

DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT μ PC3217GV, μ PC3218GV

GENERAL PURPOSE 5 V 100 MHz 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 our 10 GHz fr 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 : $IM_3 = 50 \text{ dBc TYP. @ single-ended output, } V_{out} = 0.7 V_{p-p}/\text{tone}$
- Wide AGC dynamic range : $GCR = 53 \text{ dB TYP.}$
- On-chip video amplifier : $V_{out} = 1.0 V_{p-p} \text{ TYP. @ single-ended output}$
- Supply voltage : $V_{CC} = 5.0 \text{ V TYP.}$
- Packaged in 8-pin SSOP suitable for surface mounting

APPLICATION

- Digital CATV/Cable modem receivers

ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
μ PC3217GV-E1	8-pin plastic SSOP (4.45 mm (175))	3217	• Embossed tape 8 mm wide • Pin 1 indicates pull-out direction of tape • Qty 1 kpcs/reel
μ PC3218GV-E1		3218	

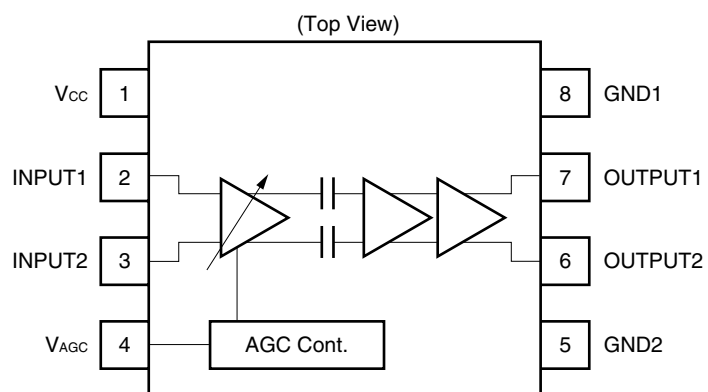
Remark To order evaluation samples, contact your nearby sales office.

Part number for sample order: μ PC3217GV, μ PC3218GV

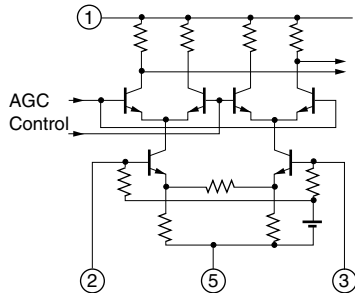
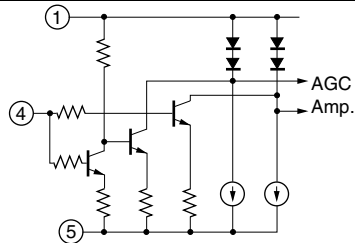
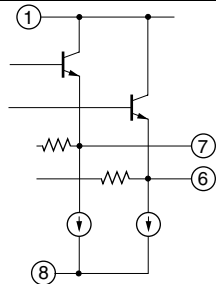
Caution Observe precautions when handling because these devices are sensitive to electrostatic discharge.

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 Compound Semiconductor Devices representative for availability and additional information.

INTERNAL BLOCK DIAGRAM AND PIN CONNECTIONS (μ PC3217GV, μ PC3218GV common)



PIN EXPLANATIONS (μ PC3217GV, μ PC3218GV common)

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	—	1.45	Signal input pins to AGC amplifier. This pin should be coupled with capacitor for DC cut.	
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 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. This pin should be coupled with capacitor for DC cut.	
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} = 5.0 V.

ABSOLUTE MAXIMUM RATINGS (μ PC3217GV, μ PC3218GV common)

Parameter	Symbol	Test 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 double-sided copper-clad 50 × 50 × 1.6 mm epoxy glass PWB

RECOMMENDED OPERATING RANGE (μ PC3217GV, μ PC3218GV common)

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	–	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	$1.3\text{ k} - j1.5\text{ k}$	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}	$f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$, $Z_L = 250\ \Omega$, $P_{in} = -50\text{ to }-20\text{ dBm/ tone}$, $V_{out} = 0.7\text{ V}_{p-p/ tone}$ @ single-ended output Note 2	50	dBc
3rd Order Intermodulation Distortion 2	IM_{32}	$f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$, $Z_L = 500\ \Omega$, $P_{in} = -50\text{ to }-20\text{ dBm/ tone}$, $V_{out} = 1.4\text{ V}_{p-p/ tone}$ @ differential output Note 3	50	dBc
2nd Order Intermodulation Distortion	IM_2	$f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$, $Z_L = 500\ \Omega$, $P_{in} = -50\text{ to }-20\text{ dBm/ tone}$, $V_{out} = 1.4\text{ V}_{p-p/ tone}$ @ differential output Note 3	50	dBc

Notes 1. By measurement circuit 3

2. By measurement circuit 1

3. By measurement circuit 4

– 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	$1.0\text{ k} - j1.1\text{ k}$	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	$f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$, $Z_L = 250\ \Omega$, $P_{in} = -60\text{ to }-30\text{ dBm/ tone}$, $V_{out} = 0.7\text{ V}_{p-p/ tone}$ @ single-ended output Note 2	50	dBc
3rd Order Intermodulation Distortion 2	IM ₃₂	$f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$, $Z_L = 500\ \Omega$, $P_{in} = -60\text{ to }-30\text{ dBm/ tone}$, $V_{out} = 1.4\text{ V}_{p-p/ tone}$ @ differential output Note 3	50	dBc
2nd Order Intermodulation Distortion	IM ₂	$f_1 = 44\text{ MHz}$, $f_2 = 45\text{ MHz}$, $Z_L = 500\ \Omega$, $P_{in} = -50\text{ to }-20\text{ dBm/ tone}$, $V_{out} = 1.4\text{ V}_{p-p/ tone}$ @ differential output Note 3	50	dBc

