PRELIMINARY DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUITS

μPC3217GV, μPC3218GV

GENERAL PURPOSE 5 V AGC AMPLIFIER

DESCRIPTION

The μPC3217GV, μPC3218GV are silicon monolithic ICs designed for use as AGC amplifier for digital CATV, cable modem systems. These ICs consist of gain control amplifier and video amplifier.

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

These ICs are 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, these ICs have excellent performance, uniformity and reliability.

FEATURES

- Low distortion — IM_3 = 50 dBc TYP. @single-ended output, V_{out} = 0.7 V_{P-P}/tone
- Wide AGC dynamic range — GCR = 53 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
μPC3217GV-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.
μPC3218GV-E1		

Remark To order evaluation samples, please contact your local NEC sales office (Part number for sample order: μPC3217GV, μPC3218GV).

Caution electro-static sensitive devices

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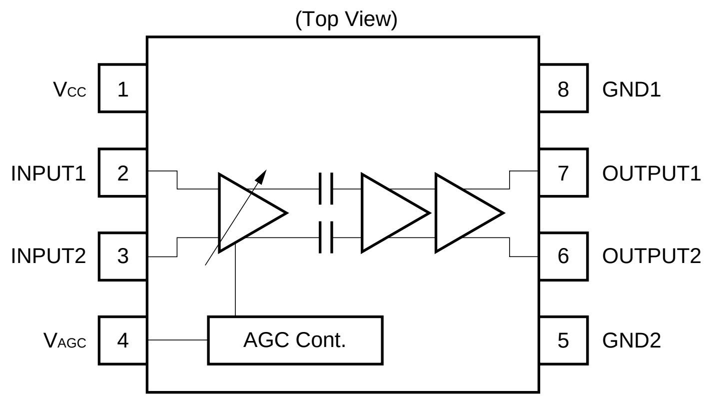
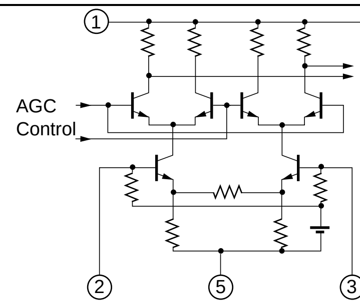
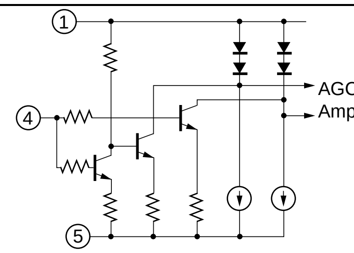
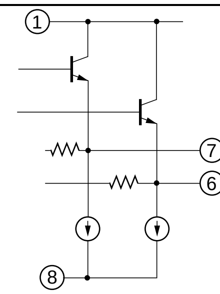
Printed in Japan

INTERNAL BLOCK DIAGRAM AND PIN CONFIGURATION (μPC3217GV, μPC3218GV common)



PIN EXPLANATIONS (μPC3217GV, μPC3218GV common)

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 (μPC3217GV, μPC3218GV common)

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 (μPC3217GV, μPC3218GV common)

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

–μPC3217GV–

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**	15	23	34	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} = –50 dBm **Note 1**	50	53	56	dB
Minimum Voltage Gain	G_{MIN}	V_{AGC} = 0.5 V, P_{in} = –20 dBm **Note 1**	–4.5	0	3.5	dB
Gain Control Range	GCR	V_{AGC} = 0.5 to 4.5 V **Note 1**	46.5	53	–	dB
Output Voltage	V_{out}	P_{in} = –49 to –10 dBm **Note 1**	–	1.0	–	V_{P-P}
Maximum Output Voltage	V_{oclip}	V_{AGC} = 4.5 V @Maximum gain **Note 1**	1.6	2.8	–	V_{P-P}
Noise Figure	NF	V_{AGC} = 4.5 V @Maximum gain **Note 2**	–	6.5	8.0	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**	1.3k – j1.5k	Ω
Output Impedance	Z_{out}	V_{AGC} = 0.5 V, f = 45 MHz **Note 1**	9.5 + j4	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**	+5	dBm
3rd Order Intermodulation Distortion 1	$IM_3$1	f_1 = 44 MHz, f_2 = 45 MHz P_{in} = –50 to –20 dBm/tone, V_{out} = 0.7 V_{P-P}/tone @single-ended output, Z_L = 250 Ω **Note 2**	50	dBc
3rd Order Intermodulation Distortion 2	$IM_3$2	f_1 = 44 MHz, f_2 = 45 MHz P_{in} = –50 to –20 dBm/tone, Z_L = 500 Ω V_{out} = 1.4 V_{P-P}/tone@differential output **Note 3**	50	dBc
2nd Order Intermodulation Distortion	IM_2	f_1 = 44 MHz, f_2 = 45 MHz P_{in} = –50 to –20 dBm/tone, Z_L = 500 Ω V_{out} = 1.4 V_{P-P}/tone@differential output **Note 3**	50	dBc

Notes 1. By measurement circuit 3
2. By measurement circuit 1
3. By measurement circuit 4

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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**	15	23	34	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} = –60 dBm	**Note 1**	60	63	66	dB
Minimum Voltage Gain	G_{MIN}	V_{AGC} = 0.5 V, P_{in} = –30 dBm	**Note 1**	4.5	10	13.5	dB
Gain Control Range	GCR	V_{AGC} = 0.5 to 4.5 V	**Note 1**	46.5	53	–	dB
Output Voltage	V_{out}	P_{in} = –59 to –15 dBm	**Note 1**	–	1.0	–	V_{P-P}
Maximum Output Voltage	V_{oclip}	V_{AGC} = 4.5 V @Maximum gain	**Note 1**	1.6	2.8	–	V_{P-P}
Noise Figure	NF	V_{AGC} = 4.5 V @Maximum gain	**Note 2**	–	3.5	4.5	dB

Notes 1. By measurement circuit 1
2. By measurement circuit 2

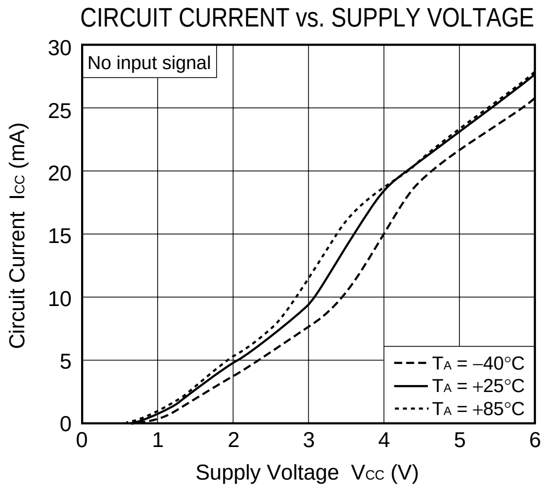
STANDARD CHARACTERISTICS (T_A = +25°C, V_{CC} = 5 V, Z_S = 50 Ω)

