800MHz Band LNA GaAs MMIC

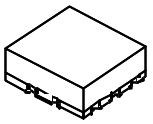
■GENERAL DESCRIPTION

NJG1127HB6 is a LNA IC designed for 800MHz band CDMA2000 cellular phone. This IC has the function which bypasses LNA, and high gain mode or low gain mode can be chosen.

High IIP3 and a low noise are achieved at the High gain mode. And low current consumption can be achieved at the low gain mode because LNA enters the state of the standby.

A small and thin package of USB8 is adopted.

■PACKAGE OUTLINE



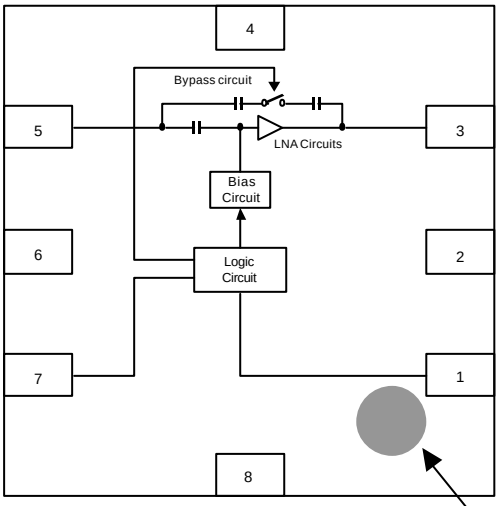
NJG1127HB6

■FEATURES

●Low voltage operation	+2.8V typ.	
●Low control voltage operation	+1.85V typ.	
[LNA High Gain Mode]		
●High Input IP3	+11dBm typ.	@ f=880MHz
●Low noise figure	1.4dB typ.	@ f=880MHz
[LNA Low Gain Mode]		
●Low current consumption	15uA typ.	
●High Input IP3	+19dBm typ.	@ f=880MHz
●Small & thin package	USB8-B6 (Package size: 1.5mm x1.5mm x 0.55mm typ.)	

■PIN CONFIGURATION

(Top View)



1 Pin INDEX

Pin Connection
1.V_{INV}
2.GND
3.RF OUT
4.GND
5.RF IN
6.GND
7. V_{CTL}
8. GND

Note: Specifications and description listed in this catalog are subject to change without prior notice.

■ABSOLUTE MAXIMUM RATINGS

(T_a=+25°C, Z_s=Z_l=50Ω)

PARAMETERS	SYMBOL	CONDITIONS	RATINGS	UNITS
Supply voltage	V_{DD}		5.0	V
Inverter supply voltage	V_{INV}		5.0	V
Control voltage	V_{CTL}		5.0	V
Input power	P_{in}		+15	dBm
Power dissipation	P_D	on PCB board, Tjmax=150°C	160	mW
Operating temperature	T_{opr}		-40~+85	°C
Storage temperature	T_{stg}		-55~+150	°C

■ELECTRICAL CHARACTERISTICS 1 (DC CHARACTERISTICS)

(General Conditions: V_{DD}=V_{INV}=2.8V, T_a=+25°C, Z_s=Z_l=50Ω)

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating voltage	V_{DD}		2.65	2.80	2.95	V
Inverter supply voltage	V_{INV}		2.65	2.80	2.95	V
Control voltage (High)	V_{CTL}(H)		1.80	1.85	V_{DD+}0.3	V
Control voltage (Low)	V_{CTL}(L)		0	0	0.3	V
Operating current1 (LNA High Gain Mode)	I_{DD}1	RF OFF, V_{CTL}=1.85V	-	10.0	16.0	mA
Operating current2 (LNA Low Gain Mode)	I_{DD}2	RFOFF, V_{CTL}=0V	-	1	5	uA
Inverter current1 (LNA High Gain Mode)	I_{INV}1	RF OFF, V_{CTL}=1.85V	-	150	240	uA
Inverter current2 (LNA Low Gain Mode)	I_{INV}2	RF OFF, V_{CTL}=0V	-	15	40	uA
Control current	I_{CTL}	RF OFF, V_{CTL}=1.85V	-	5	15	uA

■**ELECTRICAL CHARACTERISTICS 2 (LNA High Gain Mode)**

(General Conditions: V_{DD}=V_{INV}=2.8V, V_{CTL}=1.85V, f_{RF}=880MHz, T_a=+25°C, Z_s=Z_l=50Ω)

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small signal gain1	Gain1		13.5	15.0	17.0	dB
Noise figure1	NF1	Exclude PCB & connector losses (IN: 0.04dB)	-	1.4	1.8	dB
1dB gain compression output power1	P-1dB_1		+4	+9	-	dBm
3rd order Input Intercept Point1	IIP3_1	f1=f_{RF}, f2=f_{RF}+100kHz, P_{in}=-25dBm	+8	+11	-	dBm
RF IN VSWR1	$VSWR_i$_1		-	1.5	2.0	
RF OUT VSWR1	$VSWR_o$_1		-	1.5	2.0	

■**ELECTRICAL CHARACTERISTICS 2 (LNA Low Gain Mode)**

(General Conditions: V_{DD}=V_{INV}=2.8V, V_{CTL}=0V, f_{RF}=880MHz, T_a=+25°C, Z_s=Z_l=50Ω)

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small signal gain2	Gain2		-4.0	-2.5	0	dB
Noise figure2	NF2	Exclude PCB & connector losses (IN: 0.04dB)	-	2.5	5.0	dB
1dB gain compression output power2	P-1dB_2		+1	+8	-	dBm
3rd order Input Intercept Point2	IIP3_2	f1=f_{RF}, f2=f_{RF}+100kHz, P_{in}=-12dBm	+15	+19	-	dBm
RF IN VSWR2	$VSWR_i$_2		-	2.3	2.7	
RF OUT VSWR2	$VSWR_o$_2		-	1.8	2.1	

■TERMINAL INFOMATION

No.	SYMBOL	DESCRIPTION
1	VINV	Supply voltage terminal for internal logic circuit (inverter). Please place a bypass capacitor between this and GND for avoiding RF noise from outside.
2	GND	Ground terminal.
3	RFOUT	RF signal comes out from this terminal, and goes through an external matching circuit connected to this. Inductor L3 as shown in the application circuit is a part of an external matching circuit, and also provide DC power to LNA. Capacitor C2 as shown in the application circuit is a bypass capacitor.
4	GND	Ground terminal.
5	RFIN	RF input terminal. The RF signal is input through external matching circuit connected to this terminal. A DC blocking capacitor is not required.
6	GND	Ground terminal.
7	VCTL	Control port. A logic control signal is required to select High or Low gain mode of LNA. This terminal is set to more than +1.5V of logical high level for High gain mode of LNA, and set to 0~+0.3V of logical low level for Low gain mode.
8	GND	Ground terminal.

CAUTION

1) Ground terminal (No.2, 4, 6, 8) should be connected to the ground plane as close as possible for excellent RF performance, because distance to GND makes parasitic inductance.

■TRUTH TABLE

"H"=V_{CTL}(H), "L"=V_{CTL}(L)

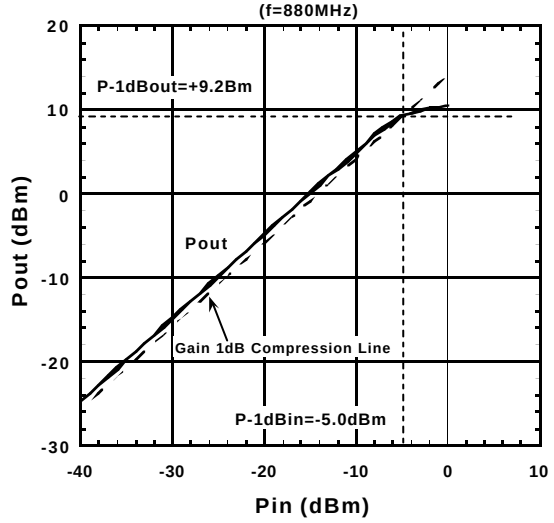
V_{CTL}	Gain Mode	LNA
L	Low	bypass
H	High	pass

■ELECTRICAL CHARACTERISTICS (LNA High Gain Mode)

(General Conditions: Ta=+25°C, V_{DD}=V_{INV}=2.8V, V_{CTL}=1.85V, Zs=Zl=50Ω)

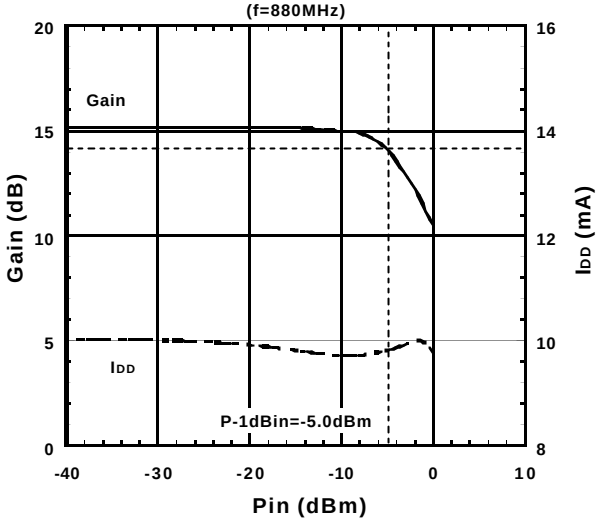
Pout vs. Pin

(f=880MHz)



