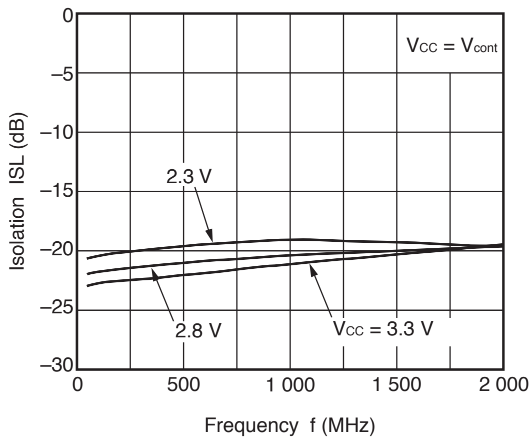


OUTPUT RETURN LOSS vs. FREQUENCY

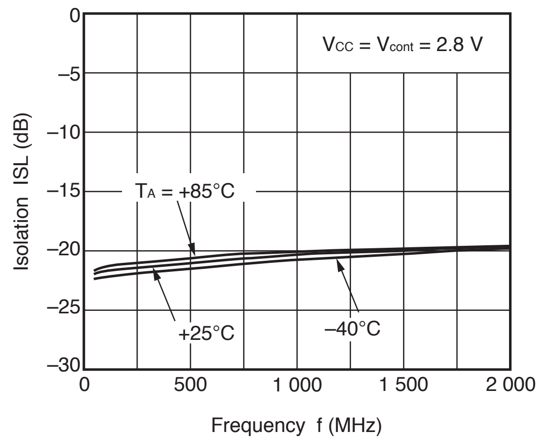


Remark The graphs indicate nominal characteristics.

