DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3234GV

GENERAL PURPOSE 5 V 100 MHz AGC AMPLIFIER

DESCRIPTION

The μPC3234GV is a 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, uniformity and reliability.

FEATURES

- Low distortion : IM_3 = 54.0 dBc TYP. @ single-ended output, V_{out} = 105 dBμV (0.5 V_{p-p}) /tone, P_{in} = −30 dBm/tone
- Low noise figure : NF = 4.0 dB TYP. @ maximum gain
- Wide AGC dynamic range : GCR_{in} = 58.5 dB TYP. @ input prescribe
- High ESD protection
- Packaged in 8-pin SSOP suitable for surface mounting

APPLICATIONS

- Digital terrestrial TV
- Digital CATV
- Cable modem receivers
- USB card

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPC3234GV-E1	μPC3234GV-E1-A	8-pin plastic SSOP (4.45 mm (175)) (Pb-Free)	3234	• Embossed tape 8 mm wide • Pin 1 indicates pull-out direction of tape • Qty 1 kpcs/reel

Remark To order evaluation samples, contact your nearby sales office.
Part number for sample order: μPC3234GV

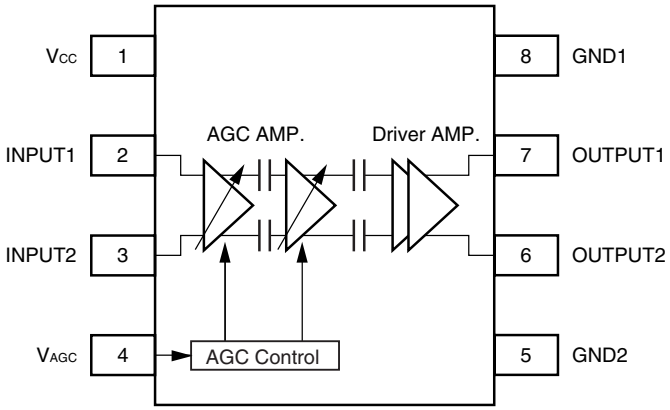
Caution Observe precautions when handling because these devices are sensitive to electrostatic discharge.

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 products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.

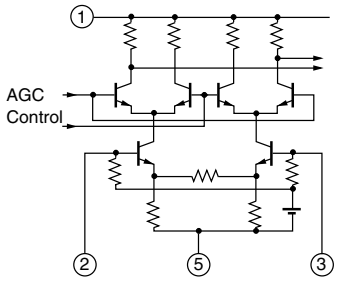
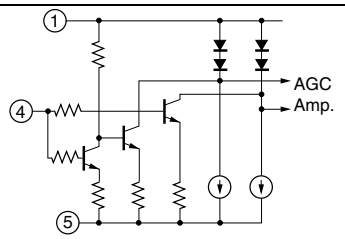
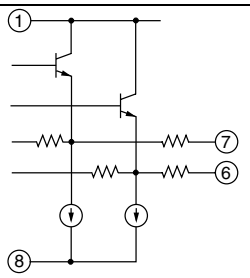
Document No. PU10695EJ01V0DS (1st edition)
Date Published November 2007 NS
Printed in Japan

INTERNAL BLOCK DIAGRAM AND PIN CONNECTIONS

(Top View)



PIN EXPLANATIONS

Pin No.	Pin Name	Applied Voltage (V)	Pin Voltage (V) Note	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	–	1.2	Signal input pins to AGC amplifier. This pin should be coupled with capacitor for DC cut.	
3	INPUT2	–	1.2		
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 0.4 V Maximum Gain at V_{AGC} : 3.0 to 3.5 V Recommended to use AGC voltage with externally resister (example: 1 kΩ).	
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	OUTPUT2	–	2.4	Signal output pins of video amplifier. This pin should be coupled with capacitor for DC cut.	
7	OUTPUT1	–	2.4		
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 wide 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} = 5.0 V.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Test Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C	6.0	V
Gain Control Voltage Range	V_{AGC}	T_A = +25°C	0 to V_{CC}	V
Power Dissipation	P_D	T_A = +85°C **Note**	250	mW
Operating Ambient Temperature	T_A		–40 to +85	°C
Storage Temperature	T_{stg}		–55 to +150	°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	°C
Gain Control Voltage Range	V_{AGC}		0	–	3.5	V
Operating Frequency Range	f_{BW}		30	–	100	MHz

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, V_{CC} = 5 V, f = 45 MHz, Z_S = 50 Ω, Z_L = 250 Ω, single-ended output)