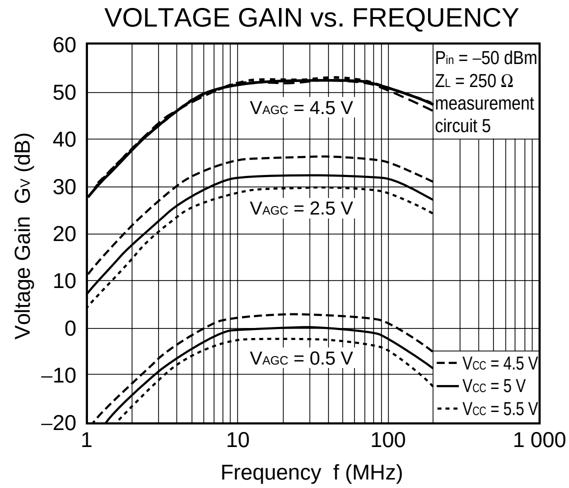
Parameter	Symbol	Test Conditions		Reference Value	Unit
Input Impedance	Z_{in}	V_{AGC} = 0.5 V, f = 45 MHz	**Note 1**	1.0k – j1.1k	Ω
Output Impedance	Z_{out}	V_{AGC} = 0.5 V, f = 45 MHz	**Note 1**	9.5 + j4	Ω
3rd Order Input Intercept Point	IIP_3	V_{AGC} = 0.5 V @Minimum gain f_1 = 44 MHz, f_2 = 45 MHz Z_L = 250 Ω @single-ended output	**Note 2**	–7	dBm
3rd Order Intermodulation Distortion 1	$IM_3$1	f_1 = 44 MHz, f_2 = 45 MHz P_{in} = –60 to –30 dBm, V_{out} = 0.7 V_{P-P}/tone @single-ended output	**Note 2**	50	dBc
3rd Order Intermodulation Distortion 2	$IM_3$2	f_1 = 44 MHz, f_2 = 45 MHz P_{in} = –60 to –30 dBm/tone, Z_L = 500 Ω, V_{out} = 1.4 V_{P-P}/tone@differential output	**Note 3**	50	dBc
2nd Order Intermodulation Distortion	IM_2	f_1 = 44 MHz, f_2 = 45 MHz P_{in} = –50 to –20 dBm/tone, Z_L = 500 Ω, V_{out} = 1.4 V_{P-P}/tone@differential output	**Note 3**	50	dBc

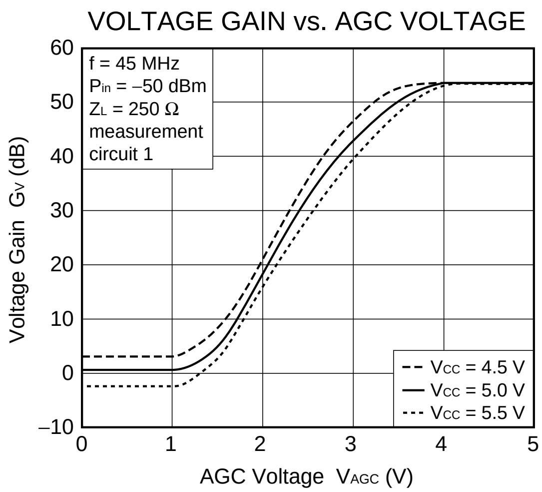
Notes 1. By measurement circuit 3
2. By measurement circuit 1
3. By measurement circuit 4

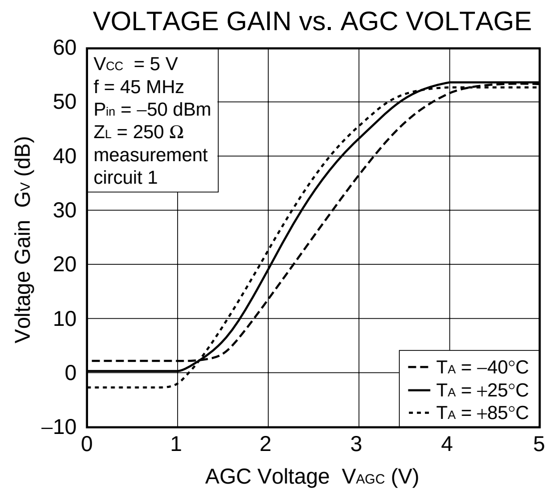
TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25°C)

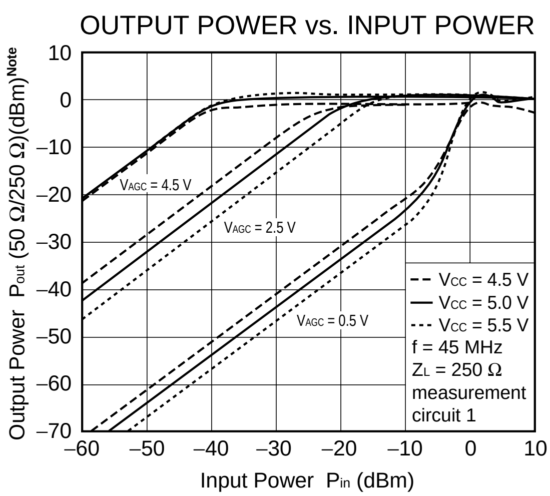
–μPC3217GV–

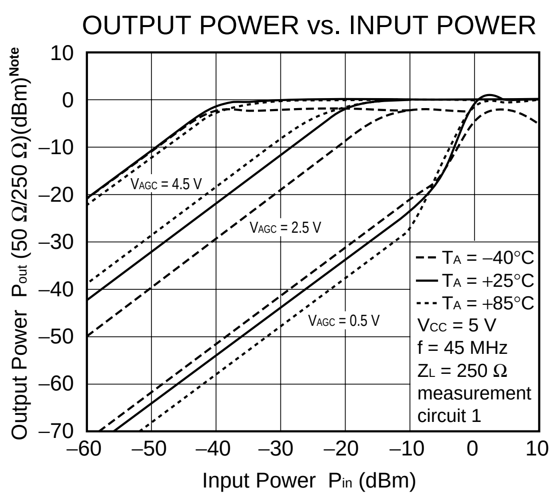








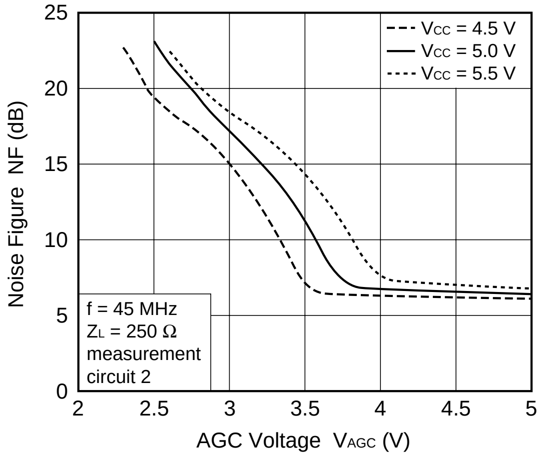




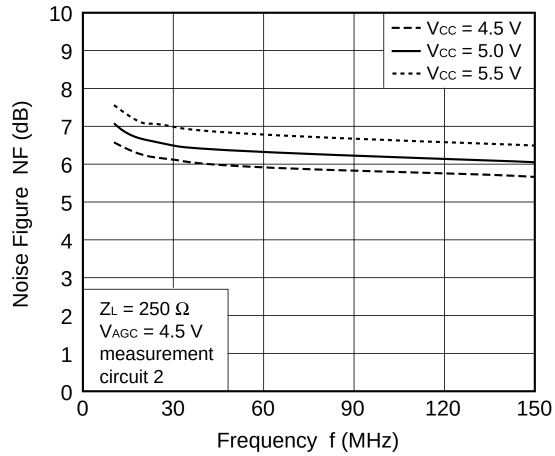
Note Measurement value with spectrum analyzer.