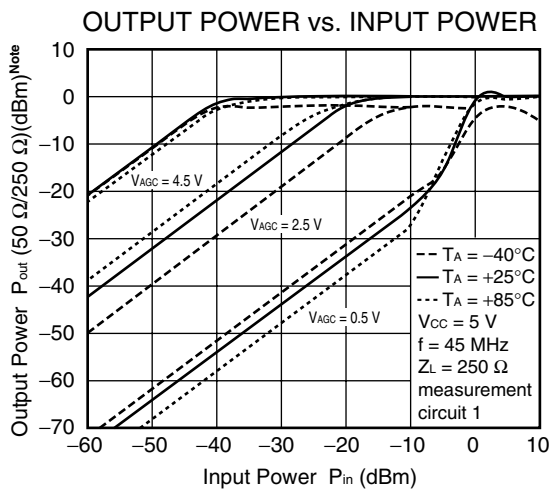
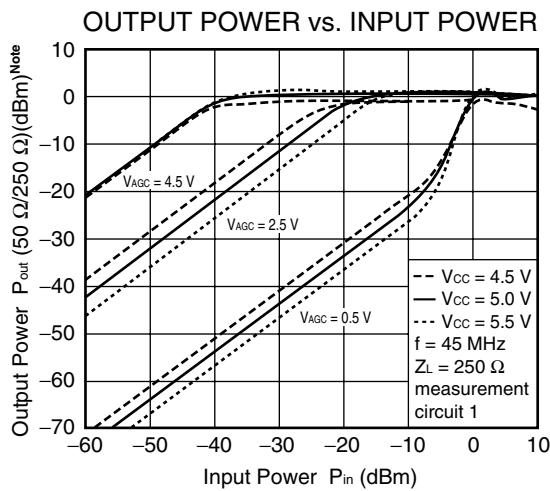
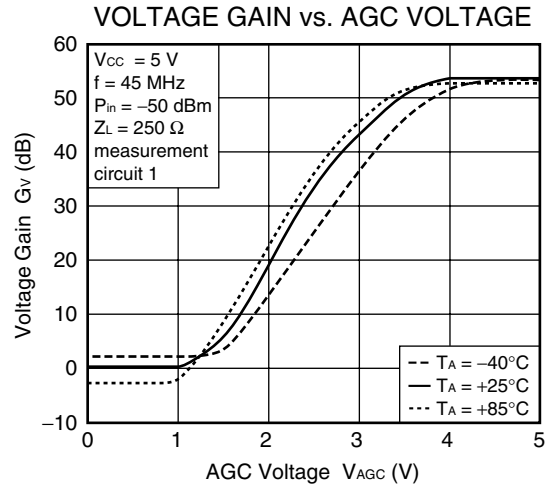
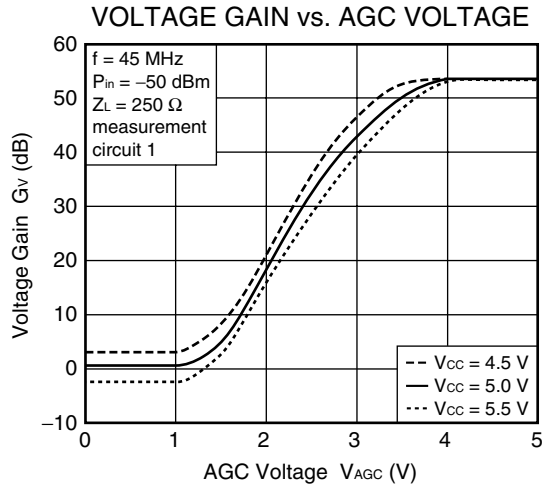
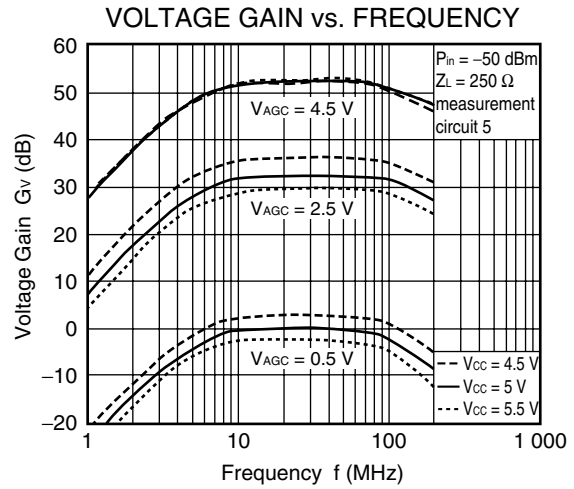
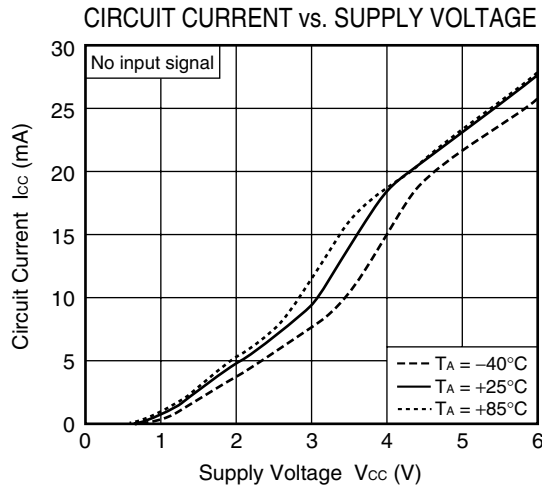
Notes 1. By measurement circuit 3

2. By measurement circuit 1

3. By measurement circuit 4

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

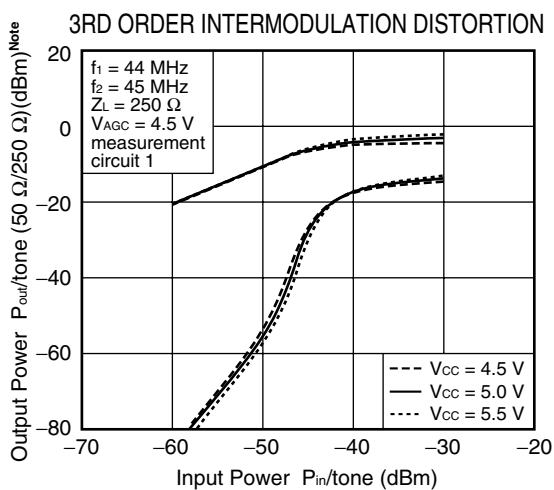
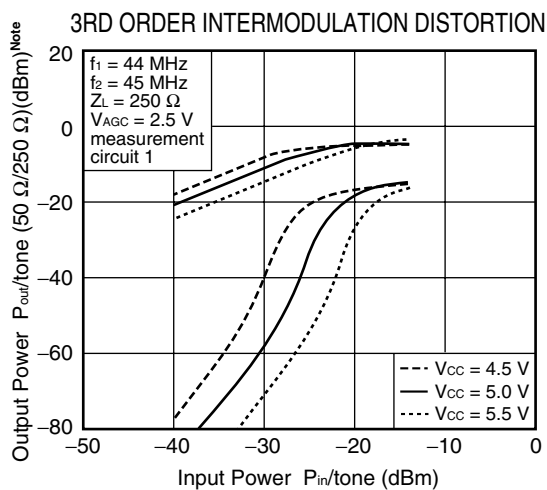
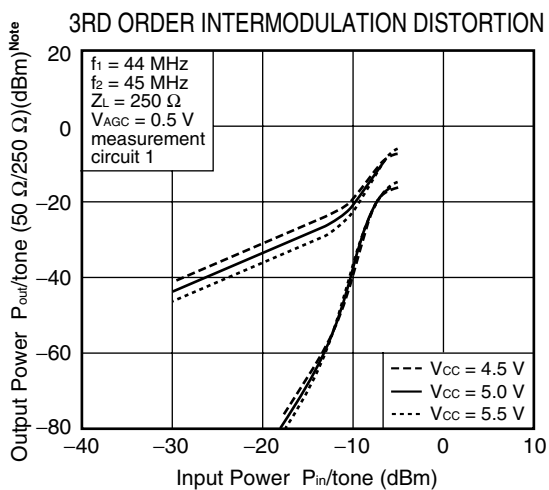
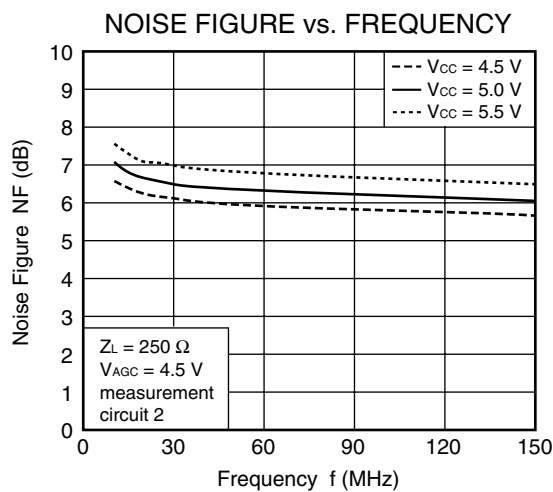
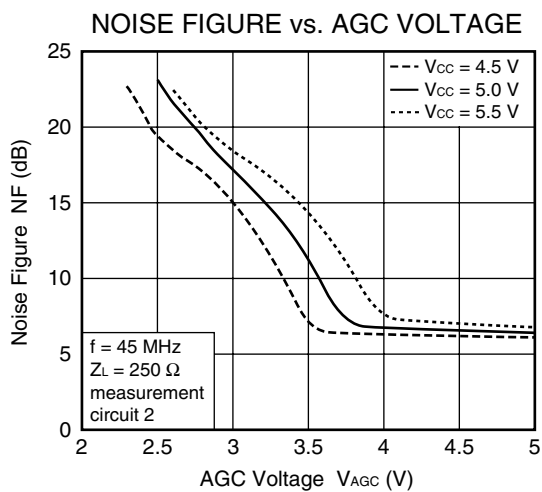
— μ PC3217GV—



Note Measurement value with spectrum analyzer.

