To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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DATA SHEET

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3217GV, μPC3218GV

GENERAL PURPOSE 5 V 100 MHz 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 our 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 : V_{CC} = 5.0 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
μPC3217GV-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
μPC3218GV-E1		3218	

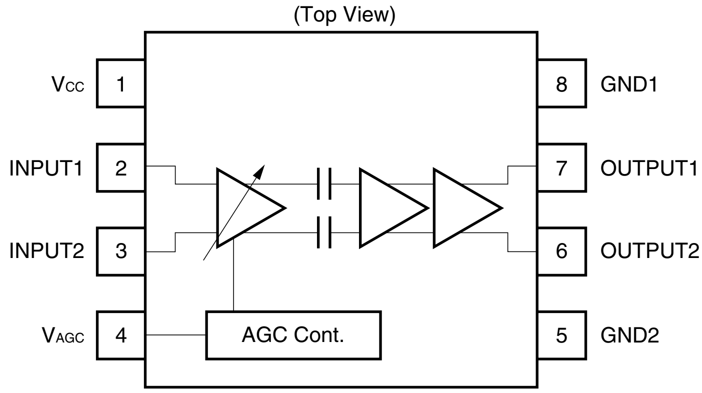
Remark To order evaluation samples, contact your nearby sales office.
Part number for sample order: μPC3217GV, μPC3218GV

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

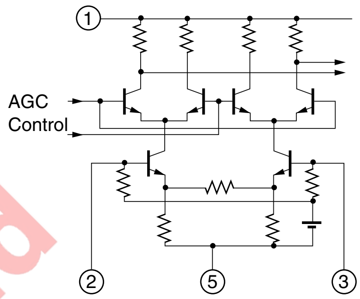
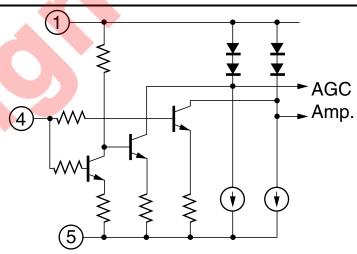
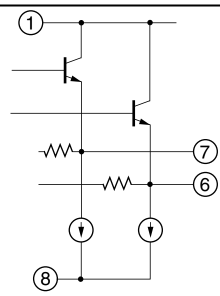
Document No. PU10524EJ01V0DS (1st edition)
(Previous No. P15200EJ1V0DS00)
Date Published August 2004 CP(K)
Printed in Japan

The mark ★ shows major revised points.

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



PIN EXPLANATIONS (μPC3217GV, μPC3218GV 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 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. 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 (μPC3217GV, μPC3218GV 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 (μPC3217GV, μPC3218GV 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

–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**	1.3 k – j1.5 k	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_31	f_1 = 44 MHz, f_2 = 45 MHz, Z_L = 250 Ω, P_{in} = –50 to –20 dBm/tone, V_{out} = 0.7 V_{P-P}/tone @single-ended output **Note 2**	50	dBc
3rd Order Intermodulation Distortion 2	IM_32	f_1 = 44 MHz, f_2 = 45 MHz, Z_L = 500 Ω, P_{in} = –50 to –20 dBm/tone, 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, Z_L = 500 Ω, P_{in} = –50 to –20 dBm/tone, 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

–μPC3218GV–

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**	1.0 k – j1.1 k	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, Z_L = 250 Ω, P_{in} = –60 to –30 dBm/tone, 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, Z_L = 500 Ω, P_{in} = –60 to –30 dBm/tone, 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, Z_L = 500 Ω, P_{in} = –50 to –20 dBm/tone, V_{out} = 1.4 V_{P-P}/tone @differential output **Note 3**	50	dBc

Notes 1. By measurement circuit 3

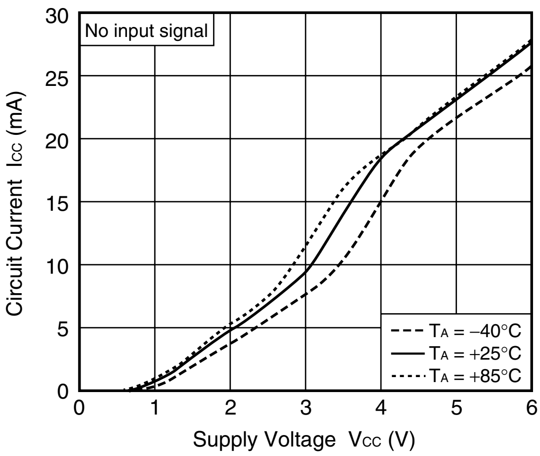
2. By measurement circuit 1

3. By measurement circuit 4

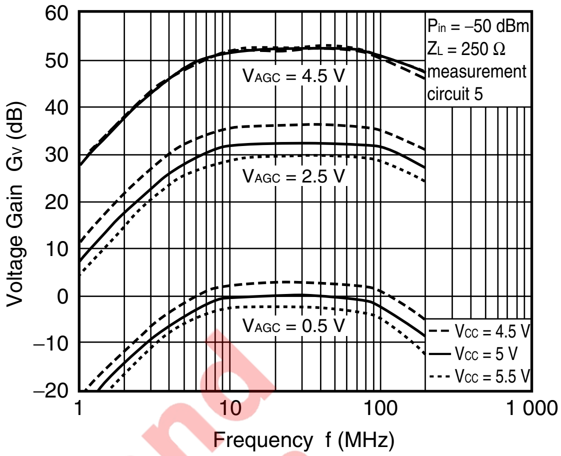
TYPICAL CHARACTERISTICS (T_A = +25°C , unless otherwise specified)

–μPC3217GV–

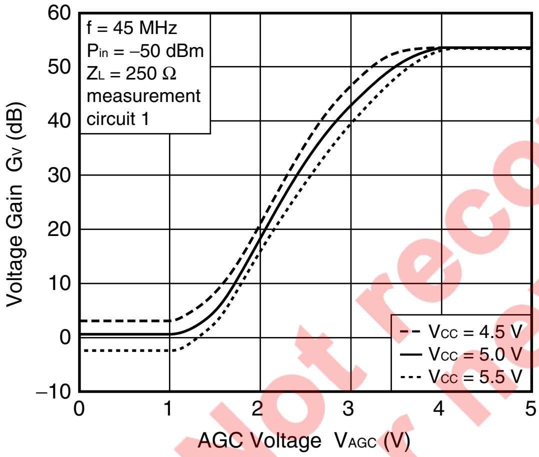
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