–μPC3217GV–

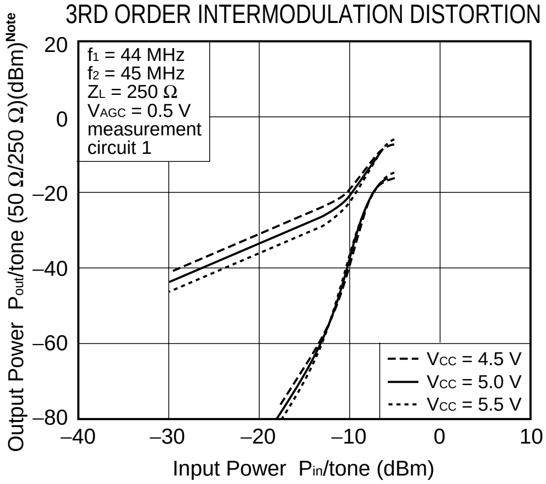
NOISE FIGURE vs. AGC VOLTAGE



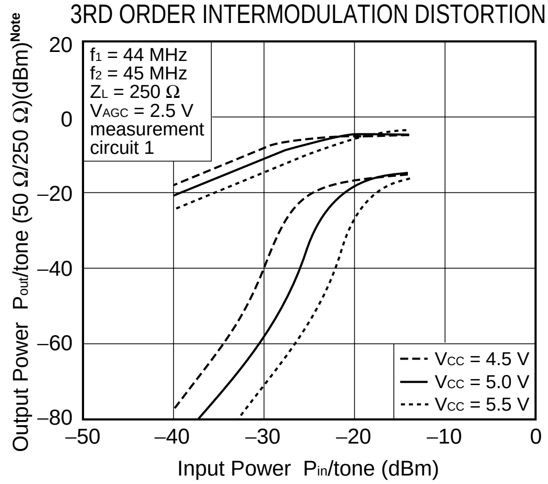
NOISE FIGURE vs. FREQUENCY



3RD ORDER INTERMODULATION DISTORTION



3RD ORDER INTERMODULATION DISTORTION



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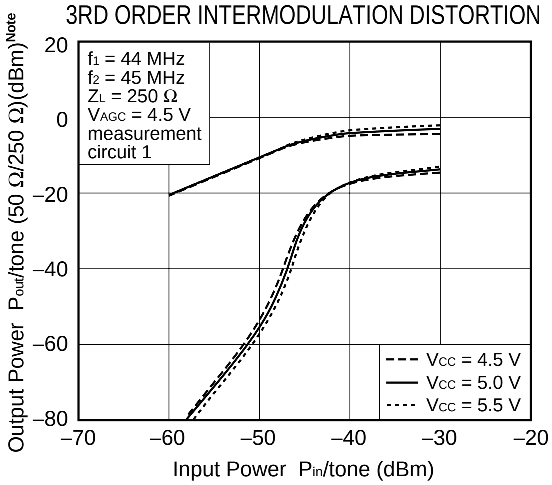
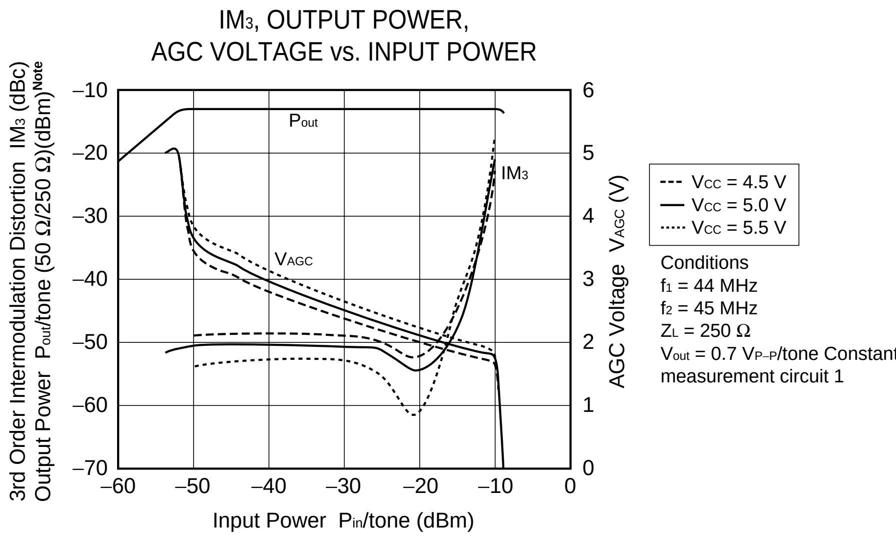
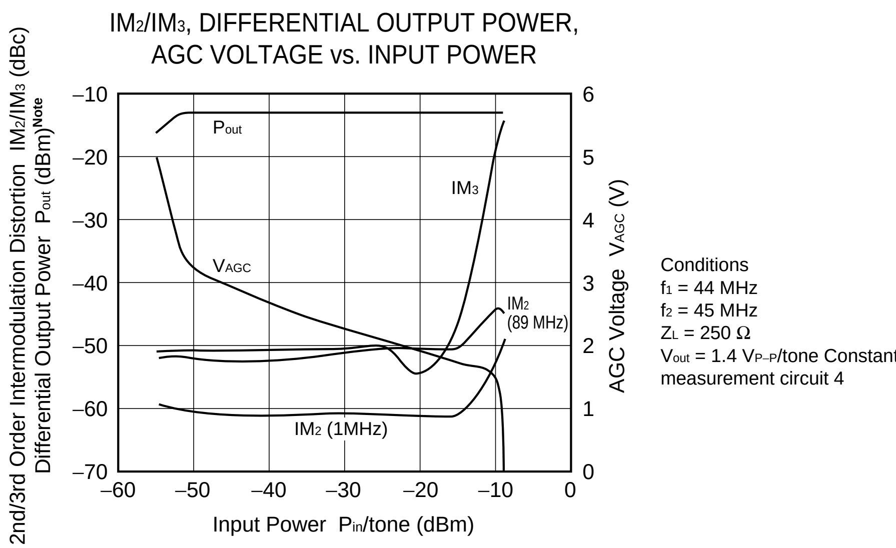


Note Measurement value with spectrum analyzer.

–μPC3217GV–

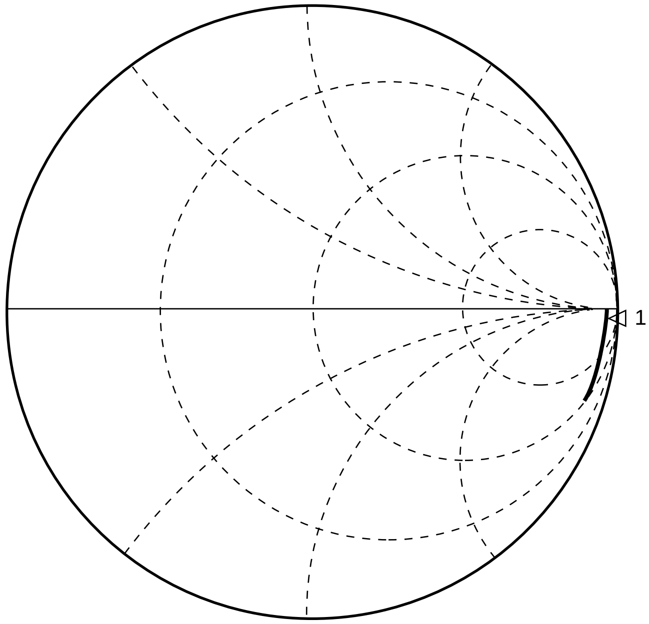




Note Measurement value with spectrum analyzer.

