NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3219GV

GENERAL PURPOSE 5 V AGC AMPLIFIER

DESCRIPTION

The μPC3219GV is a silicon monolithic IC designed for use as AGC amplifier for digital CATV, cable modem systems. This IC consists of gain control amplifier and video amplifier.

The package is 8-pin SSOP suitable for surface mount.

This IC is manufactured using NEC's 10 GHz f_T NESAT™II AL 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 = 58 dBc TYP. @single-ended output, V_{out} = 0.7 V_{P-P}/tone
- Wide AGC dynamic range — GCR = 42.5 dB TYP.
- On-chip video amplifier — V_{out} = 1.0 V_{P-P} TYP. @single-ended output
- Supply voltage: 5 V
- Packaged in 8-pin SSOP suitable for surface mounting

APPLICATIONS

- Digital CATV/Cable modem receivers

ORDERING INFORMATION

Part Number	Package	Supplying Form
μPC3219GV-E1	8-pin plastic SSOP (4.45 mm (175))	• Embossed tape 8 mm wide • Pin 1 indicates pull-out direction of tape • Qty 1 kpcs/reel

Remark To order evaluation samples, please contact your local NEC sales office.
Part number for sample order: μPC3219GV

Caution electro-static sensitive devices

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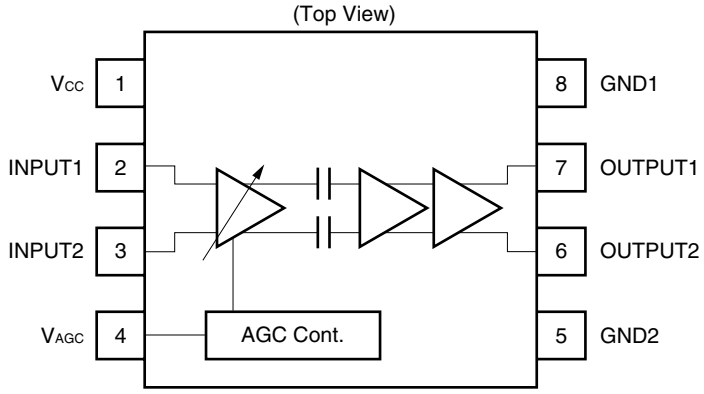
INTERNAL BLOCK DIAGRAM AND PIN CONFIGURATION

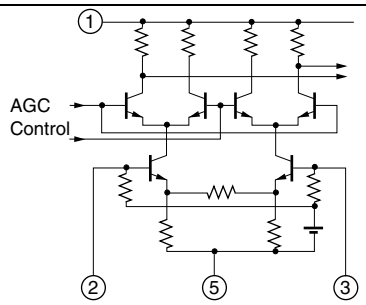
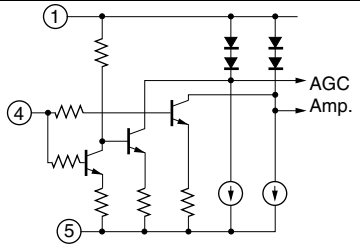
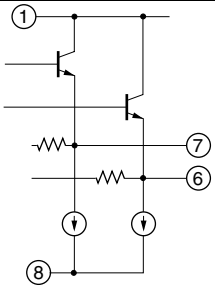


PRODUCT LINE-UP OF 5V AGC AMPLIFIER

Part Number	I_{CC} (mA)	G_{MAX} (dB)	G_{MIN} (dB)	GCR (dB)	NF (dB)	IM_3 (dBc)[Note]	Package
μPC3217GV	23	53	0	53	6.5	50	8-pin SSOP (4.45mm(175))
μPC3218GV	23	63	10	53	3.5	50	
μPC3219GV	36.5	42.5	0	42.5	9.0	58	

Note f_1 = 44 MHz, f_2 = 45 MHz, V_{out} = 0.7 V_{P-P}/tone, single-ended output

PIN EXPLANATIONS

Pin No.	Pin Name	Applied Voltage (V)	Pin Voltage (V)[Note]	Function and Applications	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	–	1.45	Signal input pins to AGC amplifier.	
3	INPUT2	–	1.45		
4	V_{AGC}	0 to V_{CC}	–	Gain control pin. This pin's bias govern the AGC output level. Minimum gain at V_{AGC} < 0.5 V Maximum gain at V_{AGC} > 4.5 V Recommended to use by dividing AGC voltage with externally resister (example: 100 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	–	2.2	Signal output pins of video amplifier.	
7	OUTPUT1	–	2.2		
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 V.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C	6.0	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 50 × 50 × 1.6 mm epoxy glass PWB, with copper patterning on both sides.

RECOMMENDED OPERATING RANGE

Parameter	Symbol	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	−	V_{CC}	V
Operating Frequency Range	f_{BW}		10	45	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}	No input signal	**Note 1**	27.5	36.5	43.5	mA
AGC Voltage High Level	$V_{AGC(H)}$	@Maximum gain	**Note 1**	4.5	–	V_{CC}	V
AGC Voltage Low Level	$V_{AGC(L)}$	@Minimum gain	**Note 1**	0	–	0.5	V
RF Characteristics							
Maximum Voltage Gain	G_{MAX}	V_{AGC} = 4.5 V, P_{in} = –40 dBm	**Note 1**	39	42.5	45	dB
Minimum Voltage Gain	G_{MIN}	V_{AGC} = 0.5 V, P_{in} = –20 dBm	**Note 1**	–4	0	4	dB
Gain Control Range	GCR	V_{AGC} = 0.5 to 4.5 V	**Note 1**	35	42.5	–	dB
Output Voltage	V_{out}	P_{in} = –38 to –13 dBm	**Note 1**	–	1.0	–	V_{P-P}
Maximum Output Voltage	V_{oclip}	V_{AGC} = 4.5 V @Maximum gain	**Note 1**	2.5	3.4	–	V_{P-P}
Noise Figure	NF	V_{AGC} = 4.5 V @Maximum gain	**Note 2**	–	9.0	10.5	dB

