

BIPOLAR ANALOG INTEGRATED CIRCUITS

μ PC3217GV, μ PC3218GV

GENERAL PURPOSE 5 V AGC AMPLIFIER

DESCRIPTION

The μ PC3217GV, μ PC3218GV 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 NESATTM 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 $IM_3 = 50 \text{ dBc TYP. @single-ended output, } V_{out} = 0.7 \text{ V}_{P-P}/\text{tone}$
- Wide AGC dynamic range $GCR = 53 \text{ dB TYP.}$
- On-chip video amplifier $V_{out} = 1.0 \text{ V}_{P-P} \text{ TYP. @single-ended output}$
- Supply voltage: 5 V
- Packaged in 8-pin SSOP suitable for surface mounting

APPLICATIONS

- Digital CATV/Cable modem receivers

ORDERING INFORMATION

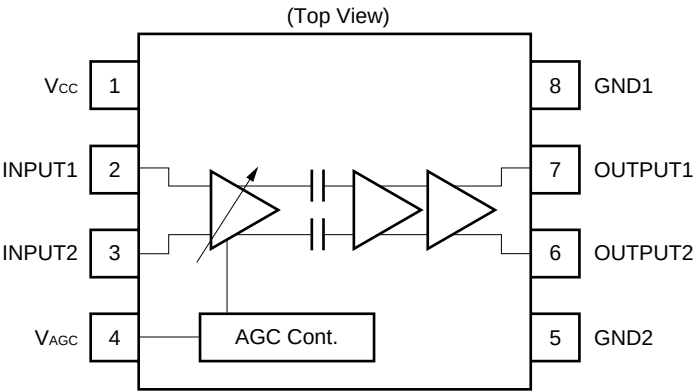
Part Number	Package	Supplying Form
μ PC3217GV-E1	8-pin plastic SSOP (4.45 mm (175))	Embossed tape 8 mm wide. Pin 1 indicates pull-out direction of tape. Qty 1 kpcs/reel.
μ PC3218GV-E1		

Remark To order evaluation samples, please contact your local NEC sales office (Part number for sample order: μ PC3217GV, μ PC3218GV).

Caution electro-static sensitive devices

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 representative for availability and additional information.

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



PIN EXPLANATIONS (μ PC3217GV, μ PC3218GV 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 resistor (example: 100 k Ω).	
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 (μ PC3217GV, μ PC3218GV 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 (μ PC3217GV, μ PC3218GV 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

– μ PC3217GV–

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}	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}	$V_{AGC} = 4.5\text{ V}$, $P_{in} = -50\text{ dBm}$ Note 1	50	53	56	dB
Minimum Voltage Gain	G_{MIN}	$V_{AGC} = 0.5\text{ V}$, $P_{in} = -20\text{ dBm}$ Note 1	–4.5	0	3.5	dB
Gain Control Range	GCR	$V_{AGC} = 0.5\text{ to }4.5\text{ V}$ Note 1	46.5	53	–	dB
Output Voltage	V_{out}	$P_{in} = -49\text{ to }-10\text{ dBm}$ Note 1	–	1.0	–	V_{P-P}
Maximum Output Voltage	V_{oclip}	$V_{AGC} = 4.5\text{ V}$ @Maximum gain Note 1	1.6	2.8	–	V_{P-P}
Noise Figure	NF	$V_{AGC} = 4.5\text{ V}$ @Maximum gain Note 2	–	6.5	8.0	dB

- Notes** 1. By measurement circuit 1
2. By measurement circuit 2

STANDARD CHARACTERISTICS ($T_A = +25^\circ\text{C}$, $V_{CC} = 5\text{ V}$, $Z_s = 50\ \Omega$)

Parameter	Symbol	Test Conditions	Reference Value	Unit
Input Impedance	Z_{in}	$V_{AGC} = 0.5\text{ V}$, $f = 45\text{ MHz}$ Note 1	$1.3k - j1.5k$	Ω
Output Impedance	Z_{out}	$V_{AGC} = 0.5\text{ V}$, $f = 45\text{ MHz}$ Note 1	$9.5 + j4$	Ω
3rd Order Input Intercept Point	IIP ₃	$V_{AGC} = 0.5\text{ V}$ @Minimum gain $f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$ $Z_L = 250\ \Omega$ @single-ended output Note 2	+5	dBm
3rd Order Intermodulation Distortion 1	IM ₃₁	$f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$ $P_{in} = -50\text{ to }-20\text{ dBm/tone}$, $V_{out} = 0.7\text{ V}_{P-P/\text{tone}}$ @single-ended output, $Z_L = 250\ \Omega$ Note 2	50	dBc
3rd Order Intermodulation Distortion 2	IM ₃₂	$f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$ $P_{in} = -50\text{ to }-20\text{ dBm/tone}$, $Z_L = 500\ \Omega$ $V_{out} = 1.4\text{ V}_{P-P/\text{tone}}$ @differential output Note 3	50	dBc
2nd Order Intermodulation Distortion	IM ₂	$f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$ $P_{in} = -50\text{ to }-20\text{ dBm/tone}$, $Z_L = 500\ \Omega$ $V_{out} = 1.4\text{ V}_{P-P/\text{tone}}$ @differential output Note 3	50	dBc

