



Preliminary Data Sheet

BIPOLAR ANALOG INTEGRATED CIRCUIT

μ PC3231GV

5 V AGC AMPLIFIER + VIDEO AMPLIFIER

DESCRIPTION

The μ PC3231GV is silicon monolithic IC designed for use as AGC amplifier for digital CATV, cable modem and digital terrestrial systems. This IC consists of gain control amplifier and video amplifier.

The package is 8-pin SSOP (shrink small outline package) suitable for surface mount.

This IC is manufactured using our 30 GHz f_{max} UHS0 (Ultra High Speed Process) silicon bipolar process. This process uses silicon nitride passivation film. This material can protect chip surface from external pollution and prevent corrosion/migration. Thus, this IC has excellent performance, uniformly and reliability.

FEATURES

- Low distortion : $IM_3 = 53.5$ dBc TYP. @ single-ended output, $V_{out} = 105$ dB μ V (0.5 V_{P-P})/tone
- Low noise figure : NF = 5.0 dB TYP. @ Maximum Gain
- Wide AGC dynamic range : GCR = 61 dB TYP. @ input prescribe
- On-chip video amplifier : $V_{out} = 1.0$ V_{P-P} TYP. @ single-ended output
- Supply Voltage : $V_{CC} = 5.0$ V TYP.
- Packaged in 8-pin SSOP suitable for surface mounting.

APPLICATIONS

- Digital terrestrial TV
- Digital CATV
- Cable modem receivers

ORDERING INFORMATION (PLAN)

Part Number	Package	Supplying Form
μ PC3231GV-E1	8-pin plastic SSOP (4.45mm(175))	Embossed tape 8mm wide. Pin 1 indicates pull-out direction of tape. Qty 1kpcs/reel.

Remark To order evaluation samples, please contact your local NEC sales office.

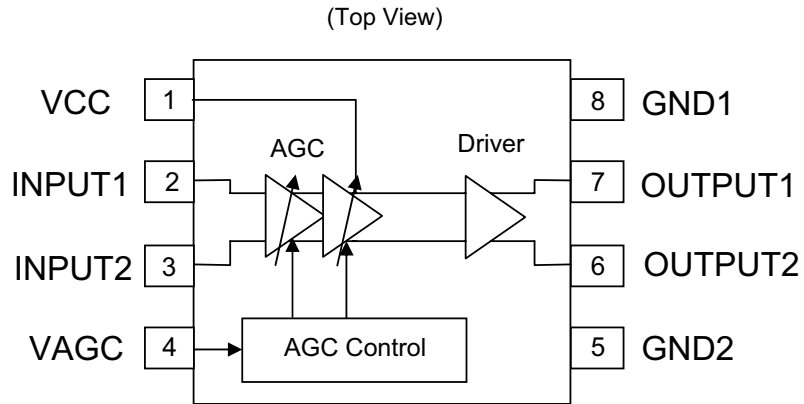
Part number for sample order: μ PC3231GV

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.

Not all devices/types available in every country. Please check with local NEC Electronics sales representative for availability and additional information.

INTERNAL BLOCK DIAGRAM AND PIN CONFIGURATION



PRODUCT LINE-UP OF 5V AGC AMPLIFIER

Part Number	I _{cc} (mA)	G _{MAX} (dB)	G _{MIN} (dB)	G _{CR} (dB)	NF (dB)	IM ₃ (dBc)	Package
μPC3217GV	23	53	0	53	6.5	50 ^{NOTE1}	8-pin SSOP (4.45mm(175))
μPC3218GV	23	63	10	53	3.5	50 ^{NOTE1}	
μPC3219GV	36.5	42.5	0	42.5	9.0	58 ^{NOTE1}	
μPC3221GV	33	60	10	50	4.2	56 ^{NOTE1}	
μPC3231GV	36	65	4	61	5.0	53.5 ^{NOTE2}	

NOTE1 f₁=44MHz, f₂=45MHz, V_{out}=0.7Vp-p/tone, single-ended output

NOTE2 f₁=44MHz, f₂=45MHz, V_{out}=0.5Vp-p/tone, single-ended output

PIN EXPLANATIONS

Pin No.	Pin Name	Applied Voltage (V)	Pin Voltage (V) <small>Note</small>	Function and application	Internal Equivalent Circuit
1	V _{CC}	4.5 to 5.5	-	Power supply pin. This pin should be externally equipped with bypass capacitor to minimize ground impedance,	
2	INPUT1	-	1.32	Signal input pins to AGC amplifier. This pin should be coupled with capacitor for DC cut.	
3	INPUT2	-	1.32		
4	V _{AGC}	0 to V _{CC}	-	Gain control pin. This pin's bias govern the AGC output level. Minimum Gain at V _{AGC} :0 to 0.1V Maximum Gain at V _{AGC} :2.7 to 3.3V Recommended to use AGC voltage with externally resistor (example:1kΩ)	
5	GND2	0	-	Ground pin. This pin should be connected to system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible.	
6	OUTUT2	-	1.91	Signal output pins of video amplifier. This pin should be coupled with capacitor for DC cut.	
7	OUTUT1	-	1.91		
8	GND1	0	-	Ground pin. This pin should be connected to system ground with minimum inductance. Ground pattern on the board should be formed as with as possible. All ground pins must be connected together with wide ground pattern to decrease impedance difference.	

Note Pin voltage is measured at V_{CC}=5.0V

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Test Conditions	Rating	Unit
Supply Voltage	V_{CC}	$T_A=+25^{\circ}C$	6.0	V
Gain Control Voltage Range	V_{AGC}	$T_A=+25^{\circ}C$	0 to V_{CC}	V
Power Dissipation	P_D	$T_A=+85^{\circ}C$ Note	250	mW
Storage Temperature	T_{stg}		-55 to +150	$^{\circ}C$

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

RECOMMENDED OPERATING RANGE

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}		4.5	5.0	5.5	V
Operating Ambient Temperature	T_A	$V_{CC} = 4.5$ to 5.5 V	-40	+25	+85	$^{\circ}C$
Gain Control Voltage Range	V_{AGC}		0	-	3.3	V
Operating Frequency Range	$f_{(BW)}$		30	-	90	MHz