Remark The graphs indicate nominal characteristics.

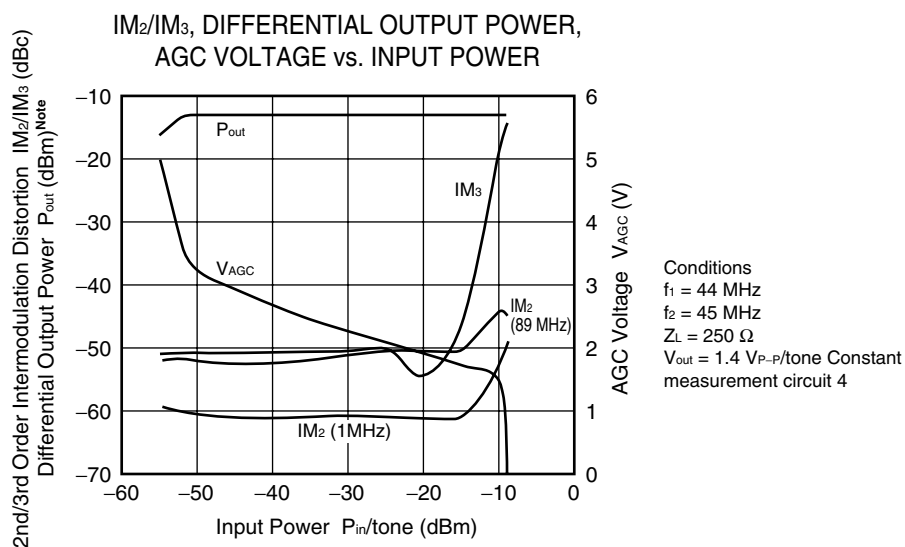
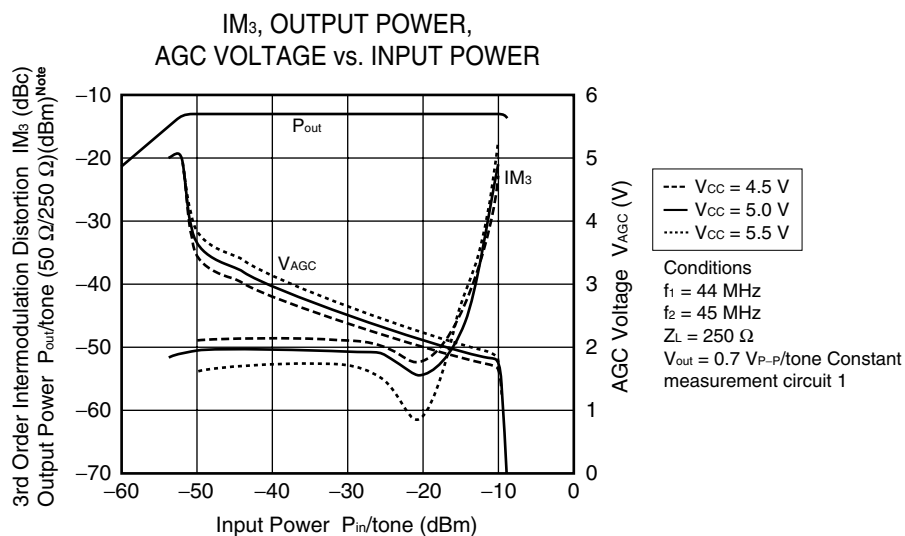
— μ PC3217GV—



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— μ PC3217GV—

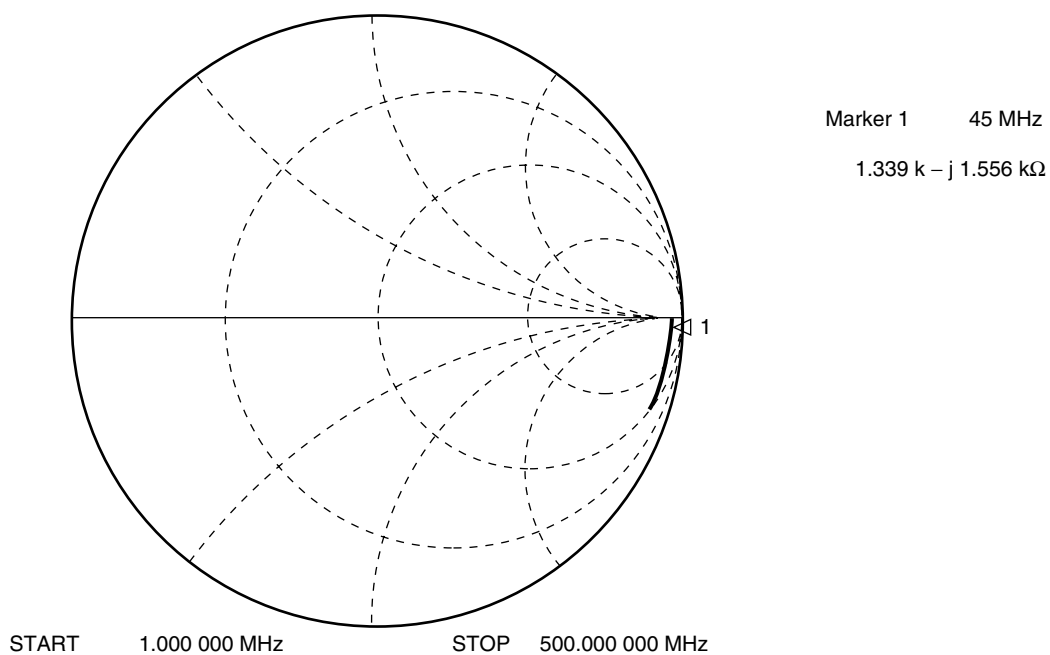


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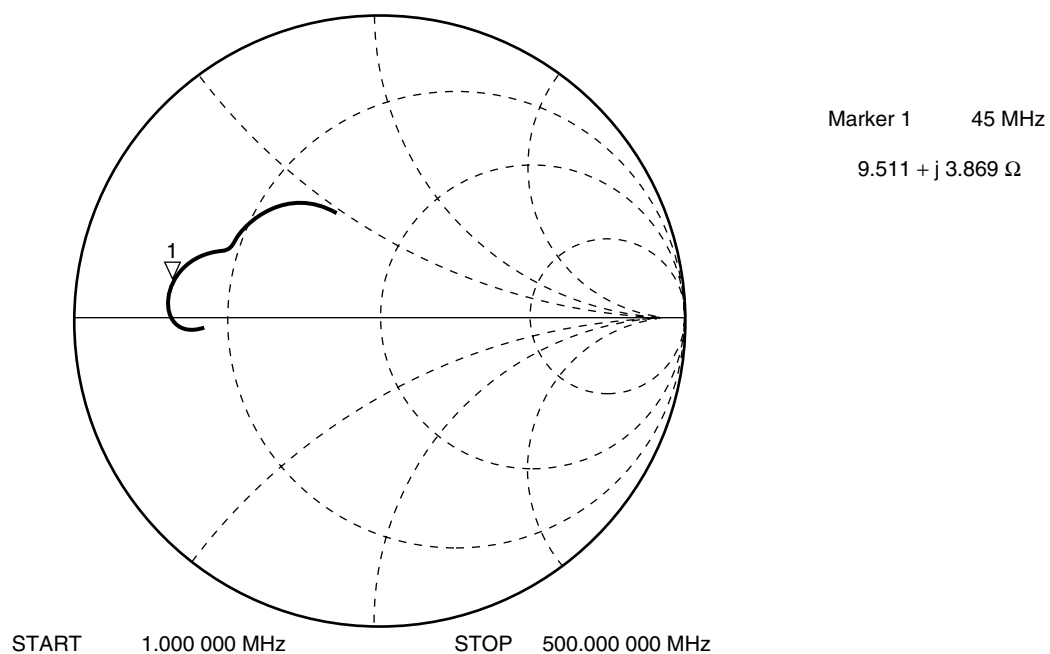
Remark The graphs indicate nominal characteristics.