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

– μ PC3218GV–

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

- Notes** 1. By measurement circuit 1
2. By measurement circuit 2

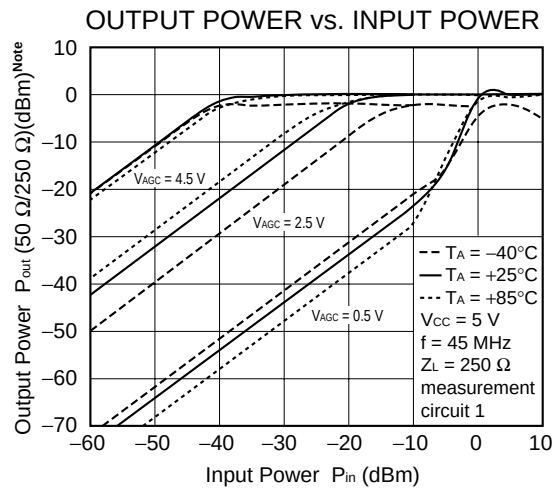
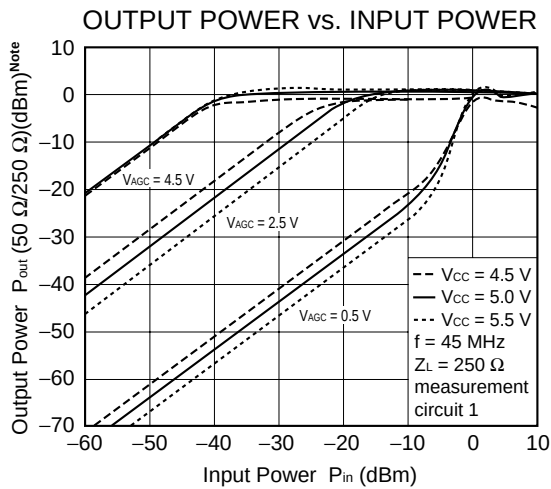
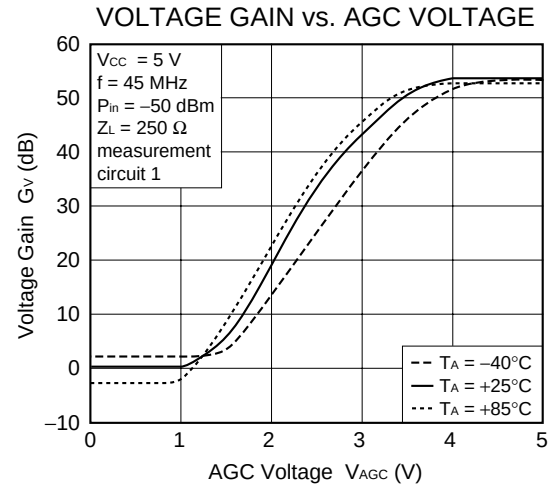
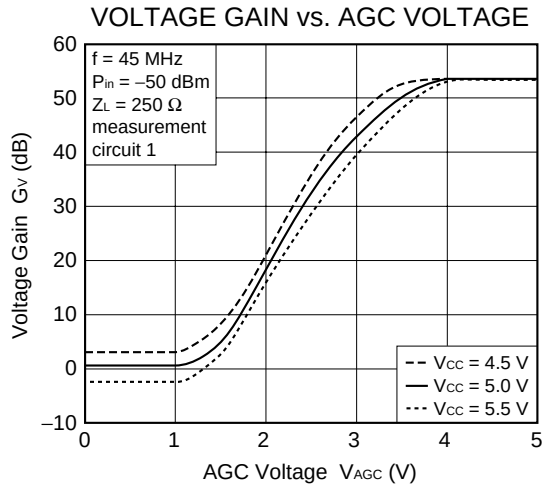
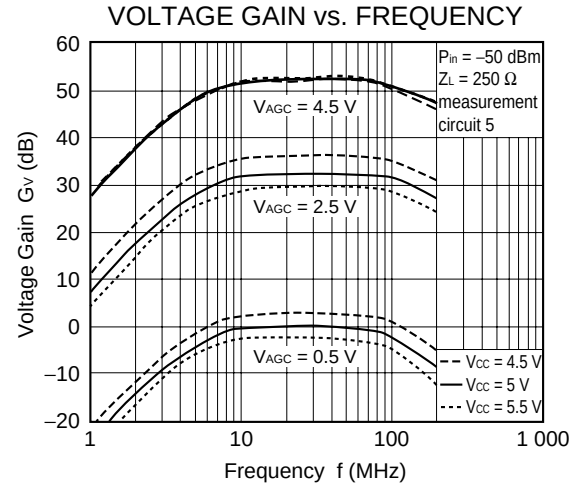
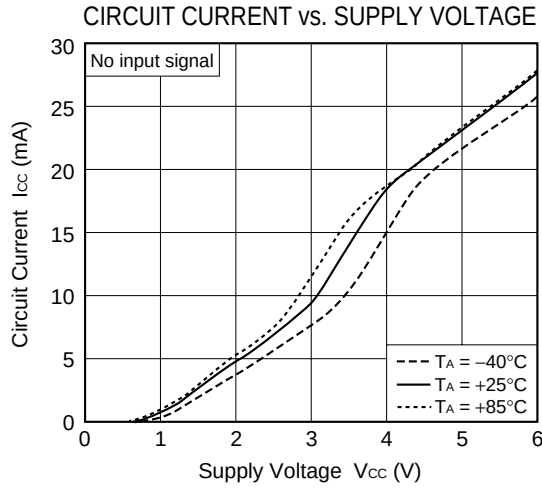
STANDARD CHARACTERISTICS ($T_A = +25^\circ\text{C}$, $V_{CC} = 5\text{ V}$, $Z_S = 50\ \Omega$)

Parameter	Symbol	Test Conditions	Reference Value	Unit
Input Impedance	Z_{in}	$V_{AGC} = 0.5\text{ V}$, $f = 45\text{ MHz}$ Note 1	$1.0k - j1.1k$	Ω
Output Impedance	Z_{out}	$V_{AGC} = 0.5\text{ V}$, $f = 45\text{ MHz}$ Note 1	$9.5 + j4$	Ω
3rd Order Input Intercept Point	IIP ₃	$V_{AGC} = 0.5\text{ V}$ @Minimum gain $f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$ $Z_L = 250\ \Omega$ @single-ended output Note 2	–7	dBm
3rd Order Intermodulation Distortion 1	IM ₃₁	$f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$ $P_{in} = -60\text{ to }-30\text{ dBm}$, $V_{out} = 0.7\text{ V}_{P-P}/\text{tone}$ @single-ended output Note 2	50	dBc
3rd Order Intermodulation Distortion 2	IM ₃₂	$f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$ $P_{in} = -60\text{ to }-30\text{ dBm}/\text{tone}$, $Z_L = 500\ \Omega$, $V_{out} = 1.4\text{ V}_{P-P}/\text{tone}$ @differential output Note 3	50	dBc
2nd Order Intermodulation Distortion	IM ₂	$f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$ $P_{in} = -50\text{ to }-20\text{ dBm}/\text{tone}$, $Z_L = 500\ \Omega$, $V_{out} = 1.4\text{ V}_{P-P}/\text{tone}$ @differential output Note 3	50	dBc