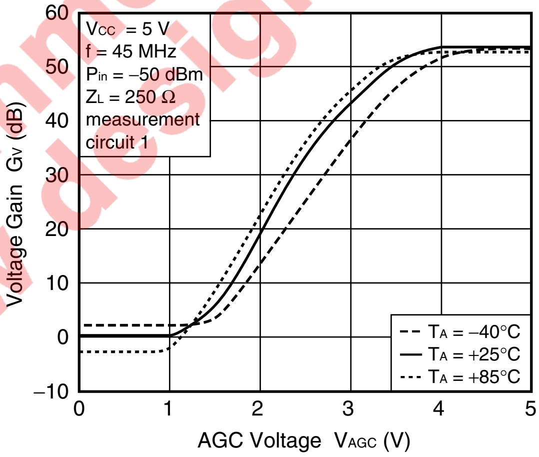
VOLTAGE GAIN vs. FREQUENCY



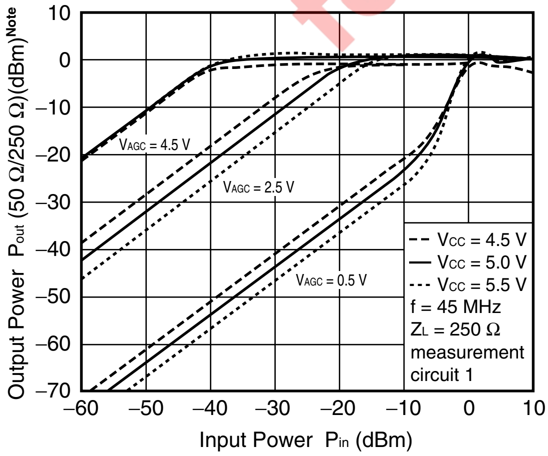
VOLTAGE GAIN vs. AGC VOLTAGE



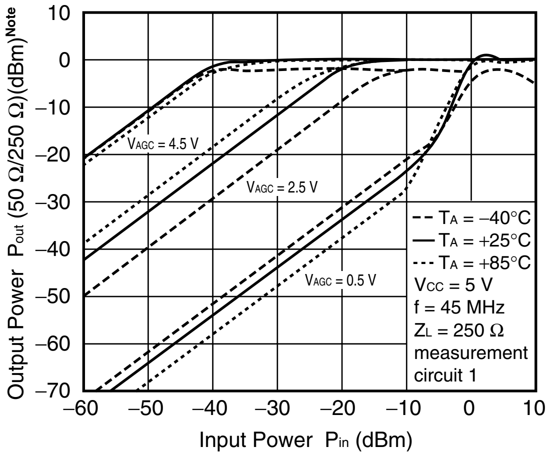
VOLTAGE GAIN vs. AGC VOLTAGE



OUTPUT POWER vs. INPUT POWER



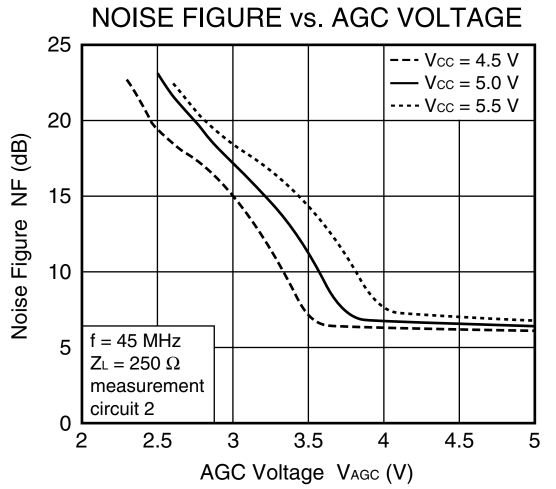
OUTPUT POWER vs. INPUT POWER

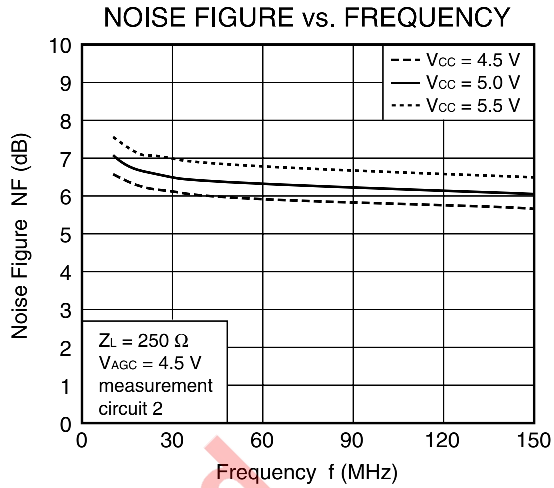


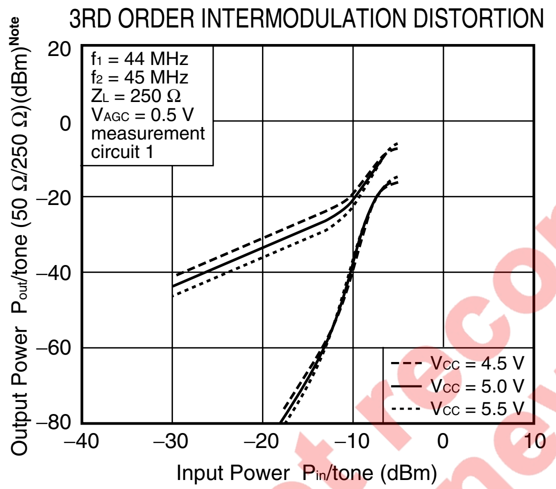
Note Measurement value with spectrum analyzer.

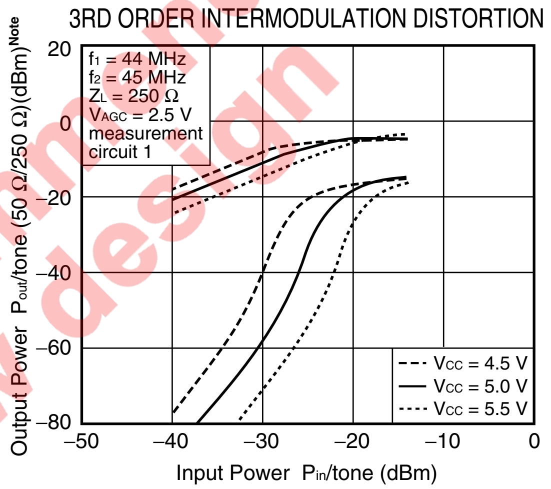
Remark The graphs indicate nominal characteristics.

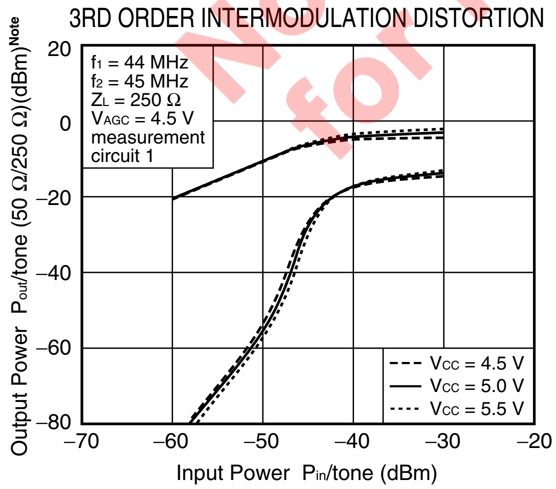
–μPC3217GV–









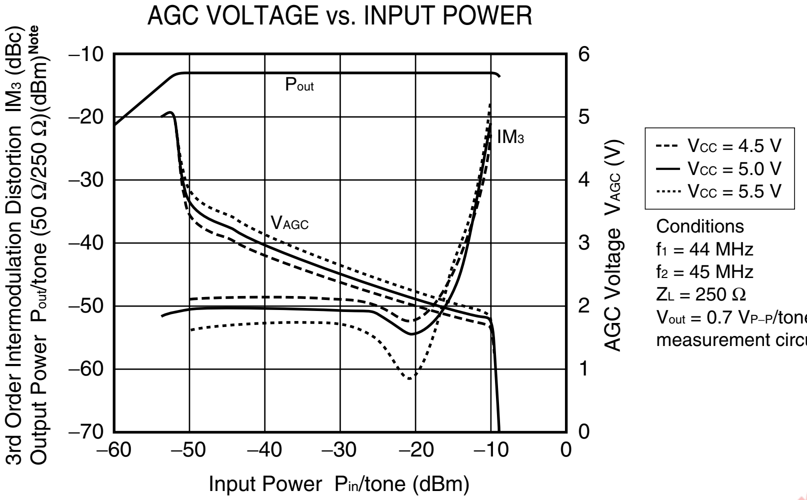


Note Measurement value with spectrum analyzer.