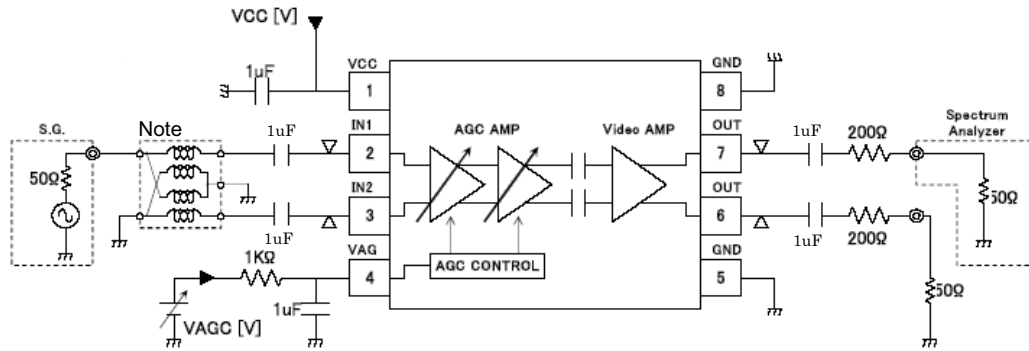
ELECTRICAL CHARACTERISTICS

($T_A=+25^{\circ}\text{C}$, $V_{CC} = 5\text{V}$, $f = 45\text{MHz}$, $Z_s = 50\Omega$, $Z_L = 250\Omega$, single-ended output)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit	
DC Characteristics							
Circuit Current	I_{CC}	$V_{CC}=5\text{V}$, No input signal	Note 1	28	36	44	mA
AGC Voltage High Level	$V_{AGC(H)}$	@ Maximum gain	Note 1	2.7	-	3.3	V
AGC Voltage Low Level	$V_{AGC(L)}$	@ Minimum gain	Note 1	0	-	0.1	V
RF Characteristics							
IF Input Frequency Range	f_{in}	$f_c = -3\text{dB}$ @45MHz	Note 1	30	-	90	MHz
Maximum Voltage Gain	G_{MAX}	$V_{AGC}=2.7\text{V}$, $P_{in} = -60\text{dBm}$	Note 1	62.5	65	67.5	dB
Minimum Voltage Gain	G_{MIN}	$V_{AGC}=0.1\text{V}$, $P_{in} = -30\text{dBm}$	Note 1	0	4	7	dB
Gain Control Range (input prescribe)	GCR_{in}	$V_{AGC}=0.1$ to 2.7V	Note 1	55.5	61	-	dB
Gain Control Range (output prescribe)	GCR_{out}	$V_{out} = 1.0\text{V}_{P-P}$	Note 1	45	55	-	dB
Output Voltage	V_{out}	$P_{in} = -61 \sim -6\text{dBm}$	Note 1	-	1.0	-	V_{P-P}
Maximum Output Voltage	V_{oclip}	$V_{AGC} = 3.0\text{V}$	Note 1	2.0	3.3	-	V_{P-P}
Noise Figure	NF	$V_{AGC} = 3.0\text{V}$	Note 2	-	5.0	6.5	dB
3rd Order Inter-modulation Distortion	IM_3	$f_1 = 44\text{MHz}$, $f_2 = 45\text{MHz}$, $P_{in} = -20\text{dBm/ tone}$, $V_{out} = 105\text{dB}\mu\text{V}$ ($0.5V_{P-P}$)/tone	Note 1	50	53.5	-	dBc
Input impedance	Z_{in}	$V_{AGC}=0\text{V}$	Note 3	-	1.35//6	-	$k\Omega//pF$

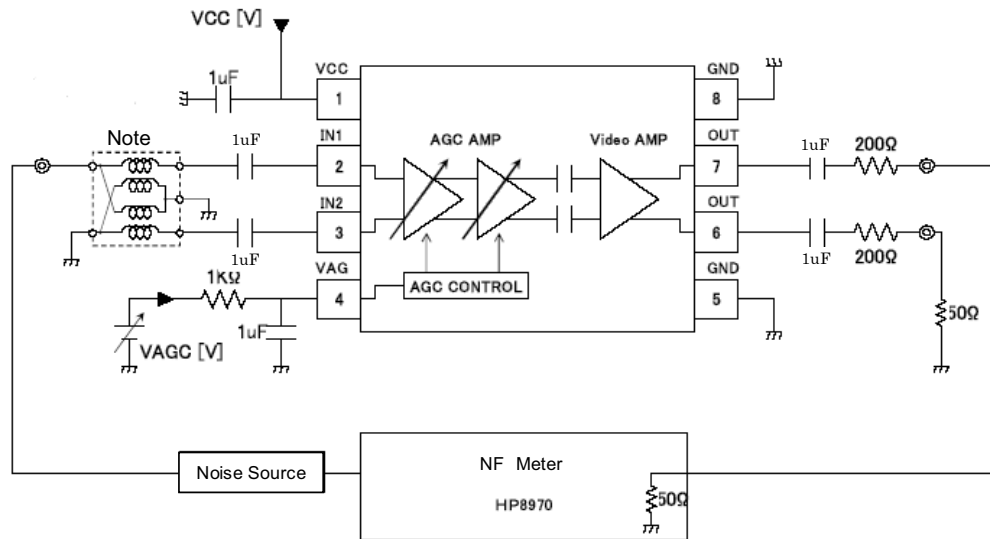
- Note**
1. By measurement circuit 1
 2. By measurement circuit 2
 3. By measurement circuit 3

MEASUREMENT CIRCUIT 1



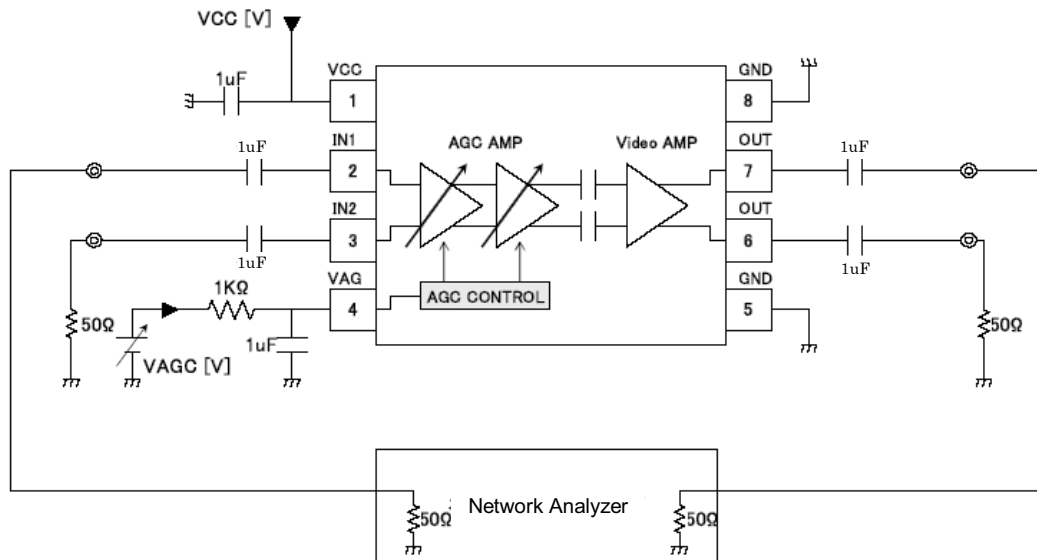
Note Balun Transformer : TOKO 617DB-1674 B4F (Double balanced type)