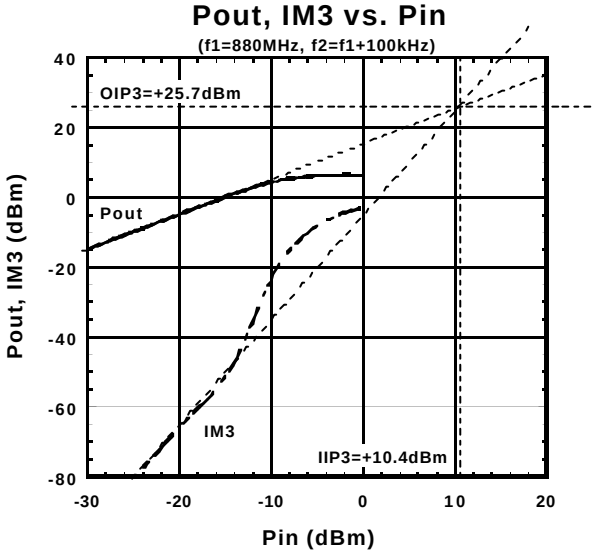
Gain, I_{DD} vs. Pin

(f=880MHz)



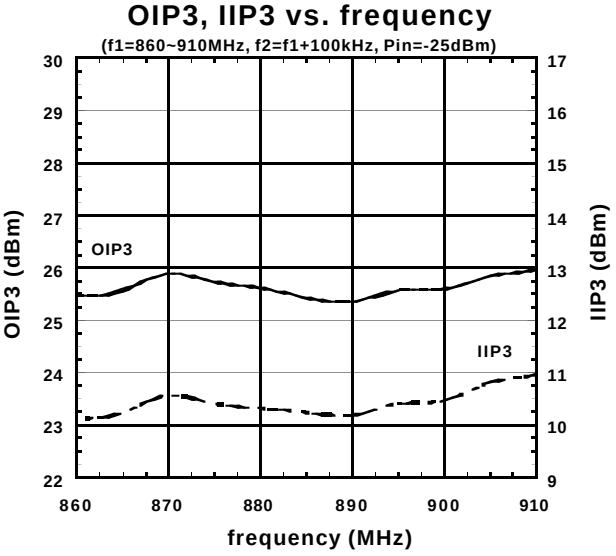
Pout, IM3 vs. Pin

(f1=880MHz, f2=f1+100kHz)



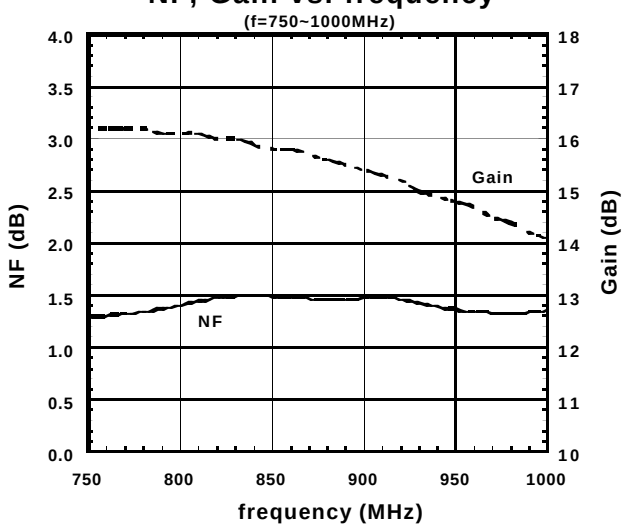
OIP3, IIP3 vs. frequency

(f1=860~910MHz, f2=f1+100kHz, Pin=-25dBm)



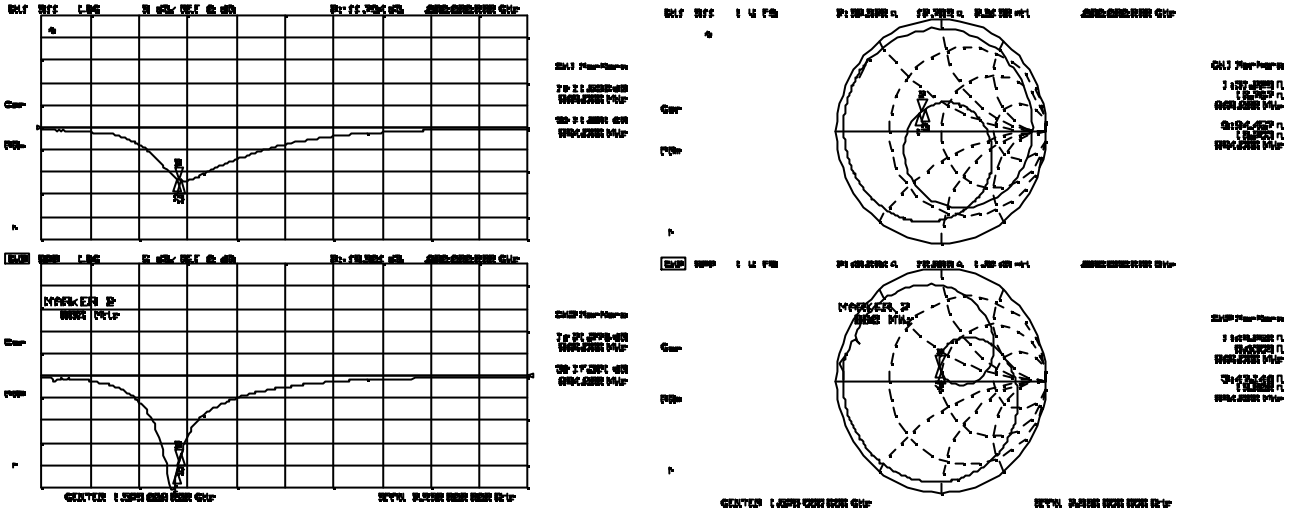
NF, Gain vs. frequency

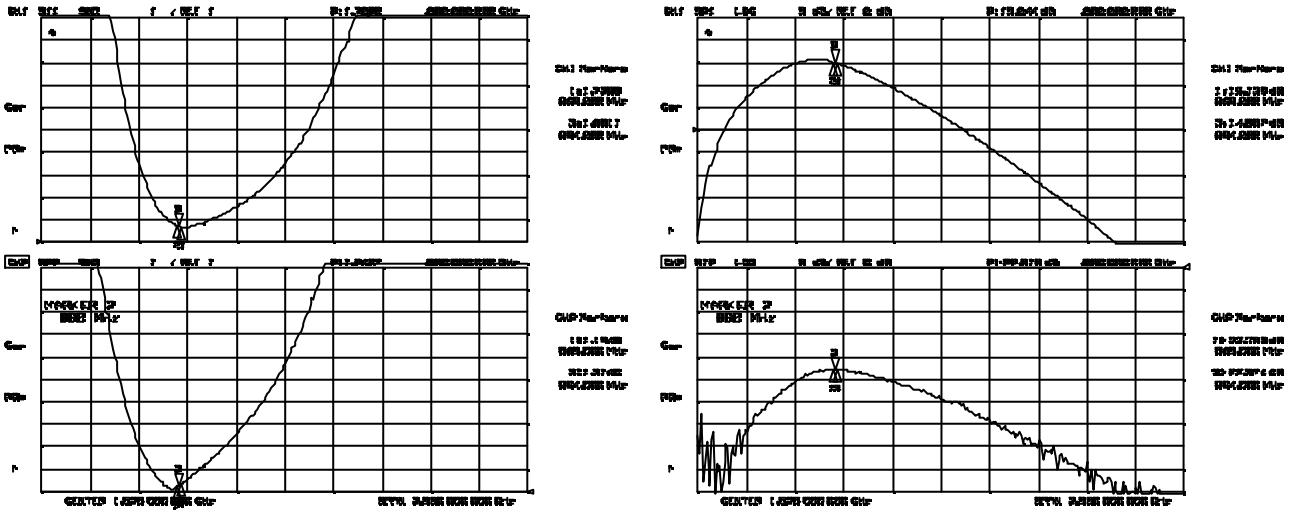
(f=750~1000MHz)