S-PARAMETERS ($T_A = +25^\circ\text{C}$, $V_{CC} = 5.0\text{ V}$)

S₁₁-FREQUENCY

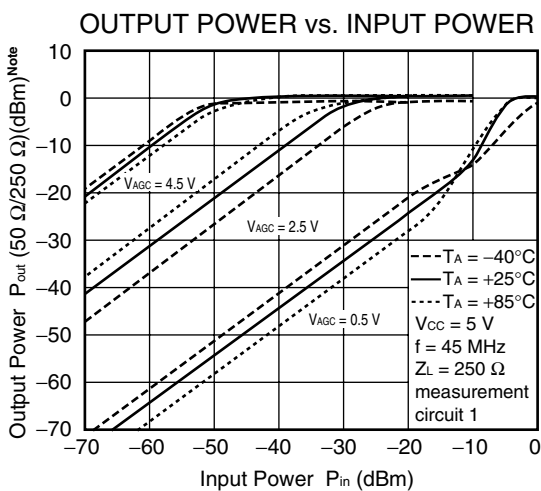
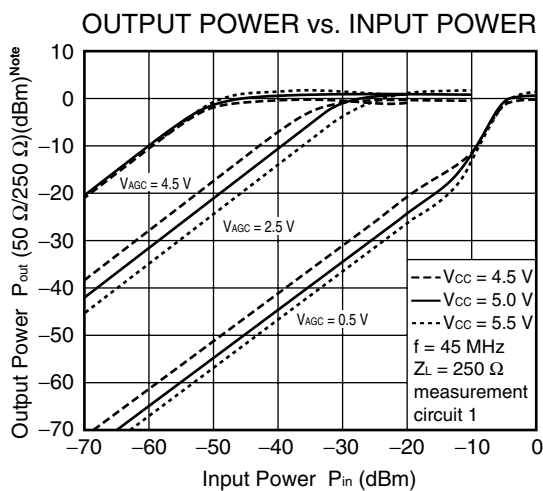
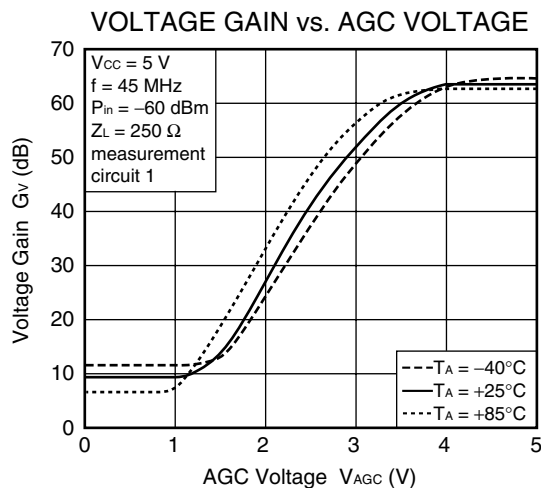
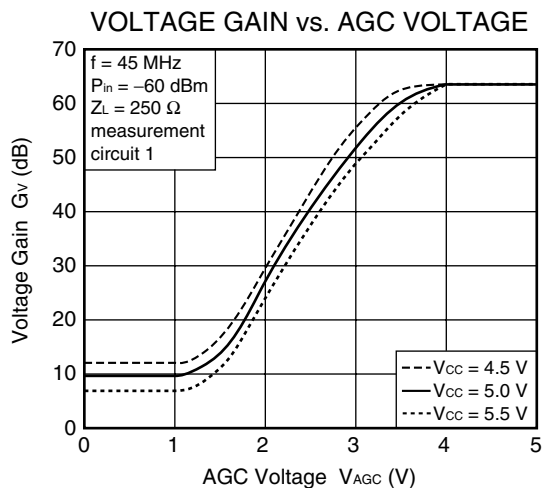
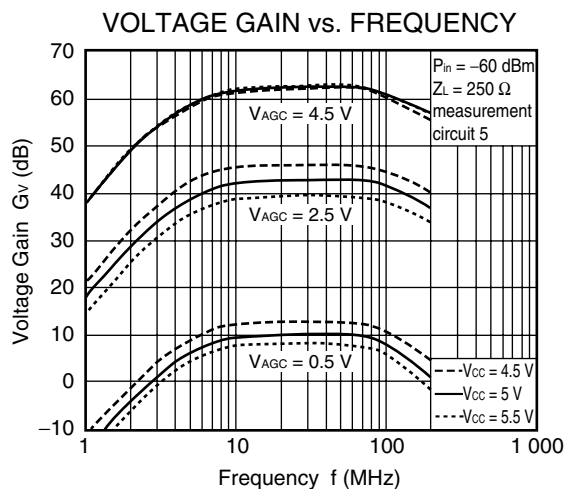
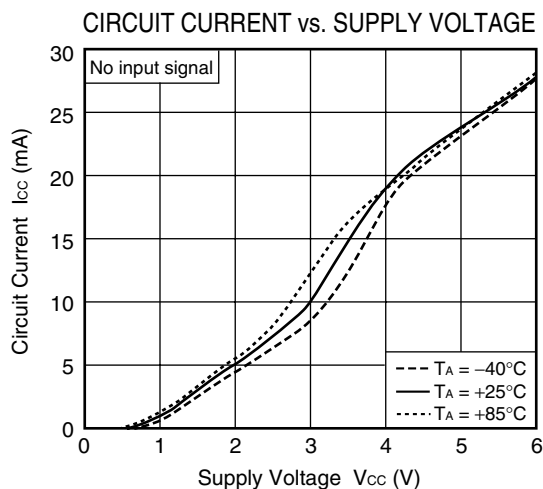