MEASUREMENT CIRCUIT 2



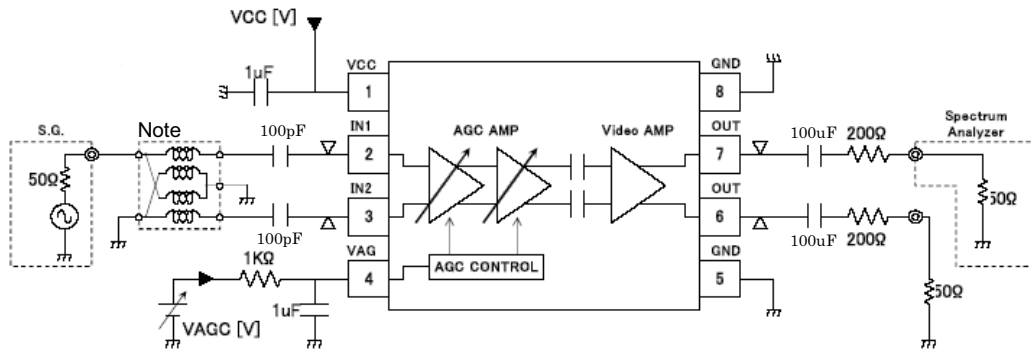
Note Balun Transformer : TOKO 617DB-1674 B4F (Double balanced type)

MEASUREMENT CIRCUIT 3



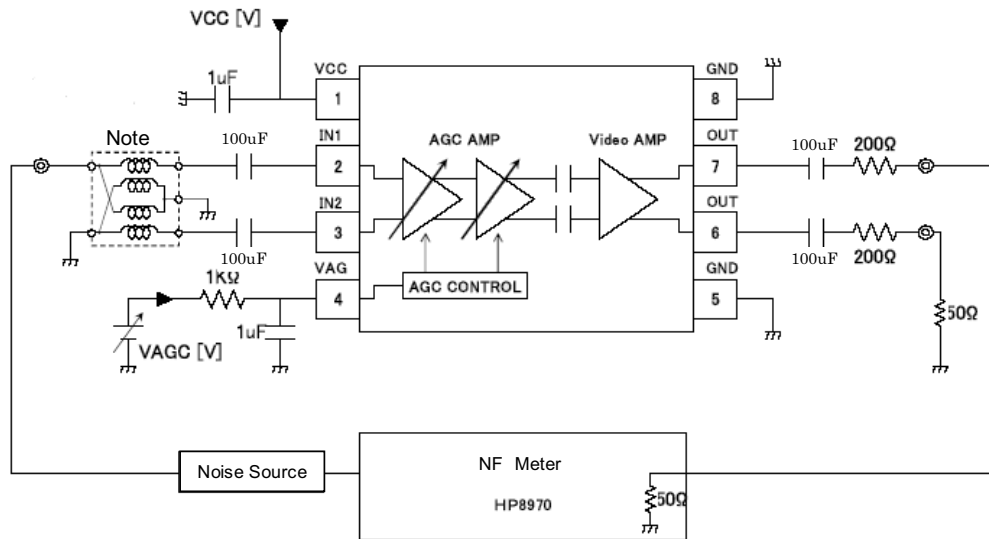
The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

MEASUREMENT CIRCUIT 4 [PRESSURE IMPROVEMENT RECOMMENDATION CIRCUIT]



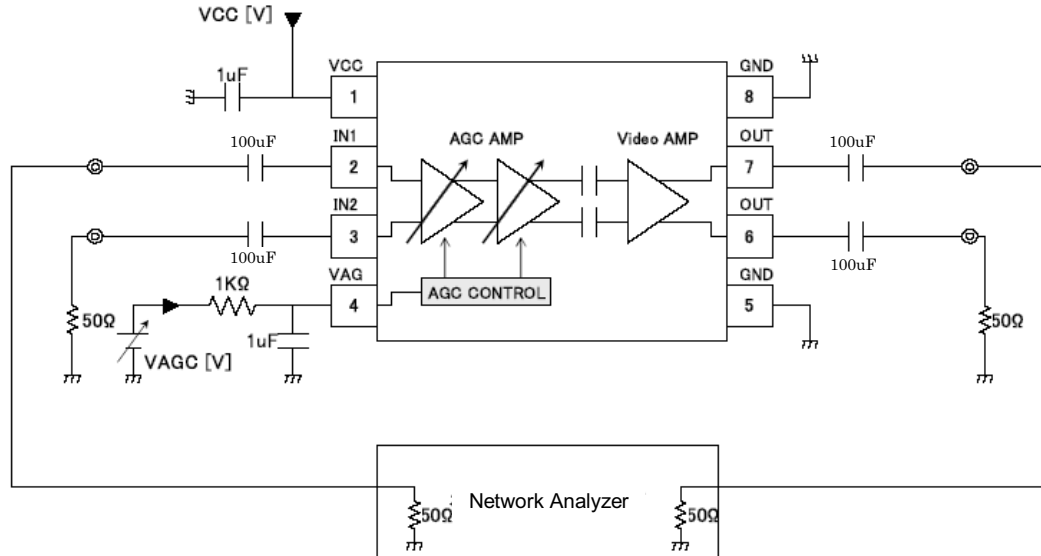
Note Balun Transformer : TOKO 617DB-1674 B4F (Double balanced type)

MEASUREMENT CIRCUIT 5 [PRESSURE IMPROVEMENT RECOMMENDATION CIRCUIT]