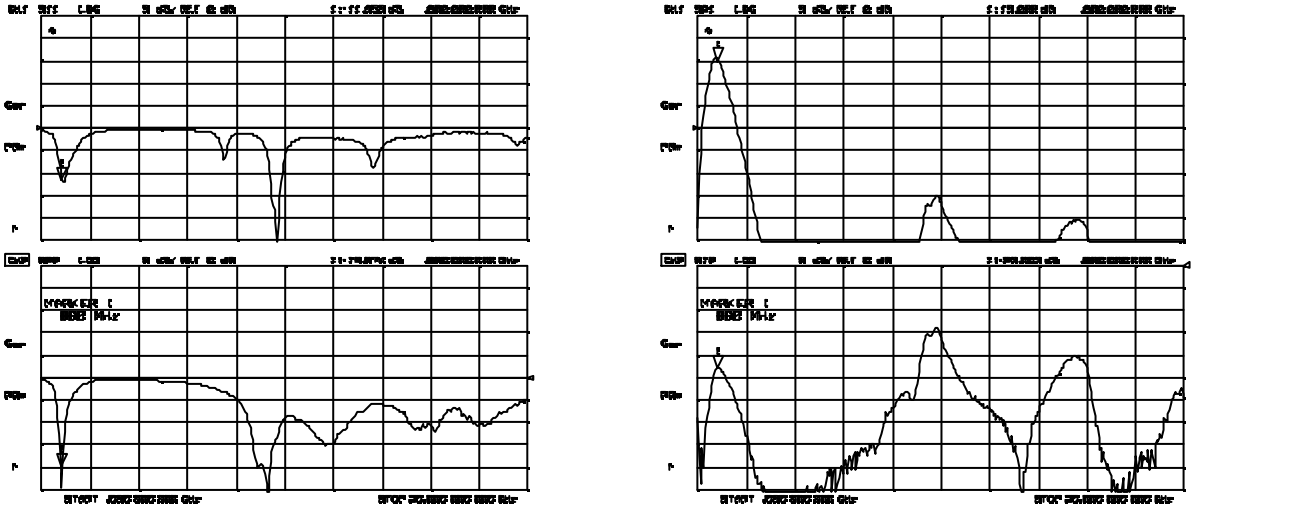


■ELECTRICAL CHARACTERISTICS (LNA High Gain Mode)

(General Conditions: Ta=+25°C, V_{DD}=V_{INV}=2.8V, V_{CTL}=1.85V, Zs=Zl=50Ω)



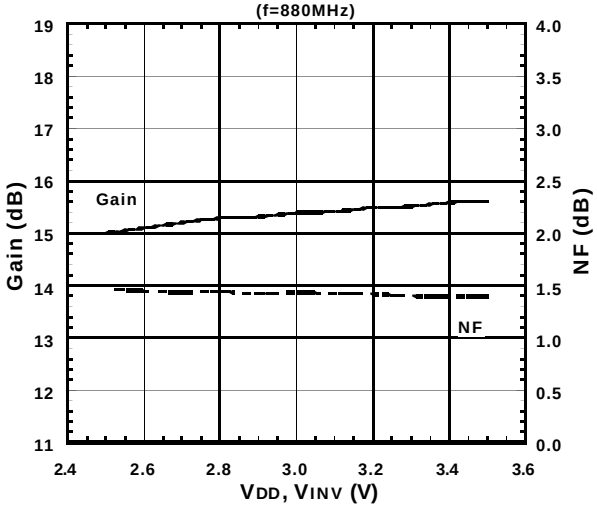




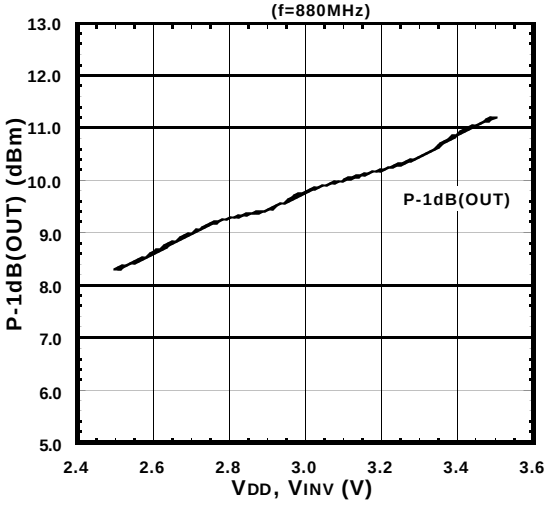
■ELECTRICAL CHARACTERISTICS (LNA High Gain Mode)

(General Conditions: Ta=+25°C, V_{DD}=V_{INV}=2.8V, V_{CTL}=1.85V, Zs=Zl=50Ω)

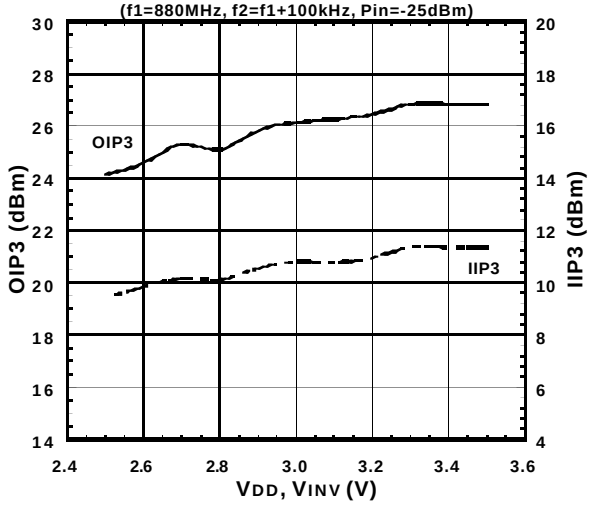
Gain, NF vs. VDD, VINV



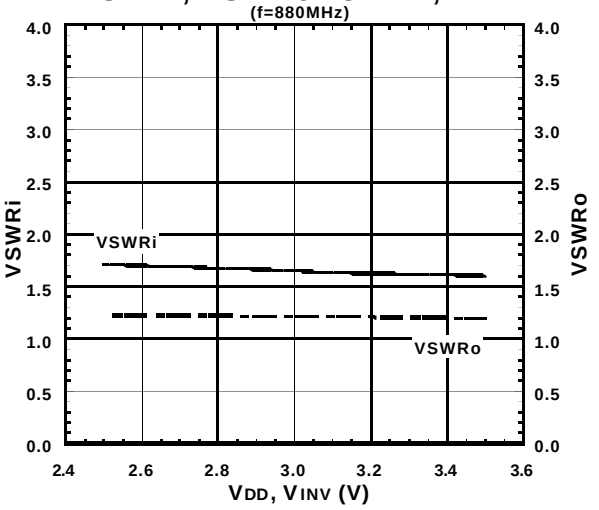
P-1dB(OUT) vs. VDD, VINV



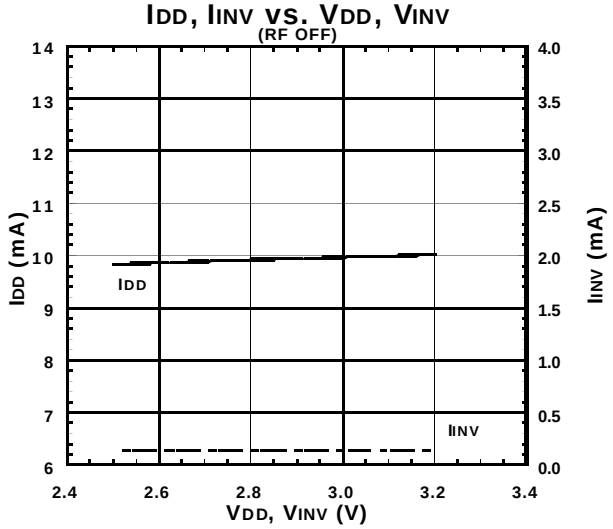
OIP3, IIP3 vs. VDD, VINV



VSWRi, VSWRo vs. VDD, VINV



IDD, IINV vs. VDD, VINV

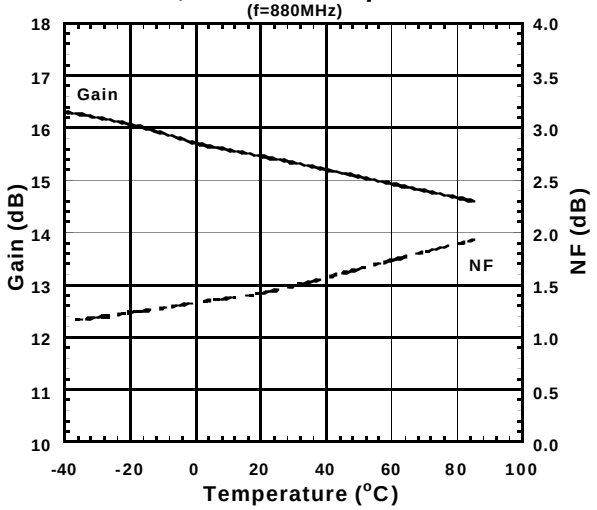


■ELECTRICAL CHARACTERISTICS (LNA High Gain Mode)