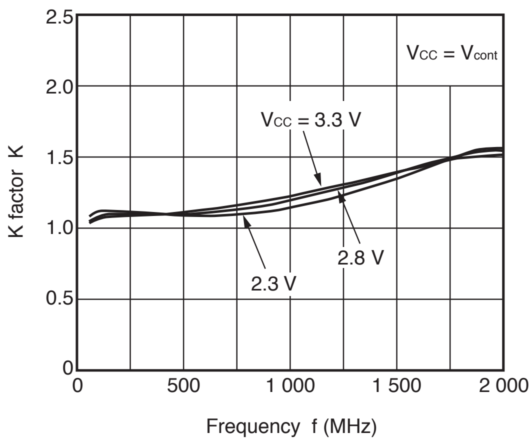
ISOLATION vs. FREQUENCY



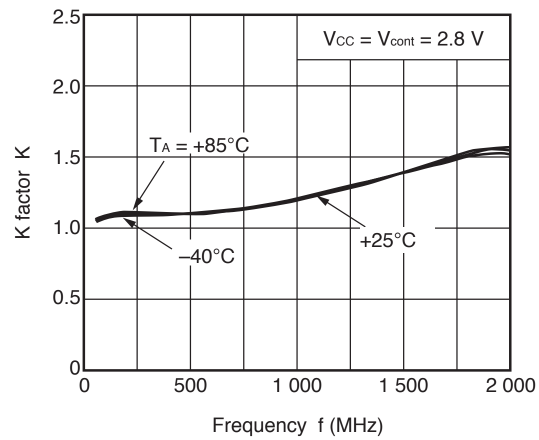
ISOLATION vs. FREQUENCY



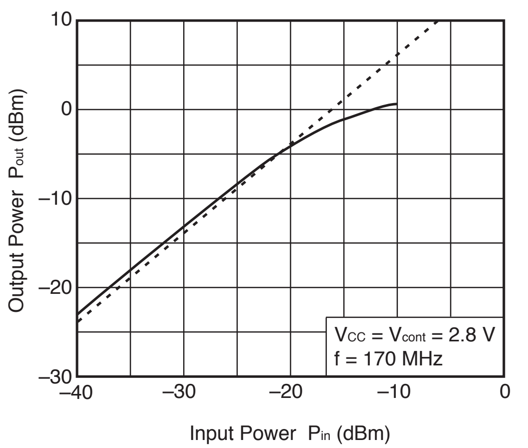
K FACTOR vs. FREQUENCY



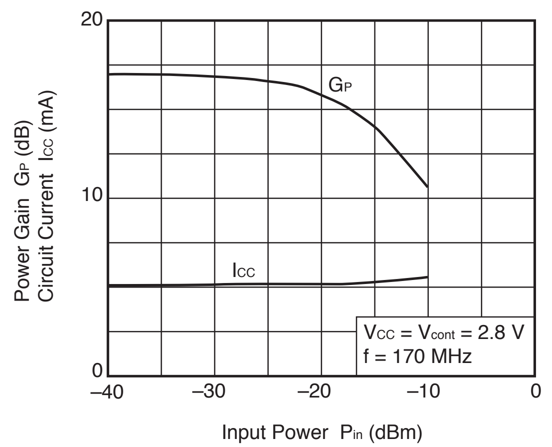
K FACTOR vs. FREQUENCY



OUTPUT POWER vs. INPUT POWER

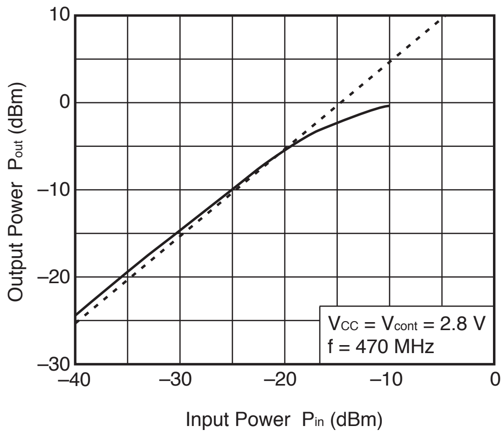


POWER GAIN, CIRCUIT CURRENT vs. INPUT POWER

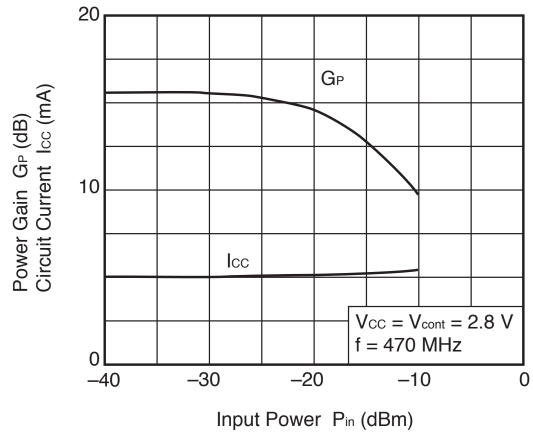


Remark The graphs indicate nominal characteristics.

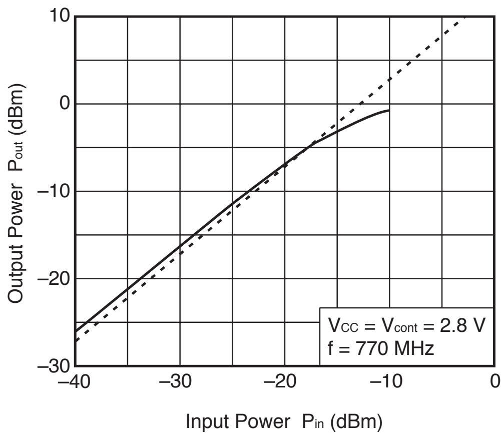
OUTPUT POWER vs. INPUT POWER



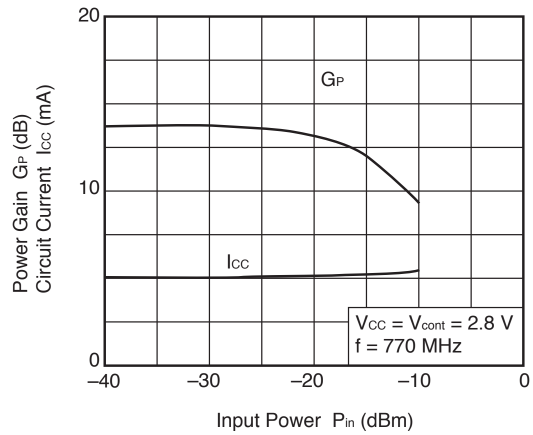
POWER GAIN, CIRCUIT CURRENT vs. INPUT POWER



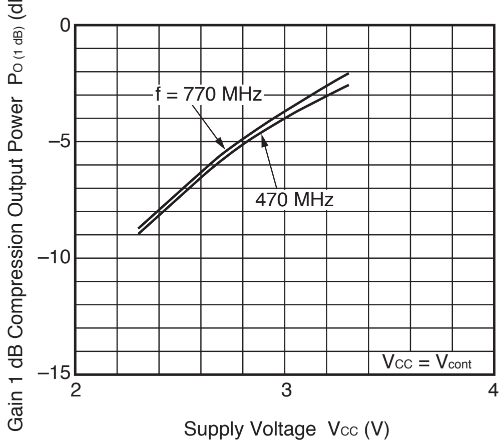
OUTPUT POWER vs. INPUT POWER



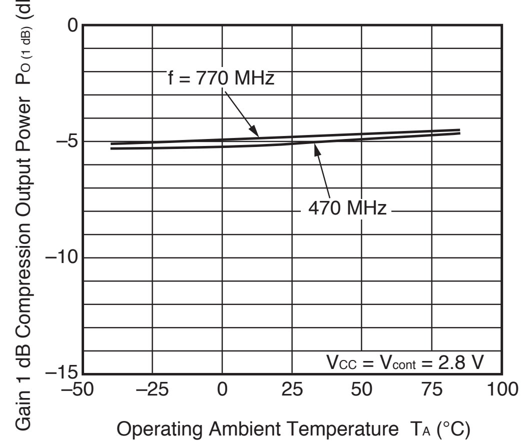
POWER GAIN, CIRCUIT CURRENT vs. INPUT POWER