S₂₂-FREQUENCY



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

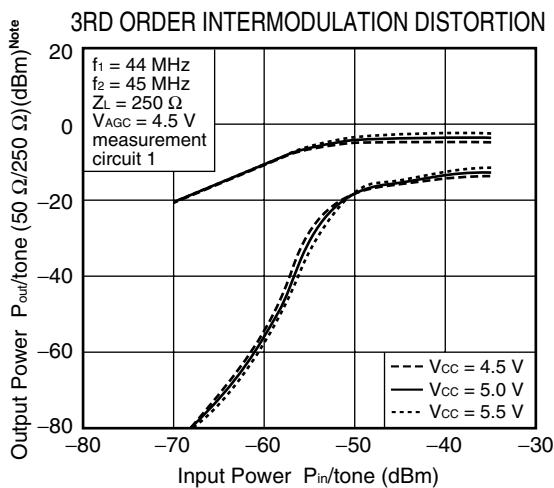
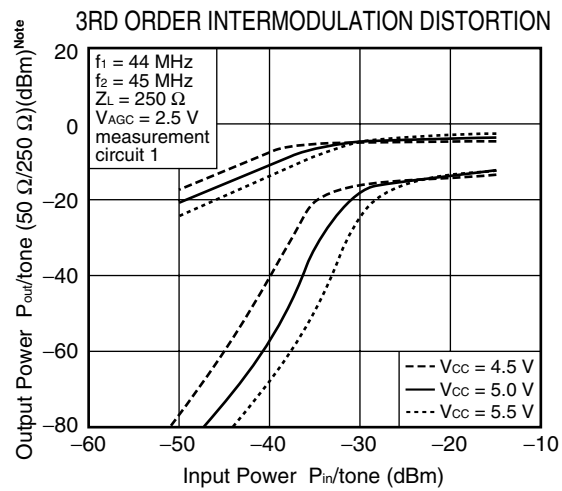
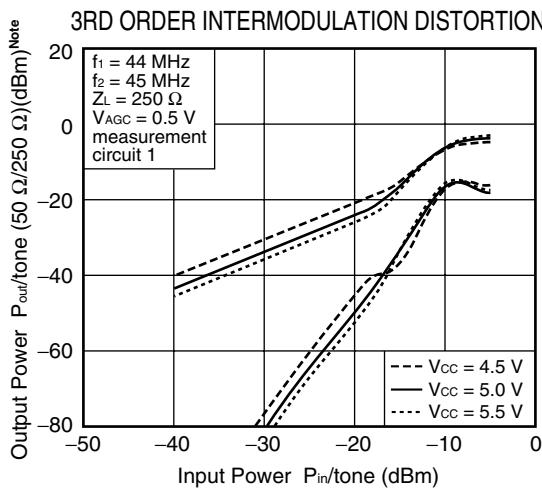
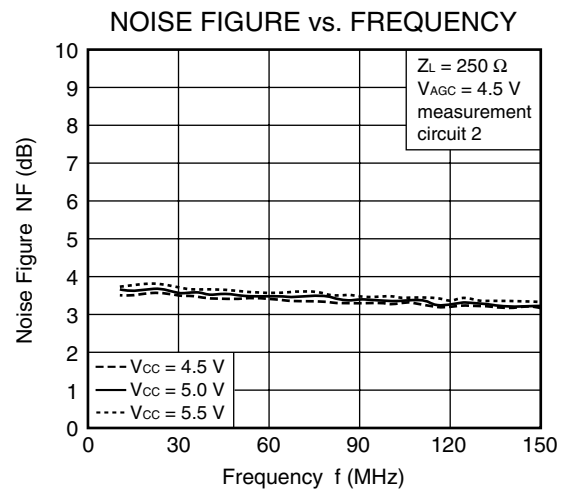
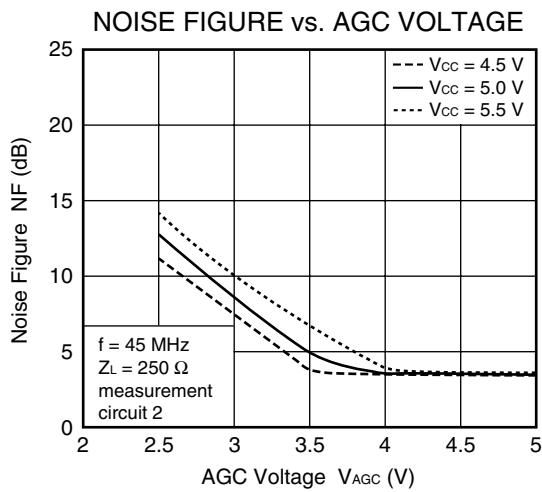
— μ PC3218GV—



Note Measurement value with spectrum analyzer.

Remark The graphs indicate nominal characteristics.

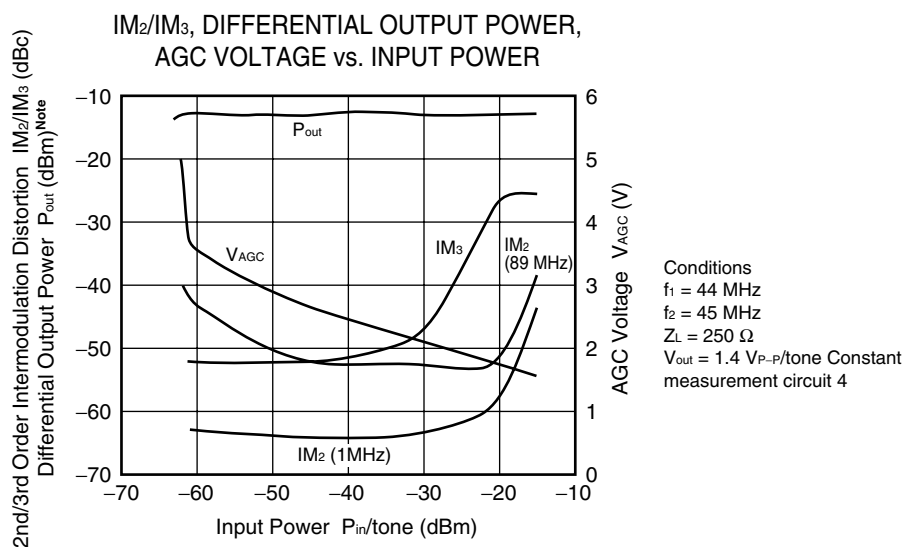
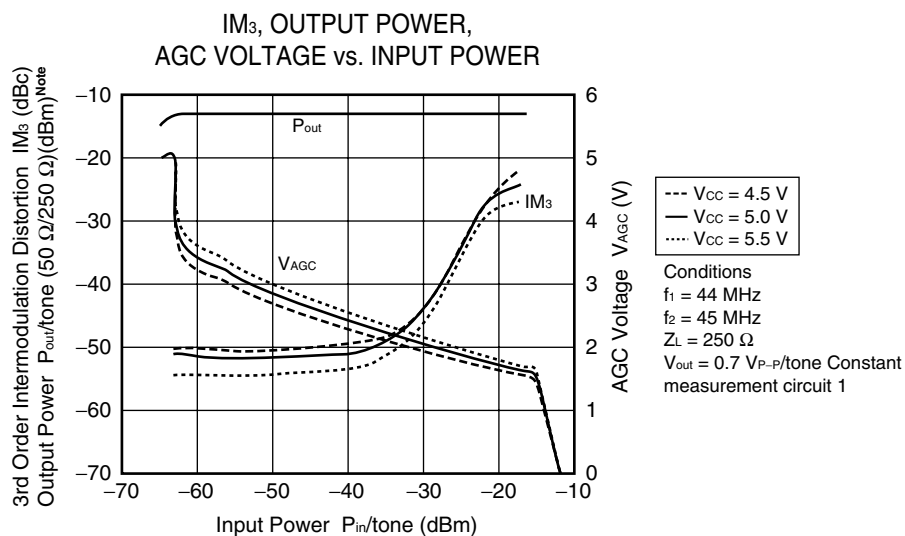
— μ PC3218GV—



Note Measurement value with spectrum analyzer.

Remark The graphs indicate nominal characteristics.