(General Conditions: Ta=+25°C, V_{DD}=V_{INV}=2.8V, V_{CTL}=1.85V, Zs=Zl=50Ω)

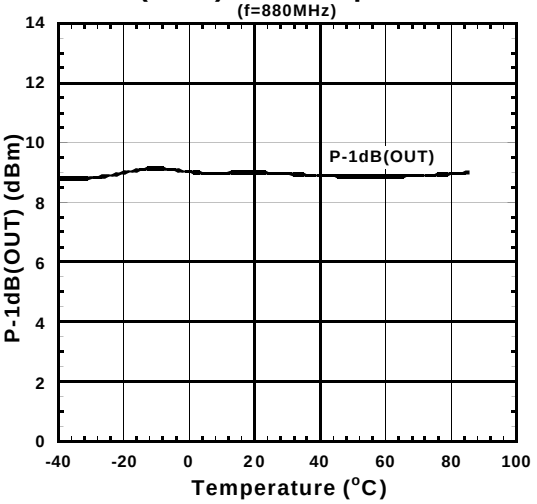
Gain, NF vs. Temperature

(f=880MHz)



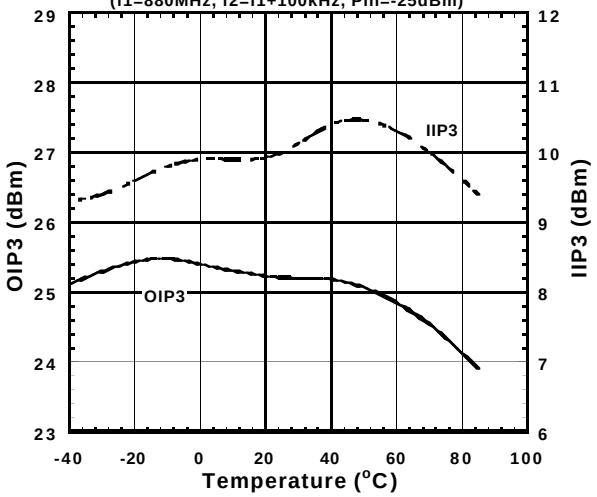
P-1dB(OUT) vs. Temperature

(f=880MHz)



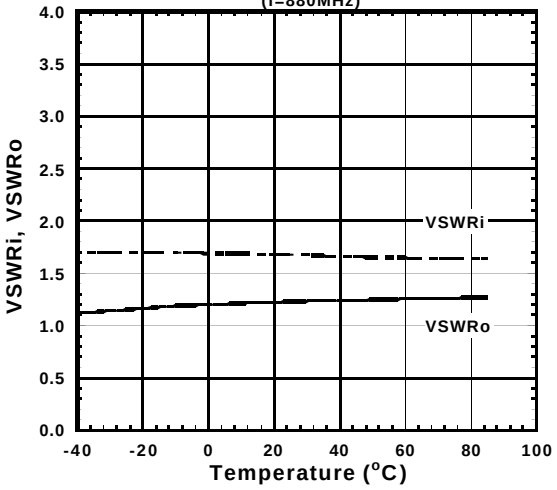
OIP3, IIP3 vs. Temperature

(f1=880MHz, f2=f1+100kHz, Pin=-25dBm)



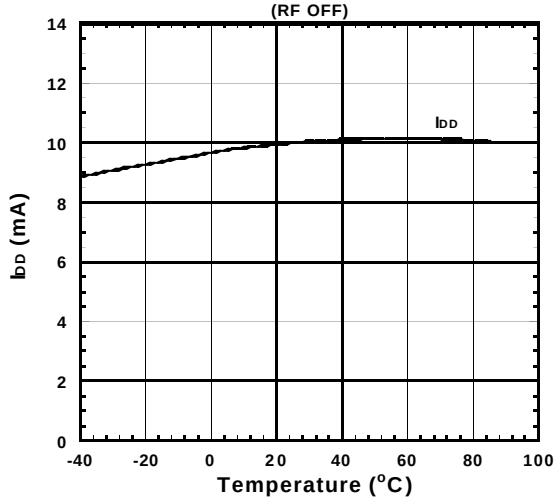
VSWRi, VSWRo vs. Temperature

(f=880MHz)



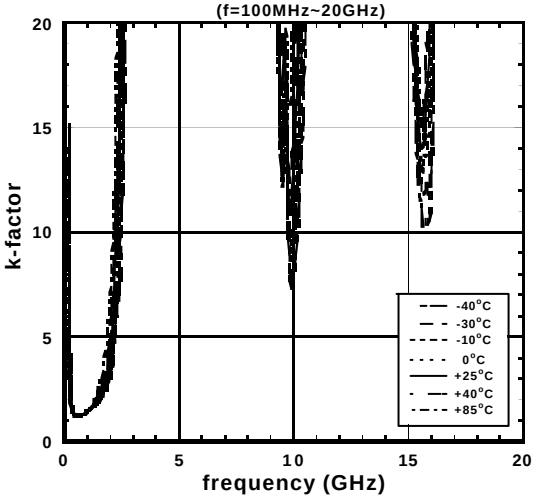
I_{DD} vs. Temperature

(RF OFF)



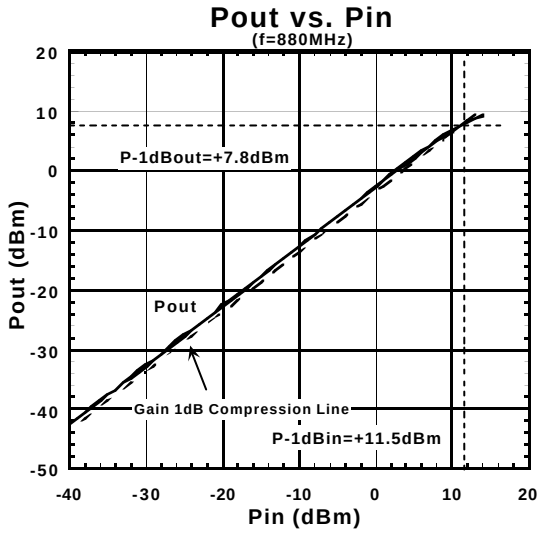
k-factor vs. Temperature

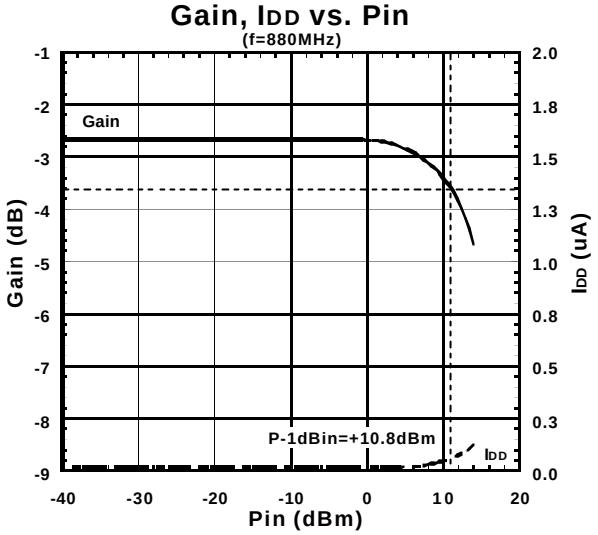
(f=100MHz~20GHz)

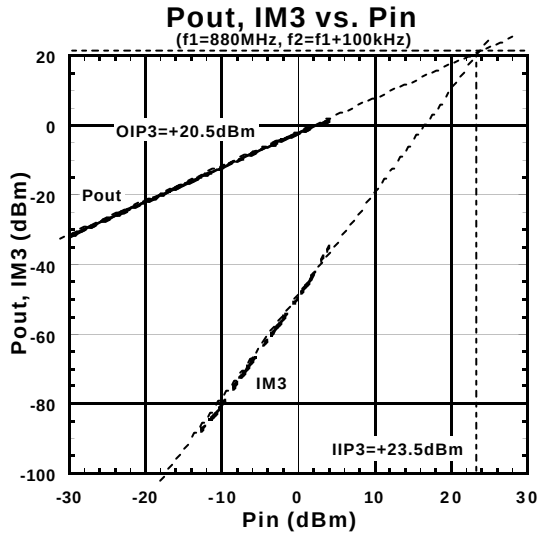


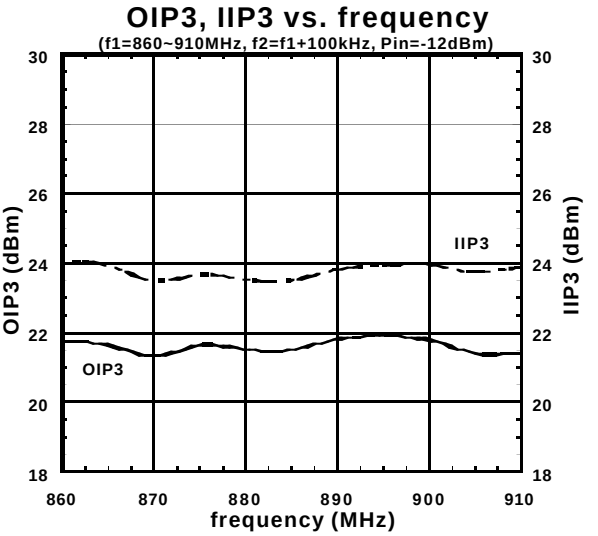
■ELECTRICAL CHARACTERISTICS (LNA Low Gain Mode)