Remark The graphs indicate nominal characteristics.

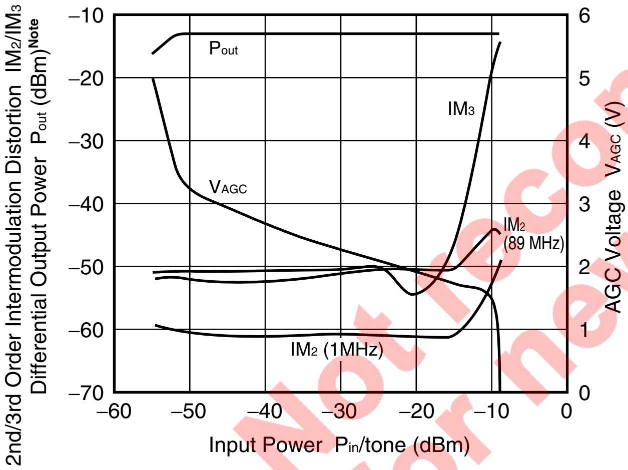
–μPC3217GV–

IM3, OUTPUT POWER,
AGC VOLTAGE vs. INPUT POWER



Conditions
f_1 = 44 MHz
f_2 = 45 MHz
Z_L = 250 Ω
V_{out} = 0.7 V_{P-P}/tone Constant
measurement circuit 1

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



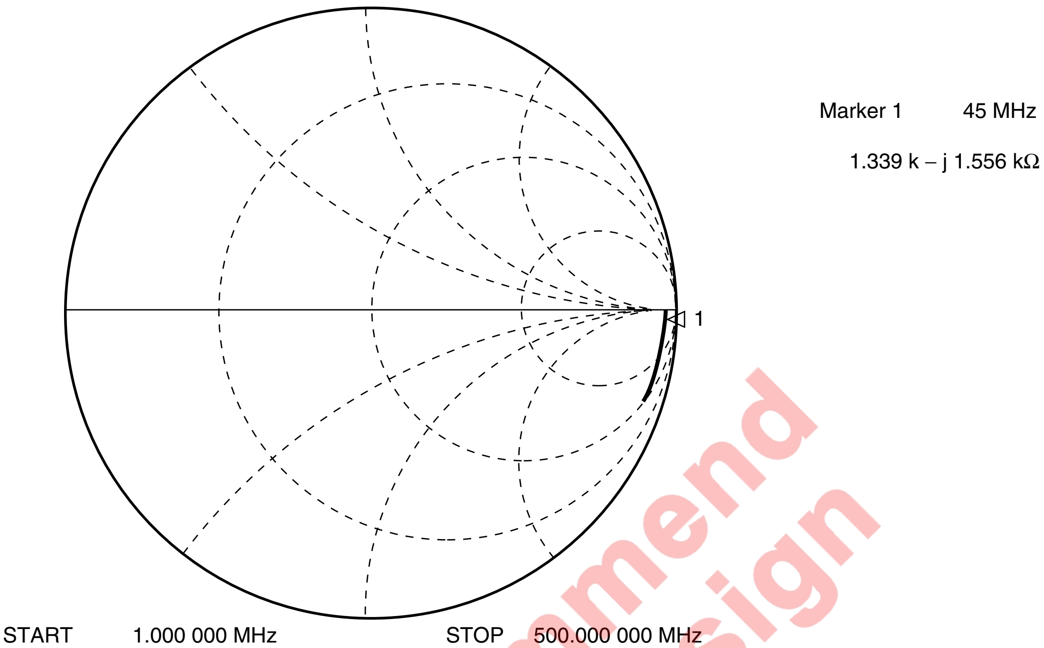
Conditions
f_1 = 44 MHz
f_2 = 45 MHz
Z_L = 250 Ω
V_{out} = 1.4 V_{P-P}/tone Constant
measurement circuit 4

Note Measurement value with spectrum analyzer.

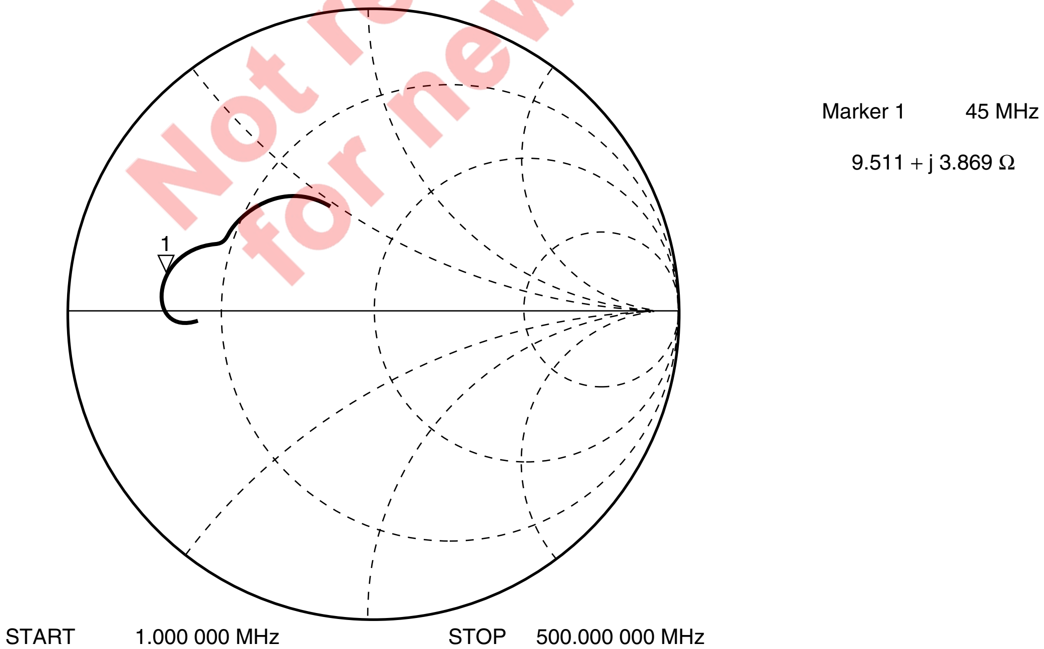
Remark The graphs indicate nominal characteristics.