GAIN 1 dB COMPRESSION OUTPUT POWER vs. SUPPLY VOLTAGE

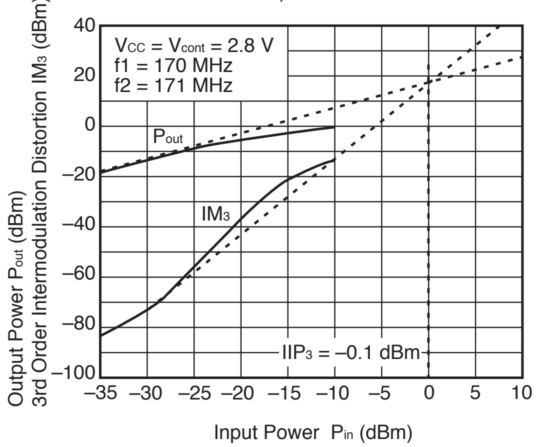


GAIN 1 dB COMPRESSION OUTPUT POWER vs. OPERATING AMBIENT TEMPERATURE

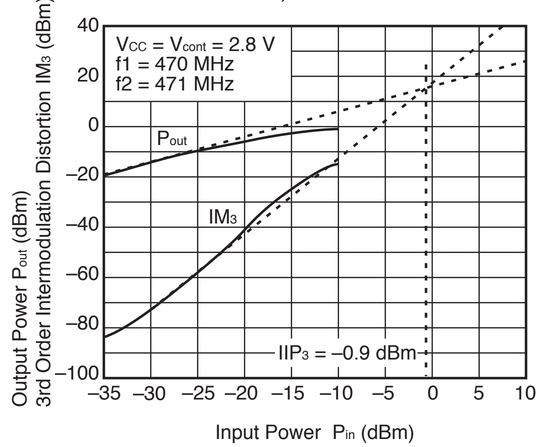


Remark The graphs indicate nominal characteristics.

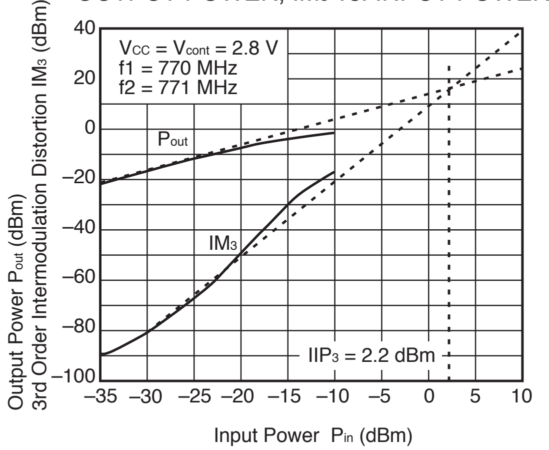
OUTPUT POWER, IM3 vs. INPUT POWER



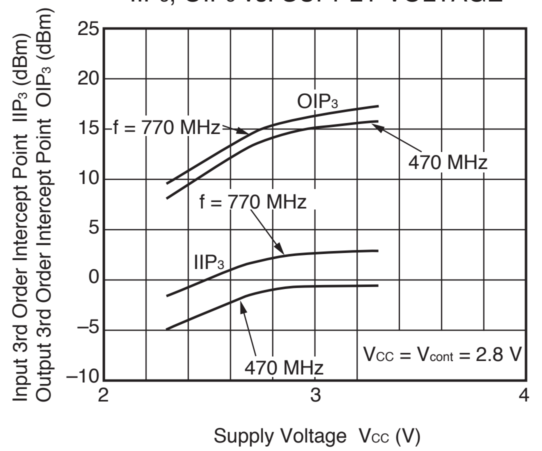
OUTPUT POWER, IM3 vs. INPUT POWER



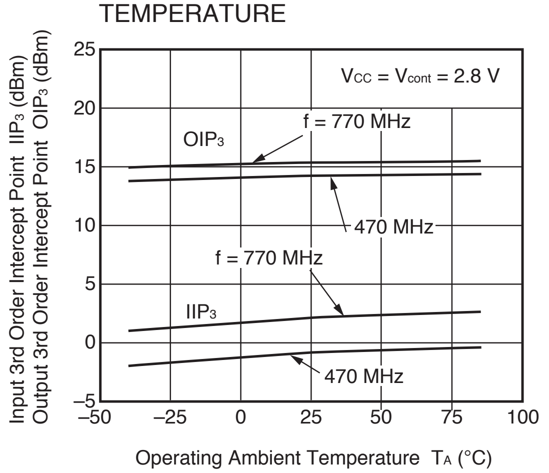
OUTPUT POWER, IM3 vs. INPUT POWER



IIP3, OIP3 vs. SUPPLY VOLTAGE



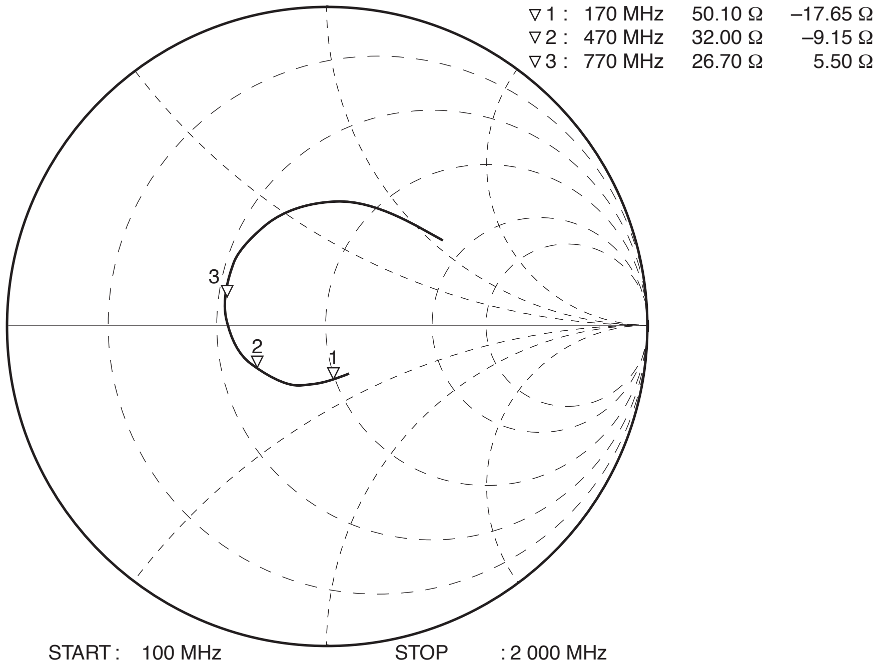
IIP3, OIP3 vs. OPERATING AMBIENT TEMPERATURE