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

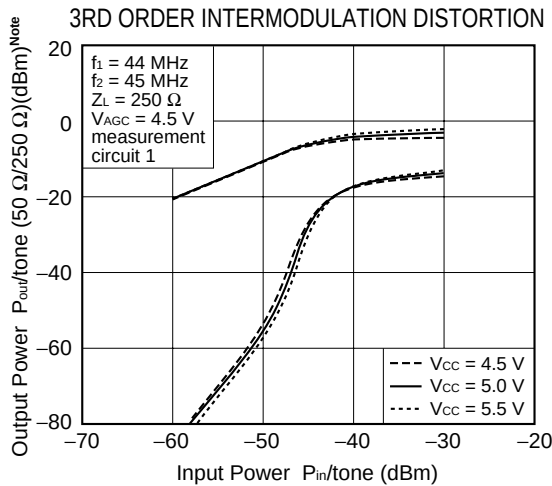
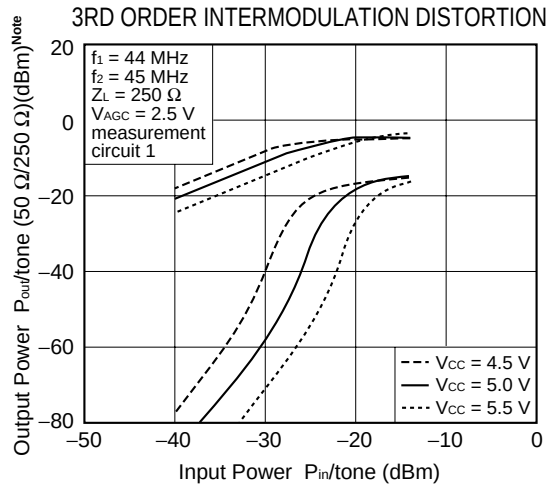
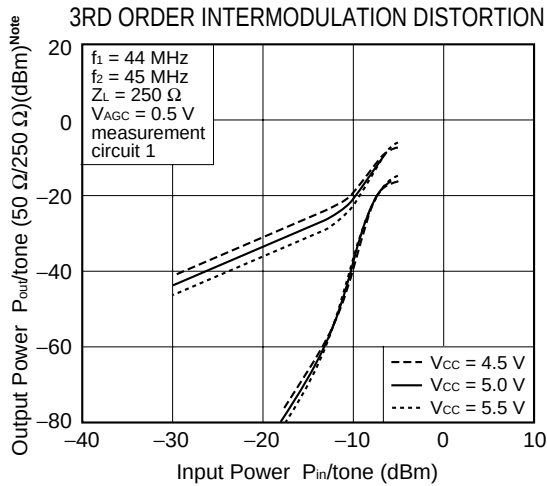
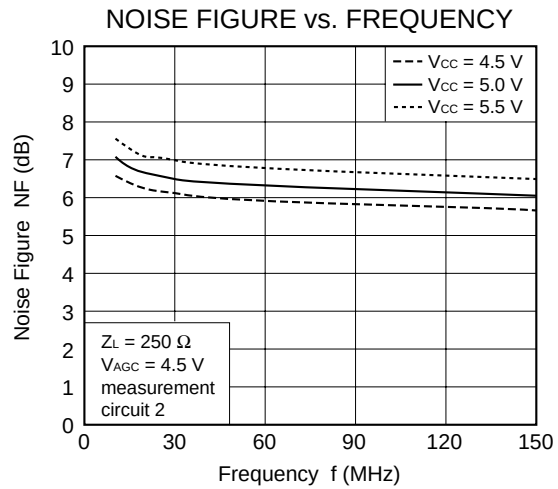
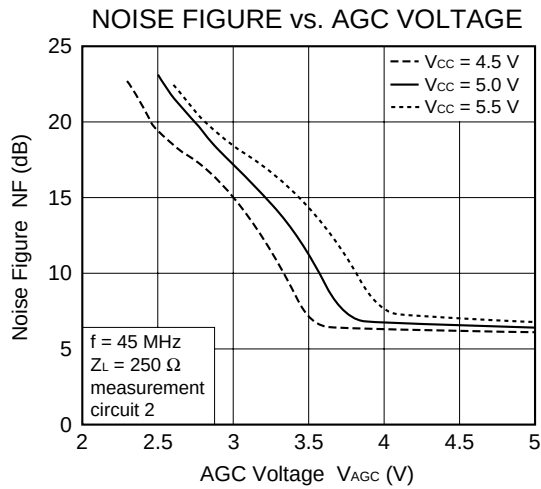
TYPICAL CHARACTERISTICS (Unless otherwise specified, $T_A = +25^\circ\text{C}$)

— μ PC3217GV—



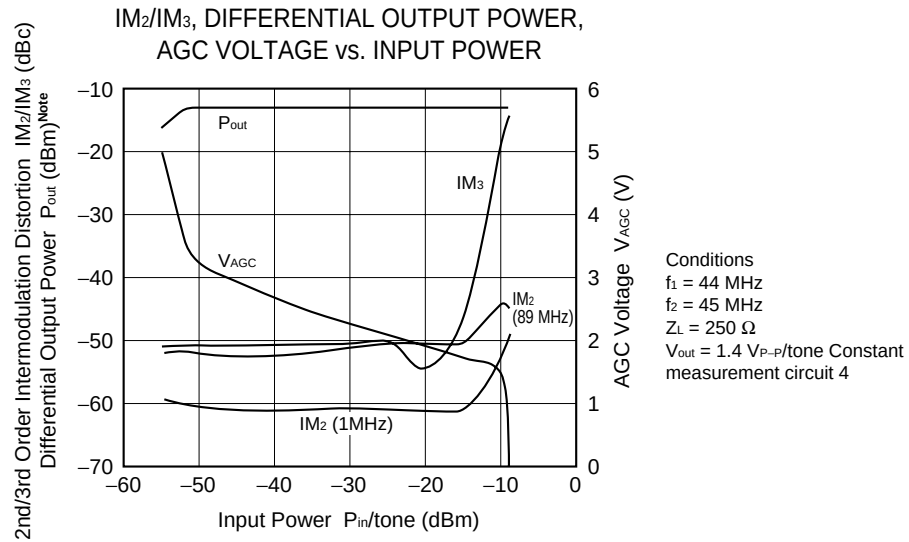
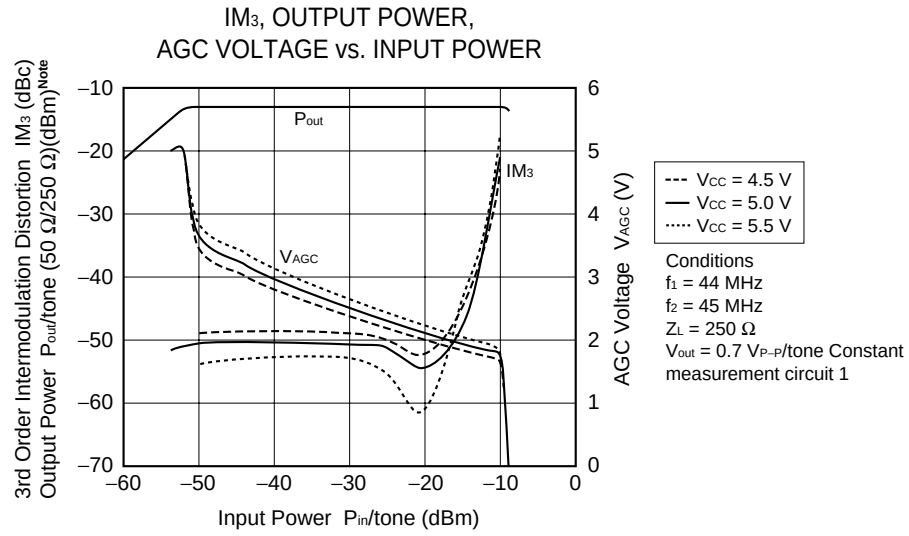
Note Measurement value with spectrum analyzer.

– μ PC3217GV–



Note Measurement value with spectrum analyzer.

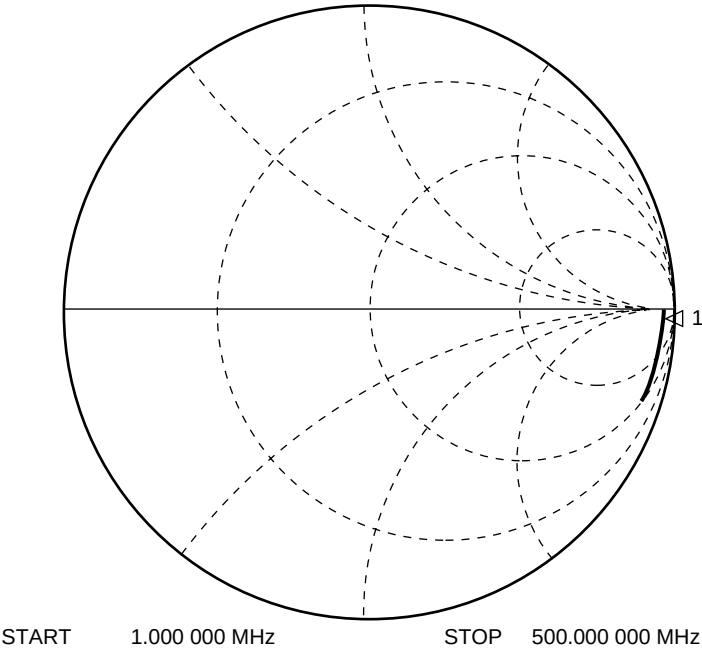
– μ PC3217GV–



Note Measurement value with spectrum analyzer.

