

BIPOLAR ANALOG INTEGRATED CIRCUIT

μ PC3206GR

50dB AGC AMP + VIDEO AMP

DESCRIPTION

The μ PC3206GR is Silicon monolithic IC designed for Digital DBS and Digital CATV receivers. This IC consists of a two stage gain control amplifier and a wideband linear video amplifier.

This IC is packaged in 20-pin SSOP. Therefore, it can make RF block small.

FEATURES

- Broadband AGC dynamic range 50 dB (MIN.)
- Supply voltage 5 V
- Packaged in 20-pin SSOP suitable for high-density surface mount

APPLICATIONS

- Digital DBS receiver
- STB of digital CATV

ORDERING INFORMATION

Part Number	Package	Supplying Form
μ PC3206GR-E1	20-pin plastic SSOP (225 mil)	Embossed tape 12 mm wide. Pin 1 indicates pull-out direction of tape. Qty 2.5 kp/reel.

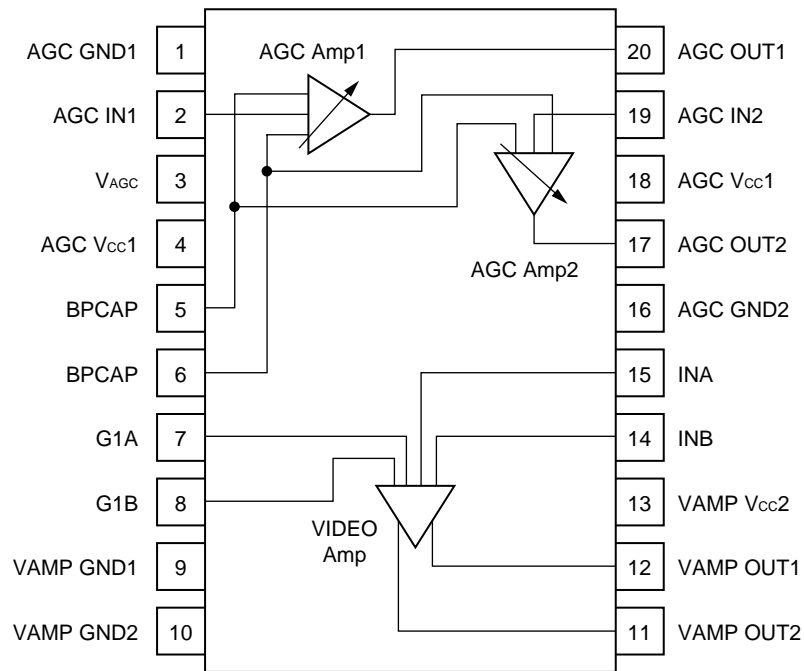
To order evaluation samples, please contact your local NEC office. (Part number for sample order : μ PC3206GR)

Caution electro-static sensitive device

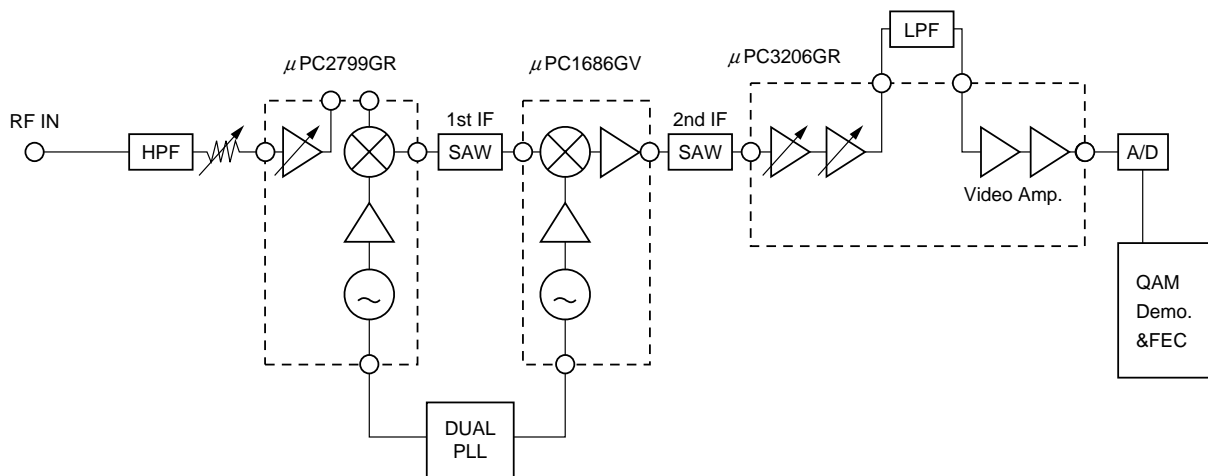
The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