Notes 1. By measurement circuit 1

2. By measurement circuit 2

STANDARD CHARACTERISTICS (T_A = +25°C, V_{CC} = 5 V, Z_S = 50 Ω)

Parameter	Symbol	Test Conditions	Reference Value	Unit
Input Impedance	Z_{in}	V_{AGC} = 0.5 V, f = 45 MHz **Note 1**	1.2k – j1.5k	Ω
Output Impedance	Z_{out}	V_{AGC} = 0.5 V, f = 45 MHz **Note 1**	6.0 + j3.2	Ω
3rd Order Input Intercept Point	IIP_3	V_{AGC} = 0.5 V @Minimum gain, f_1 = 44 MHz, f_2 = 45 MHz, Z_L = 250 Ω @single-ended output **Note 2**	–1	dBm
3rd Order Intermodulation Distortion 1	IM_31	f_1 = 44 MHz, f_2 = 45 MHz, P_{in} = –37 to –20 dBm/tone, V_{out} = 1.0 V_{P-P}/tone @single-ended output, Z_L = 250 Ω **Note 2**	52	dBc
3rd Order Intermodulation Distortion 2	IM_32	f_1 = 44 MHz, f_2 = 45 MHz, P_{in} = –40 to –23 dBm/tone, V_{out} = 0.7 V_{P-P}/tone @single-ended output, Z_L = 250 Ω **Note 2**	58	dBc
3rd Order Intermodulation Distortion 3	IM_33	f_1 = 44 MHz, f_2 = 45 MHz, P_{in} = –37 to –20 dBm/tone, Z_L = 500 Ω, V_{out} = 2.0 V_{P-P}/tone @ differential output **Note 3**	52	dBc
3rd Order Intermodulation Distortion 4	IM_34	f_1 = 44 MHz, f_2 = 45 MHz, P_{in} = –40 to –23 dBm/tone, Z_L = 500 Ω, V_{out} = 1.4 V_{P-P}/tone@differential output **Note 3**	58	dBc
2nd Order Intermodulation Distortion 1	IM_21	f_1 = 44 MHz, f_2 = 45 MHz, P_{in} = –37 to –22 dBm/tone, Z_L = 500 Ω, V_{out} = 2.0 V_{P-P}/tone@differential output **Note 3**	45	dBc
2nd Order Intermodulation Distortion 2	IM_22	f_1 = 44 MHz, f_2 = 45 MHz, P_{in} = –40 to –23 dBm/tone, Z_L = 500 Ω, V_{out} = 1.4 V_{P-P}/tone@differential output **Note 3**	47	dBc

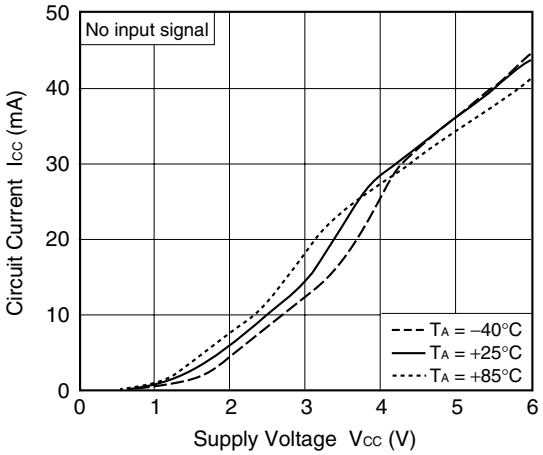
Notes 1. By measurement circuit 3

2. By measurement circuit 1

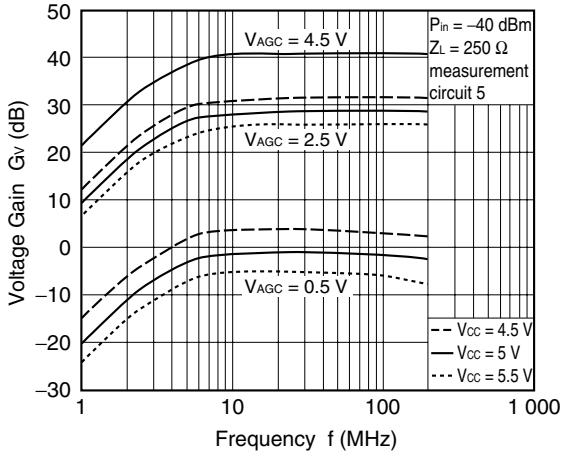
3. By measurement circuit 4

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

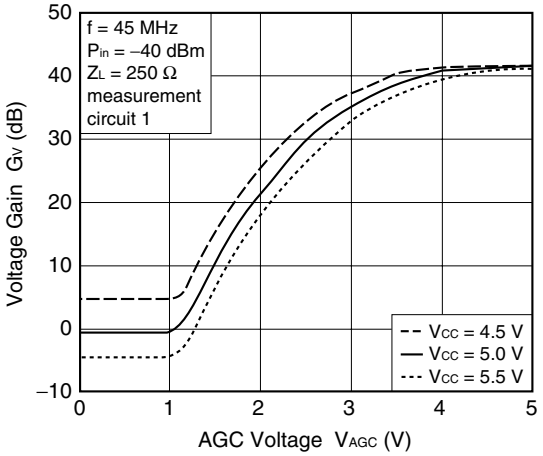
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