S-PARAMETERS

S_{11}-FREQUENCY

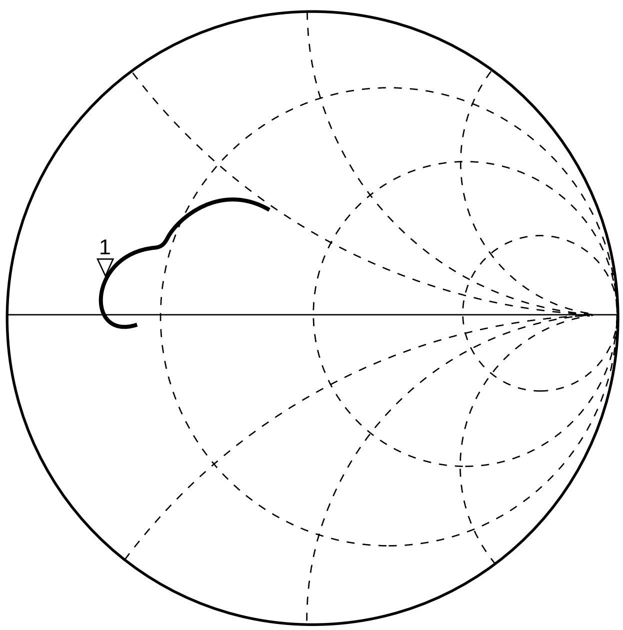


Marker 1

1.339 k – j 1.556 kΩ

START 1.000 000 MHz STOP 500.000 000 MHz

S_{22}-FREQUENCY



Marker 1

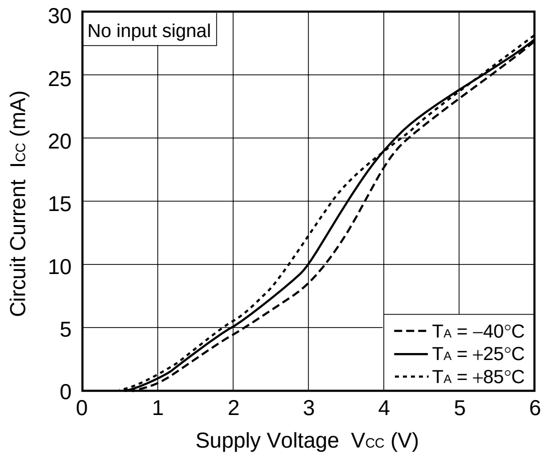
9.511 + j 3.869 Ω

START 1.000 000 MHz STOP 500.000 000 MHz

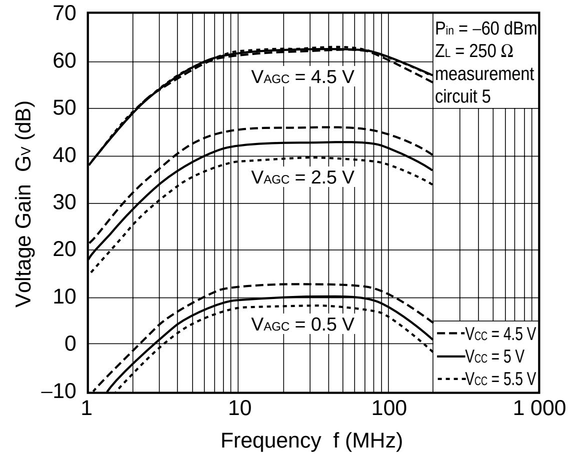
TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25°C)

–μPC3218GV–

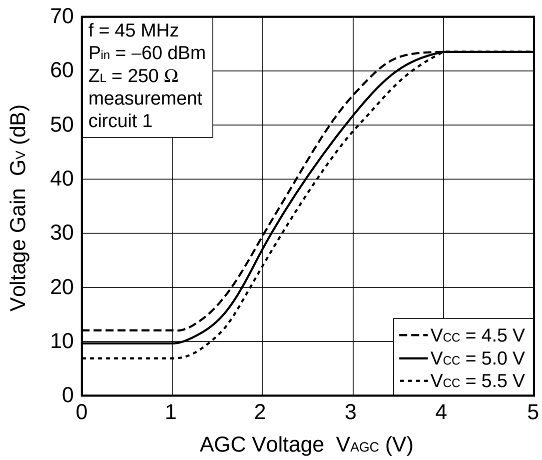
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