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

S_{11}–FREQUENCY



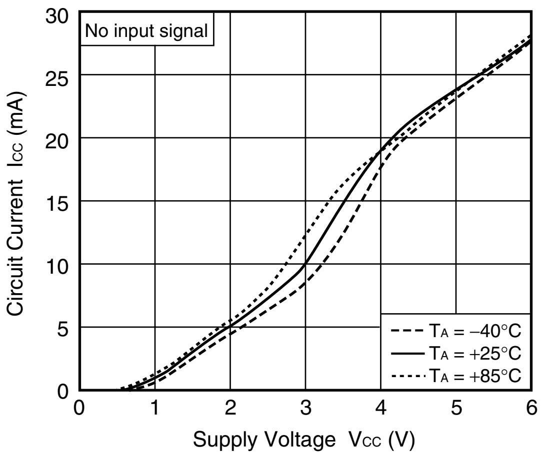
S_{22}–FREQUENCY



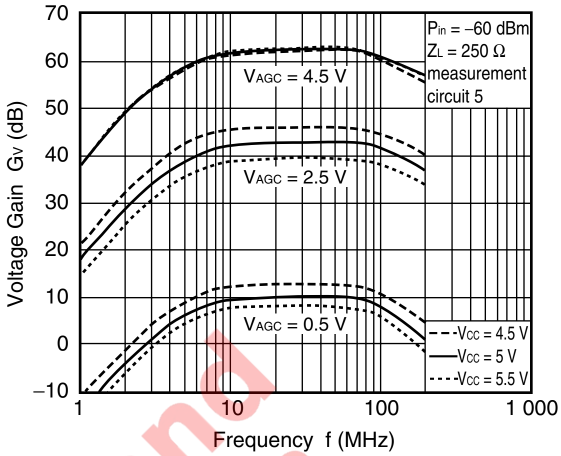
TYPICAL CHARACTERISTICS (T_A = +25°C , unless otherwise specified)

–μPC3218GV–

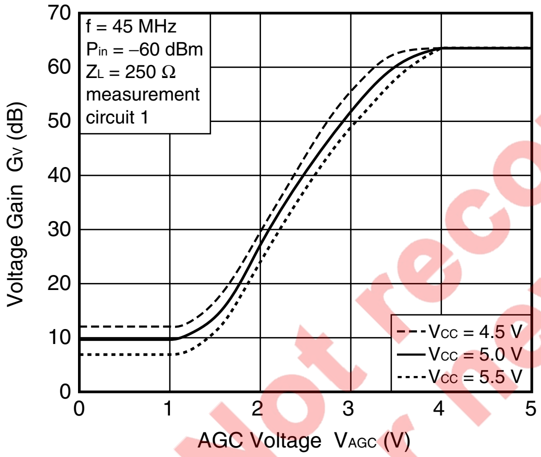
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



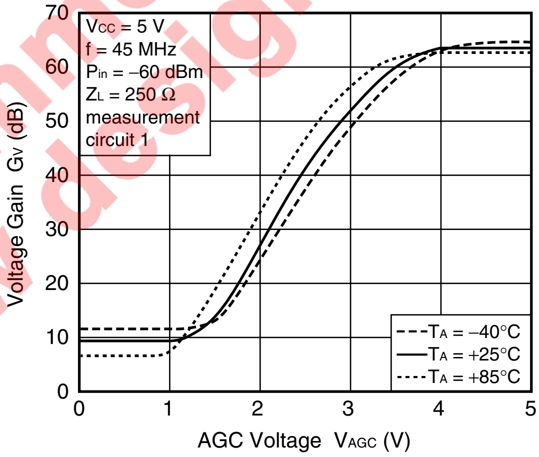
VOLTAGE GAIN vs. FREQUENCY



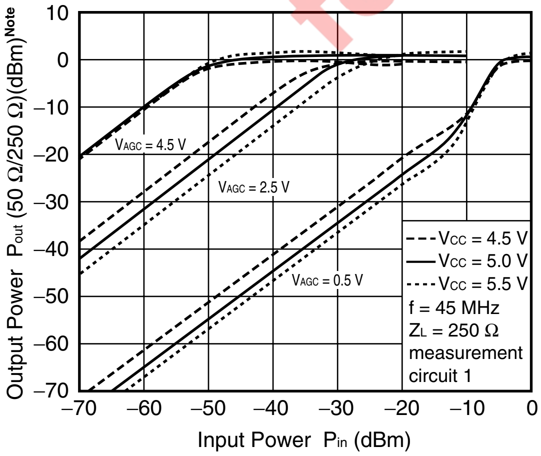
VOLTAGE GAIN vs. AGC VOLTAGE



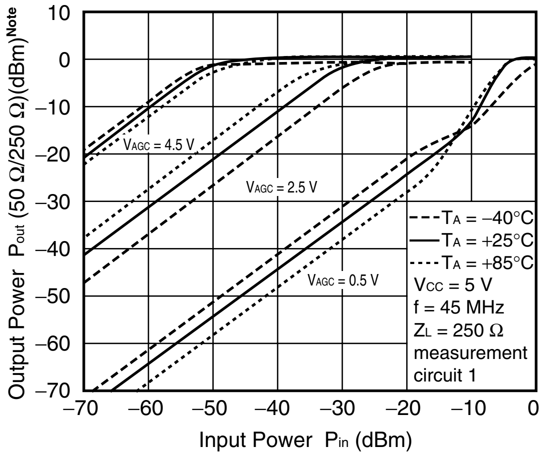
VOLTAGE GAIN vs. AGC VOLTAGE



OUTPUT POWER vs. INPUT POWER



OUTPUT POWER vs. INPUT POWER

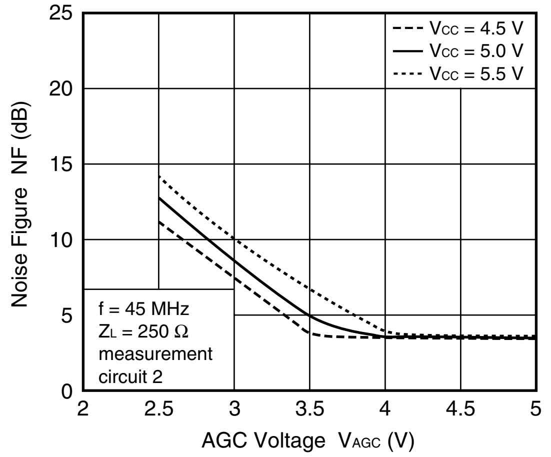


Note Measurement value with spectrum analyzer.

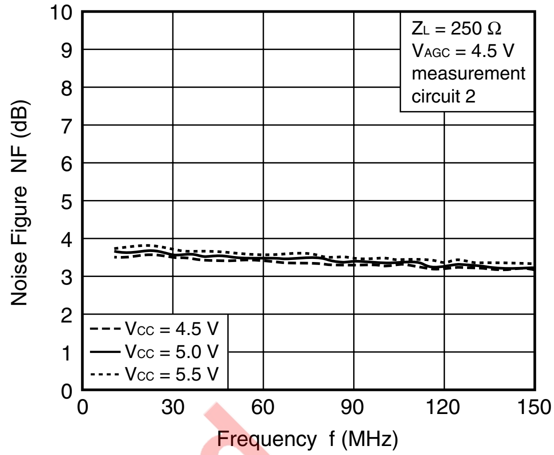
Remark The graphs indicate nominal characteristics.