— μ PC3218GV—

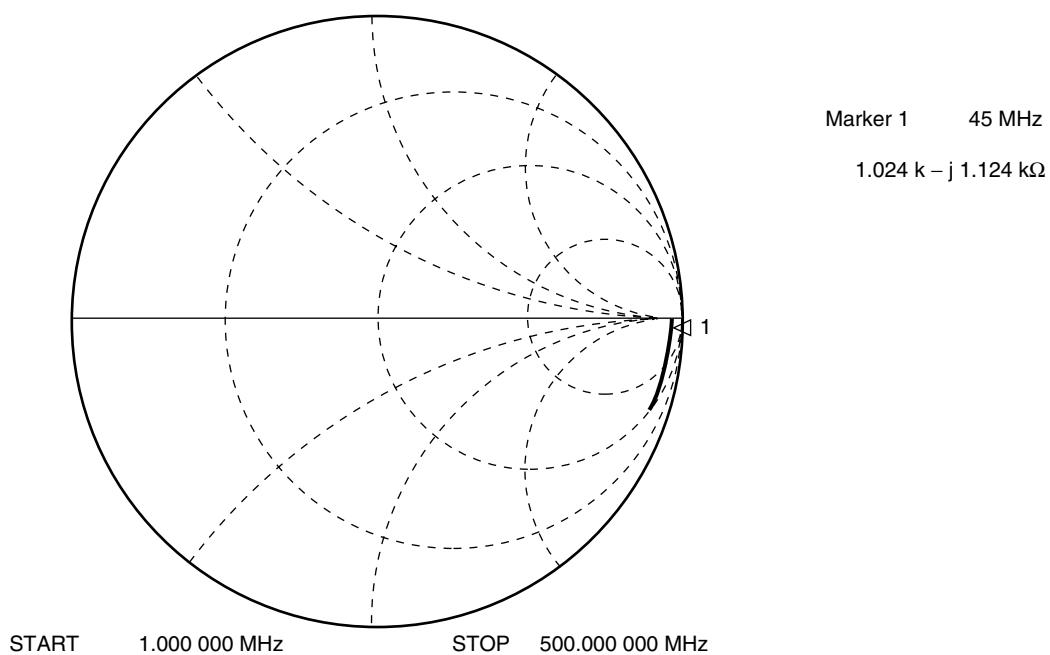


Note Measurement value with spectrum analyzer.

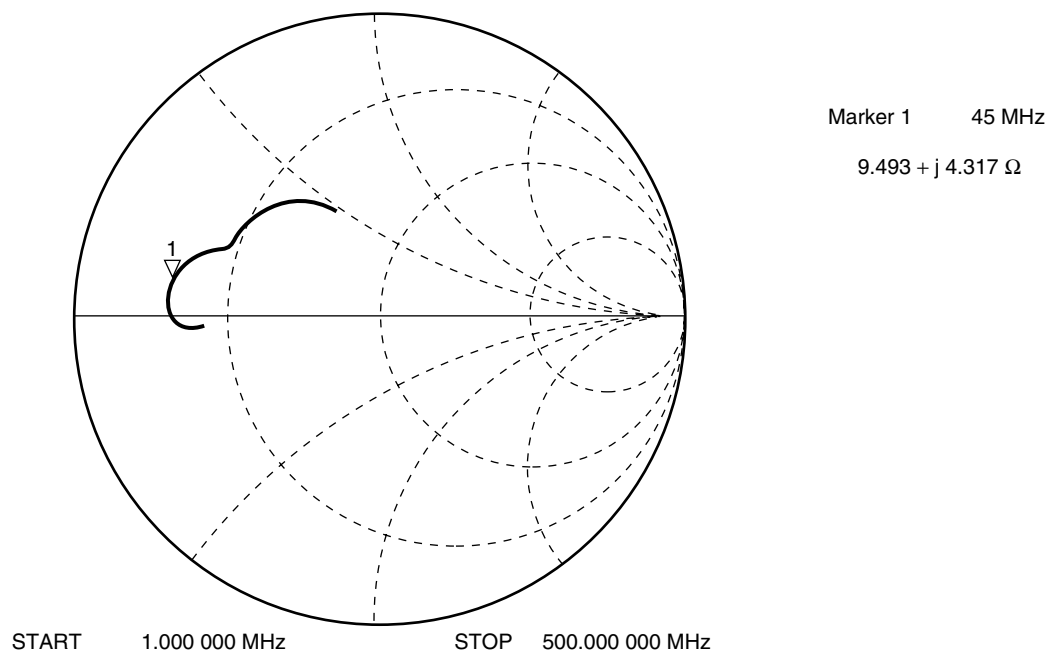
Remark The graphs indicate nominal characteristics.

S-PARAMETERS ($T_A = +25^\circ\text{C}$, $V_{CC} = 5.0\text{ V}$)