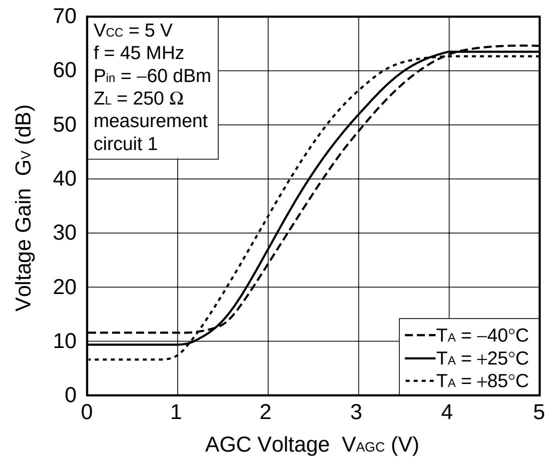
VOLTAGE GAIN vs. FREQUENCY



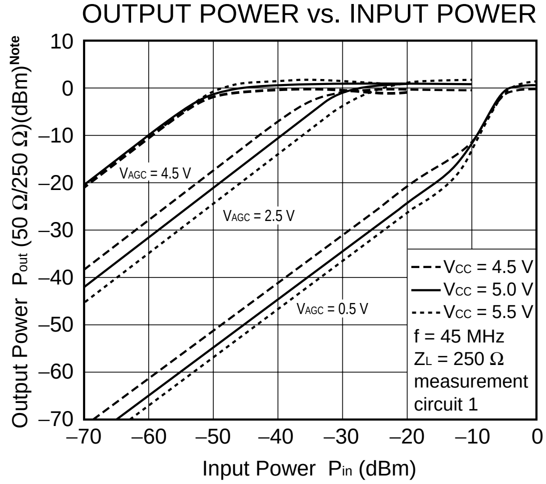
VOLTAGE GAIN vs. AGC VOLTAGE



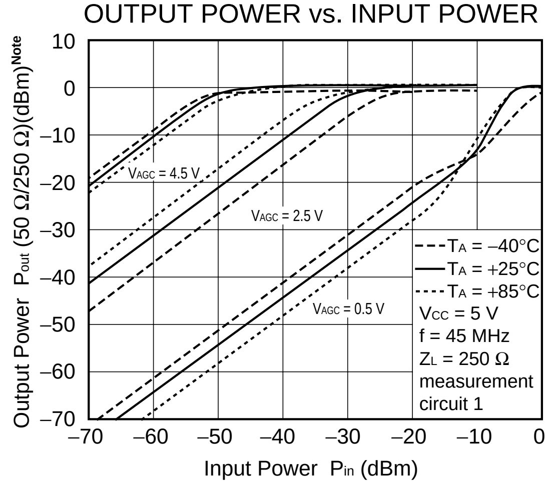
VOLTAGE GAIN vs. AGC VOLTAGE



OUTPUT POWER vs. INPUT POWER



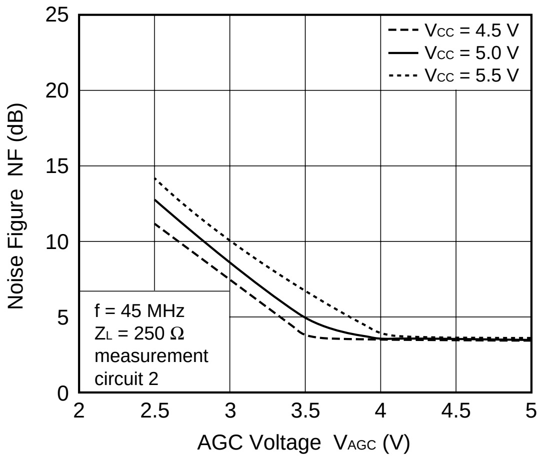
OUTPUT POWER vs. INPUT POWER



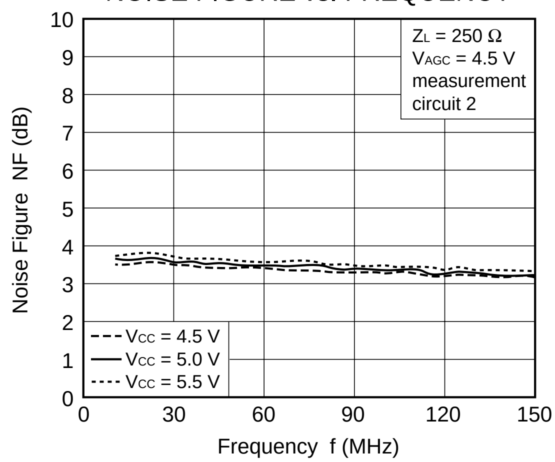
Note Measurement value with spectrum analyzer.