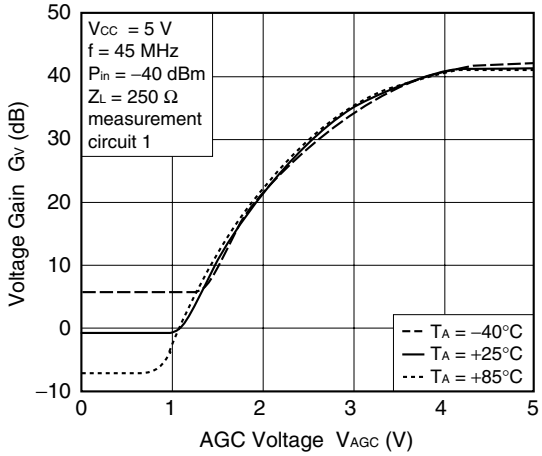
VOLTAGE GAIN vs. FREQUENCY



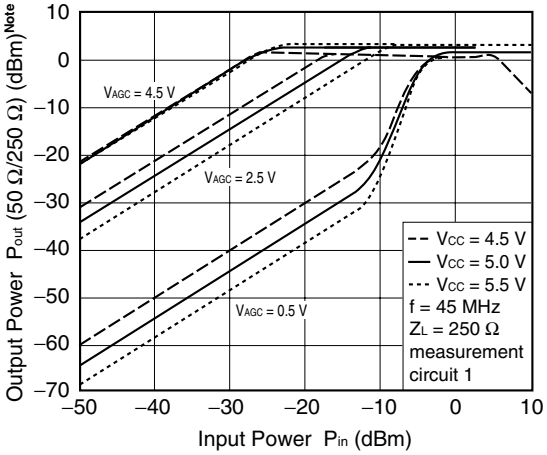
VOLTAGE GAIN vs. AGC VOLTAGE



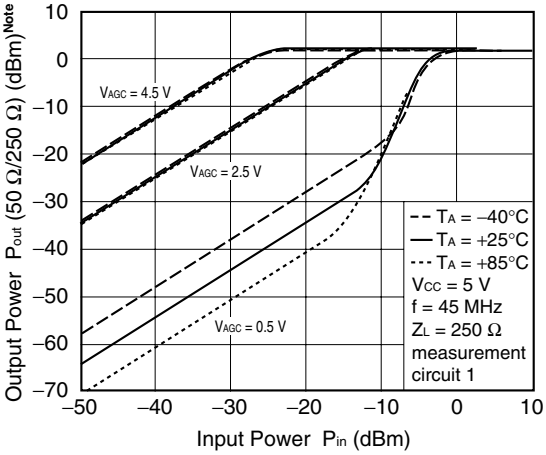
VOLTAGE GAIN vs. AGC VOLTAGE



OUTPUT POWER vs. INPUT POWER

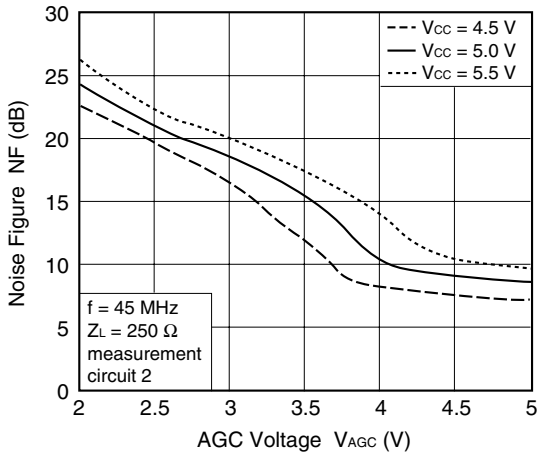


OUTPUT POWER vs. INPUT POWER

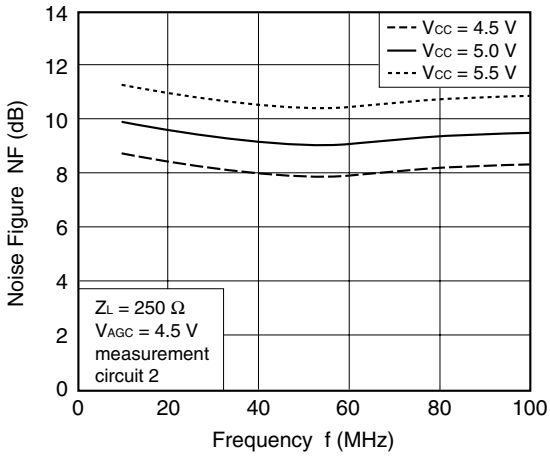


Note Measurement value with spectrum analyzer.