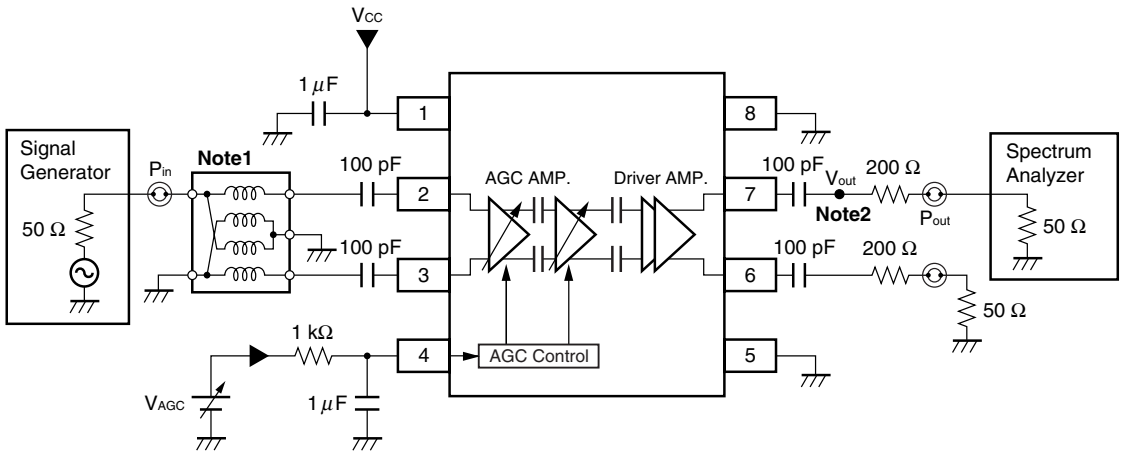
Parameter	Symbol	Test Conditions		MIN.	TYP.	MAX.	Unit
DC Characteristics							
Circuit Current	I_{CC}	V_{CC} = 5 V, No input signal	**Note 1**	–	28.5	38	mA
AGC Voltage High Level	$V_{AGC (H)}$	@ Maximum gain	**Note 1**	3.0	–	3.5	V
AGC Voltage Low Level	$V_{AGC (L)}$	@ Minimum gain	**Note 1**	0	–	0.4	V
RF Characteristics							
IF Input Frequency Range	f_{IFin}	f_C = –3 dB @ 45 MHz	**Note 1**	30	–	100	MHz
Maximum Voltage Gain	G_{MAX}	V_{AGC} = 3.0 V, P_{in} = –60 dBm	**Note 1**	60	63	66	dB
Minimum Voltage Gain	G_{MIN}	V_{AGC} = 0.4 V, P_{in} = –30 dBm	**Note 1**	1.5	4.5	7.5	dB
Gain Control Range (input prescribe)	GCR_{in}	V_{AGC} = 0.4 to 3.0 V	**Note 1**	52.5	58.5	–	dB
Output Voltage	V_{out}	P_{in} = –59 to –17 dBm	**Note 1**	–	1.0	–	V_{p-p}
Maximum Output Voltage	V_{oclip}	V_{AGC} = 3.0 V	**Note 1**	2.0	2.7	–	V_{p-p}
Noise Figure	NF	V_{AGC} = 3.0 V	**Note 2**	–	4.0	5.5	dB
3rd Order Intermodulation Distortion	IM_3	f1 = 44 MHz, f2 = 45 MHz, P_{in} = –30 dBm/tone, V_{out} = 105 dBμV (0.5 V_{p-p}) /tone	**Note 1**	48	54	–	dBc
Input Impedance	Z_{in}	V_{AGC} = 0 V	**Note 3**	–	0.7//2.8	–	kΩ//pF

Notes 1. By measurement circuit 1

2. By measurement circuit 2

3. By measurement circuit 3

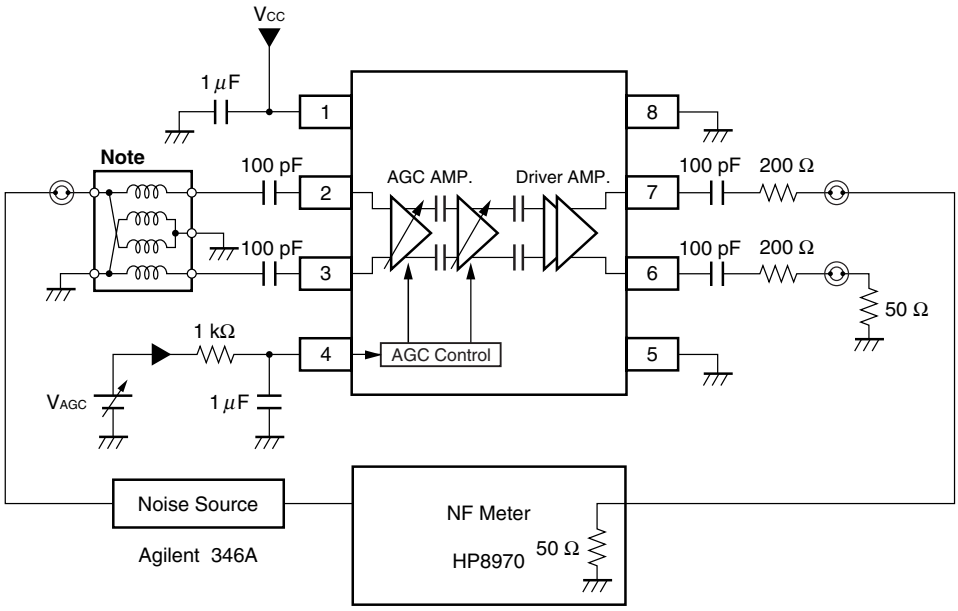
MEASUREMENT CIRCUIT 1



Notes 1. Balun Transformer: TOKO 617DB-1674 B4F (Double balanced type)