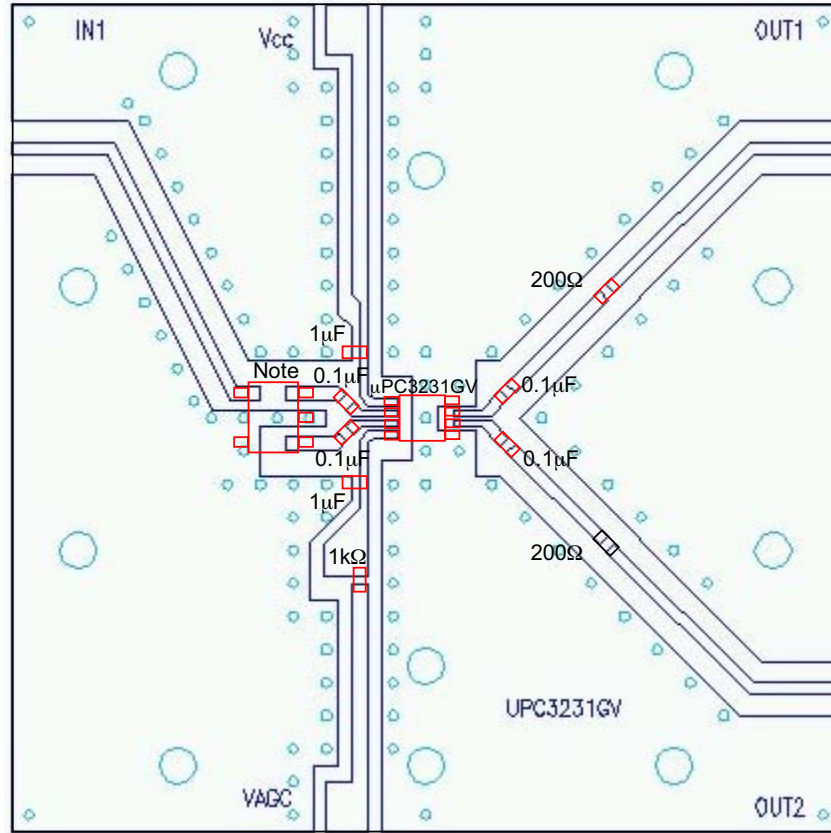
Note Balun Transformer : TOKO 617DB-1674 B4F (Double balanced type)

MEASUREMENT CIRCUIT 6 [PRESSURE IMPROVEMENT RECOMMENDATION CIRCUIT]



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

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD
(MEASUREMENT CIRCUIT 1)



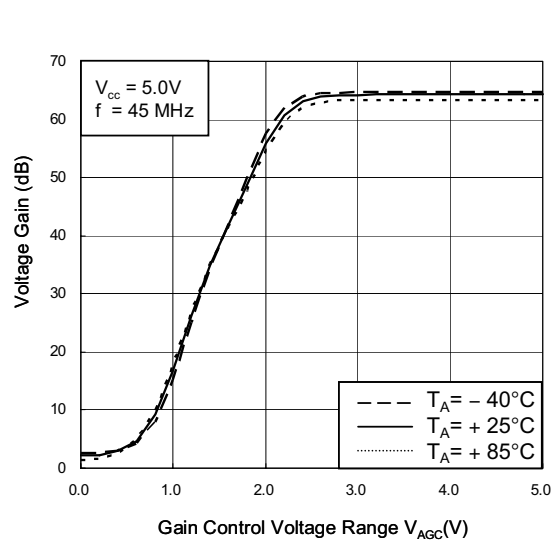
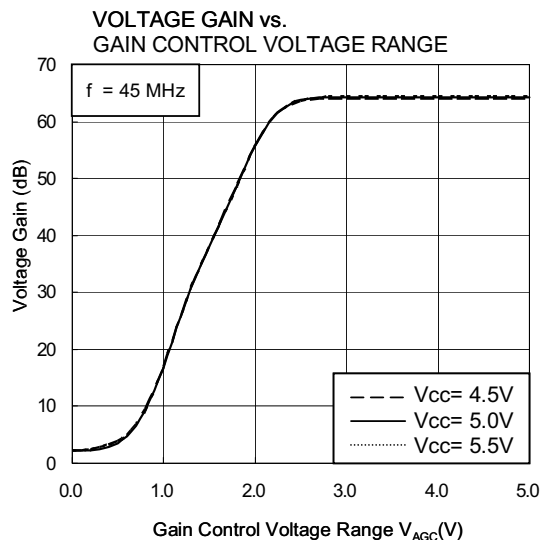
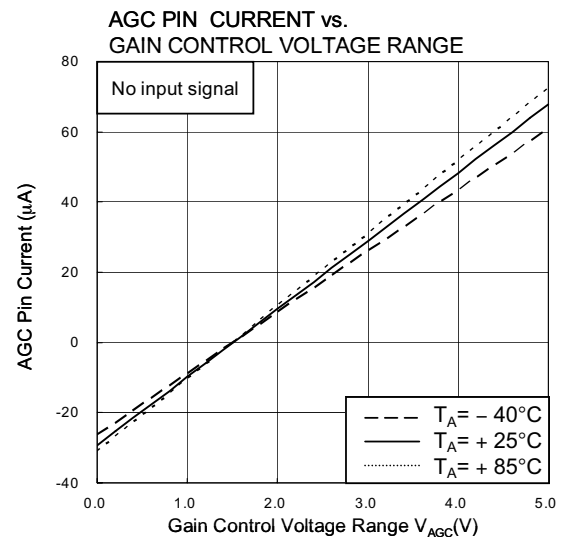
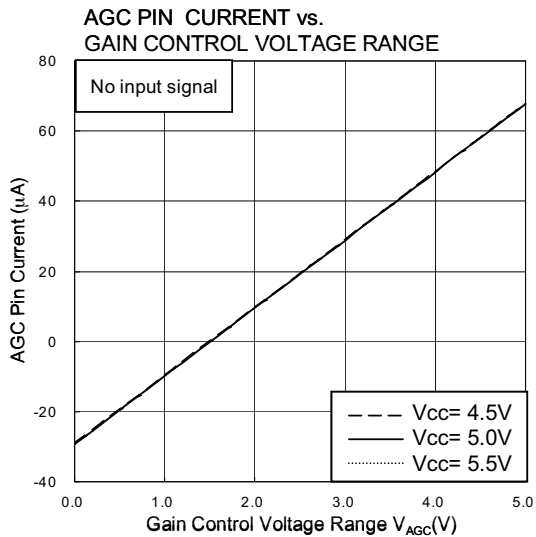
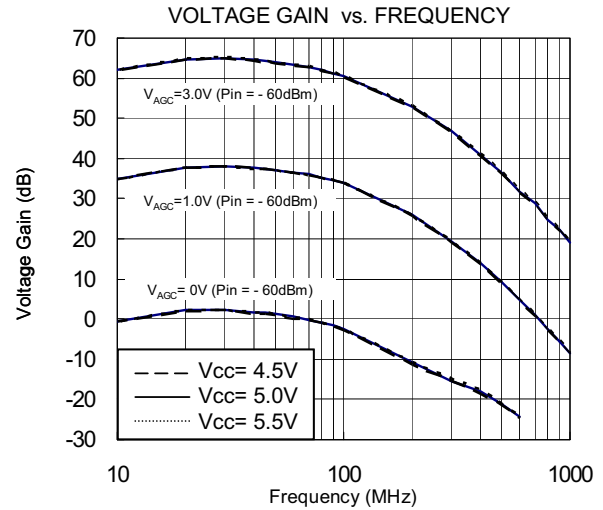
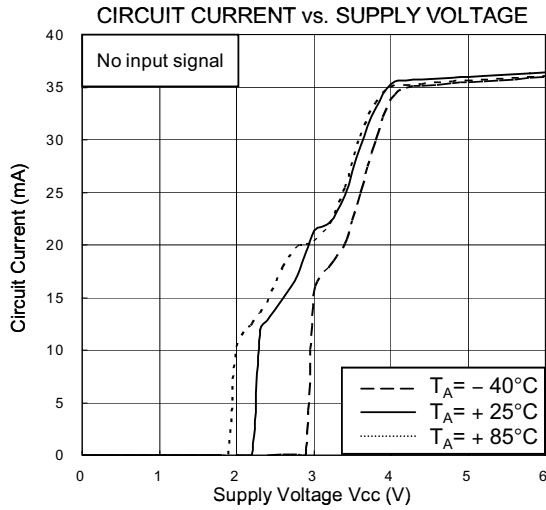
Note Balun Transformer