–μPC3218GV–

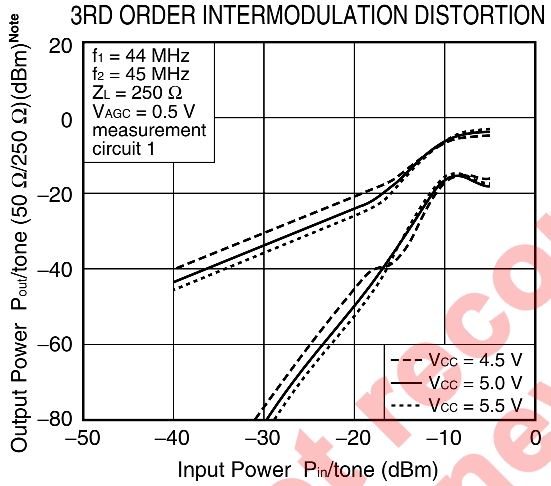
NOISE FIGURE vs. AGC VOLTAGE



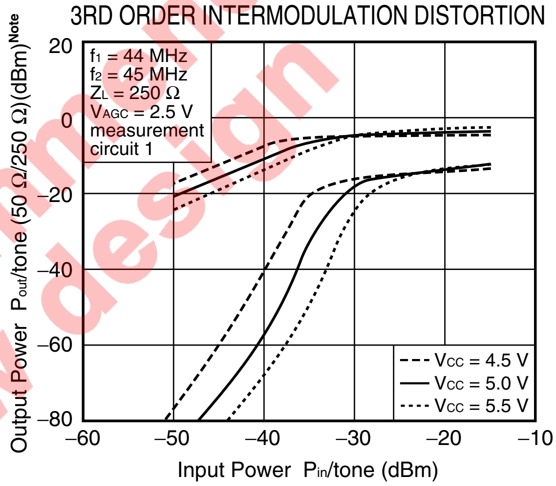
NOISE FIGURE vs. FREQUENCY



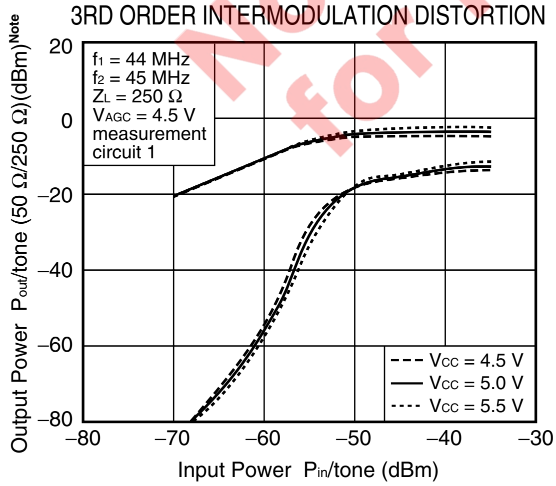
3RD ORDER INTERMODULATION DISTORTION



3RD ORDER INTERMODULATION DISTORTION



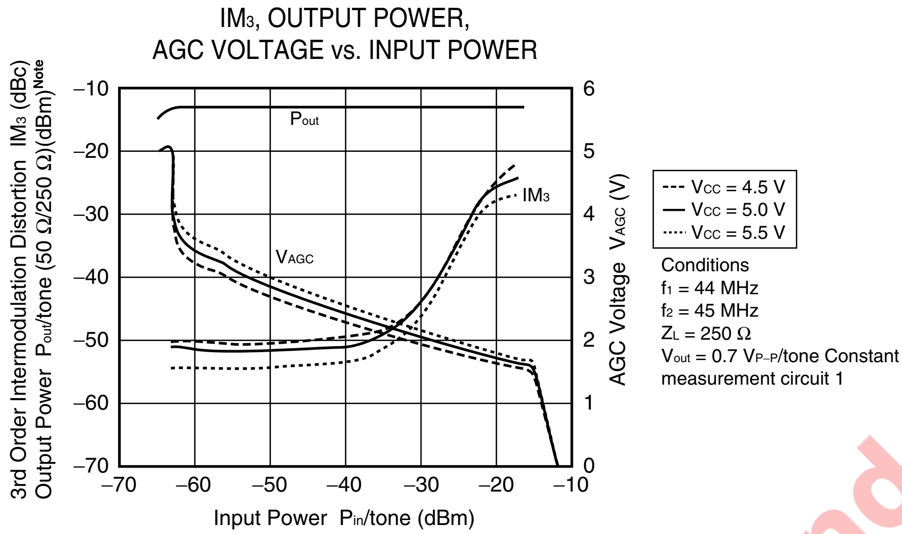
3RD ORDER INTERMODULATION DISTORTION

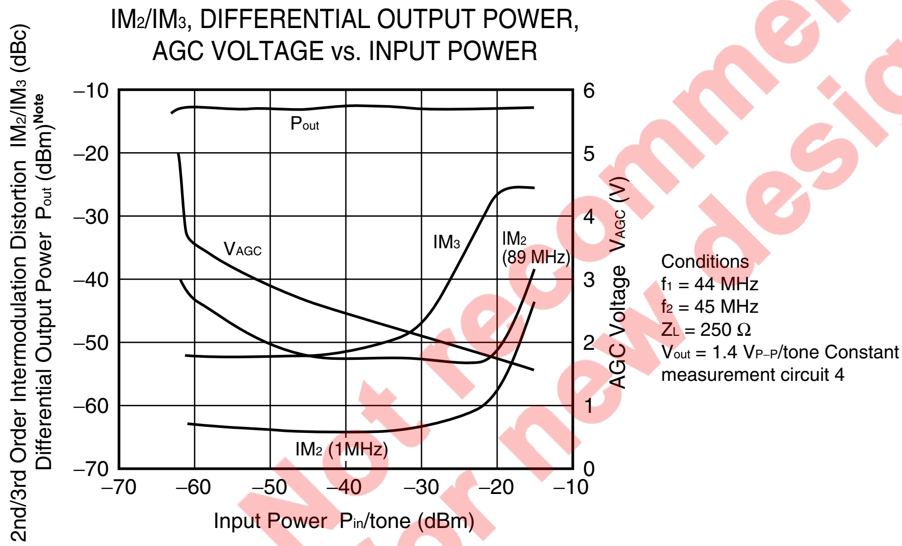


Note Measurement value with spectrum analyzer.

Remark The graphs indicate nominal characteristics.