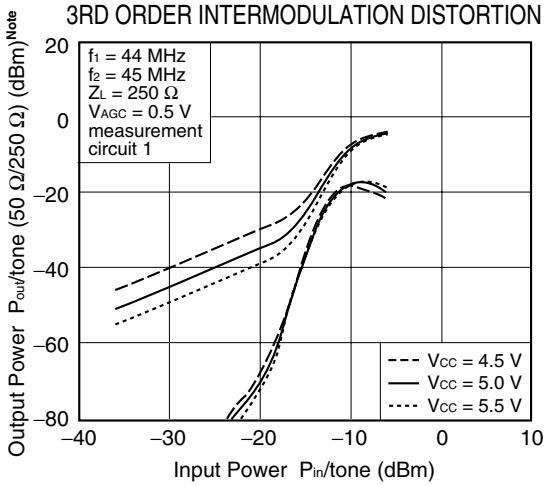
NOISE FIGURE vs. AGC VOLTAGE



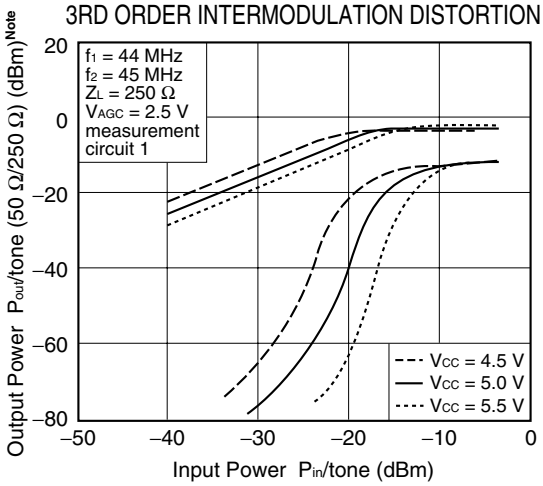
NOISE FIGURE vs. FREQUENCY



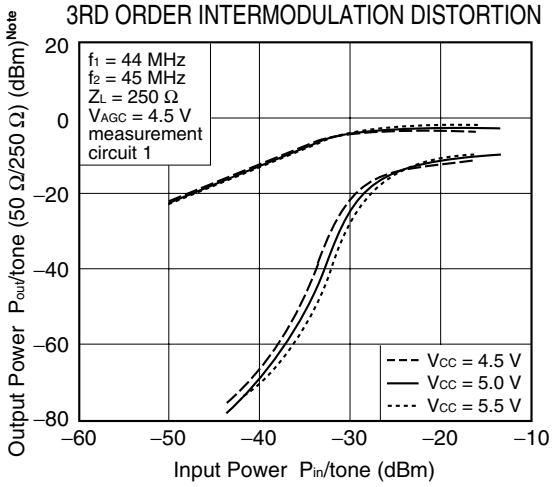
3RD ORDER INTERMODULATION DISTORTION



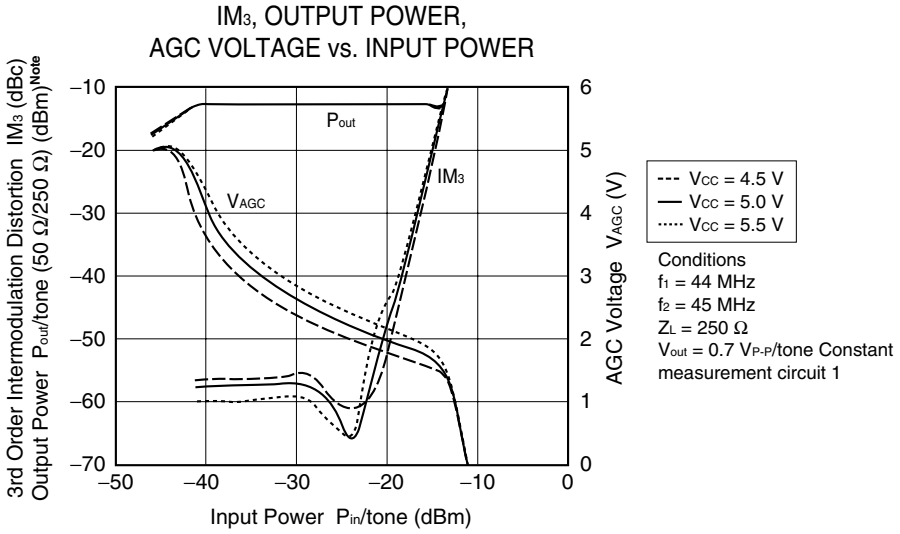
3RD ORDER INTERMODULATION DISTORTION

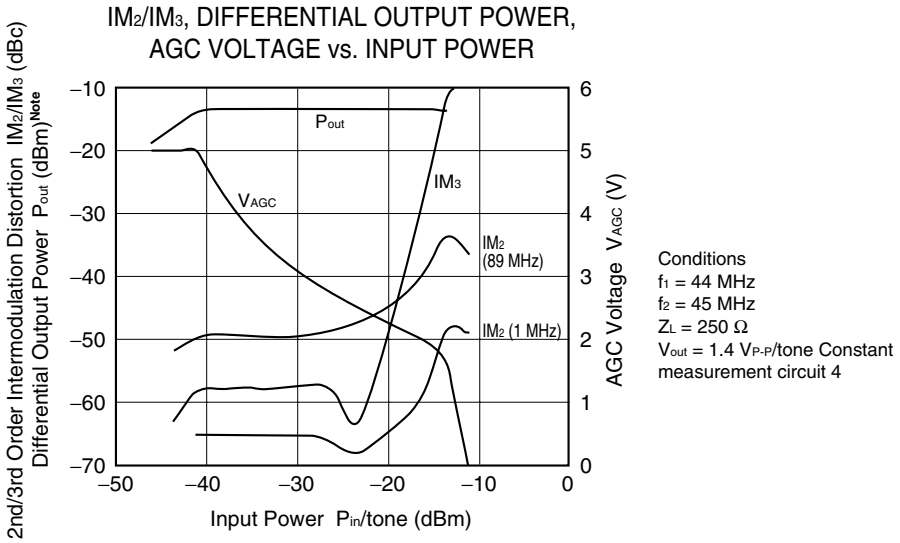


3RD ORDER INTERMODULATION DISTORTION



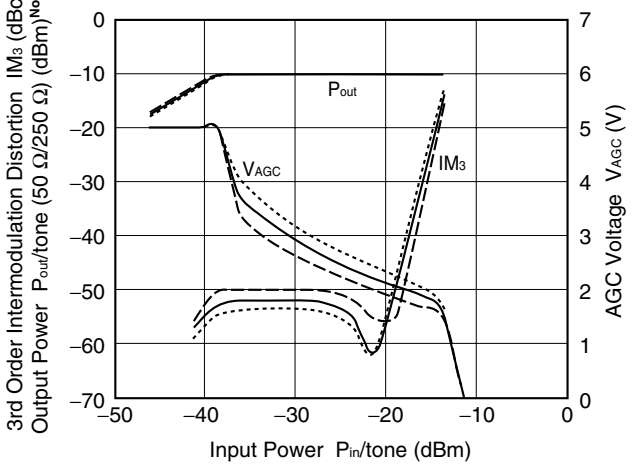
Note Measurement value with spectrum analyzer.





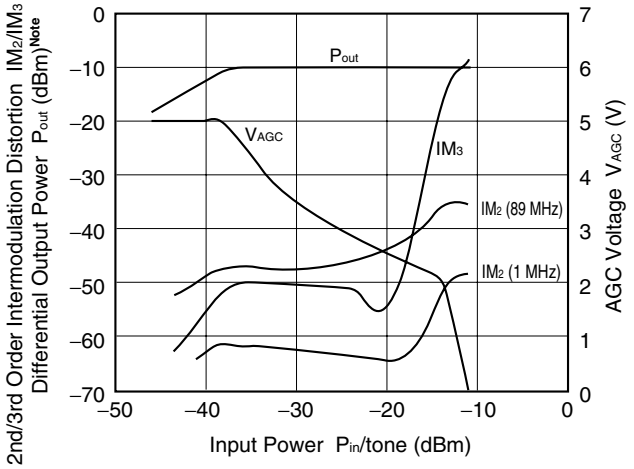
Note Measurement value with spectrum analyzer.