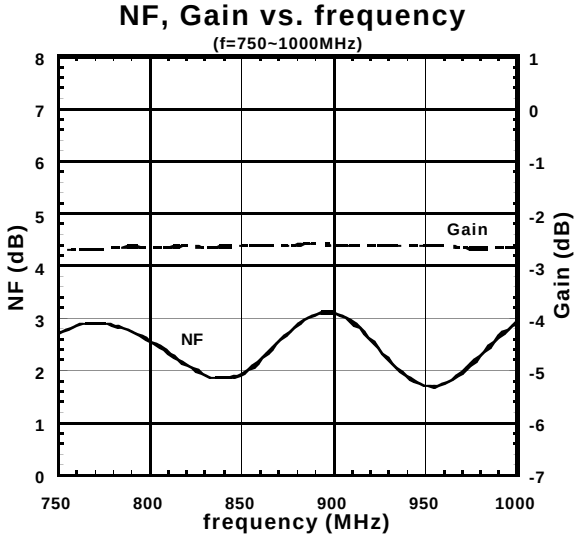
(General Conditions: Ta=+25°C, V_{DD}=V_{INV}=2.8V, V_{CTL}=0V, Zs=Zl=50Ω)





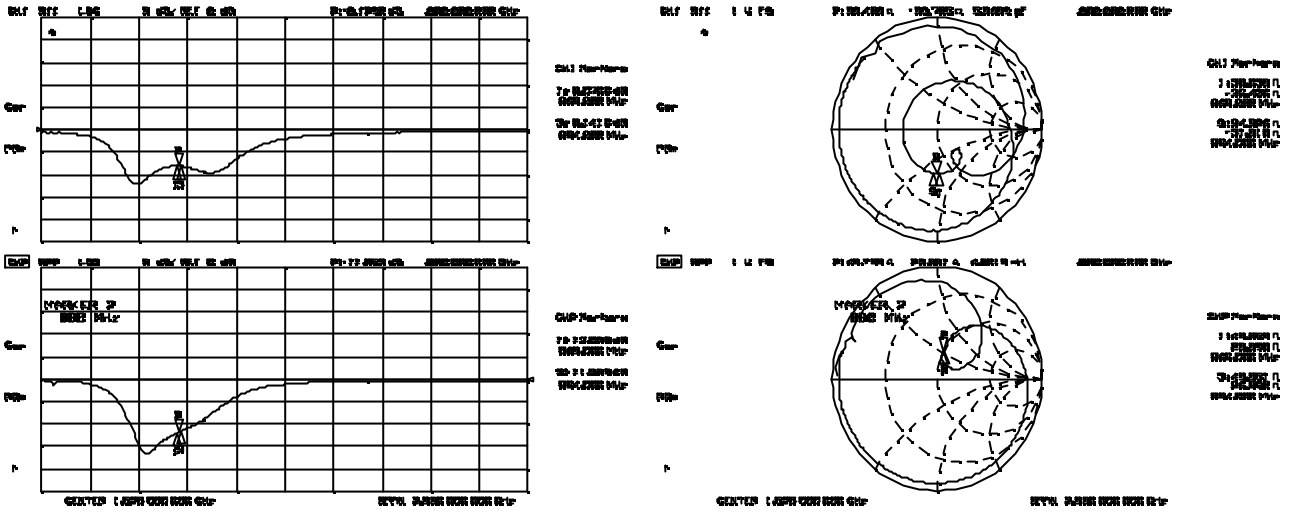


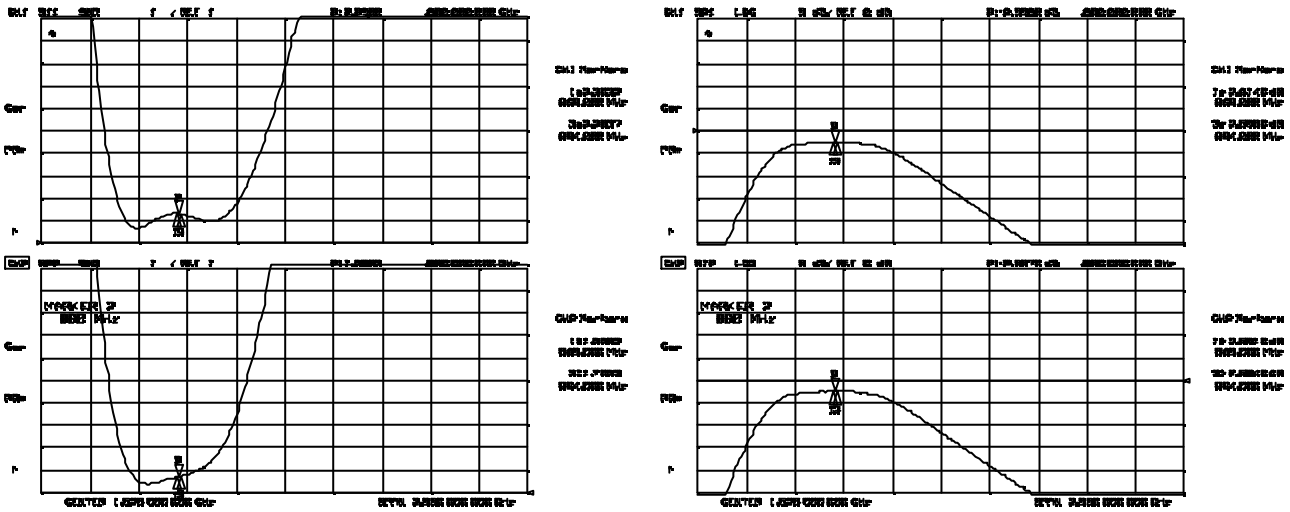


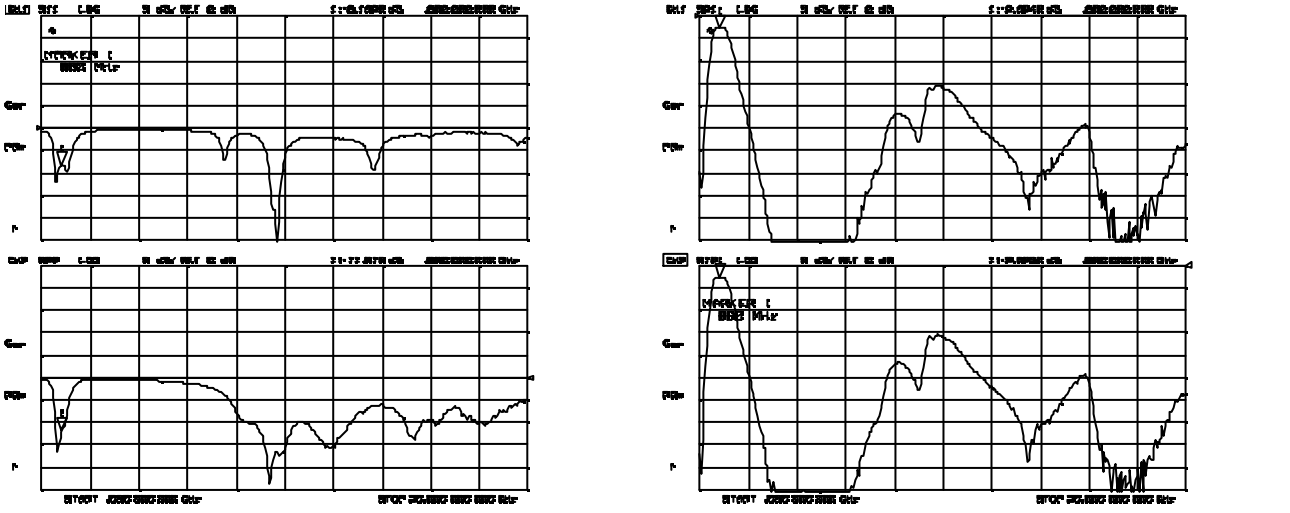


■ELECTRICAL CHARACTERISTICS (LNA Low Gain Mode)

(General Conditions: Ta=+25°C, V_{DD}=V_{INV}=2.8V, V_{CTL}=0V, Zs=Zl=50Ω)