–μPC3218GV–

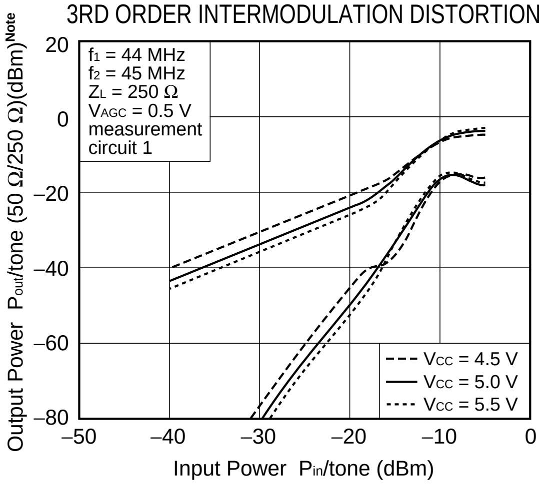
NOISE FIGURE vs. AGC VOLTAGE



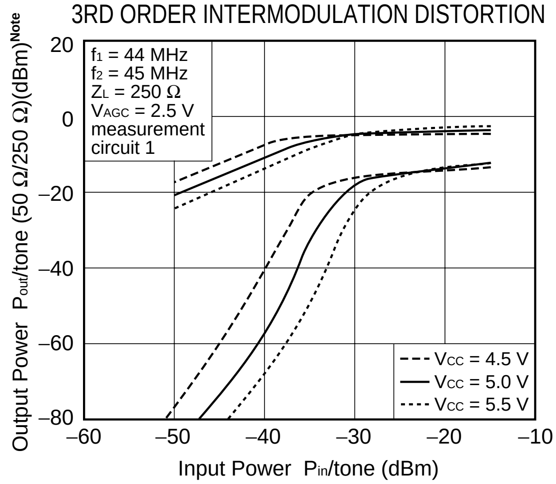
NOISE FIGURE vs. FREQUENCY



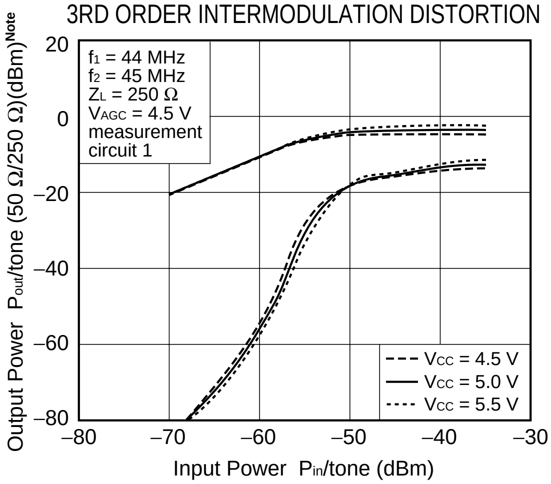
3RD ORDER INTERMODULATION DISTORTION



3RD ORDER INTERMODULATION DISTORTION

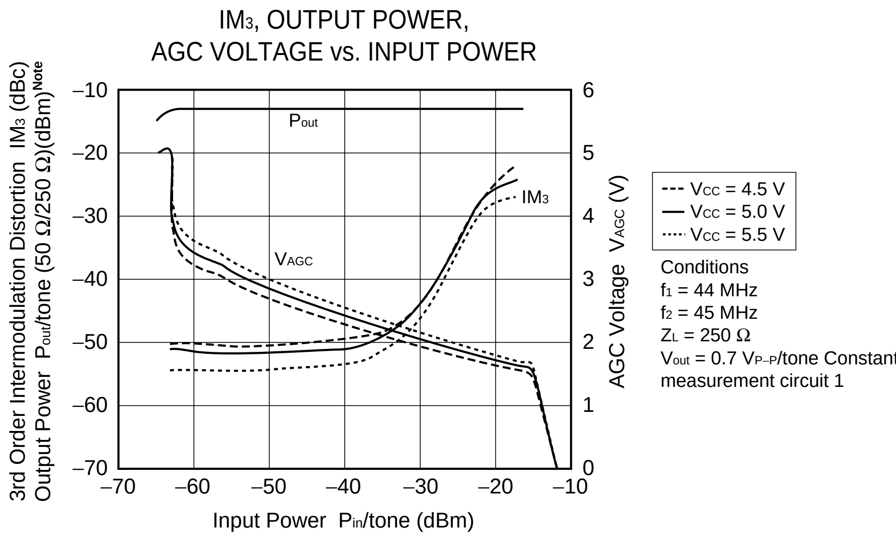


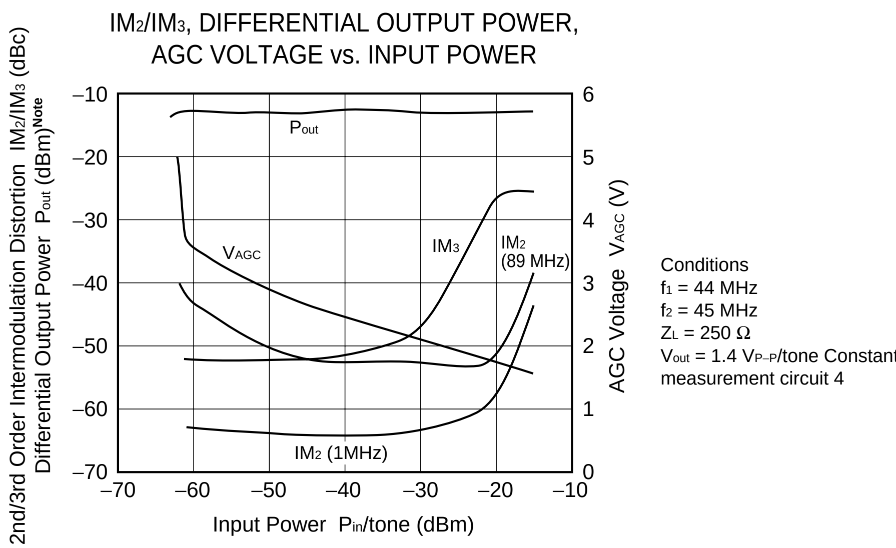
3RD ORDER INTERMODULATION DISTORTION



Note Measurement value with spectrum analyzer.

–μPC3218GV–

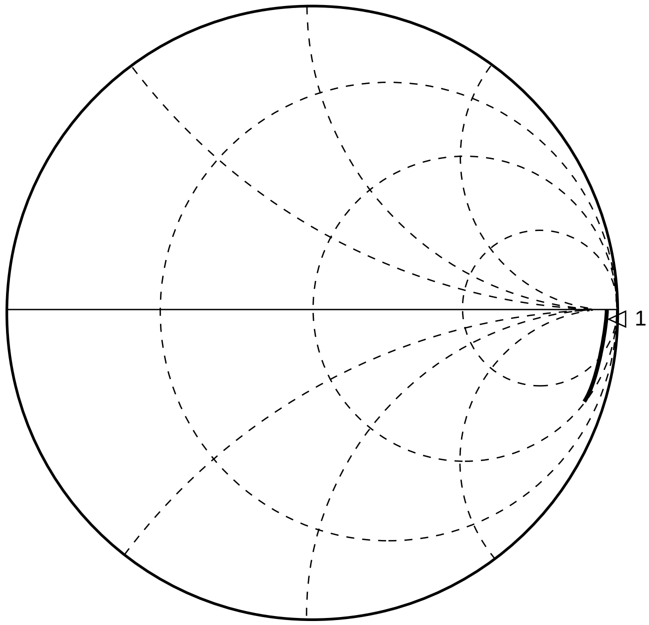




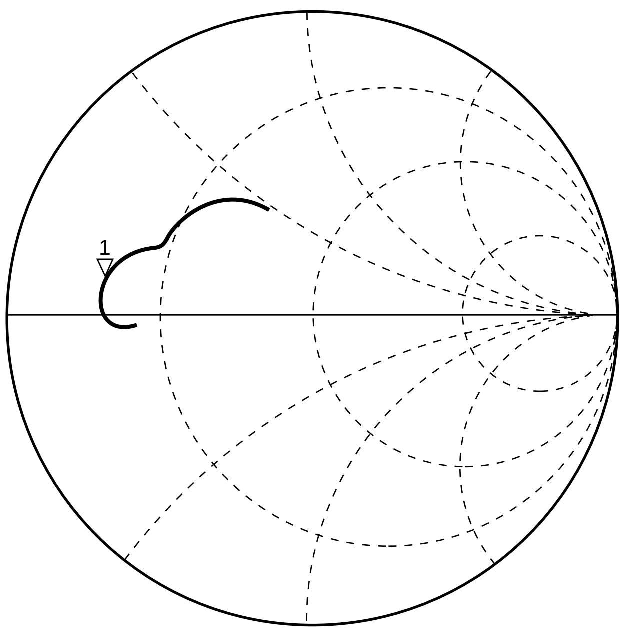
Note Measurement value with spectrum analyzer.