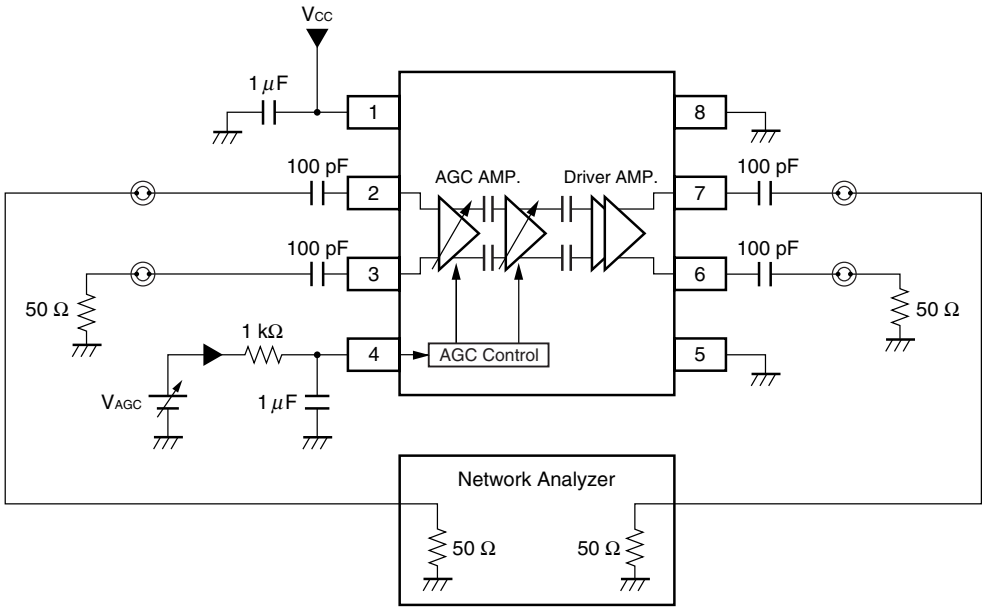
2. V_{out} (dBmV) = P_{out} (dBm) + 20 log (250 Ω/50 Ω) + 46.99

MEASUREMENT CIRCUIT 2



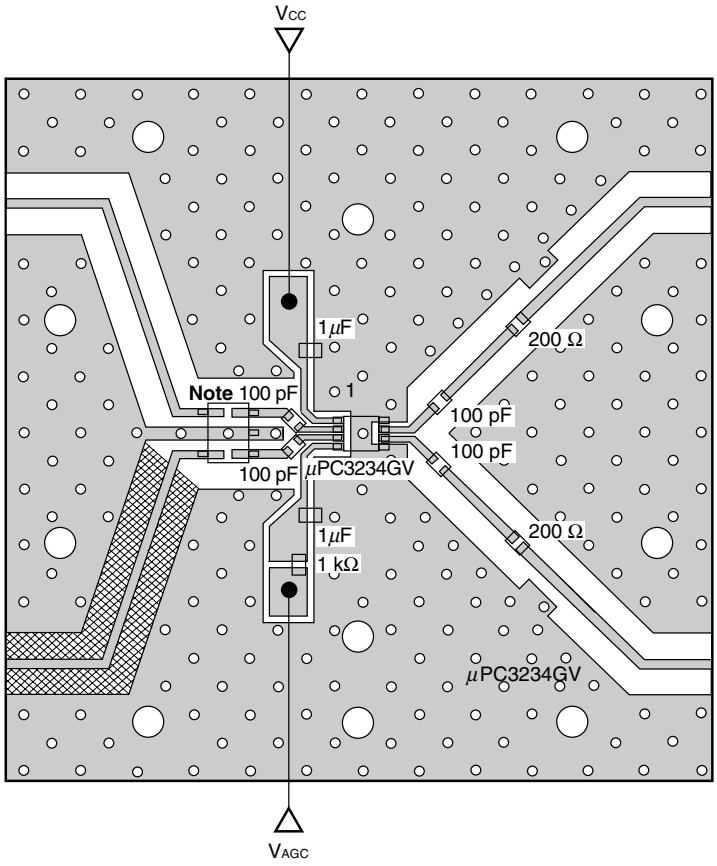
Note Balun Transformer: TOKO 617DB-1674 B4F (Double balanced type)