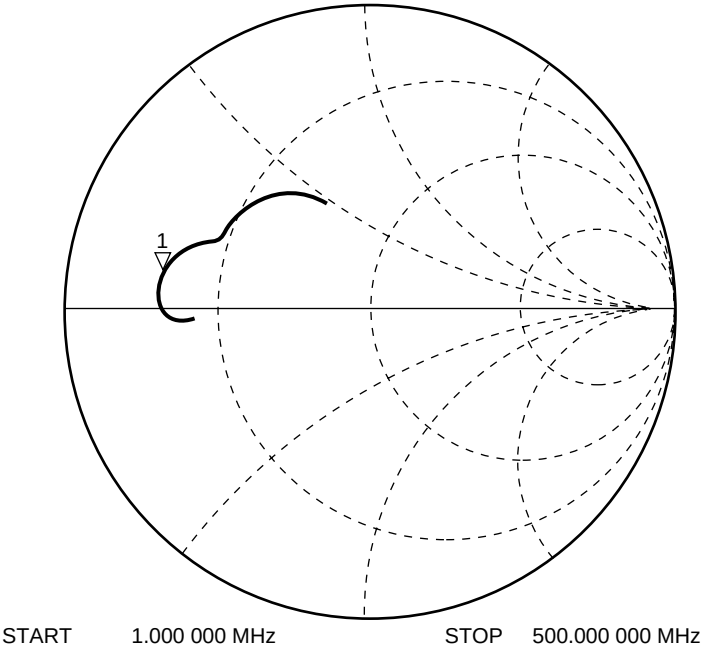
S-PARAMETERS

S₁₁-FREQUENCY



Marker 1
1.339 k – j 1.556 k Ω

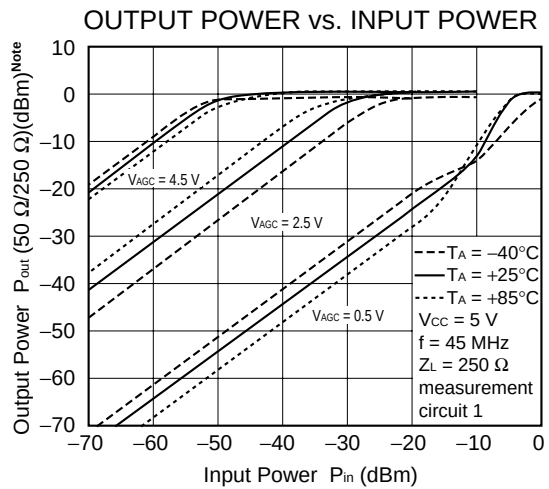
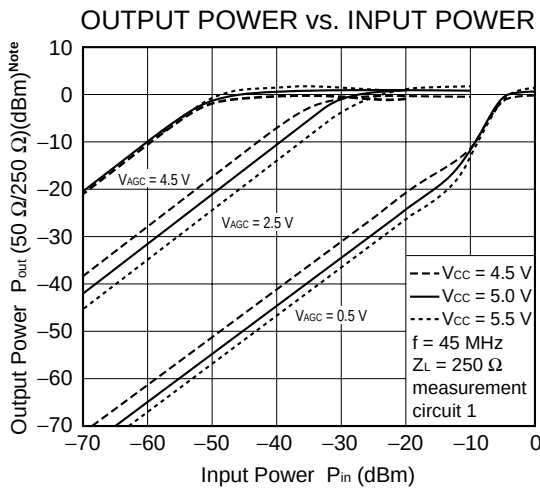
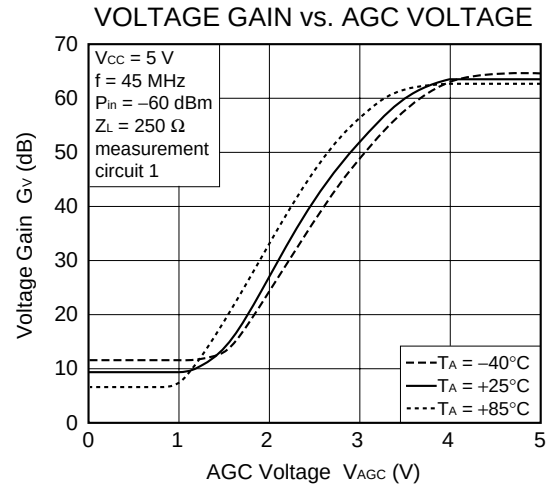
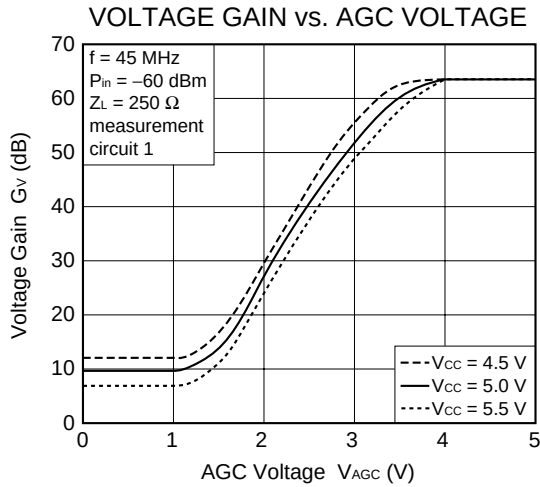
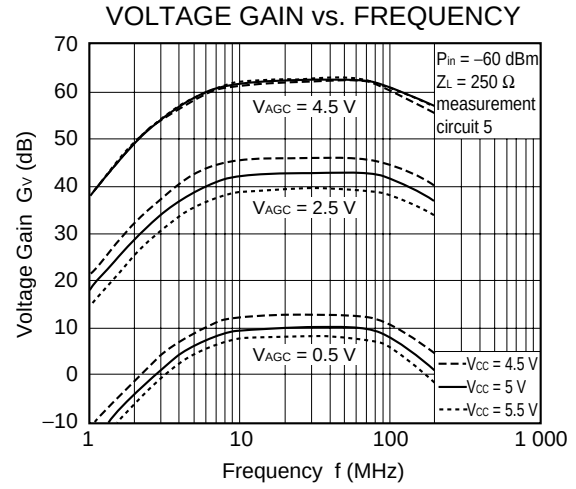
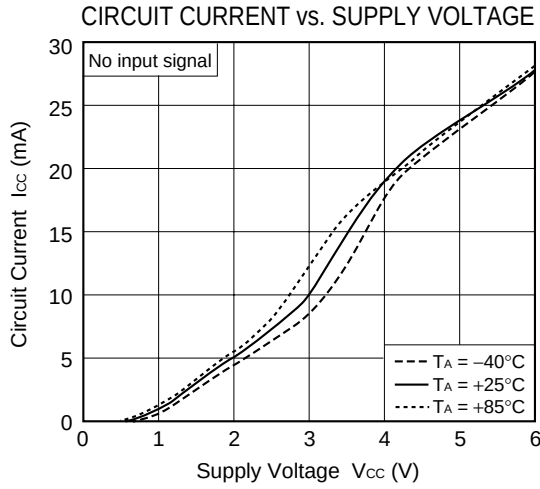
S₂₂-FREQUENCY