IM3, OUTPUT POWER,
AGC VOLTAGE vs. INPUT POWER



Conditions
f_1 = 44 MHz
f_2 = 45 MHz
Z_L = 250 Ω
V_{out} = 1.0 V_{P-P}/tone Constant
measurement circuit 1

IM2/IM3, DIFFERENTIAL OUTPUT POWER,
AGC VOLTAGE vs. INPUT POWER



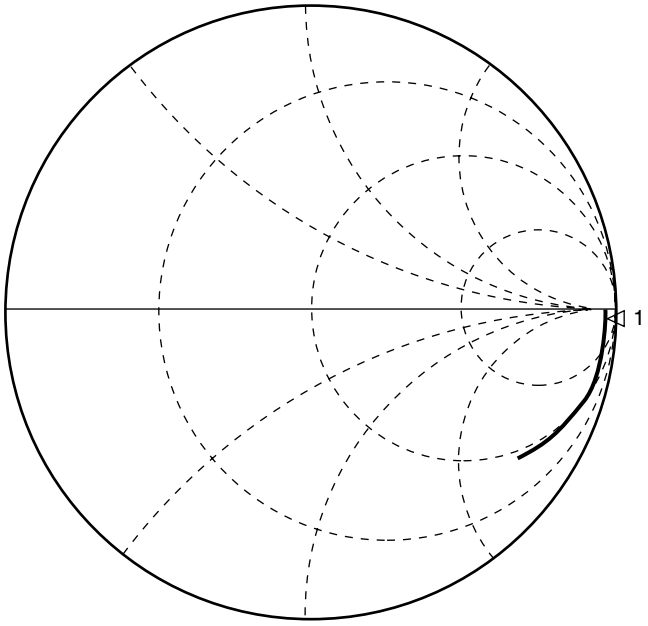
Conditions
f_1 = 44 MHz
f_2 = 45 MHz
Z_L = 250 Ω
V_{out} = 2.0 V_{P-P}/tone Constant
measurement circuit 4

Note Measurement value with spectrum analyzer.

Remark The graphs indicate nominal characteristics.