MEASUREMENT CIRCUIT 3



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

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



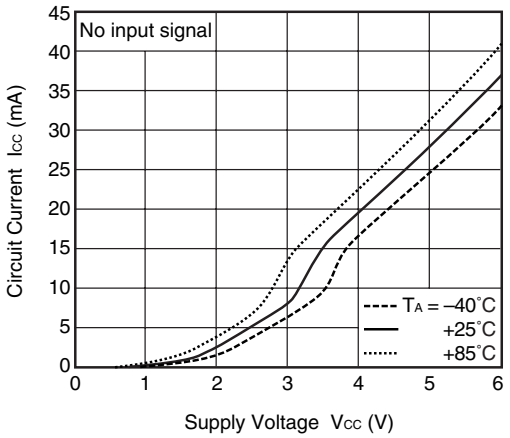
Note Balun Transformer

Remarks

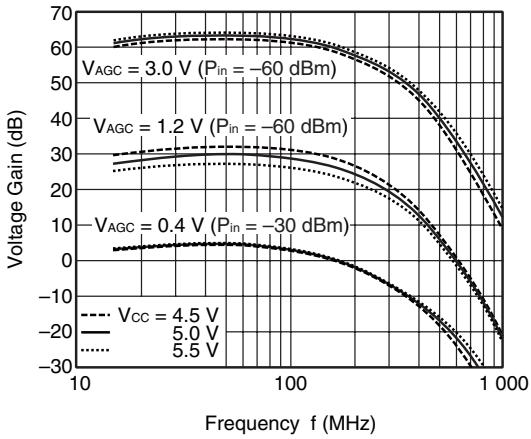
1. Back side: GND pattern
2. Au plated on pattern
3. ∘○: Through hole
4. ▨ represents short-circuit strip

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

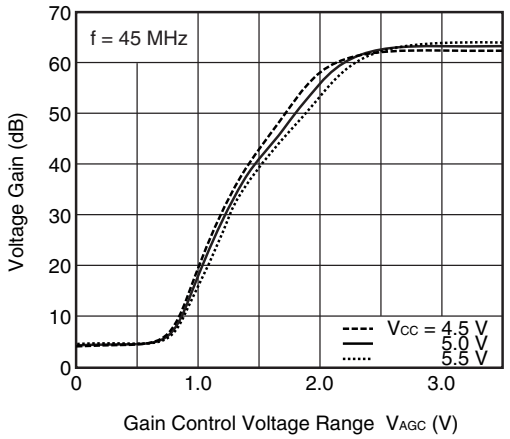
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



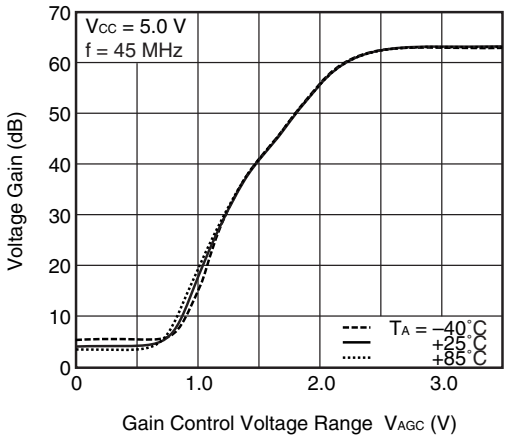
VOLTAGE GAIN vs. FREQUENCY



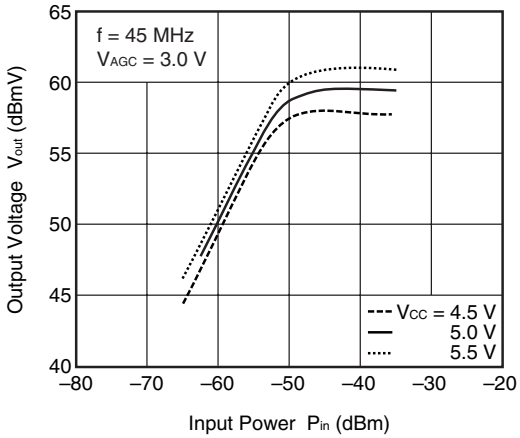
VOLTAGE GAIN vs.
GAIN CONTROL VOLTAGE RANGE



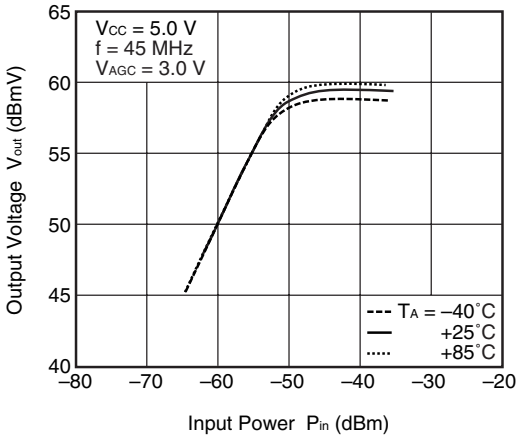
VOLTAGE GAIN vs.
GAIN CONTROL VOLTAGE RANGE