Marker 1
9.511 + j 3.869 Ω

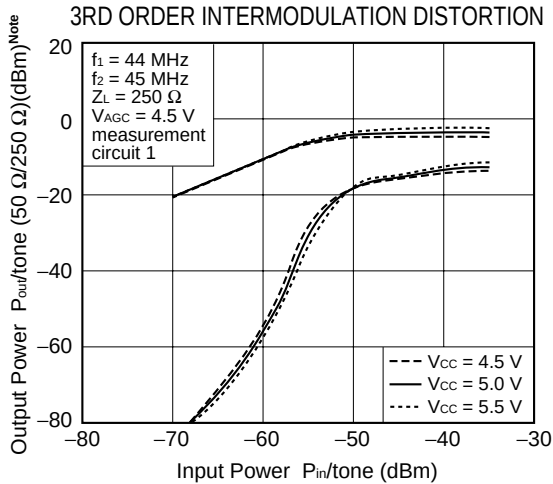
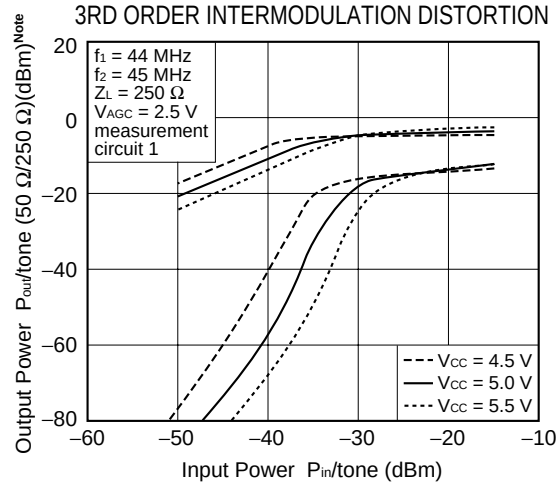
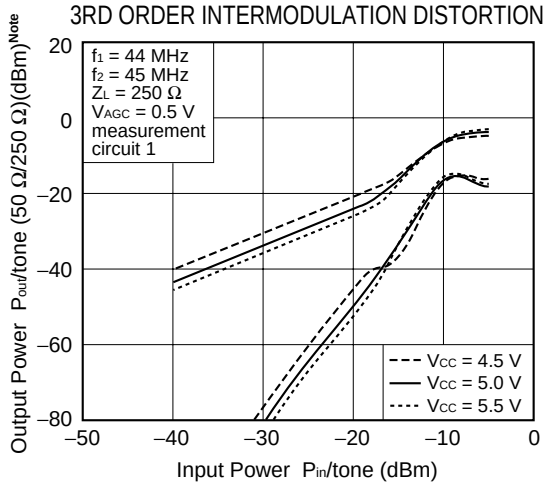
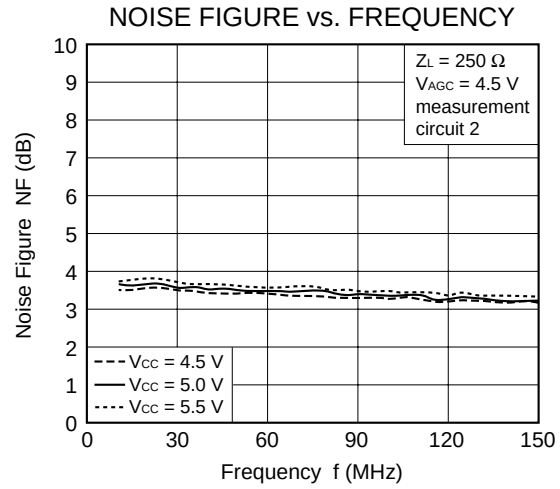
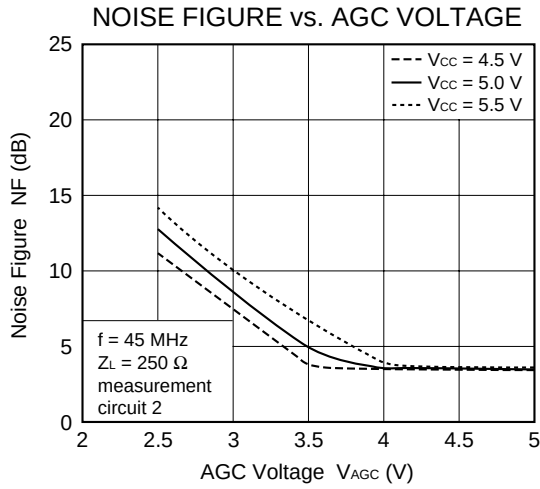
TYPICAL CHARACTERISTICS (Unless otherwise specified, $T_A = +25^\circ\text{C}$)

— μ PC3218GV—



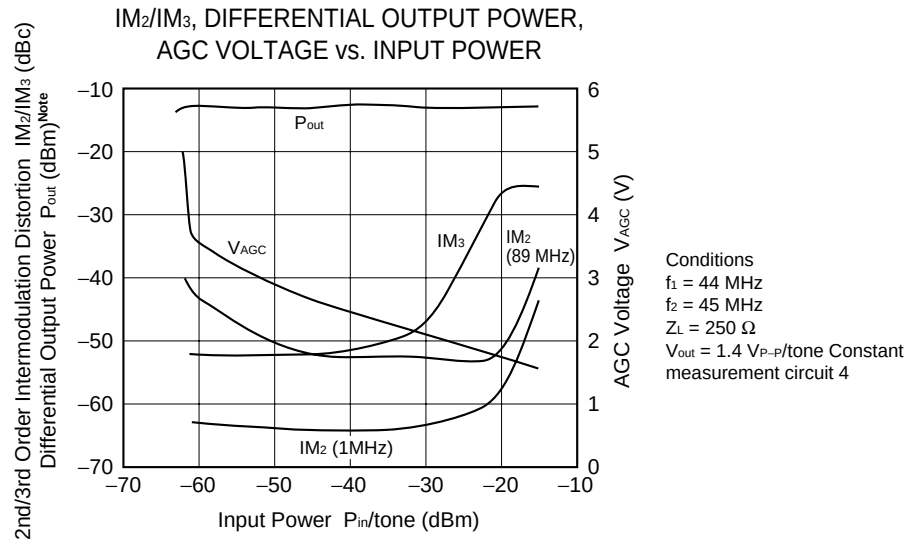
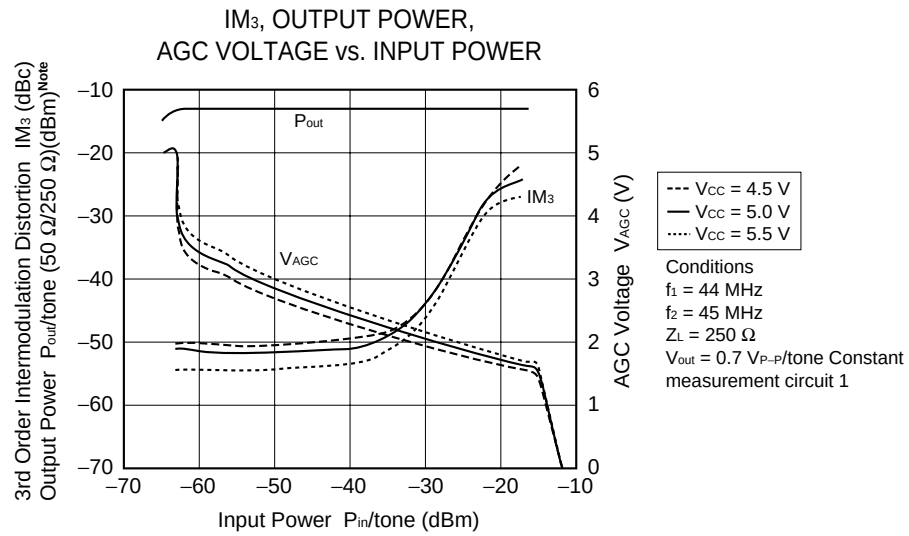
Note Measurement value with spectrum analyzer.