S-PARAMETERS

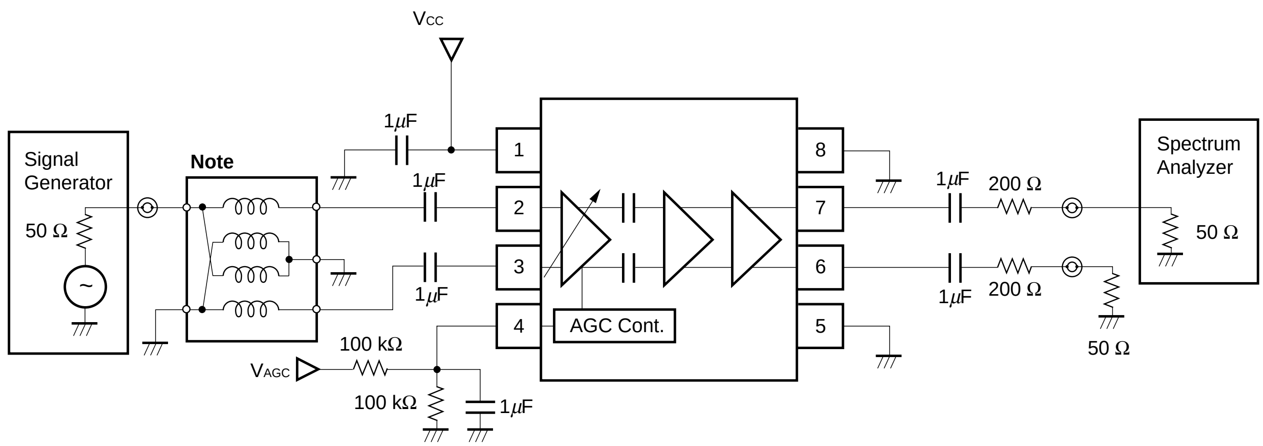
S_{11}-FREQUENCY



S_{22}-FREQUENCY

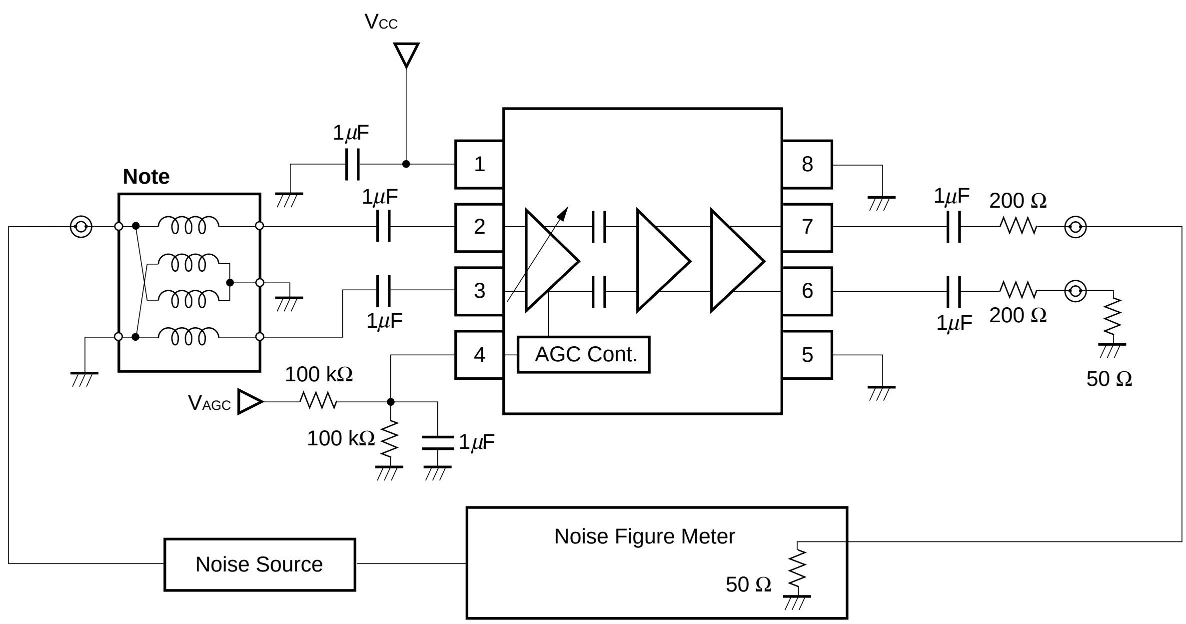


MEASUREMENT CIRCUIT 1



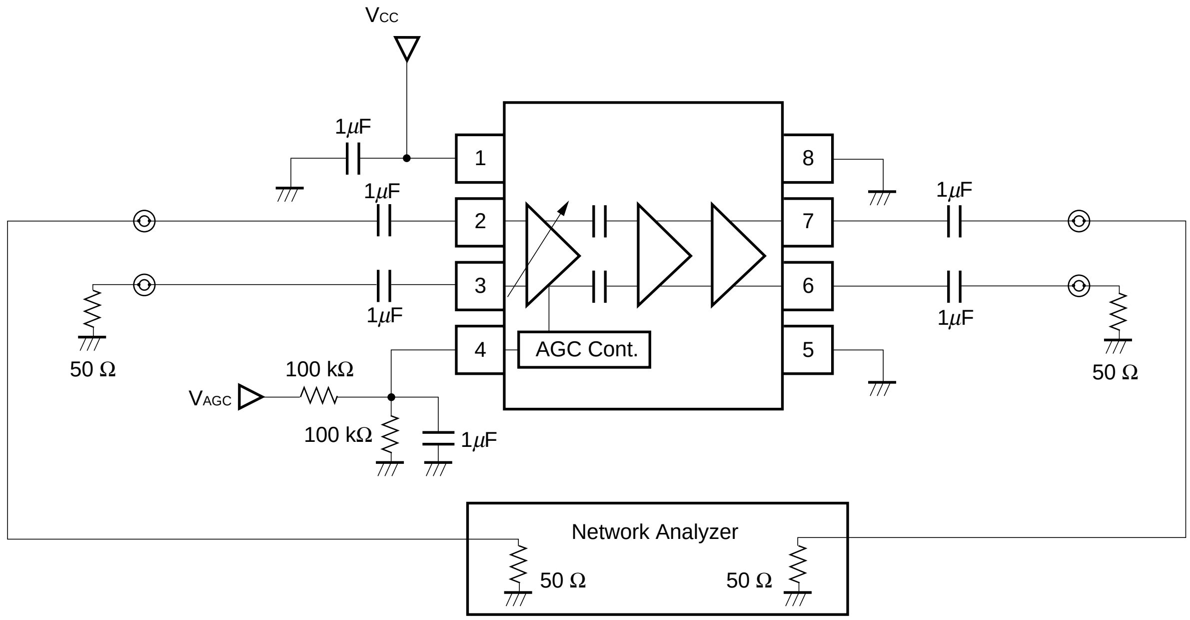
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 2