OUTPUT VOLTAGE vs. INPUT POWER

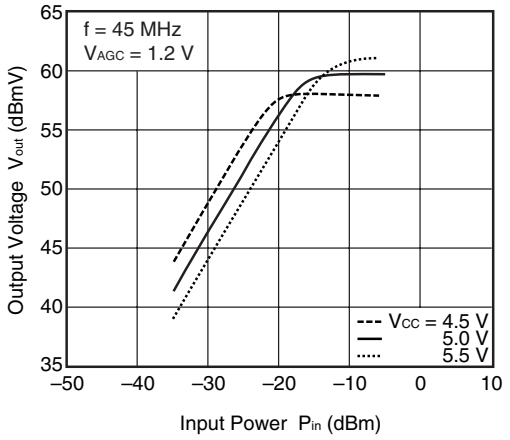


OUTPUT VOLTAGE vs. INPUT POWER

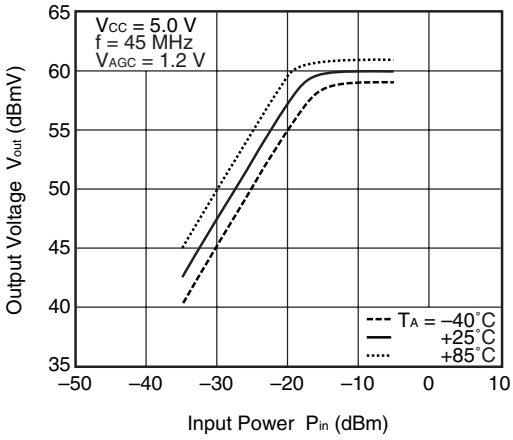


Remark The graphs indicate nominal characteristics.