– μ PC3218GV–



Note Measurement value with spectrum analyzer.

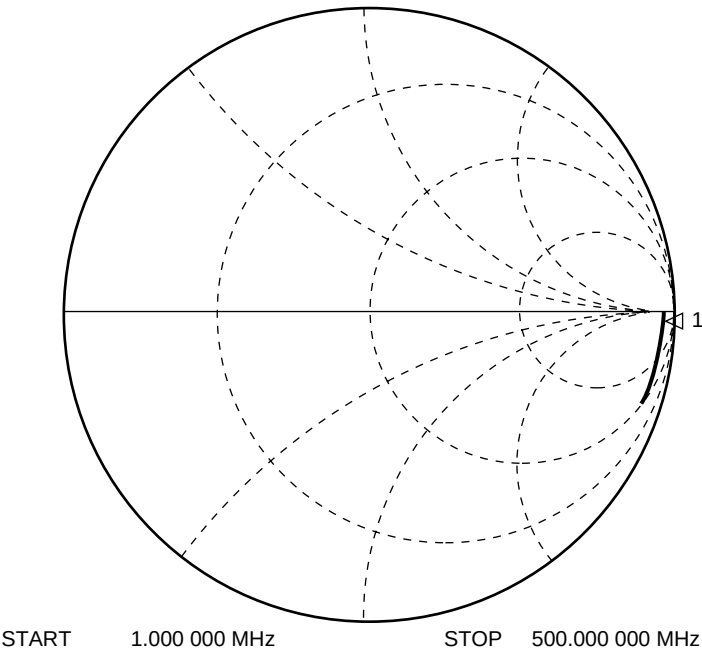
– μ PC3218GV–



Note Measurement value with spectrum analyzer.