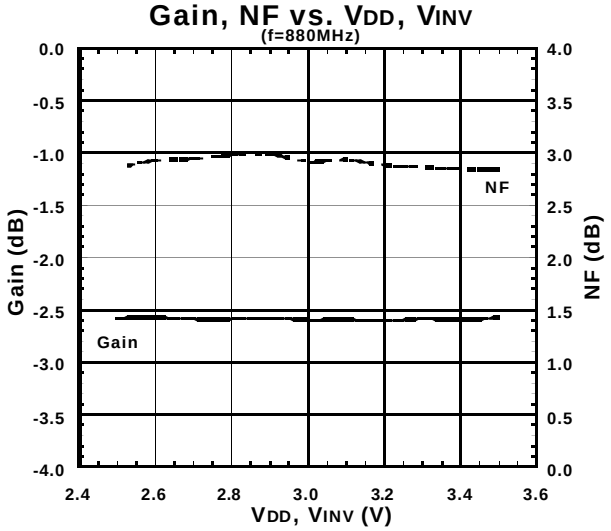


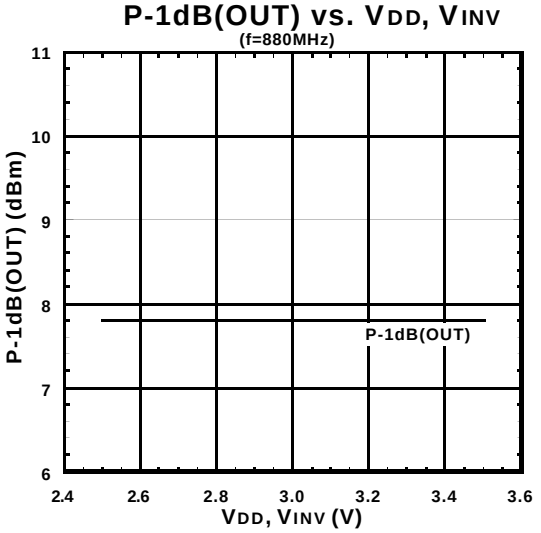


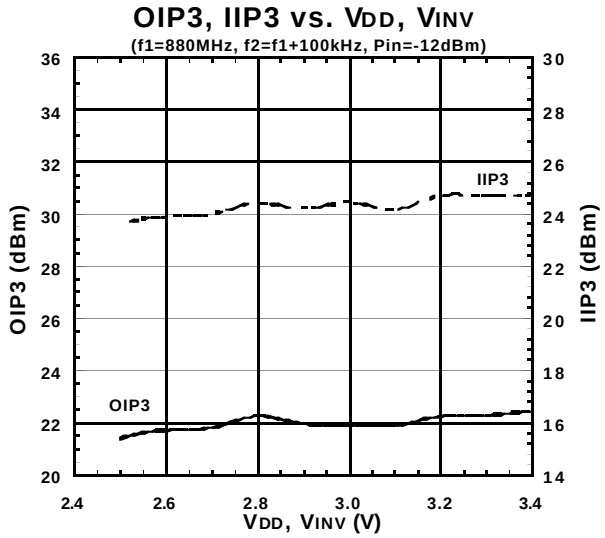


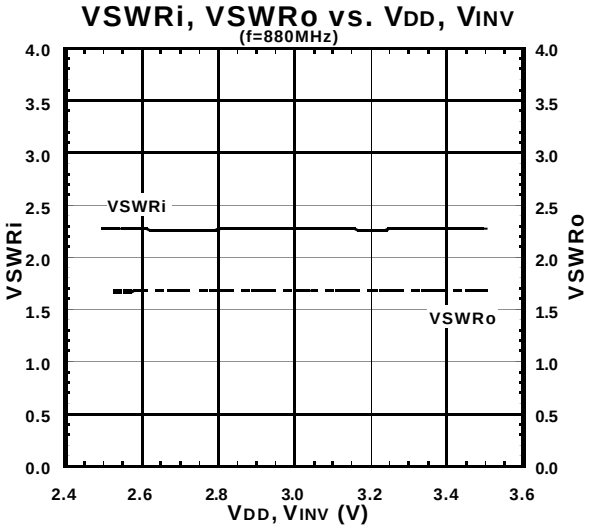
■ELECTRICAL CHARACTERISTICS (LNA Low Gain Mode)

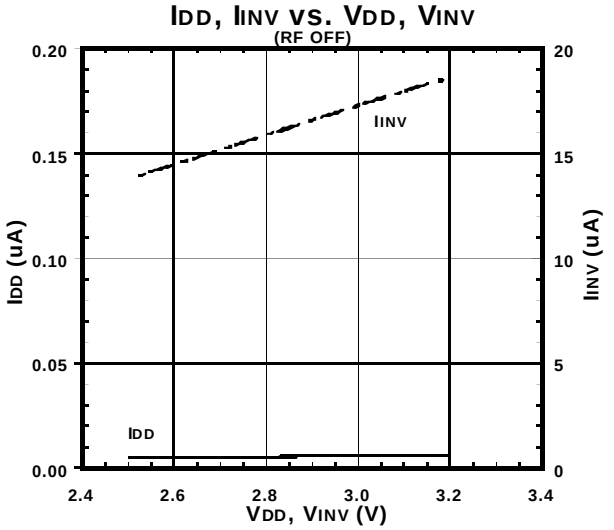
(General Conditions: Ta=+25°C, V_{DD}=V_{INV}=2.8V, V_{CTL}=0V, Zs=Zl=50Ω)







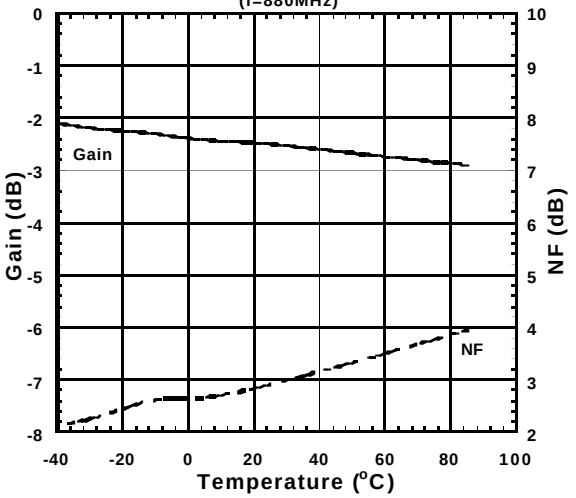




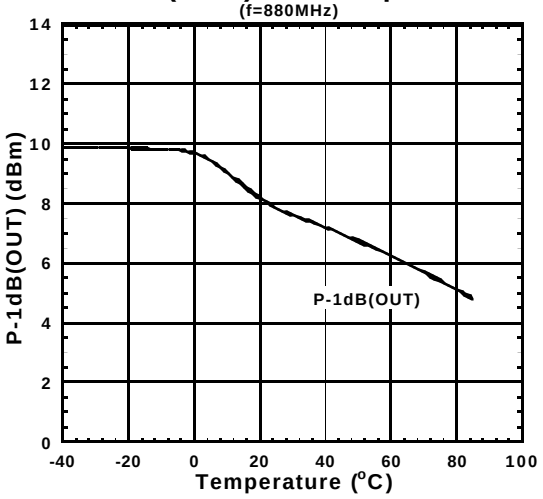
■ELECTRICAL CHARACTERISTICS (LNA Low Gain Mode)

(General Conditions: Ta=+25°C, V_{DD}=V_{INV}=2.8V, V_{CTL}=0V, Zs=Zl=50Ω)

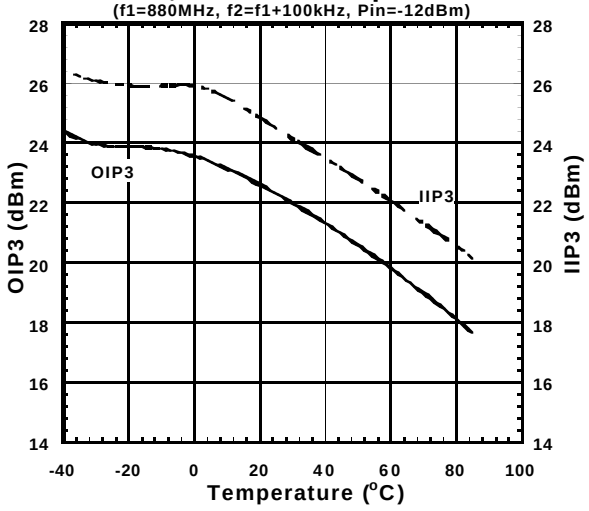
Gain, NF vs. Temperature
(f=880MHz)