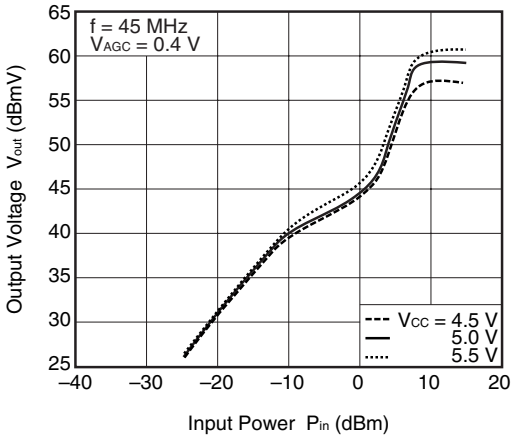
OUTPUT VOLTAGE vs. INPUT POWER



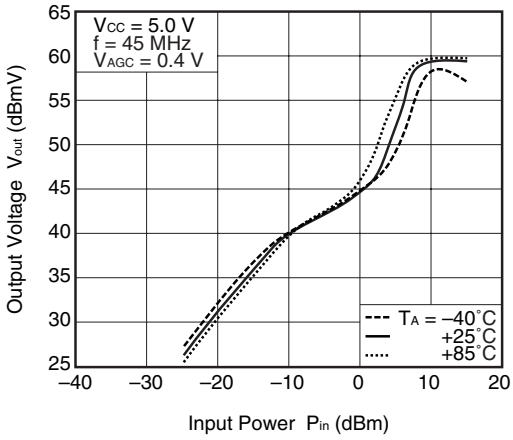
OUTPUT VOLTAGE vs. INPUT POWER



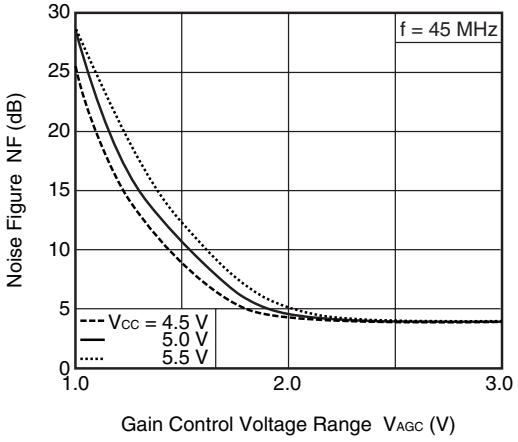
OUTPUT VOLTAGE vs. INPUT POWER



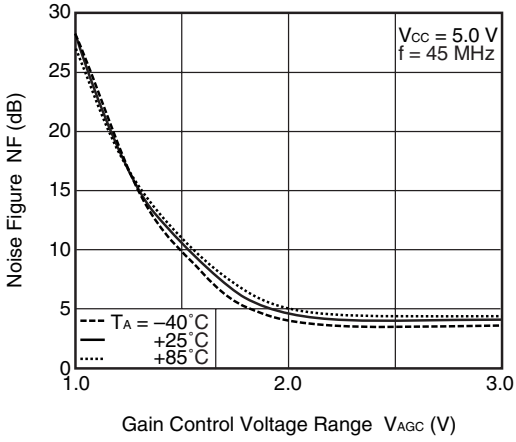
OUTPUT VOLTAGE vs. INPUT POWER



NOISE FIGURE vs.
GAIN CONTROL VOLTAGE RANGE

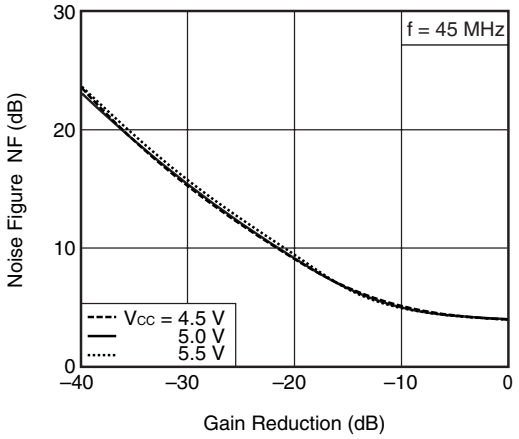


NOISE FIGURE vs.
GAIN CONTROL VOLTAGE RANGE

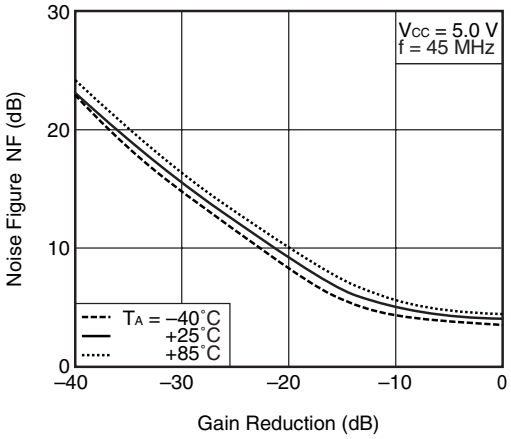


Remark The graphs indicate nominal characteristics.