–μPC3218GV–



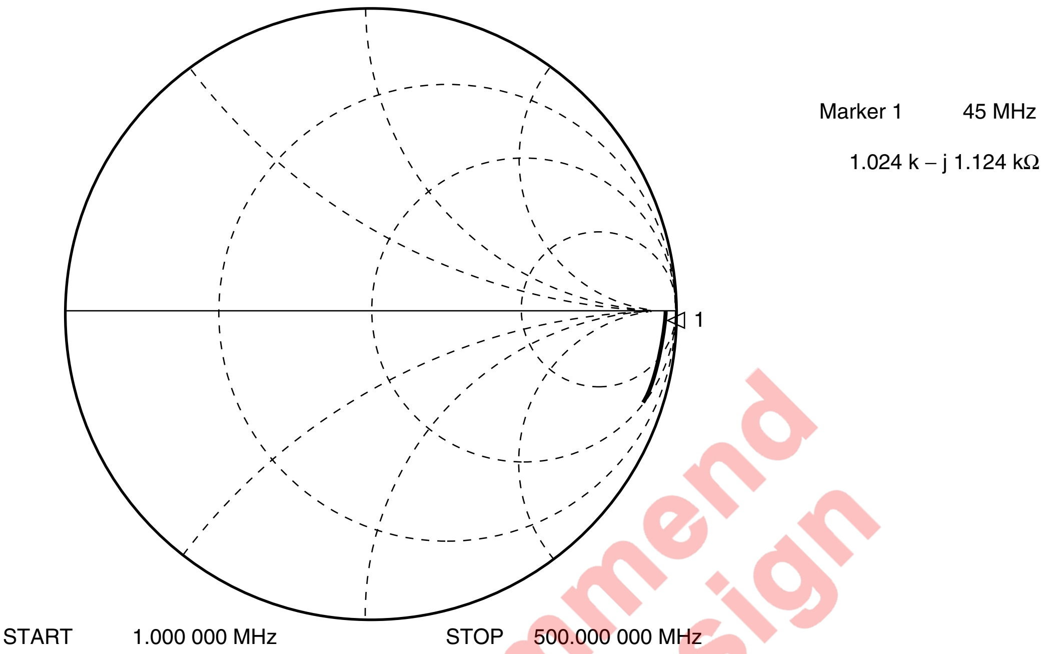


Note Measurement value with spectrum analyzer.

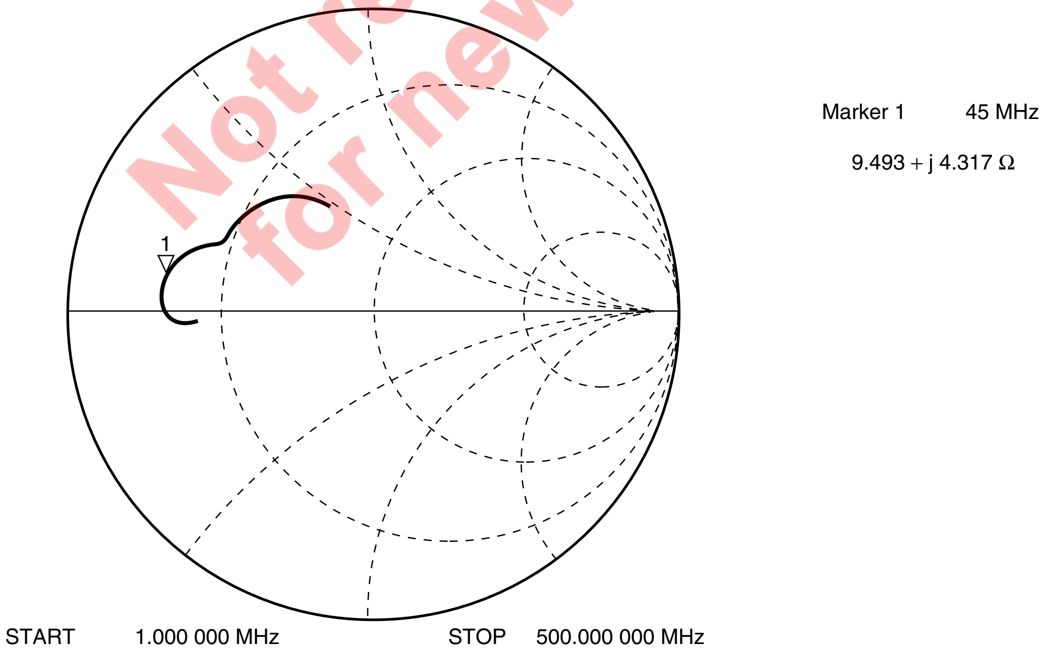
Remark The graphs indicate nominal characteristics.