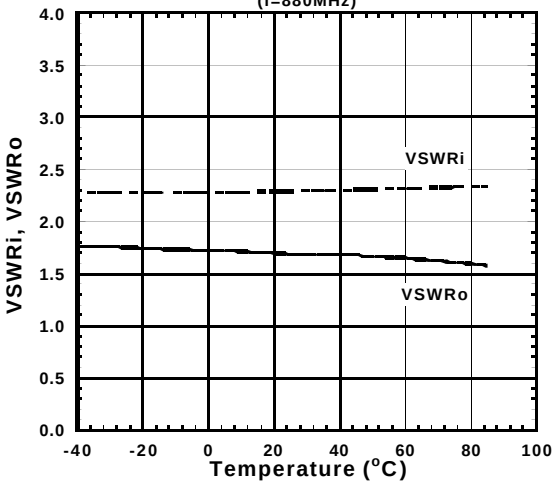
P-1dB(OUT) vs. Temperature
(f=880MHz)



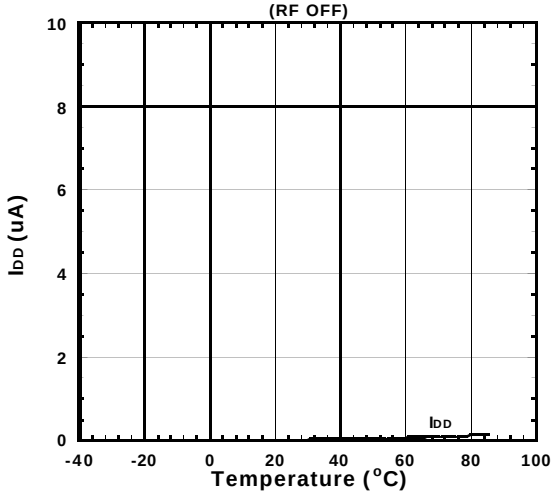
OIP3, IIP3 vs. Temperature
(f1=880MHz, f2=f1+100kHz, Pin=-12dBm)



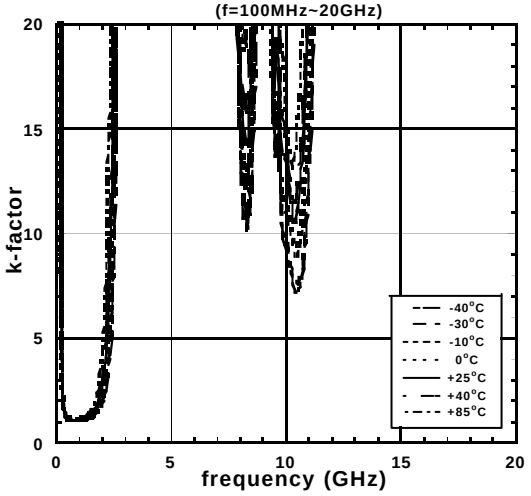
VSWRi, VSWRo vs. Temperature
(f=880MHz)



I_{DD} vs. Temperature
(RF OFF)

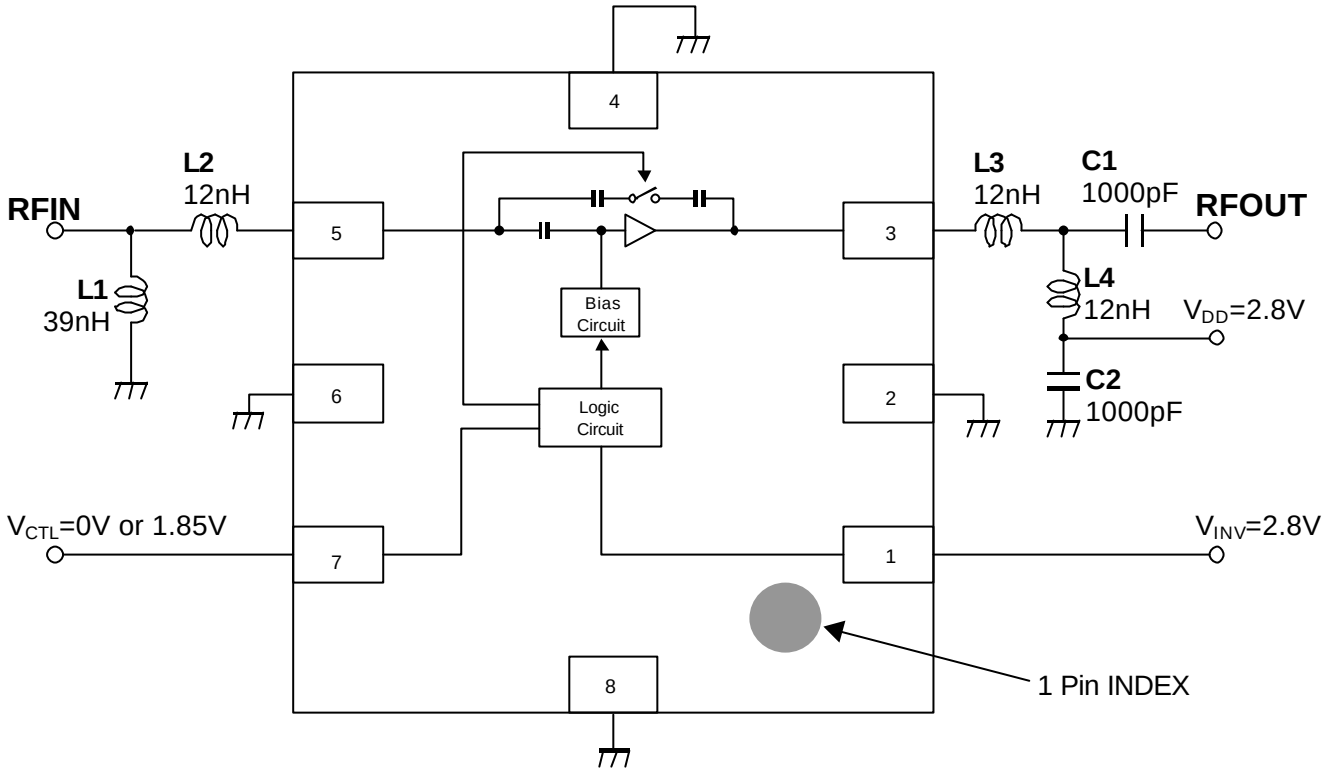


k-factor vs. Temperature
(f=100MHz~20GHz)



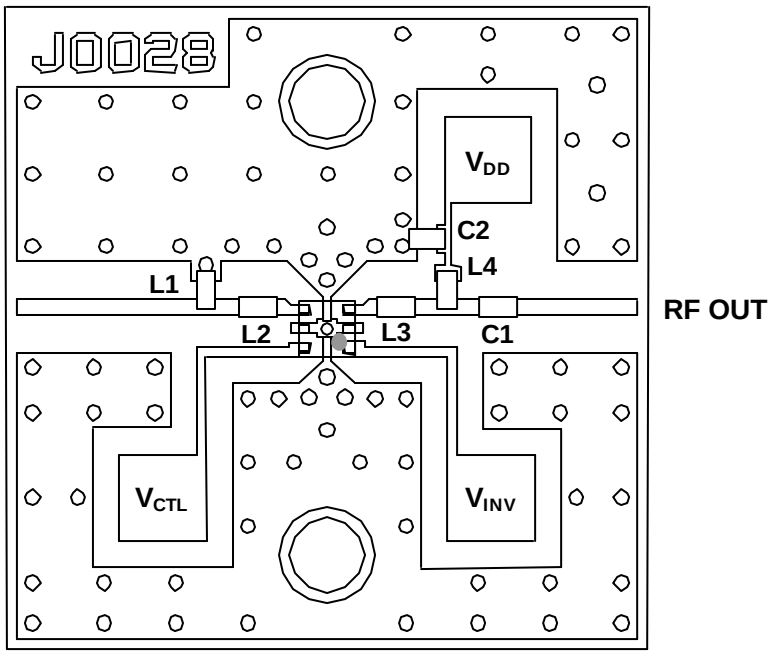
■APPLICATION CIRCUIT

(Top View)



■TEST PCB LAYOUT

(Top View)