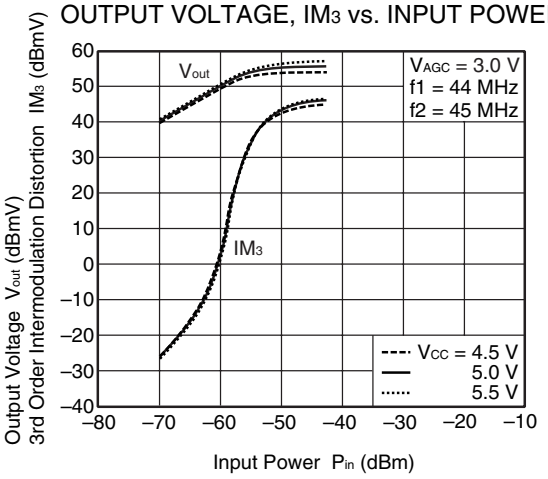
NOISE FIGURE vs. GAIN REDUCTION



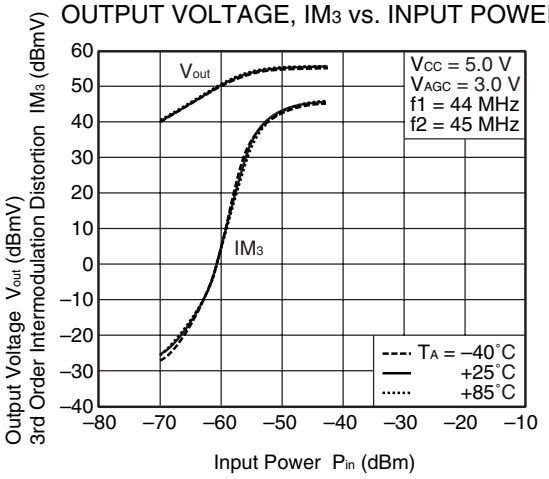
NOISE FIGURE vs. GAIN REDUCTION



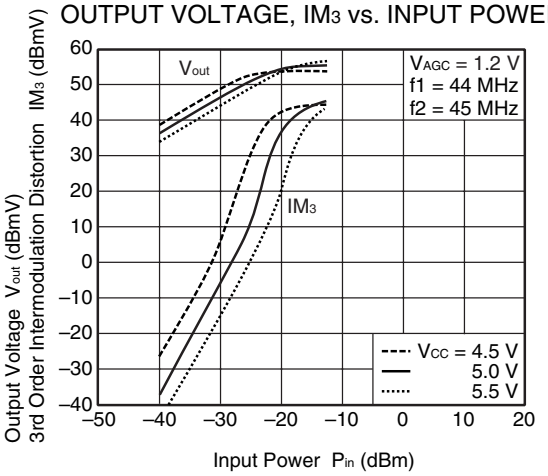
OUTPUT VOLTAGE, IM3 vs. INPUT POWER



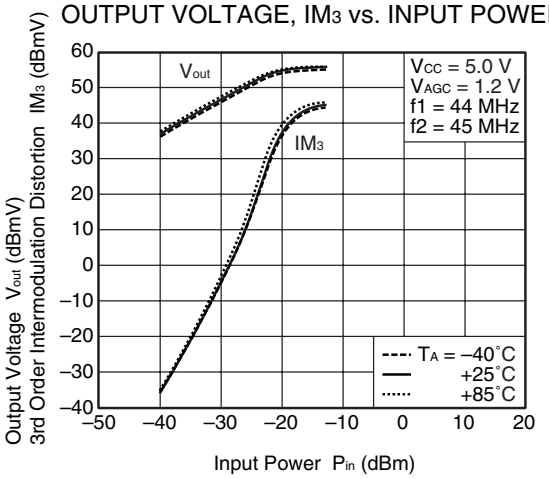
OUTPUT VOLTAGE, IM3 vs. INPUT POWER



OUTPUT VOLTAGE, IM3 vs. INPUT POWER

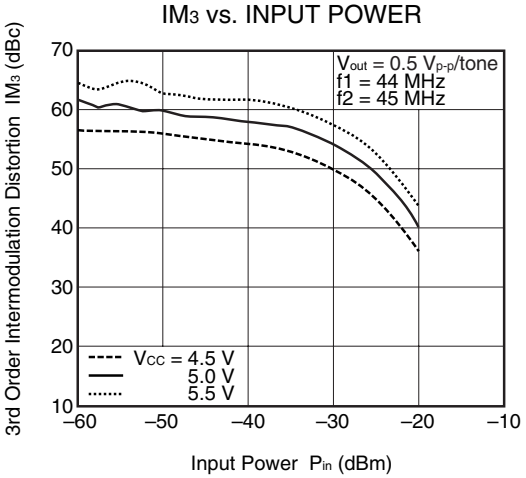


OUTPUT VOLTAGE, IM3 vs. INPUT POWER

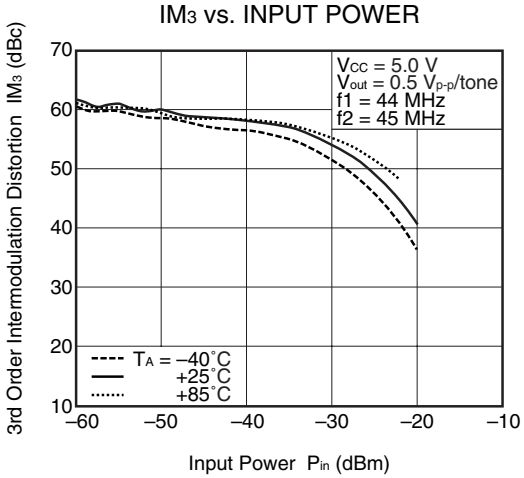


Remark The graphs indicate nominal characteristics.

IM3 vs. INPUT POWER



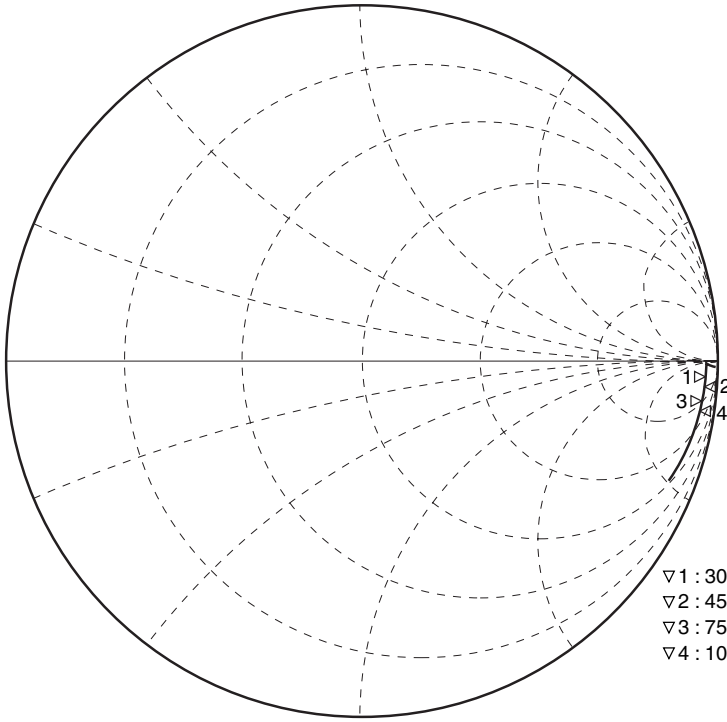
IM3 vs. INPUT POWER



Remark The graphs indicate nominal characteristics.