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

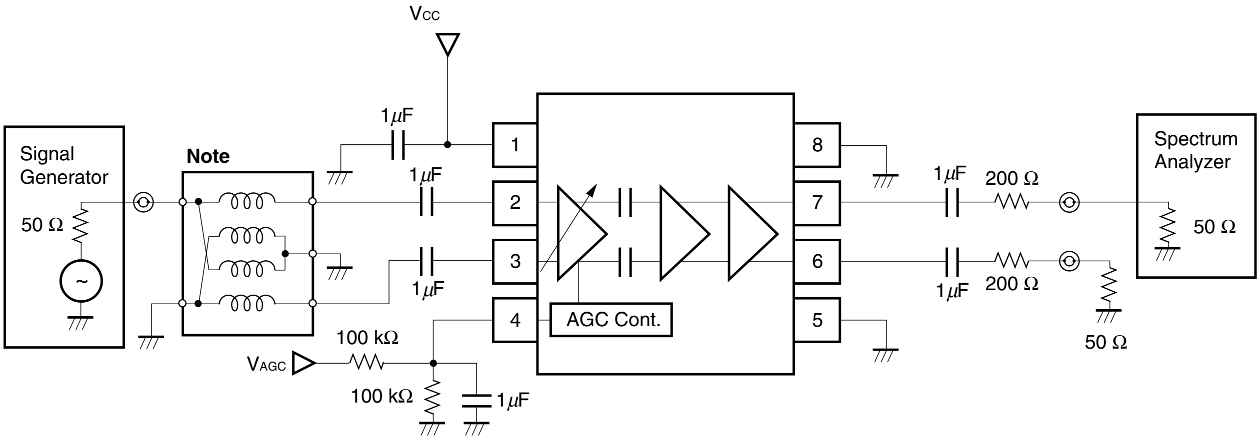
S_{11}–FREQUENCY



S_{22}–FREQUENCY

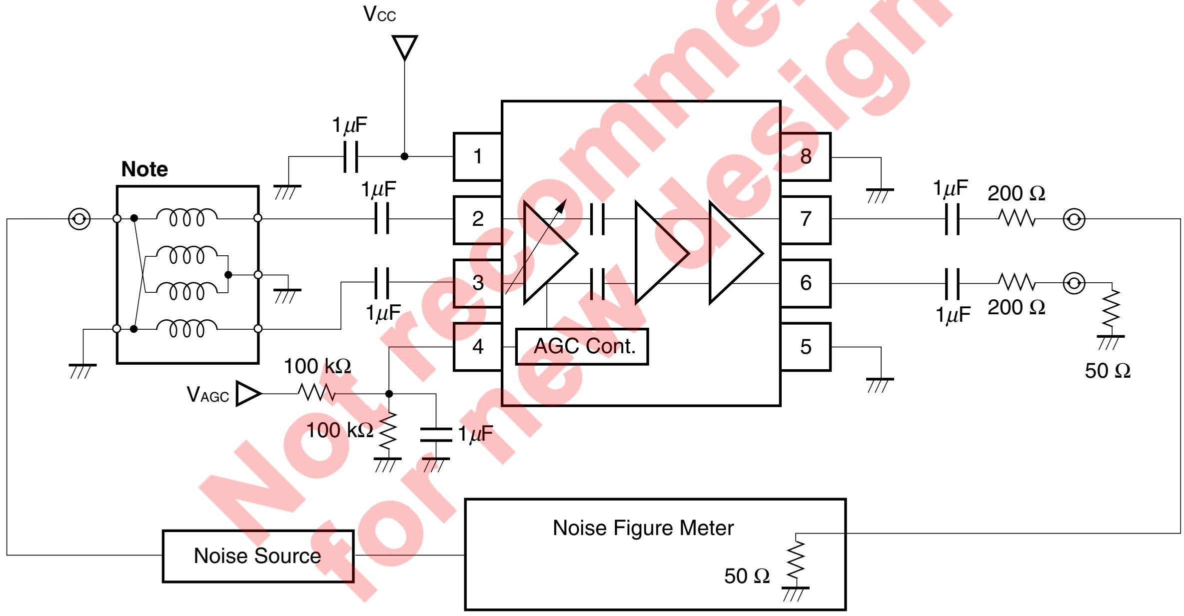


MEASUREMENT CIRCUIT 1



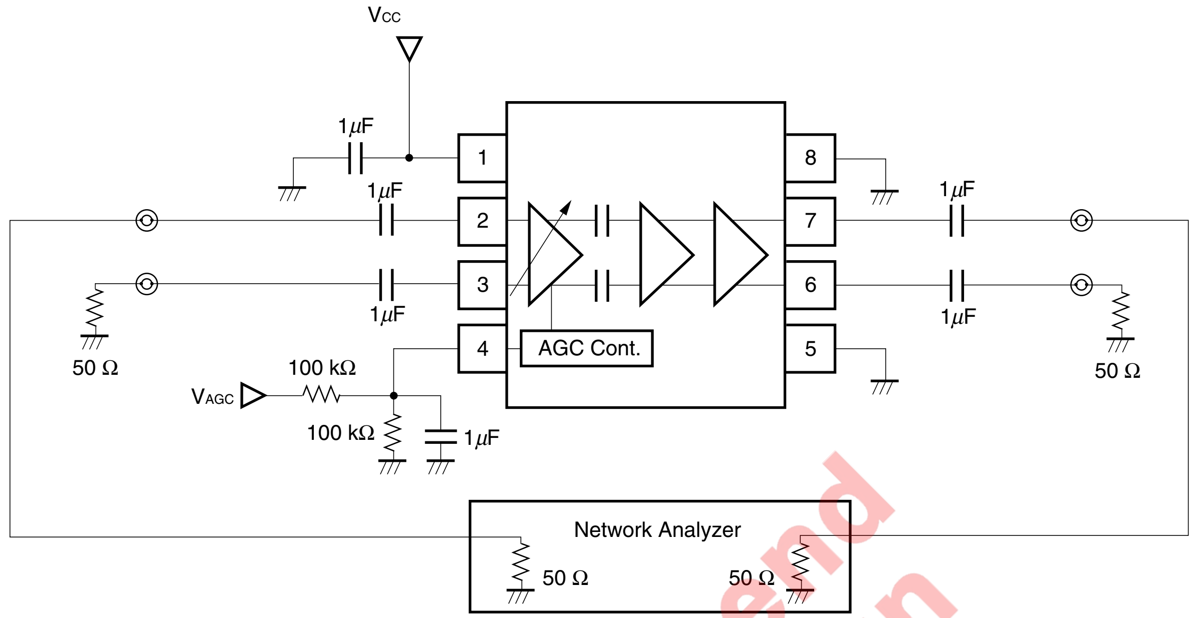
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 2