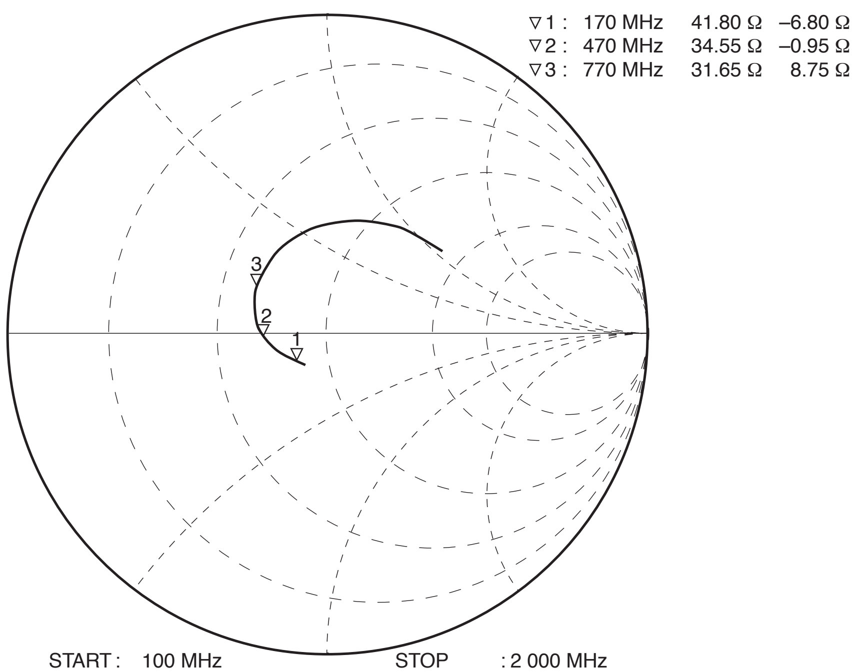
Remark The graphs indicate nominal characteristics.

S-PARAMETERS 1 (LNA-mode) (T_A = +25°C, V_{CC} = V_{cont} = 2.8 V, monitored at connector on board)

S_{11}–FREQUENCY



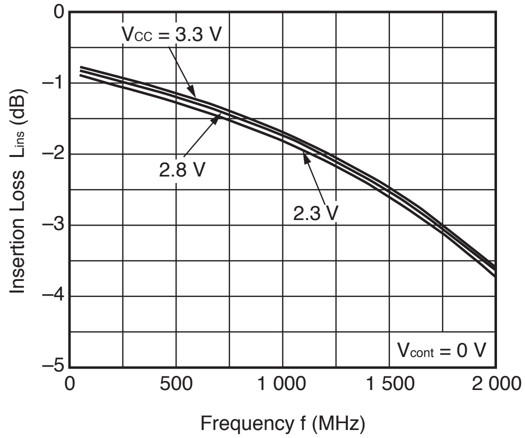
S_{22}–FREQUENCY



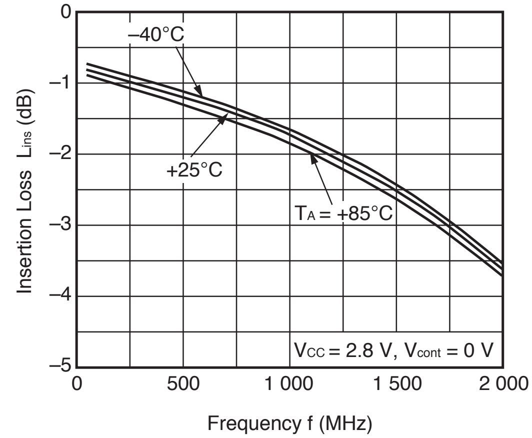
Remark The graphs indicate nominal characteristics.