Remarks

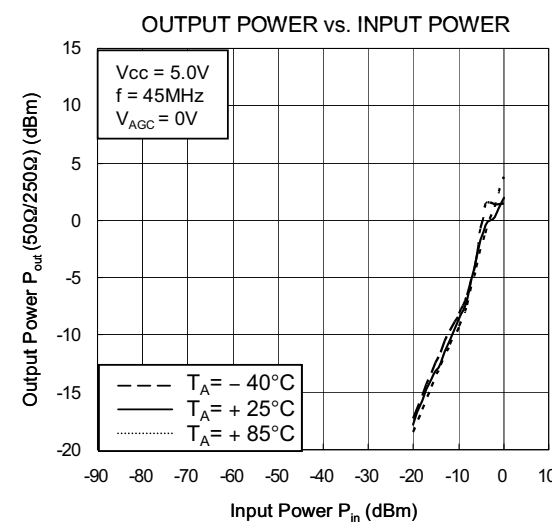
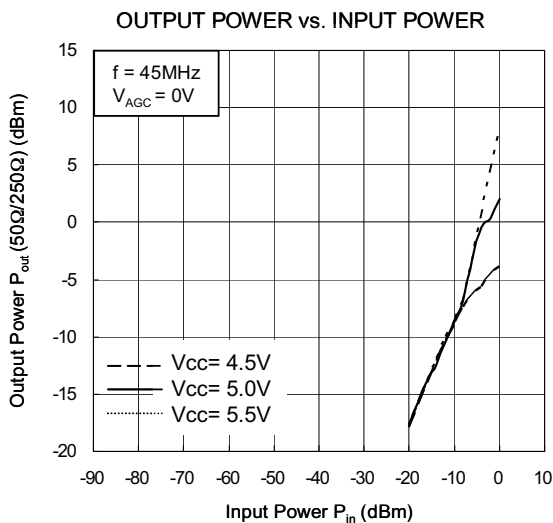
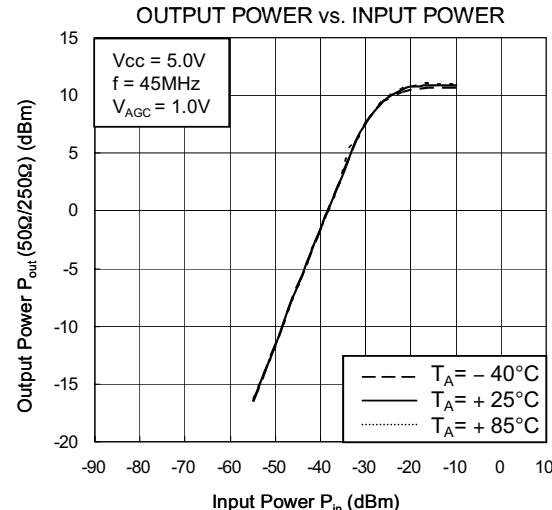
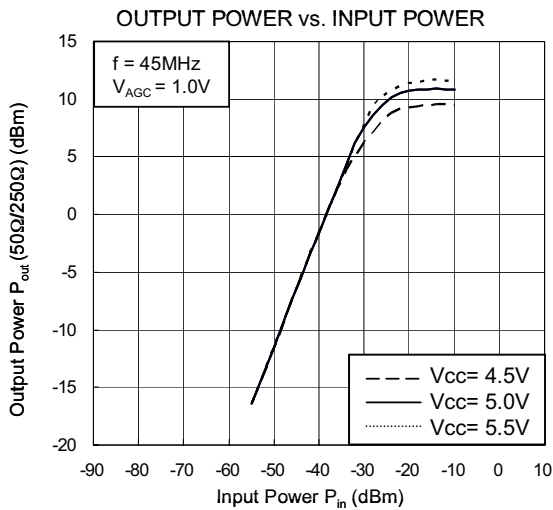
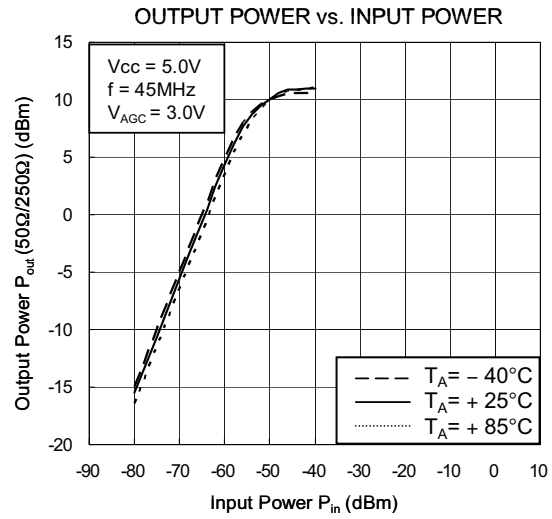
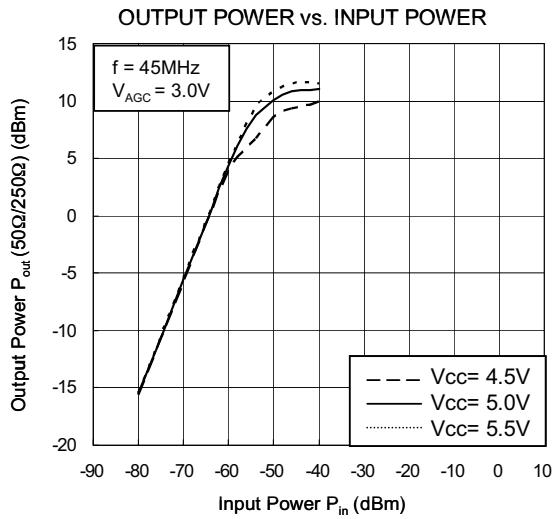
1. Back side: GND pattern
2. Au plated on pattern
3. ○: Through hole