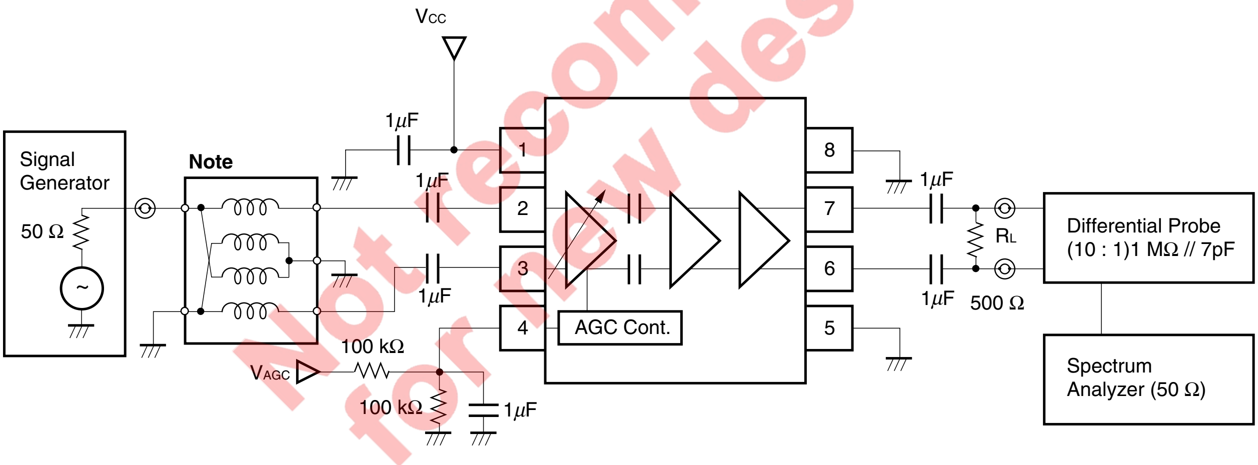


Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 3

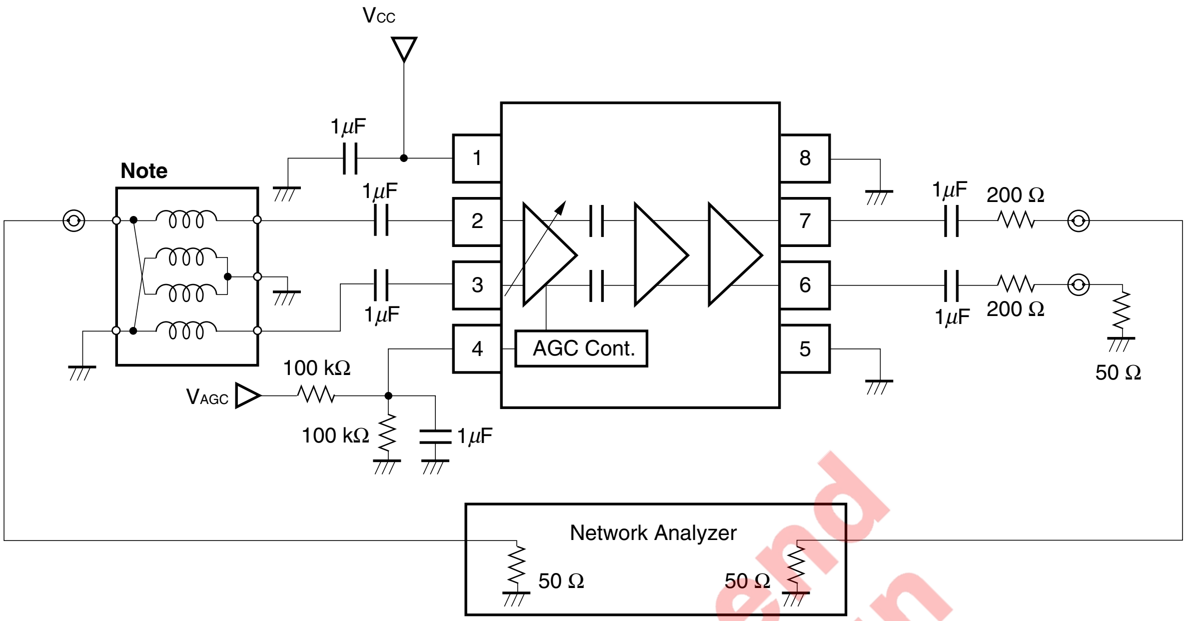


MEASUREMENT CIRCUIT 4



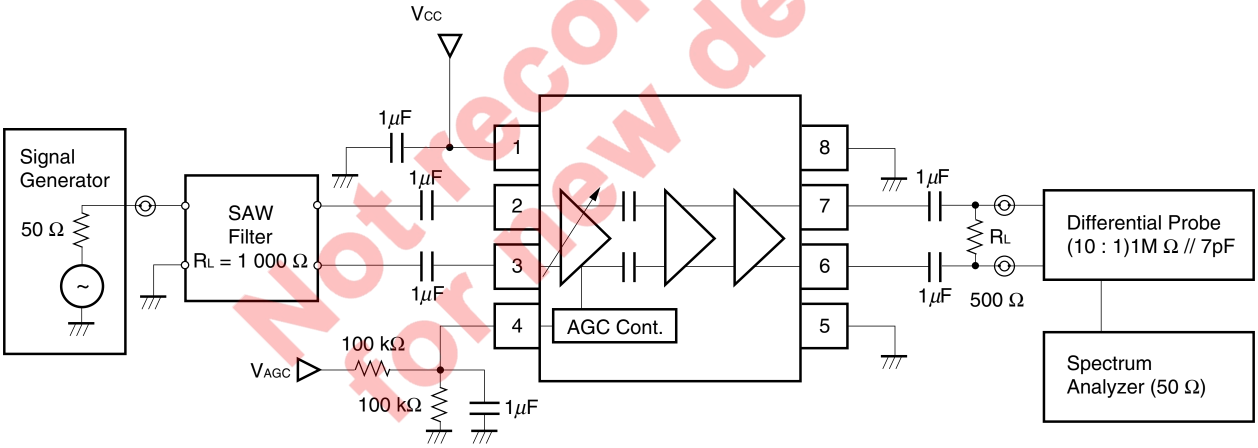
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

MEASUREMENT CIRCUIT 5



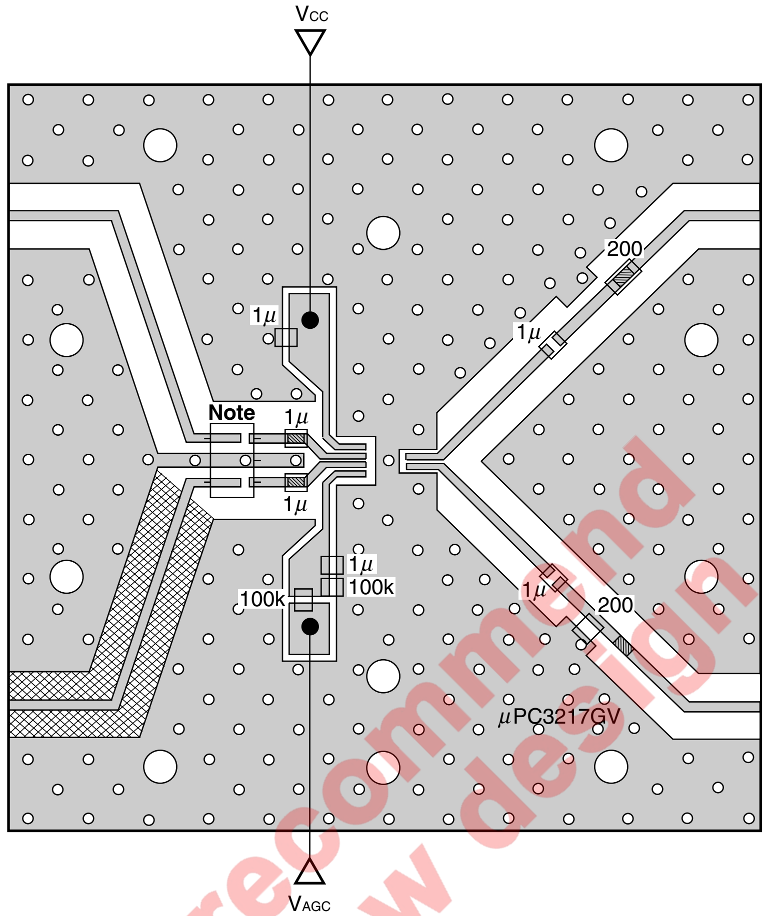
Note Balun Transformer: TOKO 617DB-1010 B4F (Double balanced type)

APPLICATION CIRCUIT EXAMPLE



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

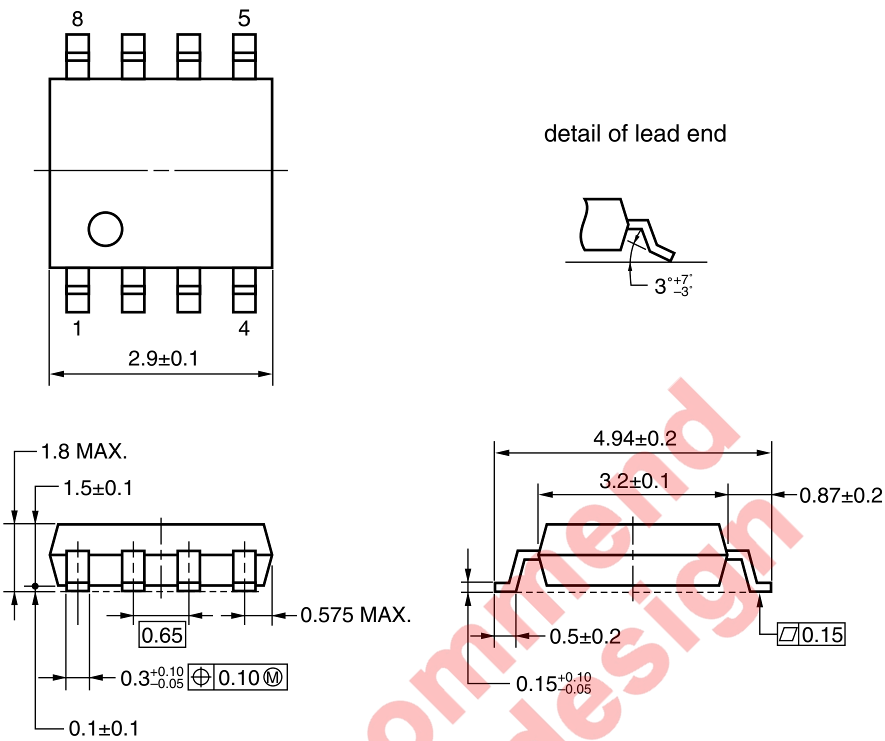


Note Balun Transformer

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

Note Excluding lead-free products

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

- **The information in this document is current as of August, 2004. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
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  "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)

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