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

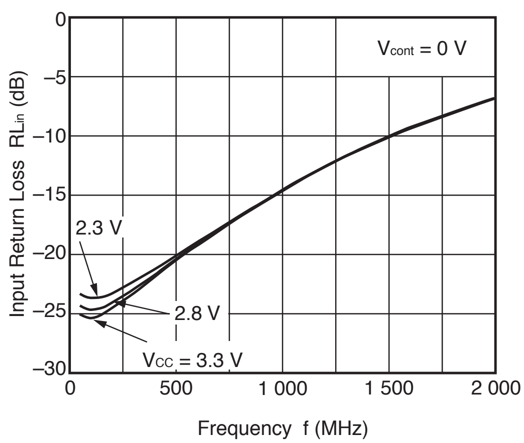
INSERTION LOSS vs. FREQUENCY



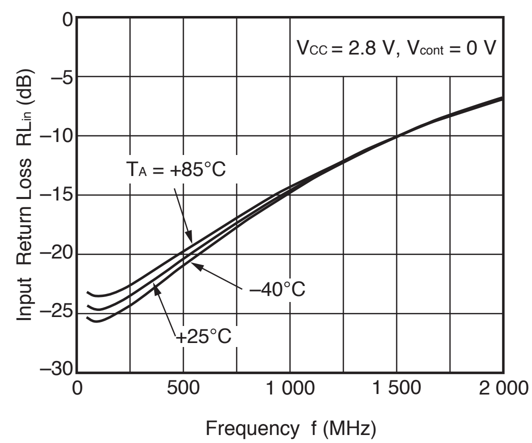
INSERTION LOSS vs. FREQUENCY



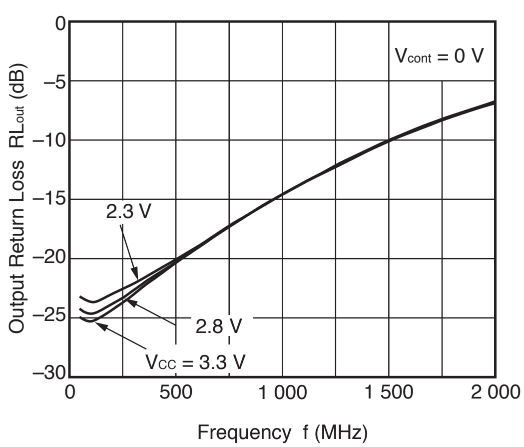
INPUT RETURN LOSS vs. FREQUENCY



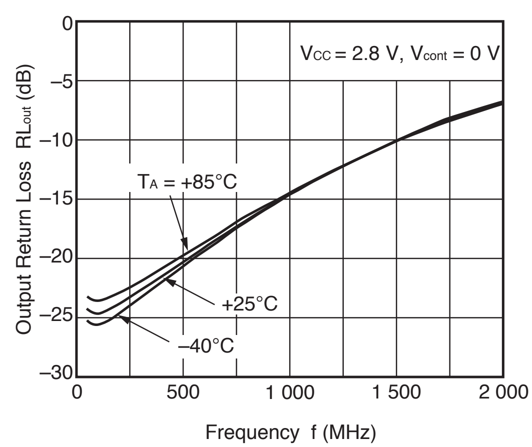
INPUT RETURN LOSS vs. FREQUENCY



OUTPUT RETURN LOSS vs. FREQUENCY

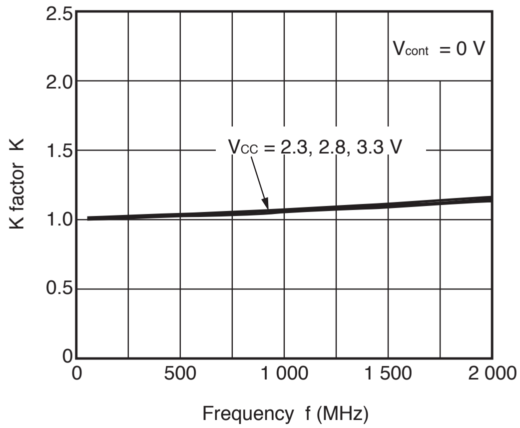


OUTPUT RETURN LOSS vs. FREQUENCY

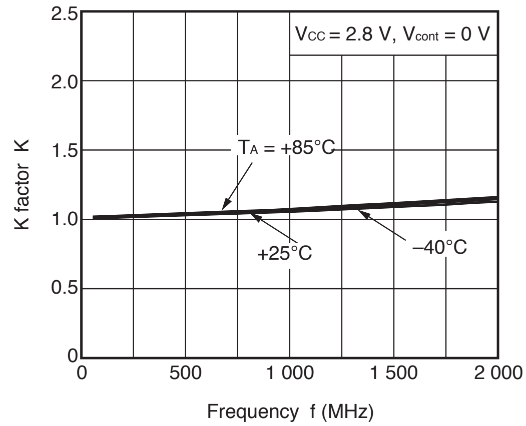


Remark The graphs indicate nominal characteristics.