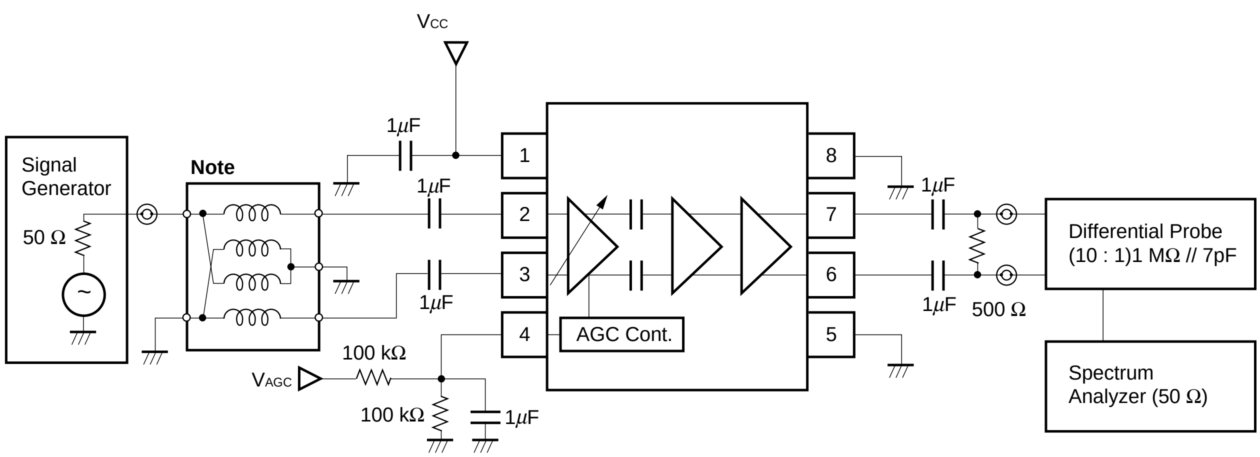


Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 3

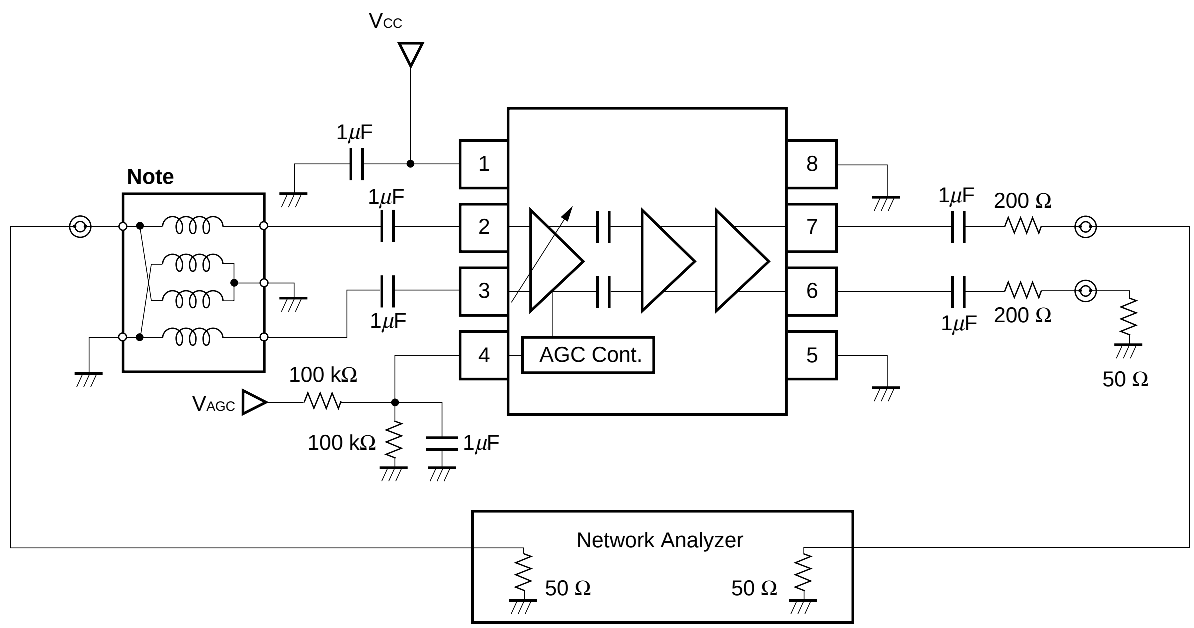


MEASUREMENT CIRCUIT 4



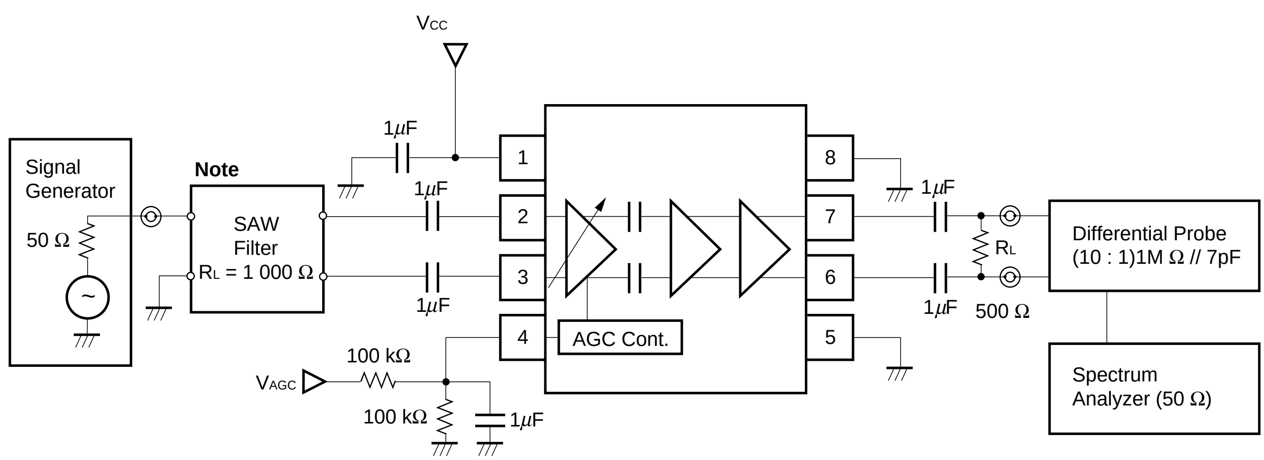
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 5



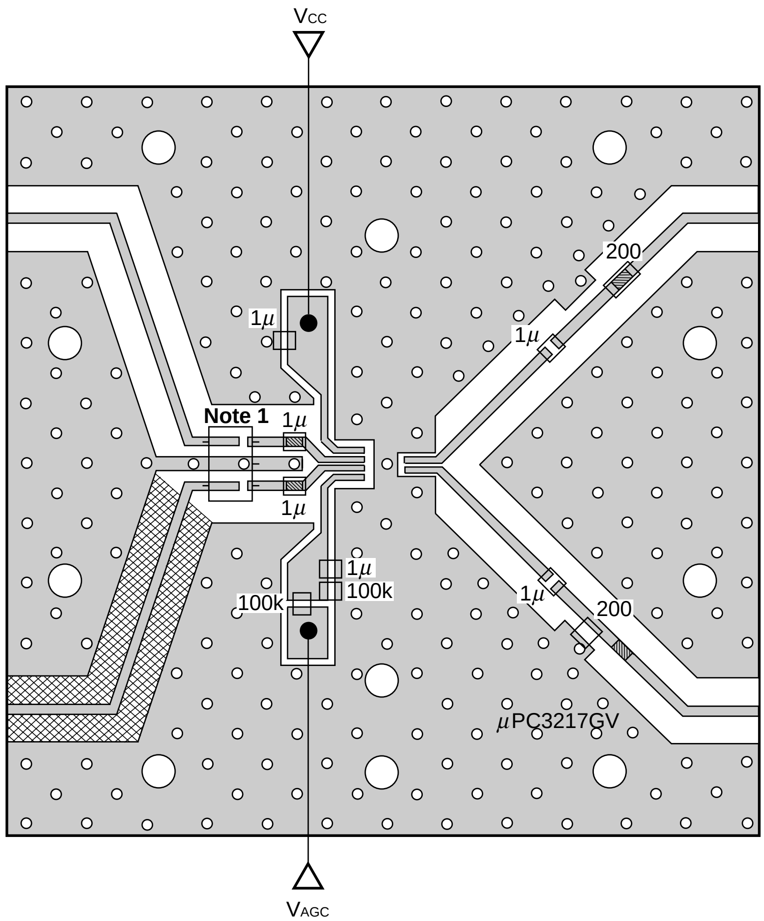
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

APPLICATION CIRCUIT EXAMPLE



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

ILLUSTRATION OF THE EVALUATION BOARD FOR MEASUREMENT CIRCUIT 1



Notes 1. Balun Transformer

2. Back side: GND pattern

3. Solder plated on pattern

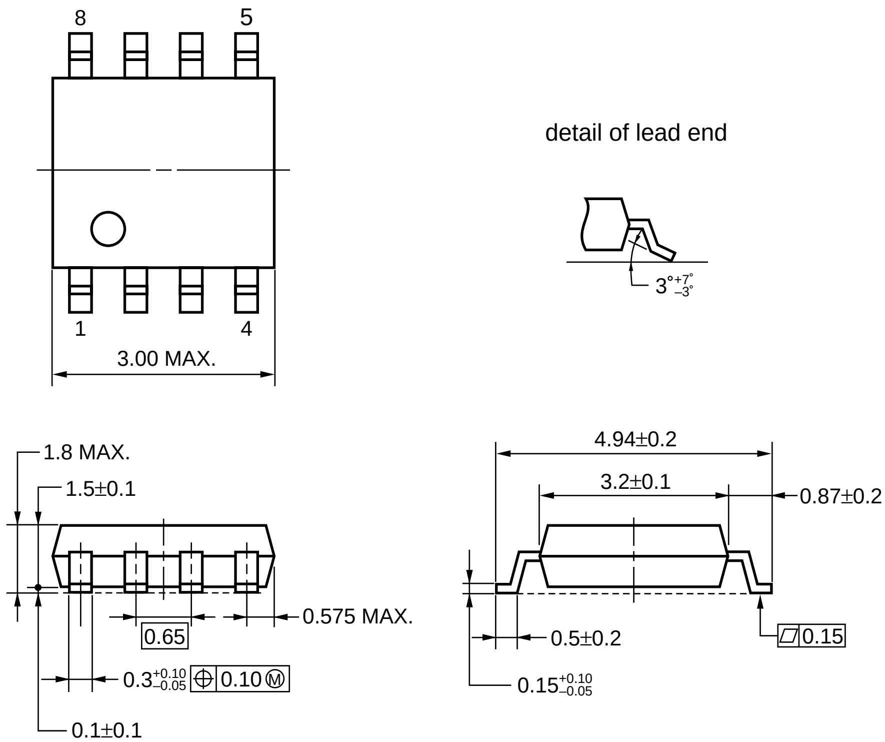
4. ◦◯: Through holes

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 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)**.

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