S-PARAMETERS

S_{11}-FREQUENCY

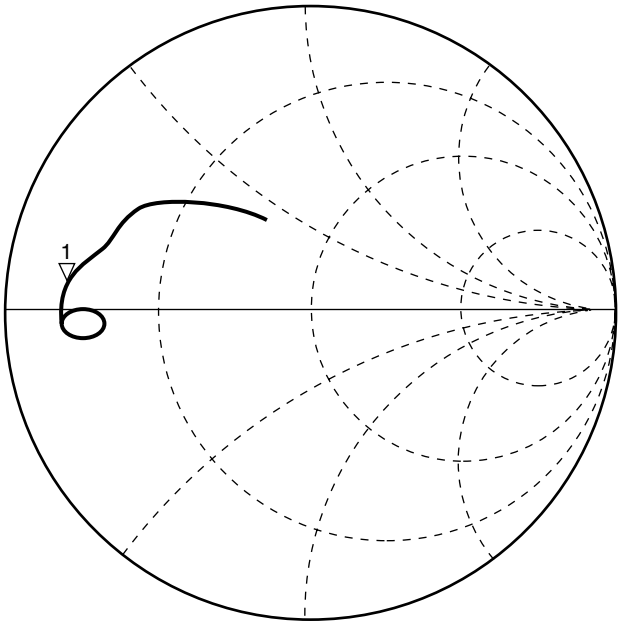


Marker 1

1.229 k – j 1.522 kΩ

START 0.100 000 MHz STOP 1000.000 000 MHz

S_{22}-FREQUENCY

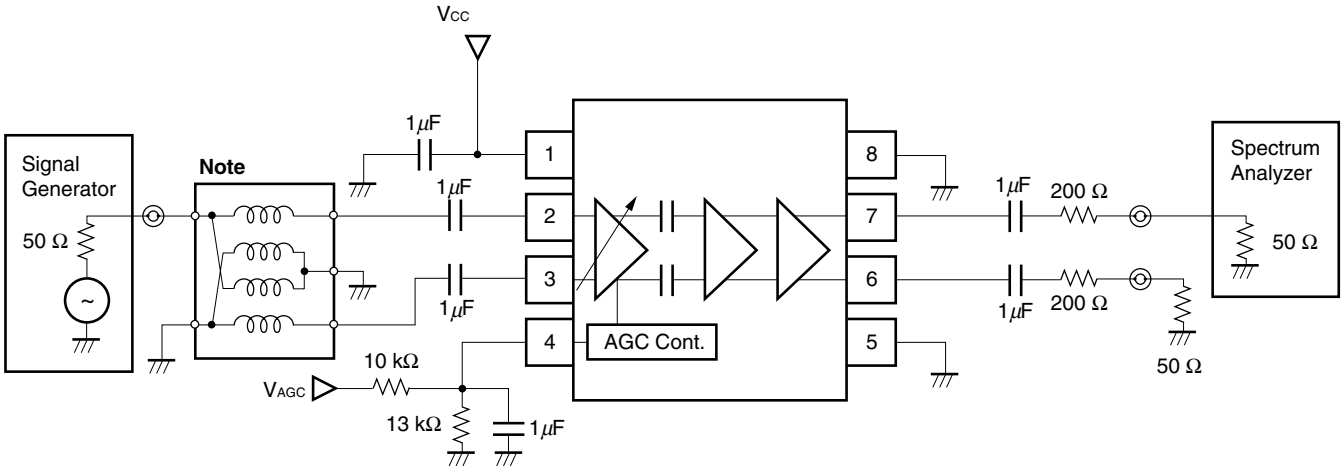


Marker 1

6.035 + j 3.157 Ω

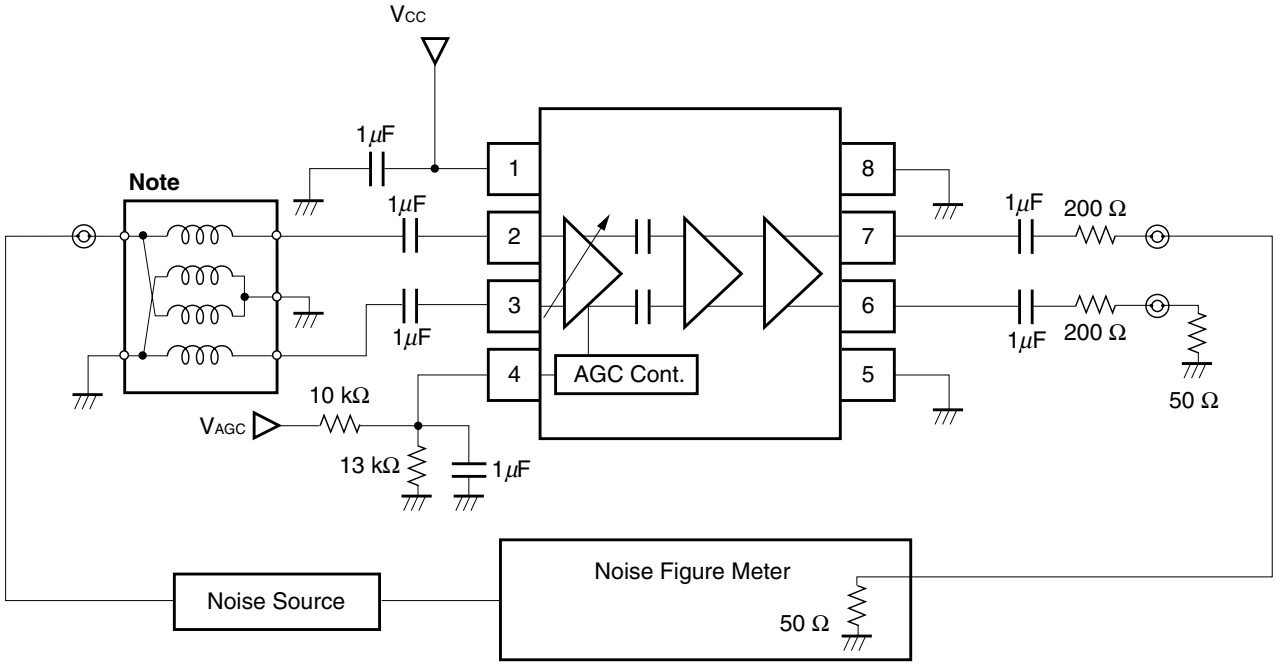
START 0.100 000 MHz STOP 1000.000 000 MHz

MEASUREMENT CIRCUIT 1



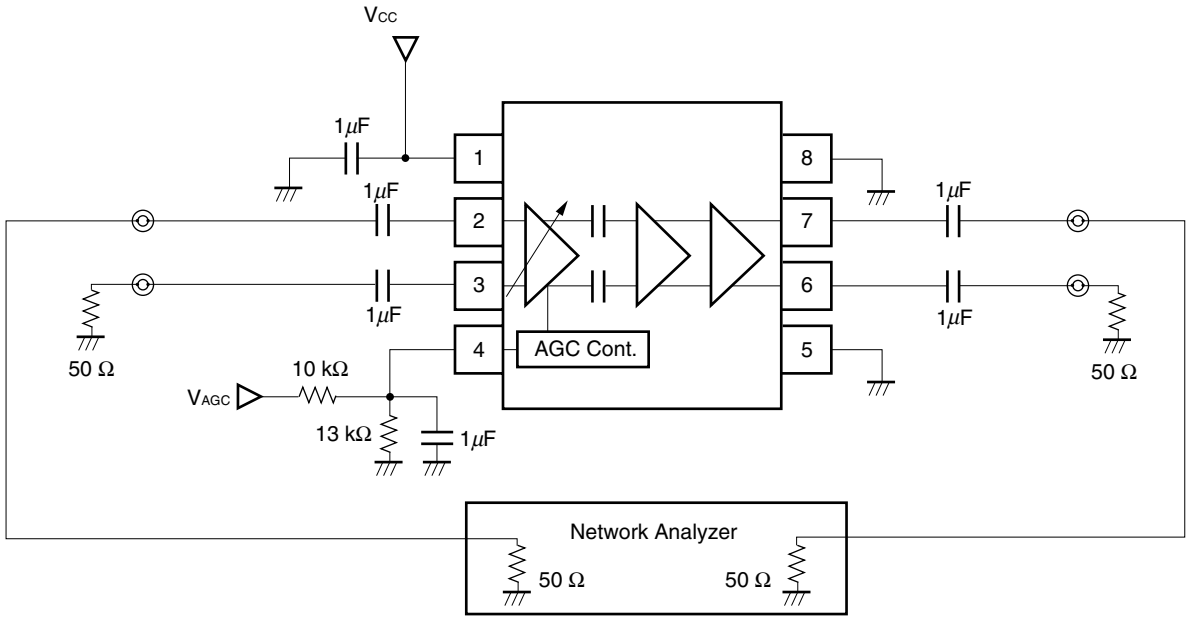
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 2