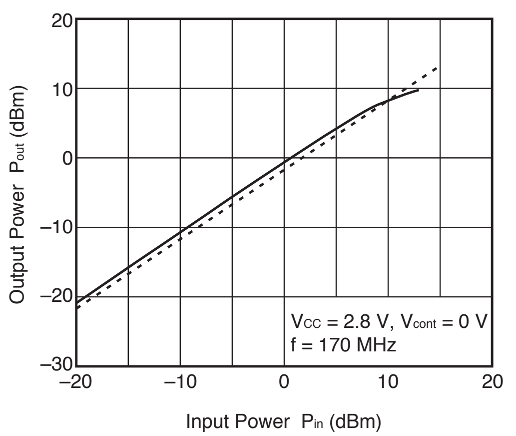
K FACTOR vs. FREQUENCY



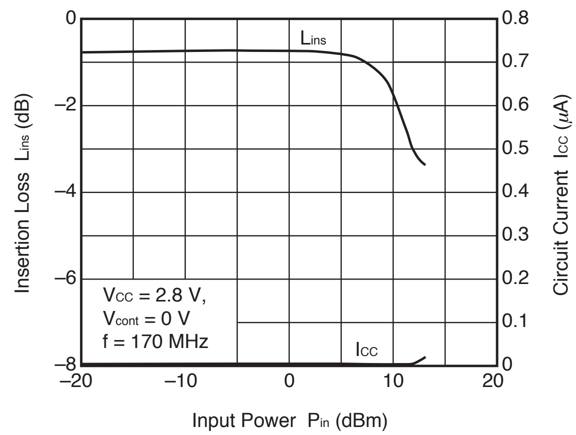
K FACTOR vs. FREQUENCY



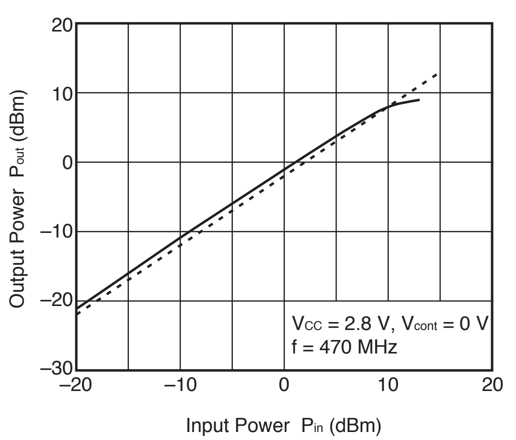
OUTPUT POWER vs. INPUT POWER



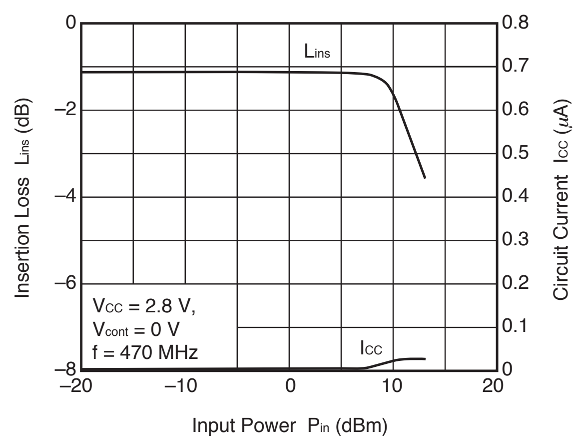
INSERTION LOSS, CIRCUIT CURRENT vs. INPUT POWER



OUTPUT POWER vs. INPUT POWER

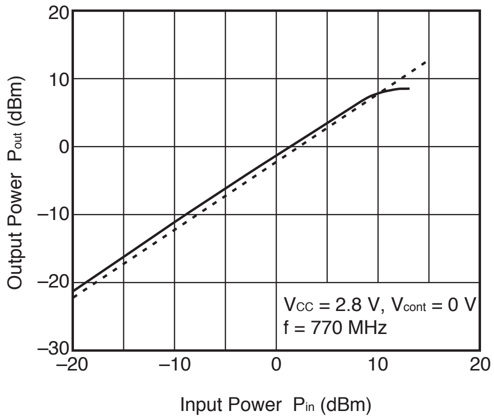


INSERTION LOSS, CIRCUIT CURRENT vs. INPUT POWER

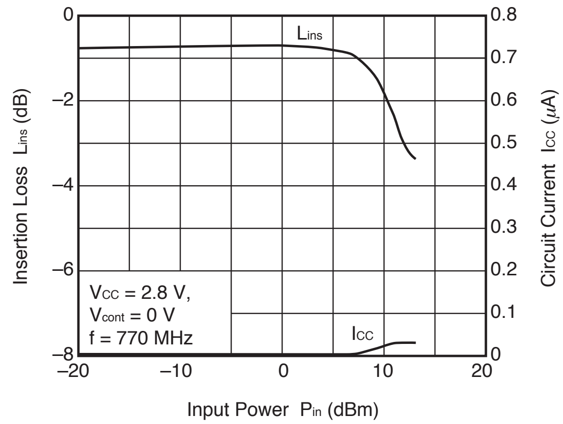


Remark The graphs indicate nominal characteristics.

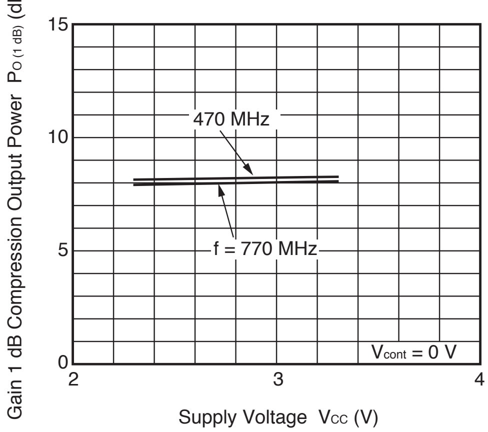
OUTPUT POWER vs. INPUT POWER



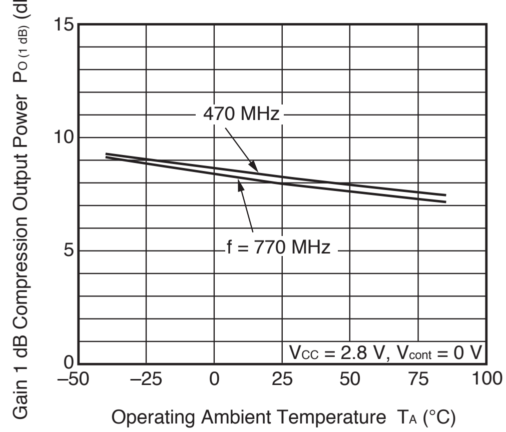
INSERTION LOSS, CIRCUIT CURRENT vs. INPUT POWER