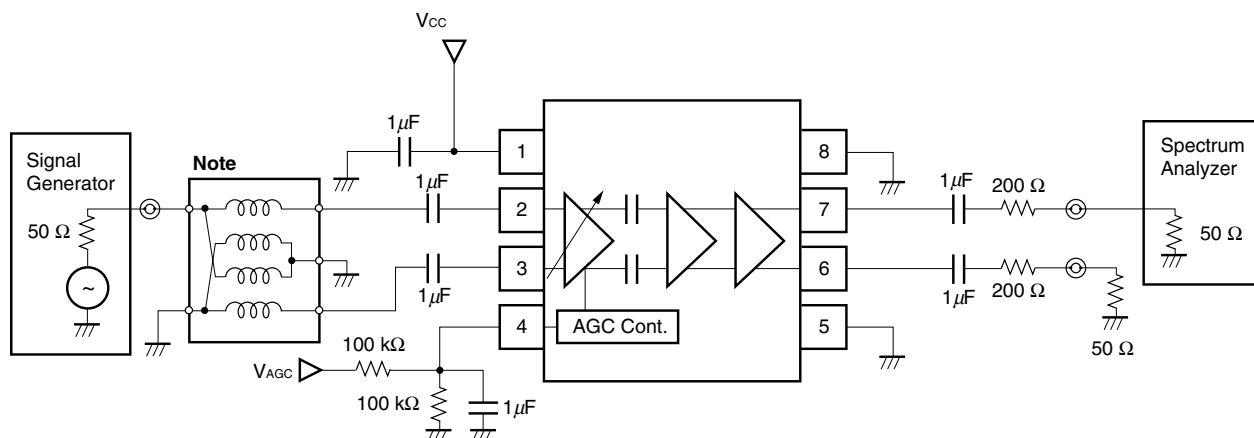
S₁₁-FREQUENCY



S₂₂-FREQUENCY

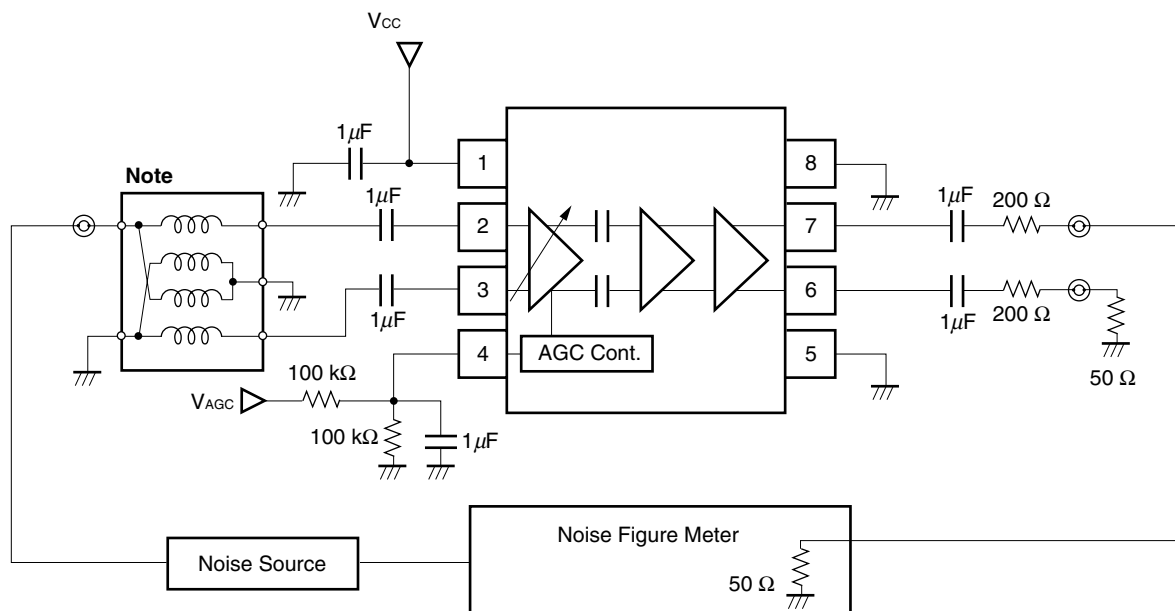


MEASUREMENT CIRCUIT 1



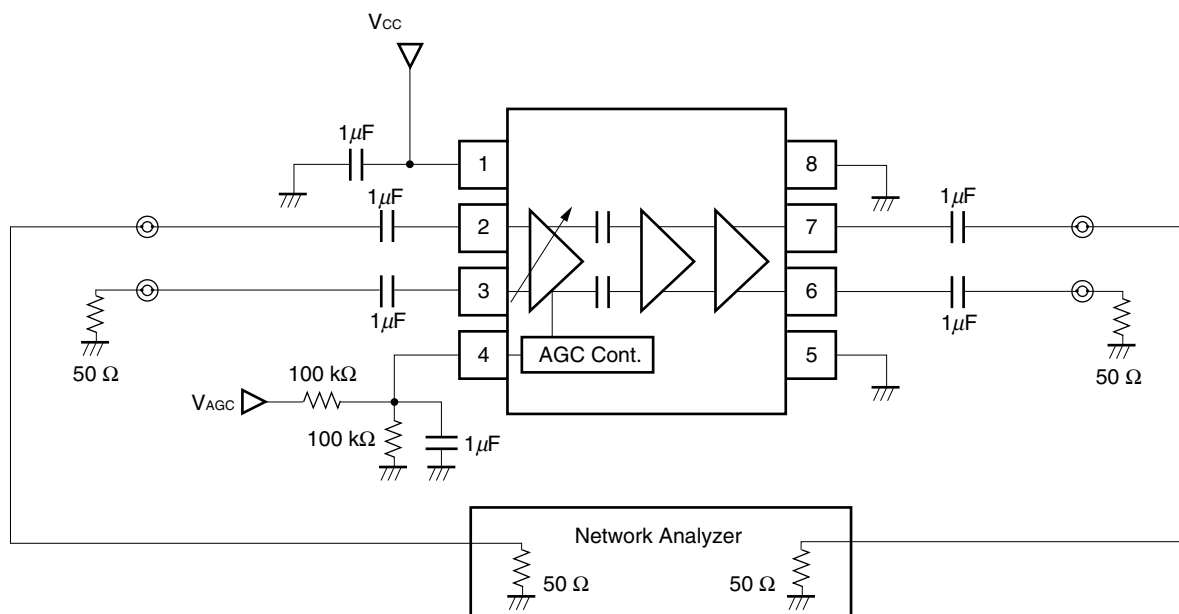
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 2