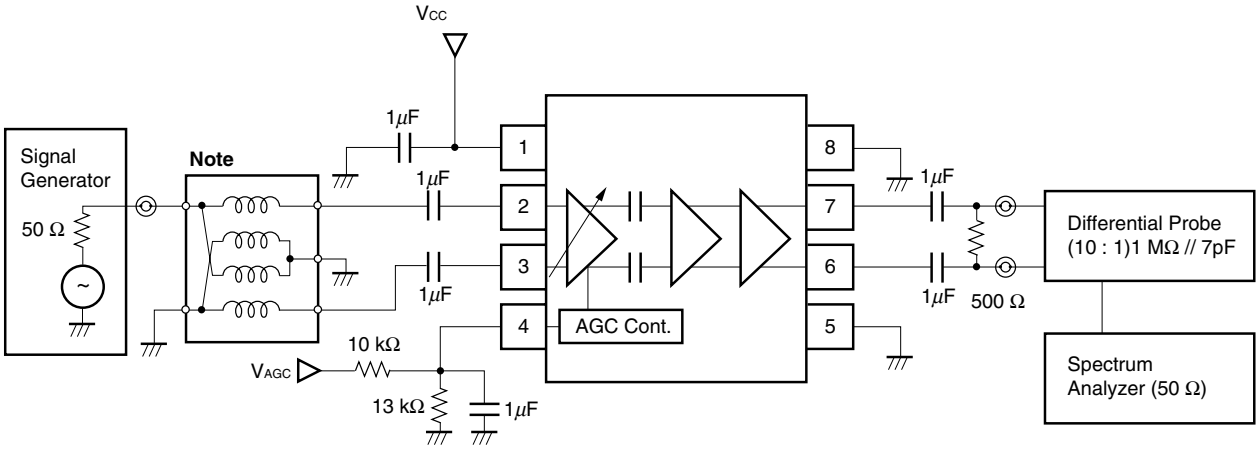


Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 3

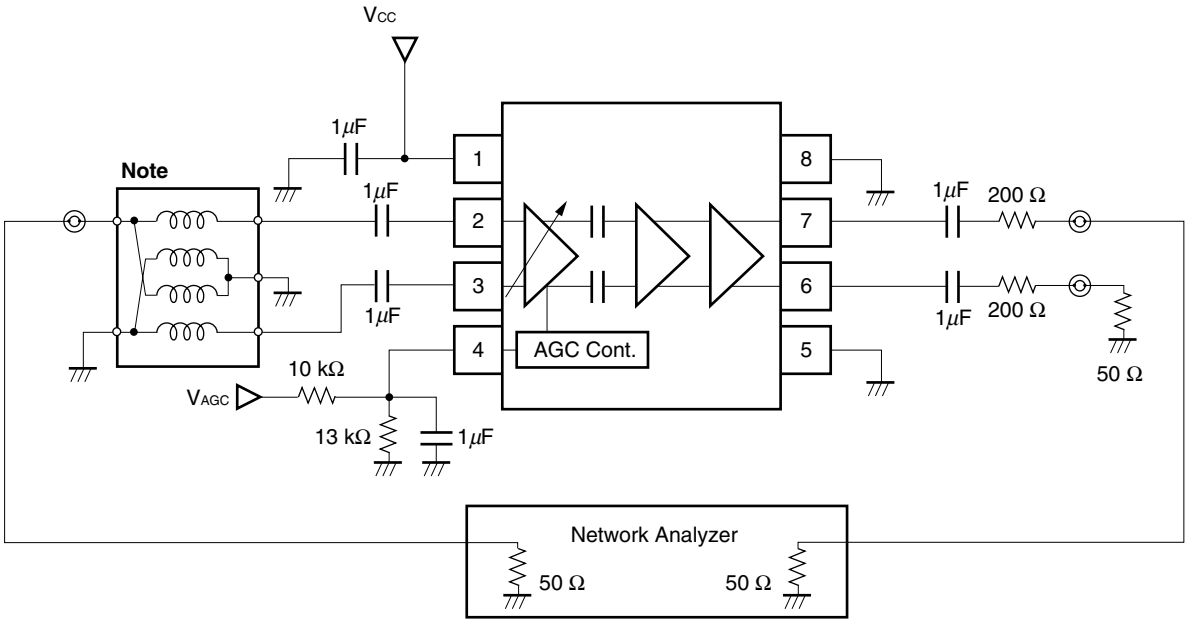


MEASUREMENT CIRCUIT 4



Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 5



Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

APPLICATION CIRCUIT EXAMPLE

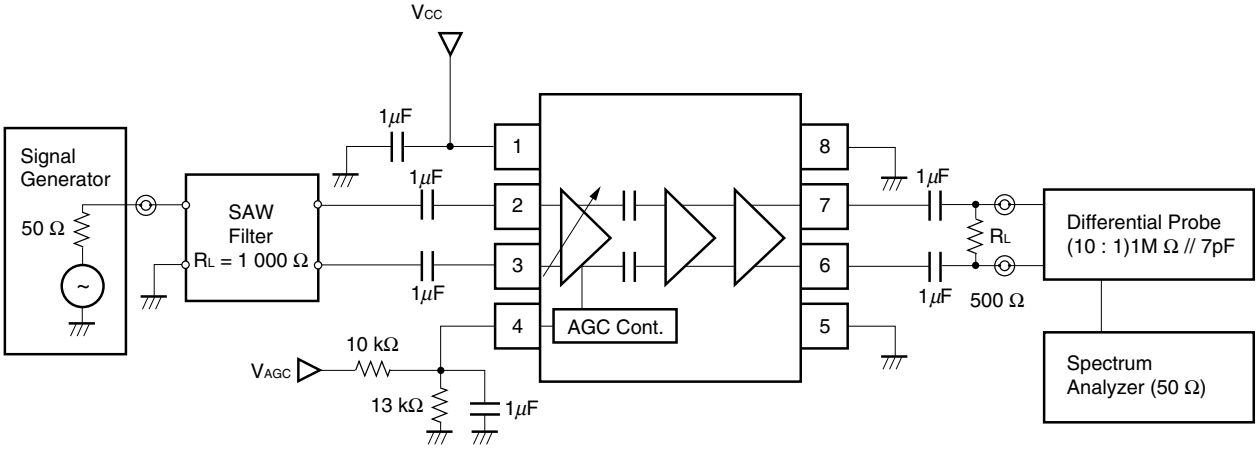
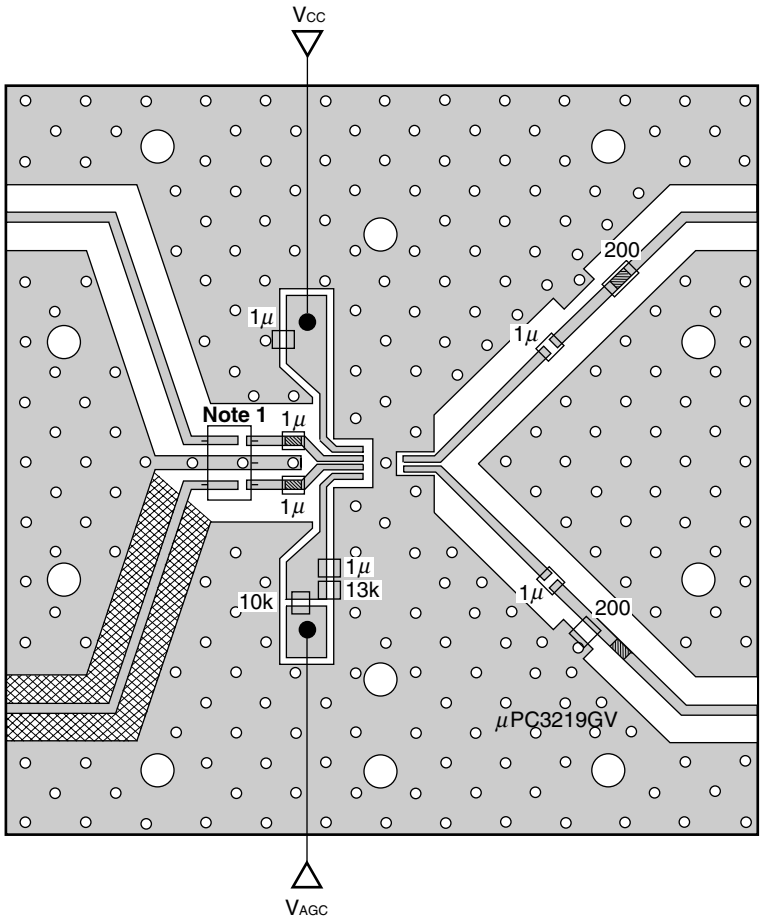


ILLUSTRATION OF THE EVALUATION BOARD FOR MEASUREMENT CIRCUIT 1



Notes 1. Balun Transformer

2. Back side: GND pattern

3. Solder plated on pattern

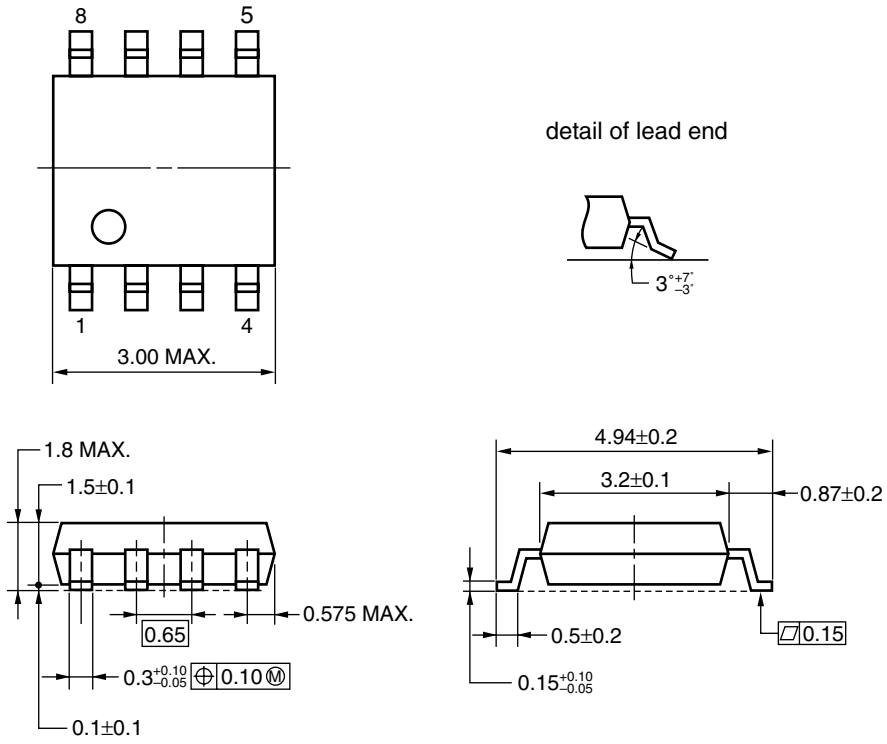
4. ○◯: Through holes

5. represents cutout

6. represents short-circuit strip

PACKAGE DIMENSIONS

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



NOTE 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 undesires oscillation).
(3) Keep the track length of the ground pins as short as possible.
(4) Bypass capacitance must be attached to V_{CC} line.

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your NEC sales representative.

Soldering Method	Soldering Conditions	Recommended Conditions Symbol
Infrared Reflow	Package peak temperature: 235°C or below Time: 30 seconds or less (at 210°C) Count: 3, Exposure limit: None[Note]	IR35-00-3
VPS	Package peak temperature: 215°C or below Time: 40 seconds or less (at 200°C) Count: 3, Exposure limit: None[Note]	VP15-00-3
Partial Heating	Pin temperature: 300°C or below Time: 3 seconds or less (per side of device) Exposure limit: None[Note]	–

Note After opening the dry pack, keep it in a place below 25°C and 65% RH for the allowable storage period.

Caution Do not use different soldering methods together (except for partial heating).

For details of recommended soldering conditions for surface mounting, refer to information document **SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E)**.

[MEMO]

[MEMO]

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