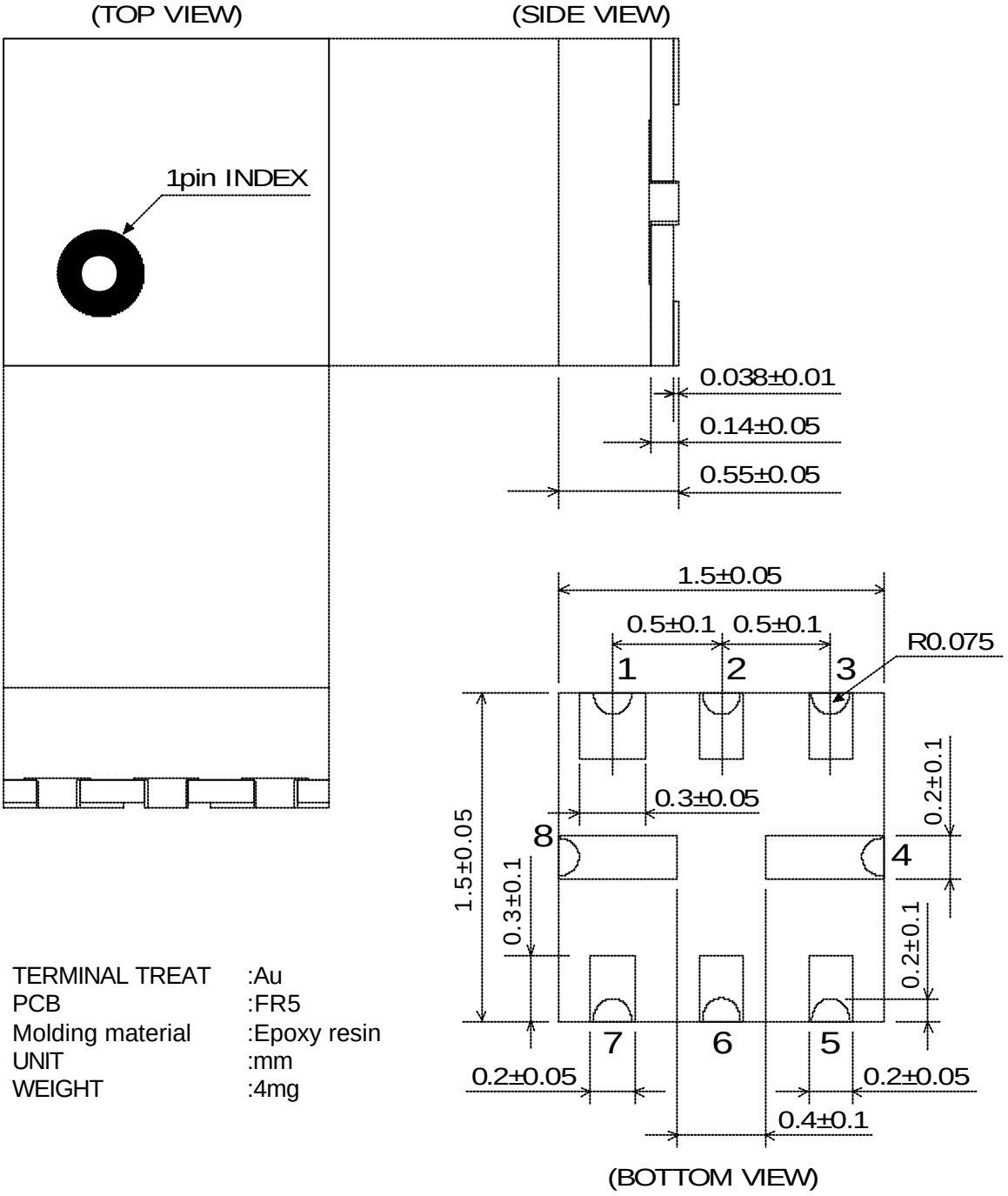


Parts List

Parts ID	Notes
L1~L4	TAIYO-YUDEN (HK1005 series)
C1,C2	MURATA (GRM15 series)

PCB (FR-4) :
t=0.2mm
MICROSTRIP LINE WIDTH
=0.4mm (Z_0=50Ω)
PCB SIZE=17.0mm X 17.0mm

■**PACKAGE OUTLINE** (USB8-B6)



TERMINAL TREAT	:Au
PCB	:FR5
Molding material	:Epoxy resin
UNIT	:mm
WEIGHT	:4mg

Cautions on using this product

This product contains Gallium-Arsenide (GaAs) which is a harmful material.

- Do NOT eat or put into mouth.
- Do NOT dispose in fire or break up this product.
- Do NOT chemically make gas or powder with this product.
- To waste this product, please obey the relating law of your country.

This product may be damaged with electric static discharge (ESD) or spike voltage. Please handle with care to avoid these damages.

射 频 和 天 线 设 计 培 训 课 程 推 荐

易迪拓培训(www.edatop.com)由数名来自于研发第一线的资深工程师发起成立，致力并专注于微波、射频、天线设计研发人才的培养；我们于 2006 年整合合并微波 EDA 网(www.mweda.com)，现已发展成为国内最大的微波射频和天线设计人才培养基地，成功推出多套微波射频以及天线设计经典培训课程和 ADS、HFSS 等专业软件使用培训课程，广受客户好评；并先后与人民邮电出版社、电子工业出版社合作出版了多本专业图书，帮助数万名工程师提升了专业技术能力。客户遍布中兴通讯、研通高频、埃威航电、国人通信等多家国内知名公司，以及台湾工业技术研究院、永业科技、全一电子等多家台湾地区企业。

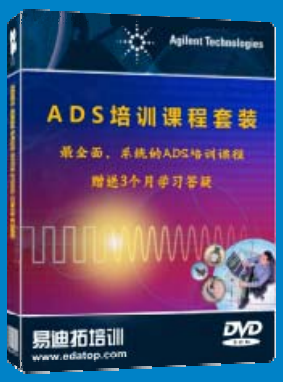
易迪拓培训课程列表：http://www.edatop.com/peixun/rfe/129.html

射频工程师养成培训课程套装

该套装精选了射频专业基础培训课程、射频仿真设计培训课程和射频电路测量培训课程三个类别共 30 门视频培训课程和 3 本图书教材；旨在引领学员全面学习一个射频工程师需要熟悉、理解和掌握的专业知识和研发设计能力。通过套装的学习，能够让学员完全达到和胜任一个合格的射频工程师的要求…

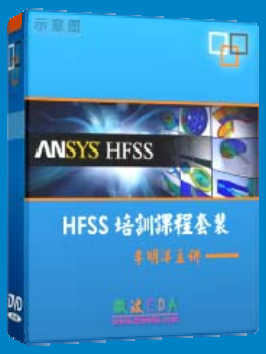
课程网址：http://www.edatop.com/peixun/rfe/110.html

ADS 学习培训课程套装



该套装是迄今国内最全面、最权威的 ADS 培训教程，共包含 10 门 ADS 学习培训课程。课程是由具有多年 ADS 使用经验的微波射频与通信系统设计领域资深专家讲解，并多结合设计实例，由浅入深、详细而又全面地讲解了 ADS 在微波射频电路设计、通信系统设计和电磁仿真设计方面的内容。能让您在最短的时间内学会使用 ADS，迅速提升个人技术能力，把 ADS 真正应用到实际研发工作中去，成为 ADS 设计专家...

课程网址： http://www.edatop.com/peixun/ads/13.html



HFSS 学习培训课程套装

该套课程套装包含了本站全部 HFSS 培训课程，是迄今国内最全面、最专业的 HFSS 培训教程套装，可以帮助您从零开始，全面深入学习 HFSS 的各项功能和在多个方面的工程应用。购买套装，更可超值赠送 3 个月免费学习答疑，随时解答您学习过程中遇到的棘手问题，让您的 HFSS 学习更加轻松顺畅…

课程网址：http://www.edatop.com/peixun/hfss/11.html

CST 学习培训课程套装

该培训套装由易迪拓培训联合微波 EDA 网共同推出，是最全面、系统、专业的 CST 微波工作室培训课程套装，所有课程都由经验丰富的专家授课，视频教学，可以帮助您从零开始，全面系统地学习 CST 微波工作的各项功能及其在微波射频、天线设计等领域的设计应用。且购买该套装，还可超值赠送 3 个月免费学习答疑…

课程网址：http://www.edatop.com/peixun/cst/24.html

HFSS 天线设计培训课程套装

套装包含 6 门视频课程和 1 本图书，课程从基础讲起，内容由浅入深，理论介绍和实际操作讲解相结合，全面系统的讲解了 HFSS 天线设计的全过程。是国内最全面、最专业的 HFSS 天线设计课程，可以帮助您快速学习掌握如何使用 HFSS 设计天线，让天线设计不再难…

课程网址：http://www.edatop.com/peixun/hfss/122.html

13.56MHz NFC/RFID 线圈天线设计培训课程套装

套装包含 4 门视频培训课程，培训将 13.56MHz 线圈天线设计原理和仿真设计实践相结合，全面系统地讲解了 13.56MHz 线圈天线的工作原理、设计方法、设计考量以及使用 HFSS 和 CST 仿真分析线圈天线的具体操作，同时还介绍了 13.56MHz 线圈天线匹配电路的设计和调试。通过该套课程的学习，可以帮助您快速学习掌握 13.56MHz 线圈天线及其匹配电路的原理、设计和调试…

详情浏览：http://www.edatop.com/peixun/antenna/116.html

我们的课程优势：

※ 成立于 2004 年，10 多年丰富的行业经验，

※ 一直致力并专注于微波射频和天线设计工程师的培养，更了解该行业对人才的要求

※ 经验丰富的一线资深工程师讲授，结合实际工程案例，直观、实用、易学

联系我们：

※ 易迪拓培训官网：http://www.edatop.com

※ 微波 EDA 网：http://www.mweda.com

※ 官方淘宝店：http://shop36920890.taobao.com