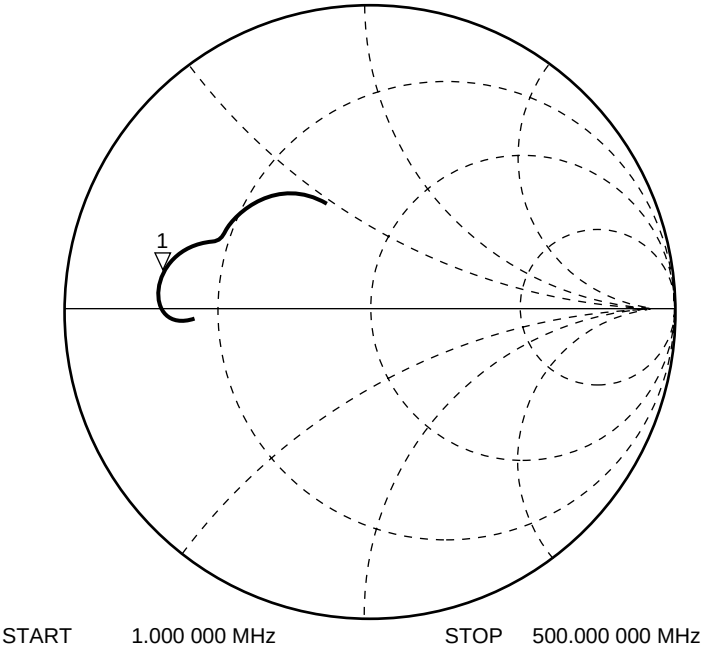
S-PARAMETERS

S₁₁-FREQUENCY



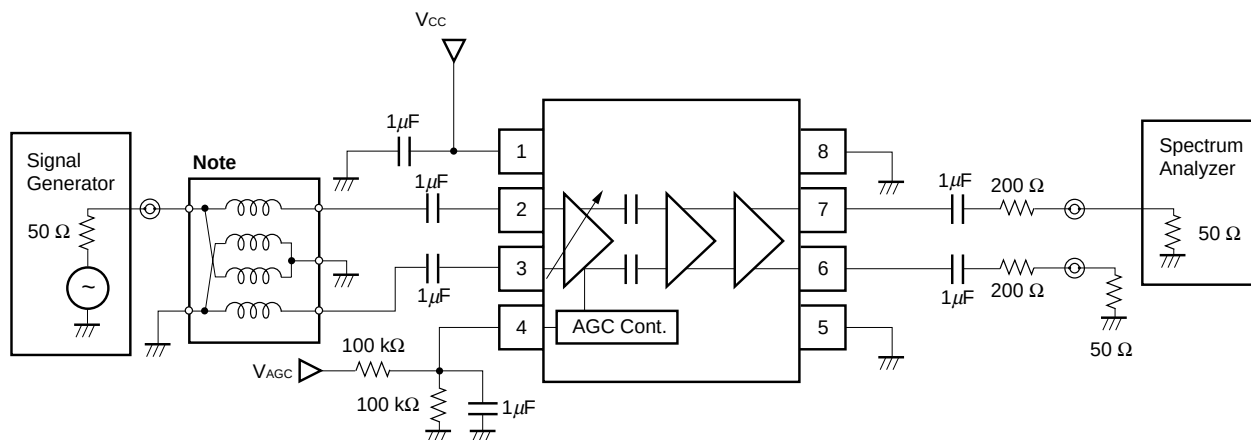
Marker 1
1.024 k – j 1.124 kΩ

S₂₂-FREQUENCY



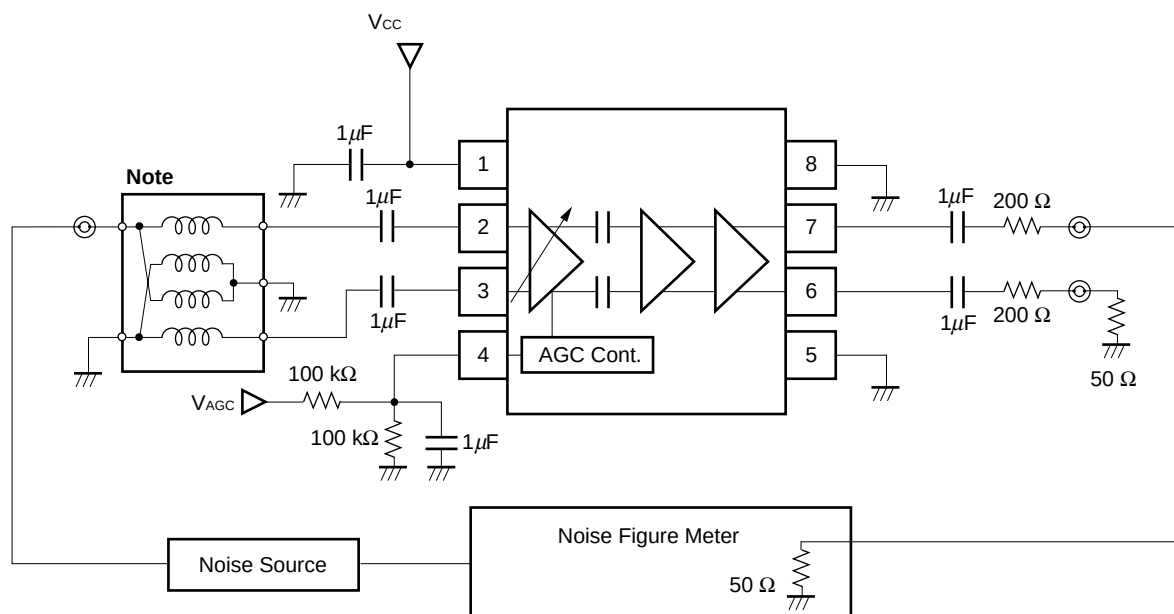
Marker 1
9.493 + j 4.317 Ω

MEASUREMENT CIRCUIT 1



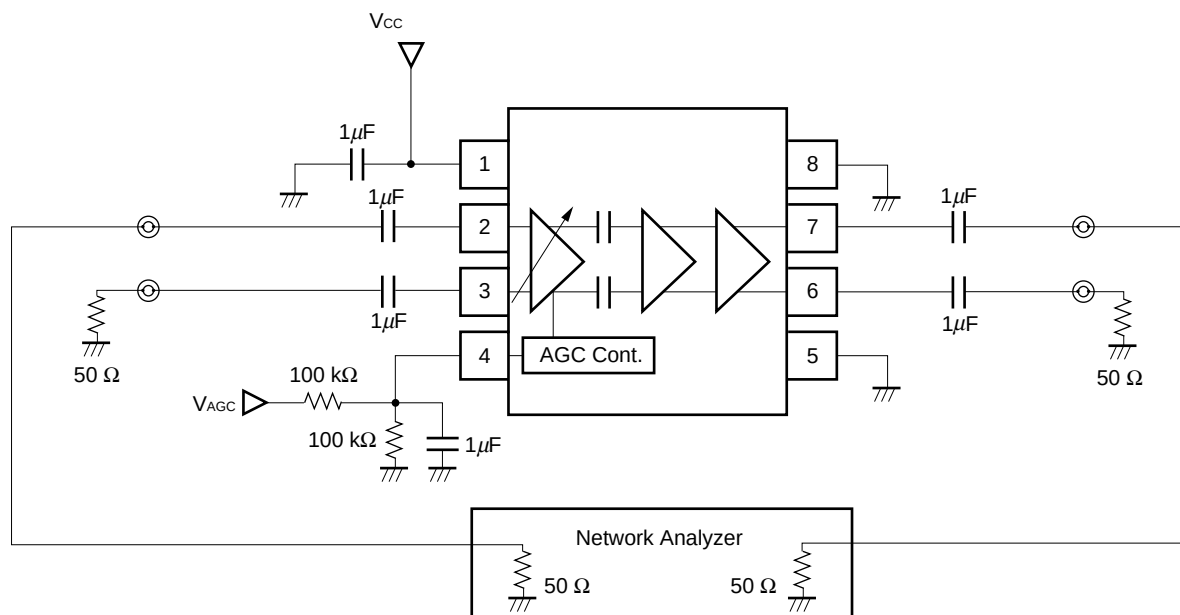
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 2