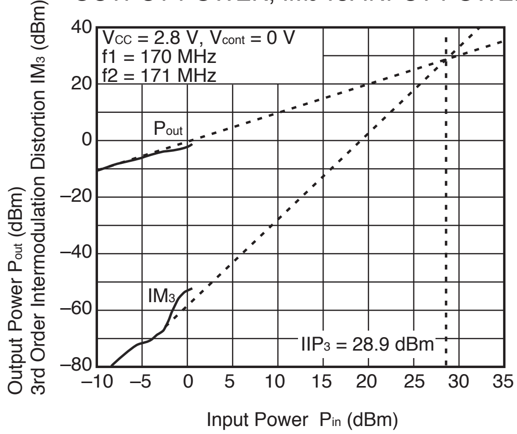
GAIN 1 dB COMPRESSION OUTPUT POWER vs. SUPPLY VOLTAGE



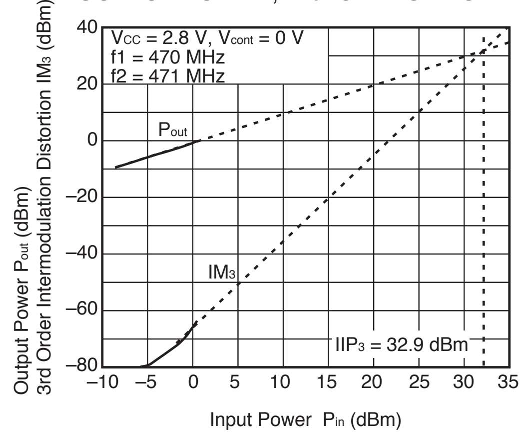
GAIN 1 dB COMPRESSION OUTPUT POWER vs. OPERATING AMBIENT TEMPERATURE



OUTPUT POWER, IM3 vs. INPUT POWER

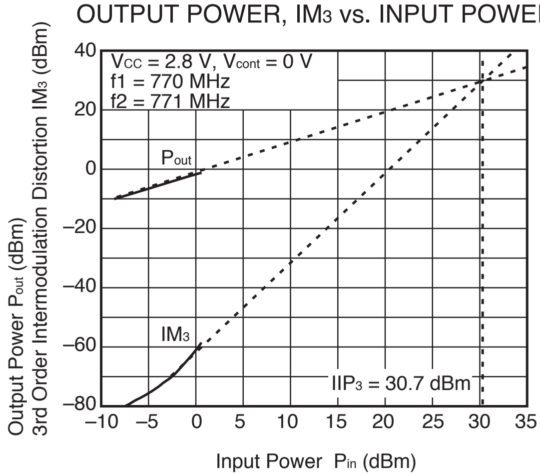


OUTPUT POWER, IM3 vs. INPUT POWER

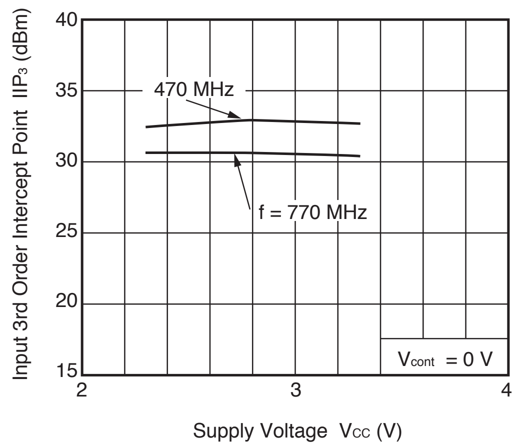


Remark The graphs indicate nominal characteristics.