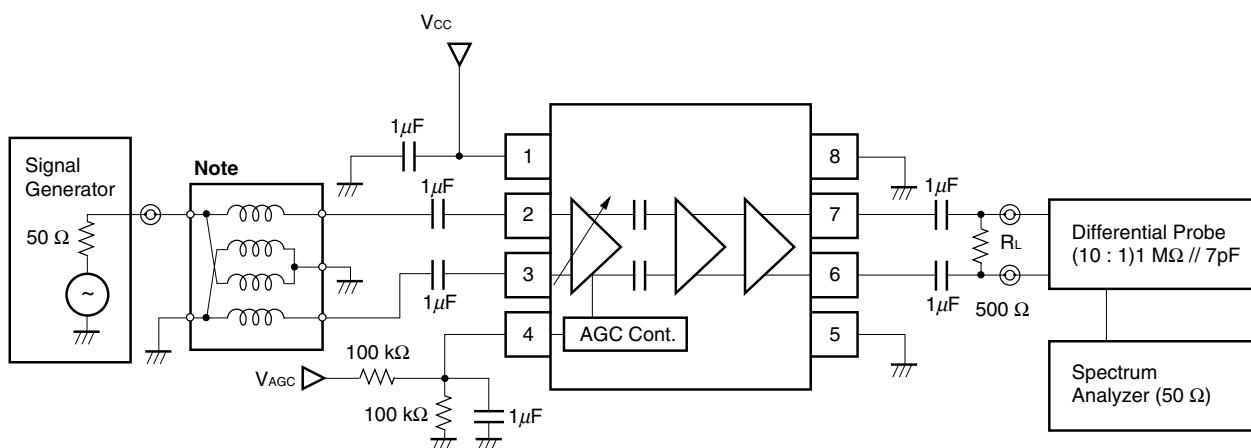


Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 3

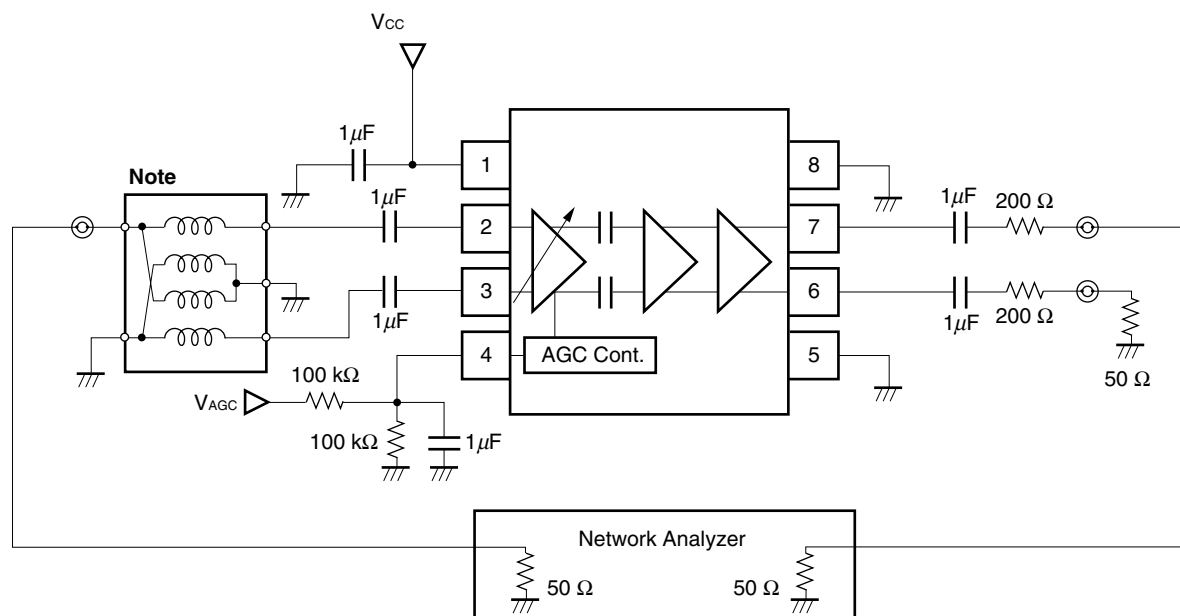


MEASUREMENT CIRCUIT 4



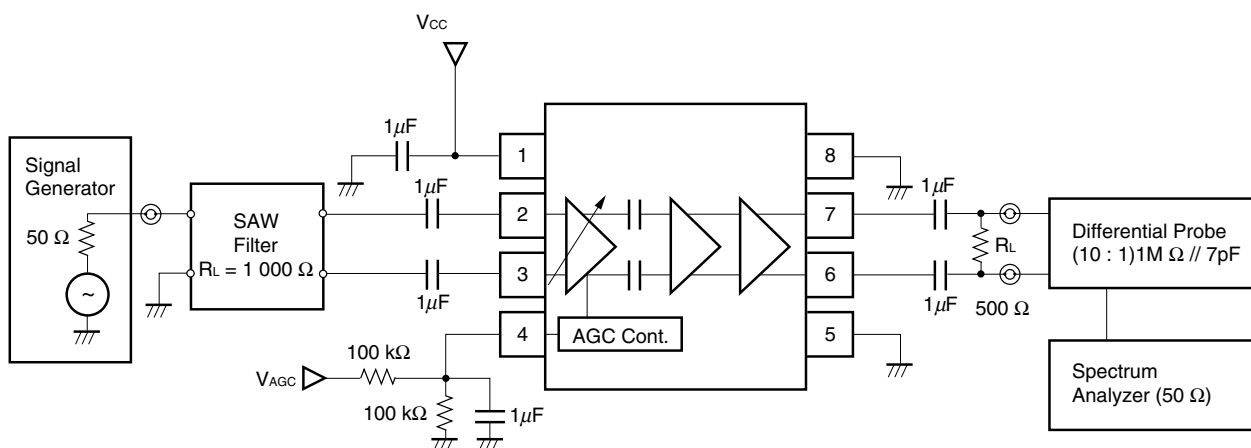
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 5



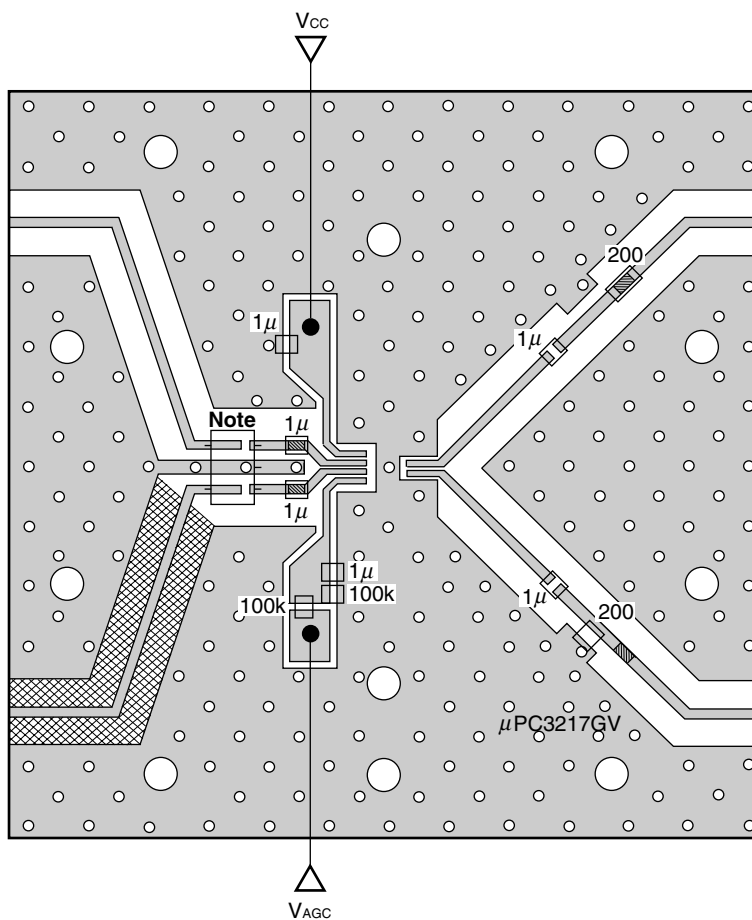
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

APPLICATION CIRCUIT EXAMPLE



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

ILLUSTRATION OF THE EVALUATION BOARD FOR MEASUREMENT CIRCUIT 1

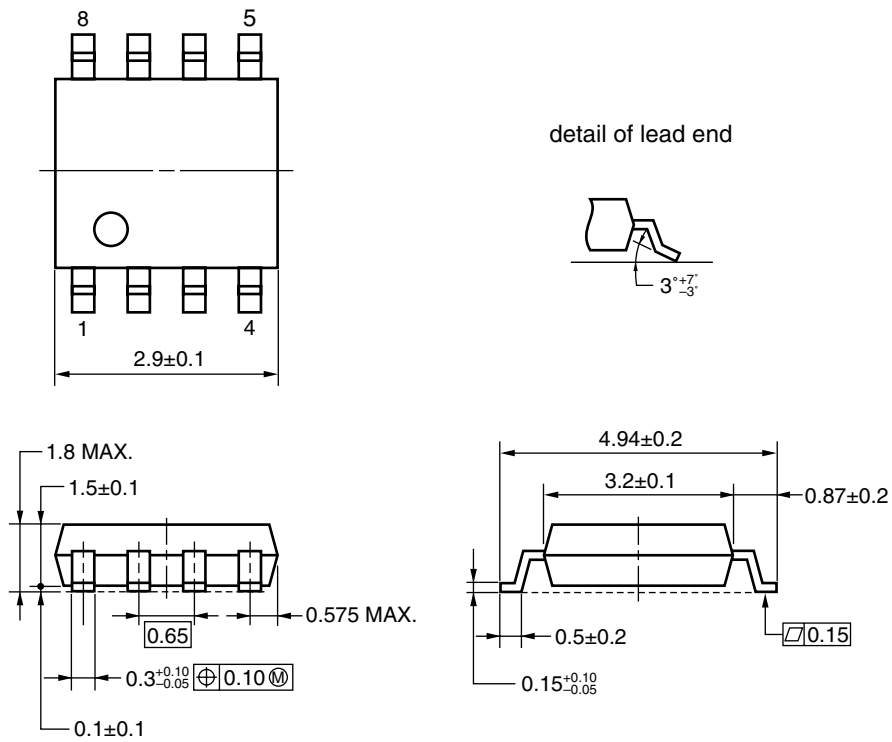


Note Balun Transformer

- Remarks**
1. Back side: GND pattern
 2. Solder plated on pattern
 3. ○: Through holes
 4.  represents cutout
 5.  represents short-circuit strip

★ PACKAGE DIMENSIONS

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



NOTES 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).
All the ground pins must be connected together with wide ground pattern to decrease impedance difference.
- (3) The bypass capacitor should be attached to Vcc line.

★ 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
VPS Note	Peak temperature (package surface temperature) : 215°C or below Time at temperature of 200°C or higher : 25 to 40 seconds Preheating time at 120 to 150°C : 30 to 60 seconds Maximum number of reflow processes : 3 times Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	VP215
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 (pin 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

Note Excluding lead-free products

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

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► For further information, please contact

NEC Compound Semiconductor Devices, Ltd. <http://www.ncsd.necel.com/>

E-mail: salesinfo@ml.ncsd.necel.com (sales and general)

techinfo@ml.ncsd.necel.com (technical)

Sales Division TEL: +81-44-435-1588 FAX: +81-44-435-1579

NEC Compound Semiconductor Devices Hong Kong Limited

E-mail: ncsd-hk@elhk.nec.com.hk (sales, technical and general)

Hong Kong Head Office TEL: +852-3107-7303 FAX: +852-3107-7309

Taipei Branch Office TEL: +886-2-8712-0478 FAX: +886-2-2545-3859

Korea Branch Office TEL: +82-2-558-2120 FAX: +82-2-558-5209

NEC Electronics (Europe) GmbH <http://www.ee.nec.de/>

TEL: +49-211-6503-0 FAX: +49-211-6503-1327

California Eastern Laboratories, Inc. <http://www.cel.com/>

TEL: +1-408-988-3500 FAX: +1-408-988-0279