TYPICAL CHARACTERISTICS

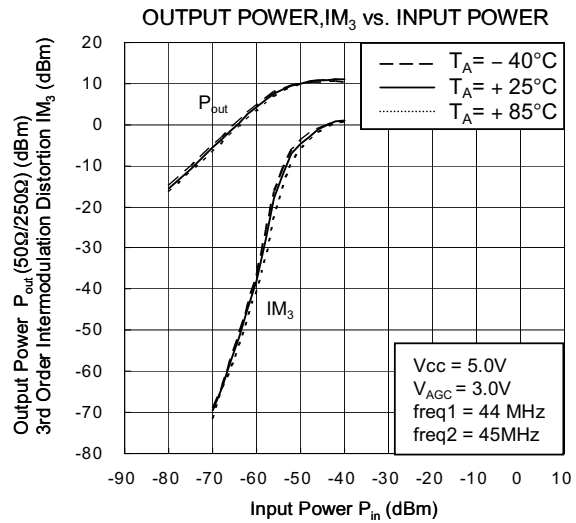
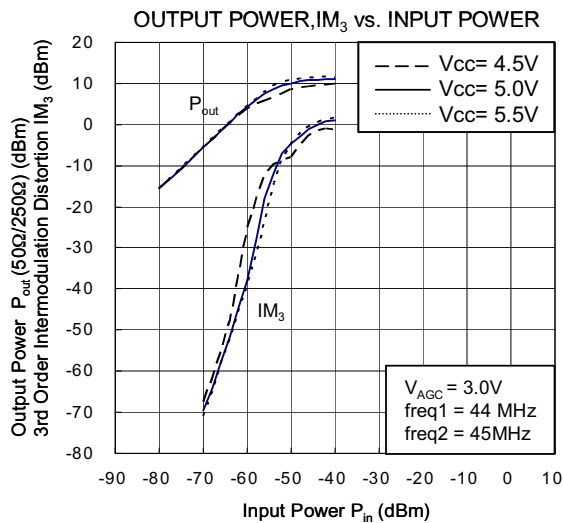
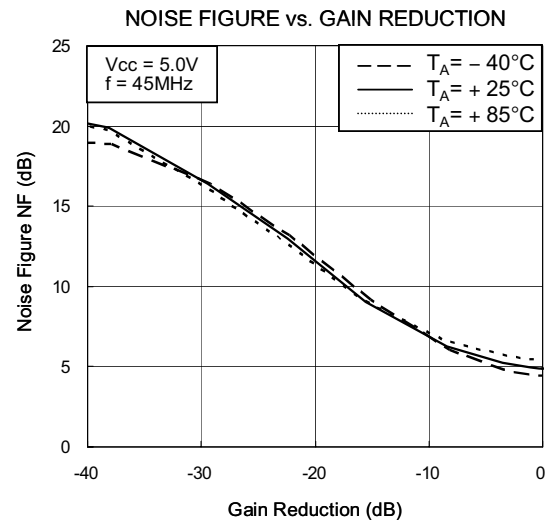
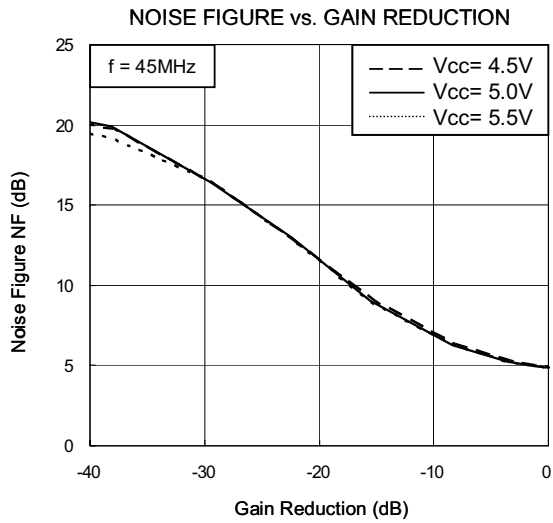
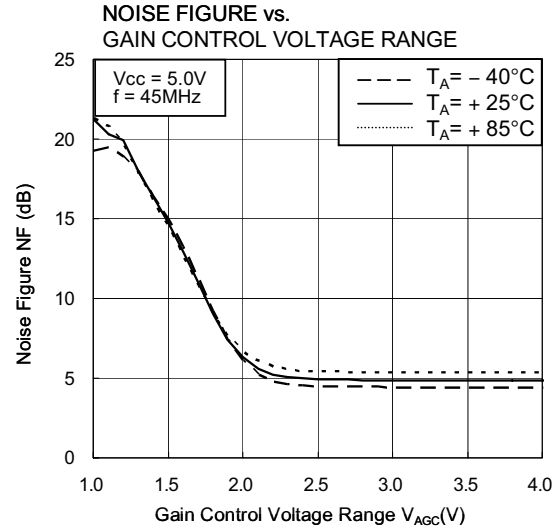
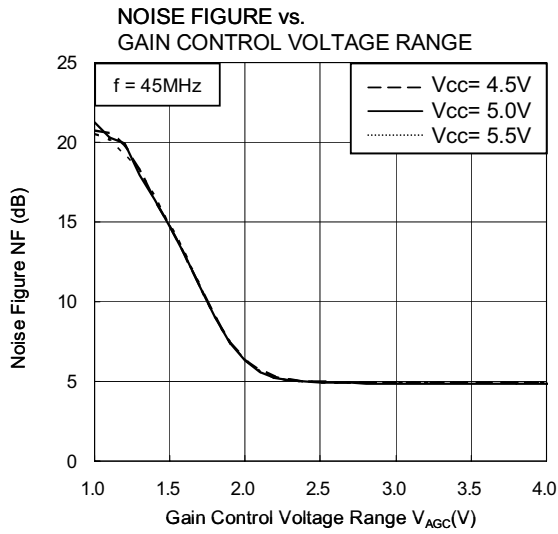
($T_A = +25^\circ\text{C}$, unless otherwise specified)