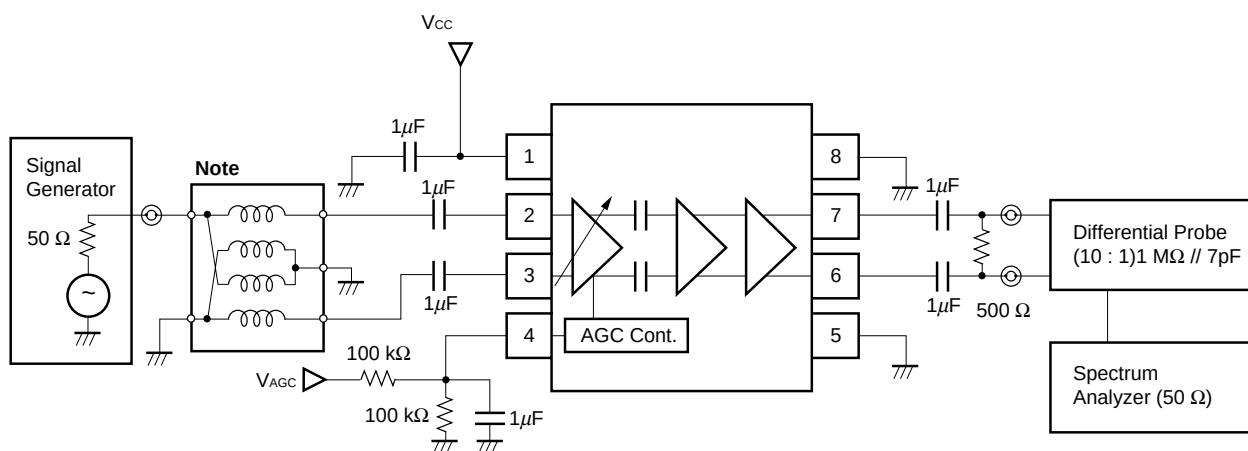


Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 3

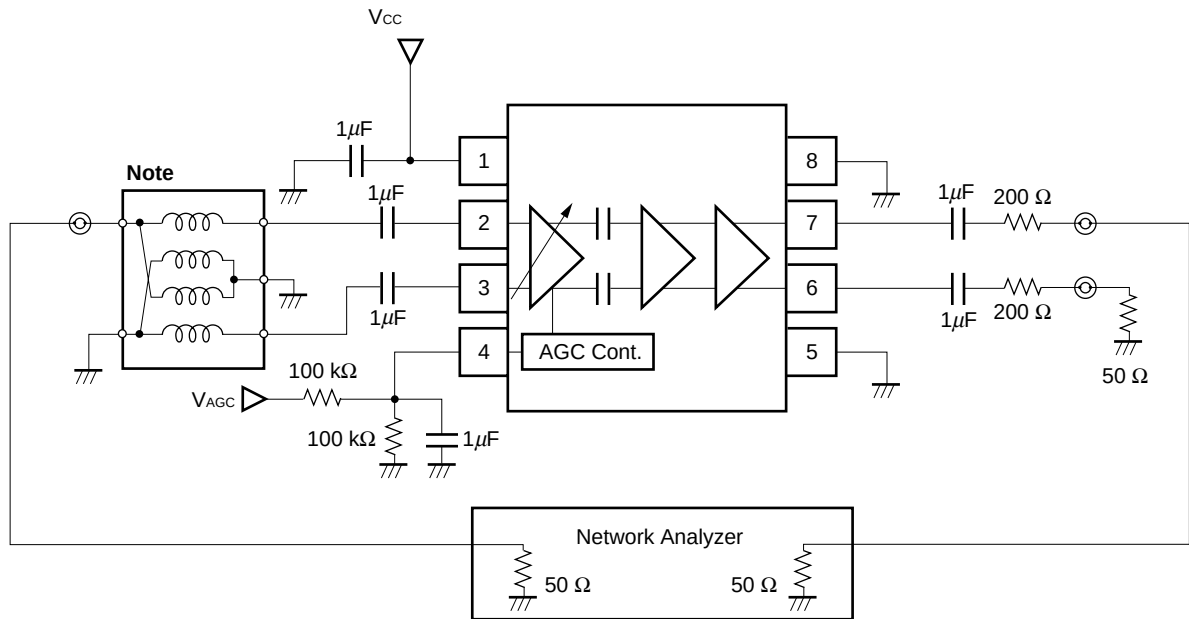


MEASUREMENT CIRCUIT 4



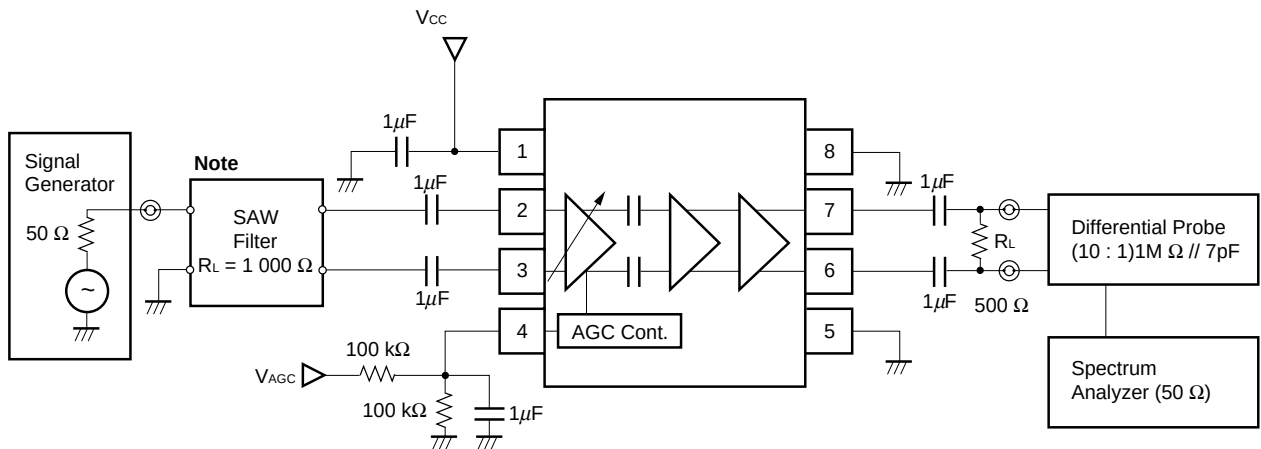
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 5



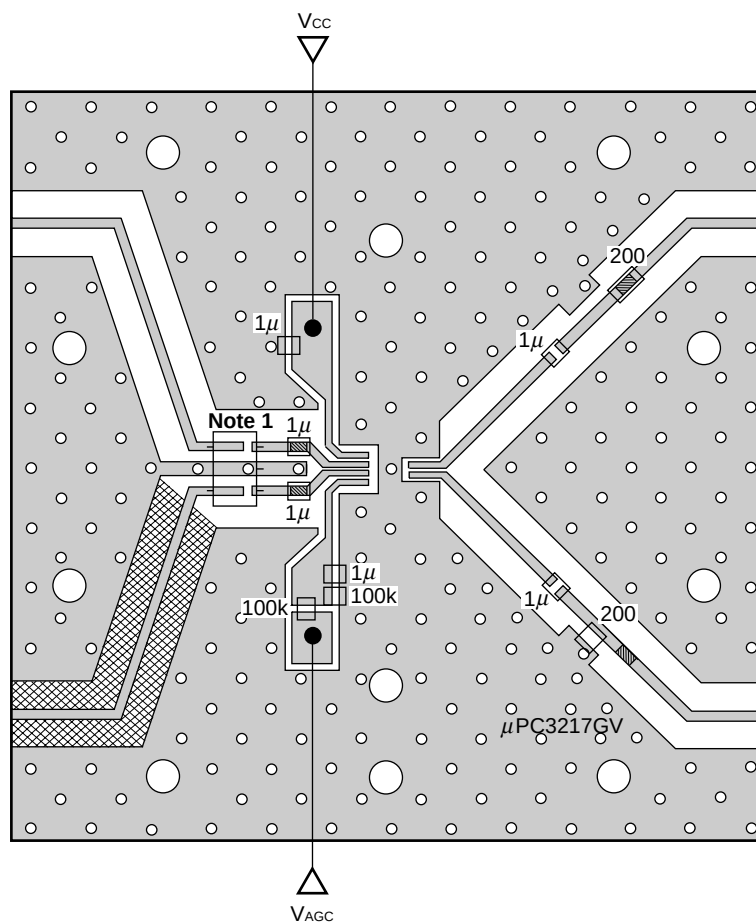
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

APPLICATION CIRCUIT EXAMPLE



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

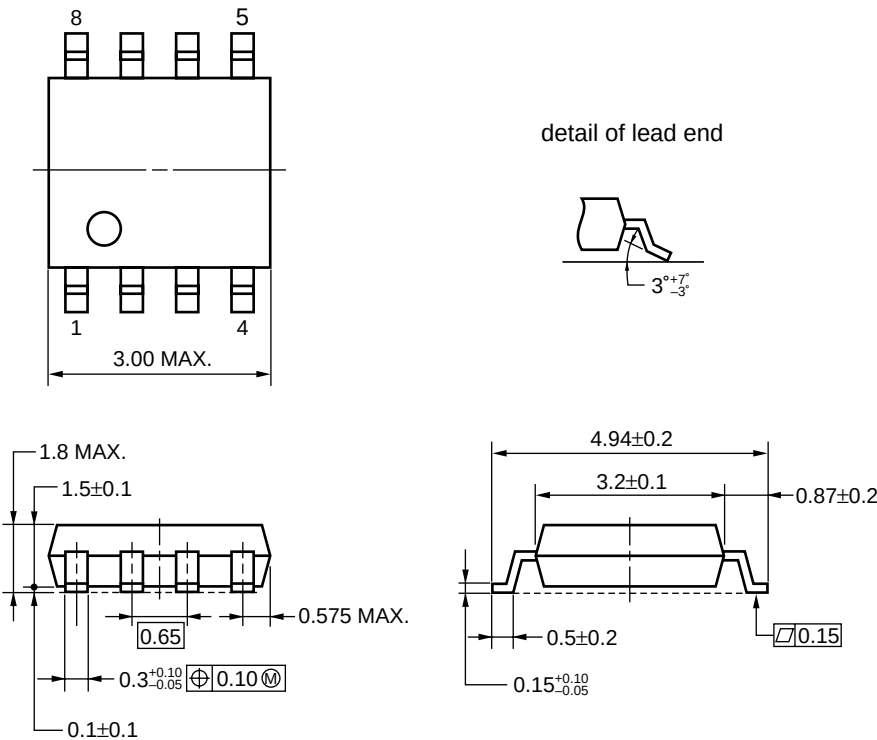
ILLUSTRATION OF THE EVALUATION BOARD FOR MEASUREMENT CIRCUIT 1



- Notes**
1. Balun Transformer
 2. Back side: GND pattern
 3. Solder plated on pattern
 4. $\circ$: 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 undesired 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).

[MEMO]

[MEMO]

[MEMO]

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- NEC semiconductor products are classified into the following three quality grades:
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 "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 semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.

(Note)

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