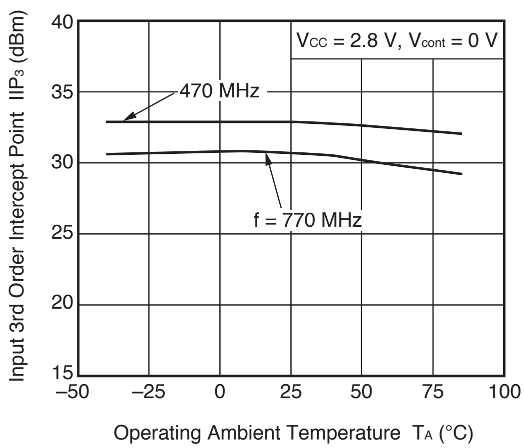
OUTPUT POWER, IM3 vs. INPUT POWER



IIP3 vs. SUPPLY VOLTAGE



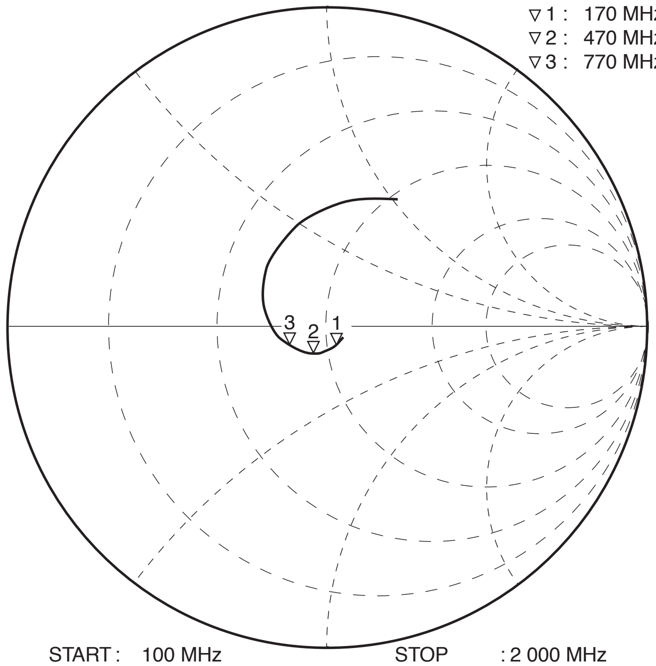
IIP3 vs. OPERATING AMBIENT TEMPERATURE



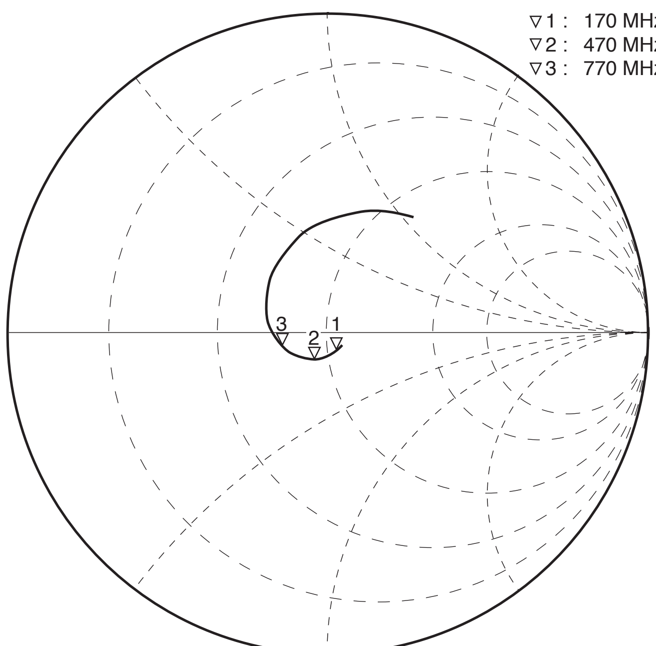
Remark The graphs indicate nominal characteristics.

S-PARAMETERS 2 (Bypass-mode)
(T_A = +25°C, V_{CC} = 2.8 V, V_{cont} = 0 V, monitored at connector on board)

S_{11}–FREQUENCY



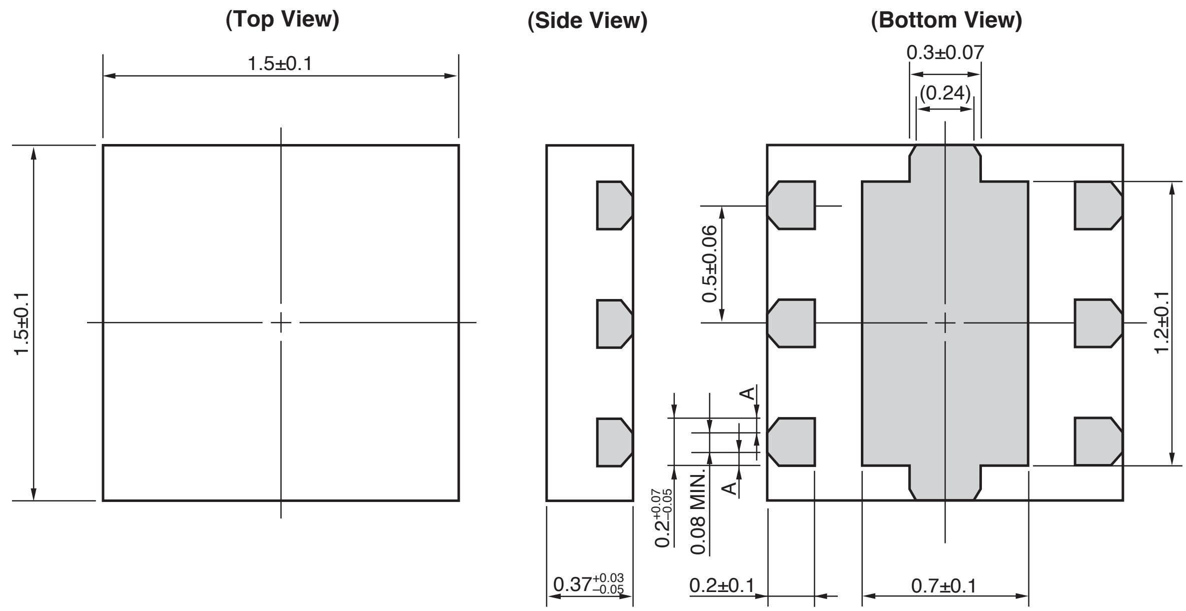
S_{22}–FREQUENCY



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). All the ground terminals must be connected together with wide ground pattern to decrease impedance difference.
(3) The bypass capacitor should be attached to V_{CC} line.
(4) Do not supply DC voltage to INPUT pin.
(5) Pin 5 (NC) should be connected to the ground pattern.

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
Partial Heating	Peak temperature (terminal 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).

- **The information in this document is current as of June, 2009. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.**
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