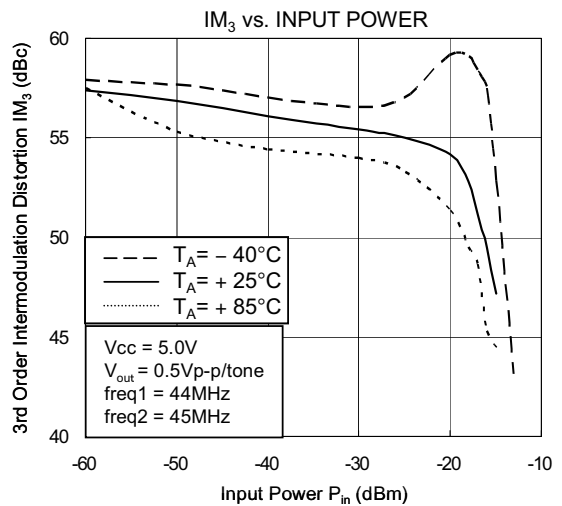
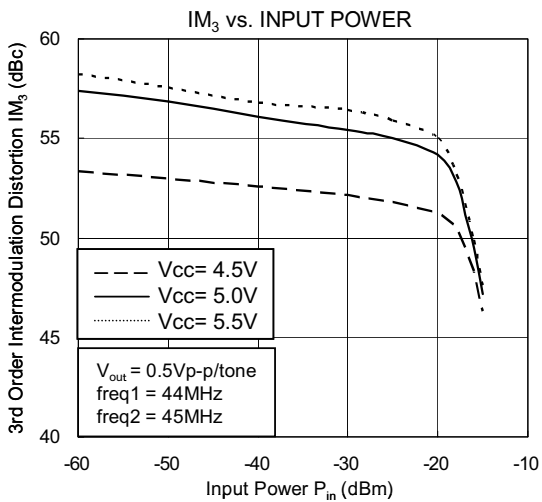
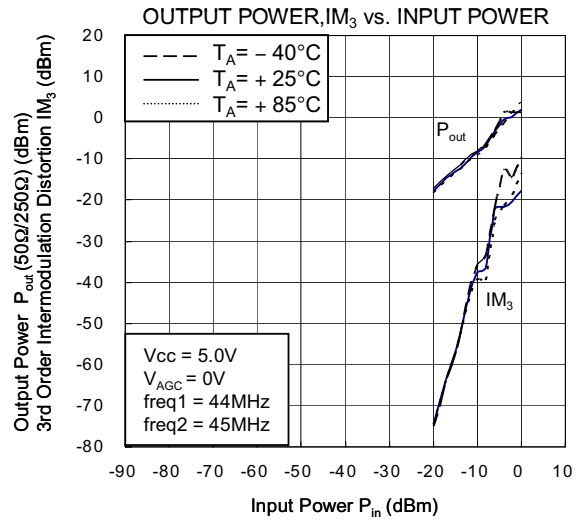
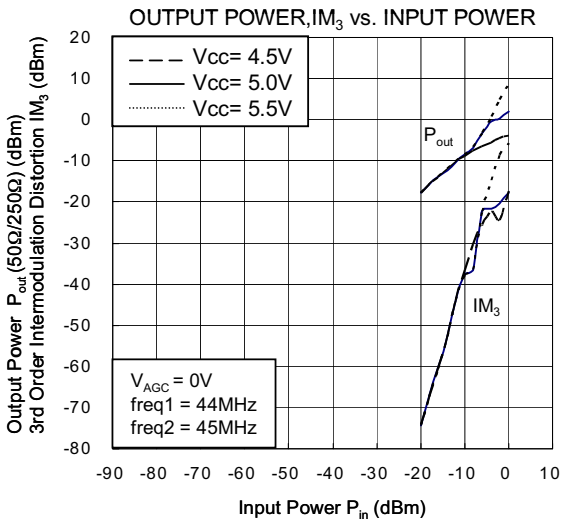
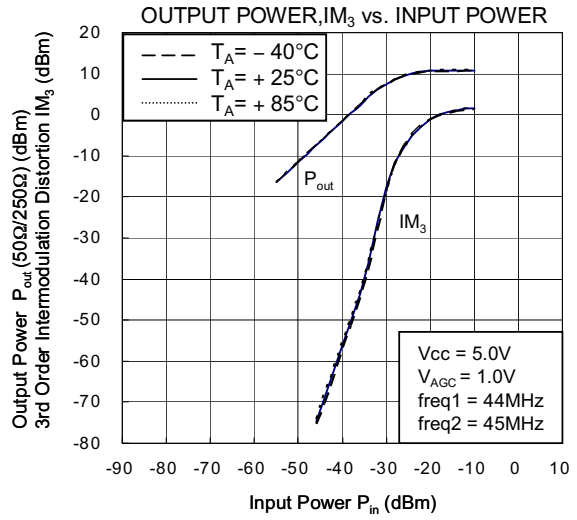
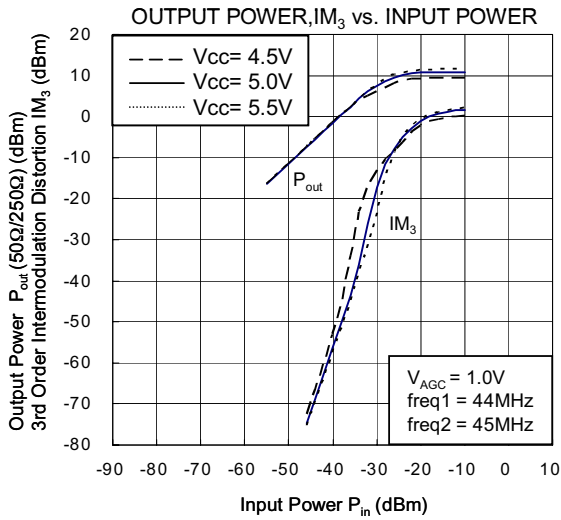
Remark The graphs is indicate nominal characteristics.



Remark The graphs indicate nominal characteristics.



Remark 0The graphs is indicate nominal characteristics.