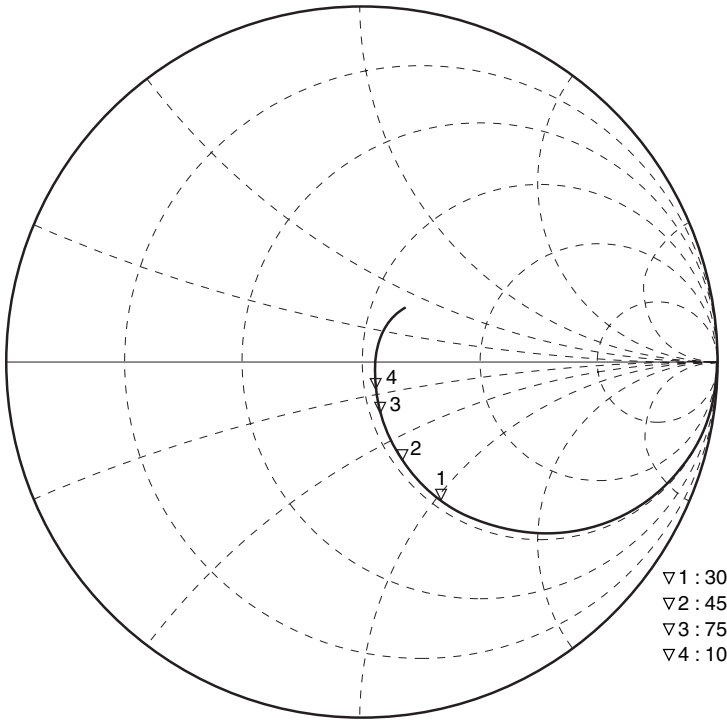
S-PARAMETERS (T_A = +25°C, V_{CC} = 5.0 V, V_{AGC} = 0 V)

S_{11}–FREQUENCY



▽1 : 30 MHz	1.191 kΩ	–1.468 kΩ	3.614 pF
▽2 : 45 MHz	707.0 Ω	–1.248 kΩ	2.834 pF
▽3 : 75 MHz	340.1 Ω	–894.3 Ω	2.373 pF
▽4 : 100 MHz	215.7 Ω	–712.6 Ω	2.233 pF

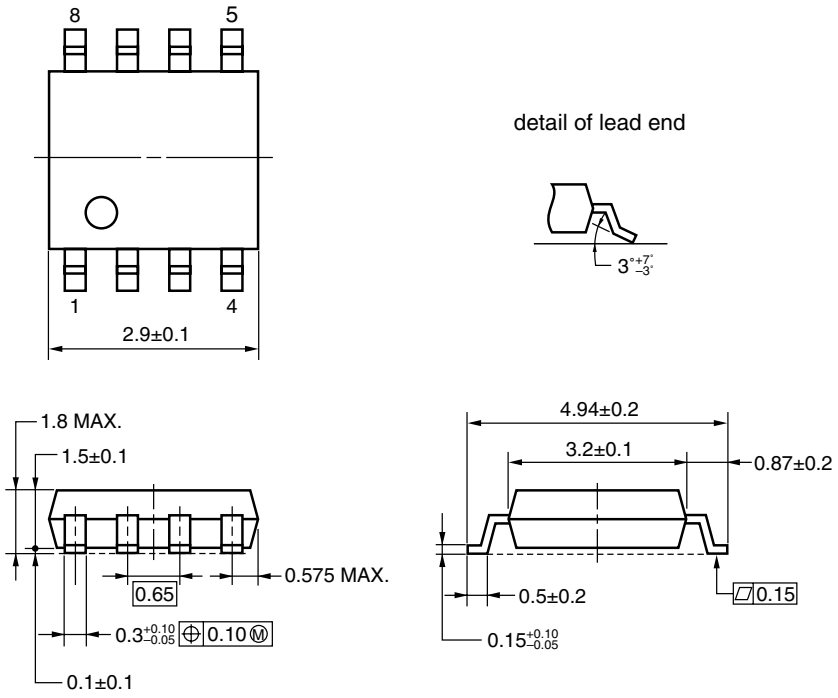
S_{22}–FREQUENCY



▽1 : 30 MHz	53.28 Ω	–51.66 Ω	102.7 pF
▽2 : 45 MHz	53.32 Ω	–32.47 Ω	108.9 pF
▽3 : 75 MHz	53.42 Ω	–15.82 Ω	134.1 pF
▽4 : 100 MHz	53.79 Ω	–8.586 Ω	185.4 pF

PACKAGE DIMENSIONS

8-PIN PLASTIC SSOP (4.45 mm (175)) (UNIT: mm)



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
Wave Soldering	Peak temperature (molten solder temperature) Time at peak temperature Preheating temperature (package surface temperature) Maximum number of flow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 120°C or below : 1 time : 0.2%(Wt.) or below	WS260
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 November, 2007. 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).

M8E 02. 11-1