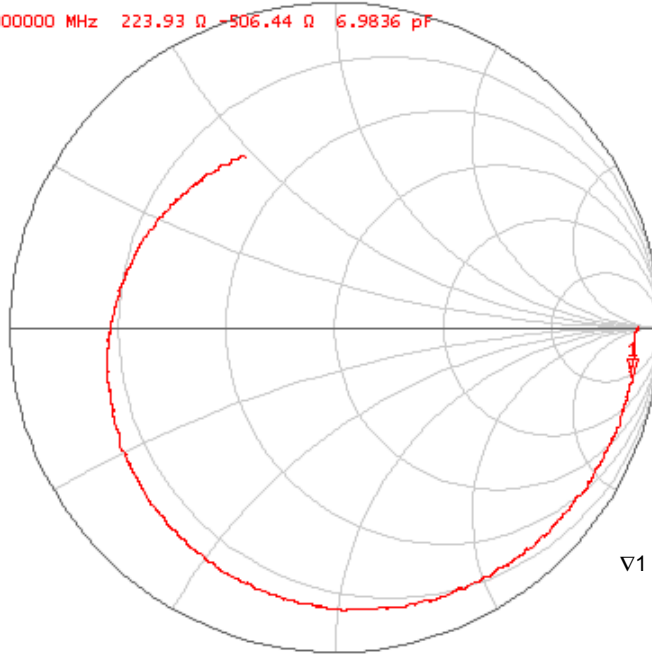


Remark The graphs indicate nominal characteristics.

S-PARAMETERS (T_A = + 25°C, V_{cc} = 5V, V_{AGC}=0V)

S11 – FREQUENCY

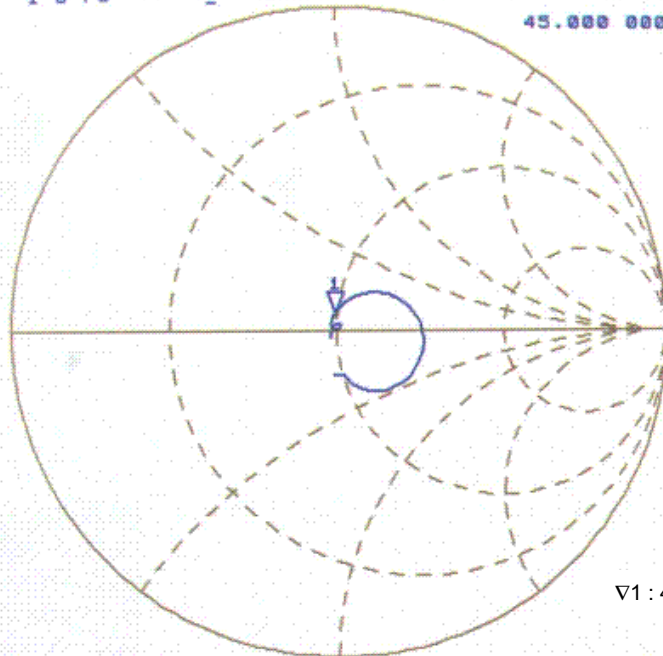
>1 45.00000000 MHz 223.93 Ω -506.44 Ω 6.9836 pF



∇1 : 45MHz 223.93Ω -506.44Ω 6.98pF

S22 – FREQUENCY

1 0 FS 1: 49.68 Ω 5.3887 Ω 19.859 nH
45.000 000 MHz

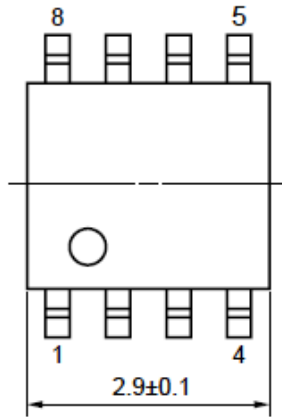


∇1 : 45MHz 49.68Ω 5.39Ω 19.86nH

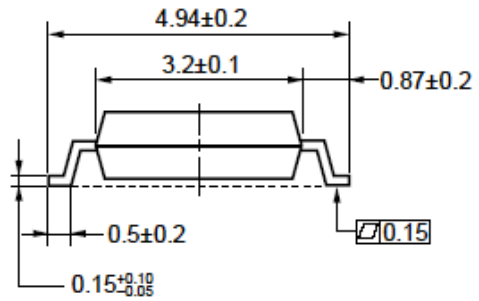
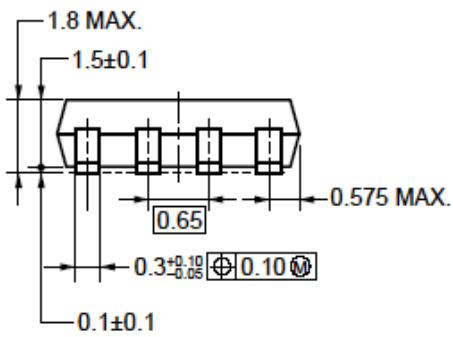
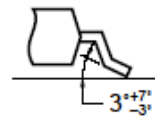
START 1.000 000 MHz STOP 1 000.000 000 MHz

μ PC3231GV* PACKAGE DIMENSIONS

8 PIN PLASTIC SSOP (4.45mm(175)) (Unit : mm)



detail of lead end



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
Wave Soldering	Peak temperature (molten solder temperature) : 260°C or below Time at peak temperature : 10 seconds or less Preheating temperature (package surface temperature) : 120°C or below Maximum number of flow processes : 1 time Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	WS260
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 (except for partial heating).

- The information in this document is current as of April, 2006. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets or data books, 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.
- No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Electronics. NEC Electronics assumes no responsibility for any errors that may appear in this document.
- NEC Electronics does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC Electronics products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Electronics or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of a customer's equipment shall be done under the full responsibility of the customer. NEC Electronics assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC Electronics endeavors to enhance the quality, reliability and safety of NEC Electronics products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC Electronics products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment and anti-failure features.
- NEC Electronics products are classified into the following three quality grades: "Standard", "Special" and "Specific".

The "Specific" quality grade applies only to NEC Electronics products developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of an NEC Electronics product depend on its quality grade, as indicated below. Customers must check the quality grade of each NEC Electronics product before using it in a particular application.

"Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots.

"Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support).

"Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC Electronics products is "Standard" unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact an NEC Electronics sales representative in advance to determine NEC Electronics' willingness to support a given application.

(Note)

- (1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.
- (2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

Important Information and Disclaimer: Information provided by CEL on its website or in other communications concerning the substance content of its products represents knowledge and belief as of the date that it is provided. CEL bases its knowledge and belief on information provided by third parties and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. CEL has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. CEL and CEL suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall CEL’s liability arising out of such information exceed the total purchase price of the CEL part(s) at issue sold by CEL to customer on an annual basis.

See CEL Terms and Conditions for additional clarification of warranties and liability.