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 (Top View)



TYPICAL APPLICATION



PIN FUNCTIONS

Pin No.	Pin Name	Pin Voltage TYP.(V)	Function and Explanation	Equivalent Circuit
1	AGC GND1	0	Ground pin of AGC amplifier1. Form a ground pattern as wide as possible to maintain the minimum impedance.	
2	AGC IN 1 <small>Note 1</small>	1.02 1.02	Signal input pin to AGC amplifier.	
3	VAGC	0 to 5	Gain control pin. This pin's bias govern the AGC output level. Minimum gain at $V_{AGC} = 0\text{ V}$ Maximum gain at $V_{AGC} = 5\text{ V}$ Recommended to use by dividing AGC voltage with externally resistor (ex.100 kΩ).	
4	AGC Vcc1	5	Power supply pin of AGC amplifier1. Must be connected bypass capacitor to minimize ground impedance.	<p>Refer to Equivalent circuit of pin1 and pin2.</p>
5	BPCAP4 <small>Note 1</small>	2.61 2.61	Bypass pin of AGC amplifier1 and 2.	
6	BPCAP2 <small>Note 1</small>	2.84 2.49		
7	G1A <small>Note 2</small>	1.72 3.34		
8	G1B <small>Note 2</small>	1.72 3.34		
9	VAMP GND1	0	Ground pin of video amplifier. Form a ground pattern as wide as possible to maintain the minimum impedance.	
10	VAMP GND2	0		
11	VAMP OUT2 <small>Note 2</small>	2.52 4.92	Signal output pin of video amplifier. In case of $R_L = 1\text{ k}\Omega$, single-end output voltage equal $2V_{P-P}$.	
12	VAMP OUT1 <small>Note 2</small>	2.52 4.92		

Notes 1. above : $V_{AGC} = V_{CC1}$ below : $V_{AGC} = 0\text{ V}$
 2. above : $V_{CC2} = 5\text{ V}$ below : $V_{CC2} = 9\text{ V}$

Pin No.	Pin Name	Pin Voltage TYP.(V)	Function and Explanation	Equivalent Circuit
13	VAMP V _{cc2}	5 to 9	Power supply pin of video amplifier. Must be connected bypass capacitor to minimize ground impedance.	
14	INB ^{Note 2}	2.49	Signal input pin to video amplifier.	
		4.13		
15	INA ^{Note 2}	2.49		
		4.13		
16	AGCGND2	0	Ground pin of AGC amplifier2. Form a ground pattern as wide as possible to maintain the minimum impedance.	
17	AGCOUT2 ^{Note 1}	1.69	Signal output pin of AGC amplifier2.	
		3.31		
18	AGC V _{cc1}	5	Power supply pin of AGC amplifier2. Must be connected bypass capacitor to minimize ground impedance.	
19	AGC IN2 ^{Note 1}	1.01	Signal input pin of AGC amplifier2.	
		1.01		
20	AGCOUT1 ^{Note 1}	1.71	Signal output pin of AGC amplifier1.	
		3.35		

Notes 1. above : V_{AGC} = V_{cc1} below : V_{AGC} = 0 V

2. above : V_{cc2} = 5 V below : V_{cc2} = 9 V

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C unless otherwise specified)

Parameter	Symbol	Conditions	Rating	Unit
Supply Voltage 1	V _{CC1}	MIXER Block	6.0	V
Supply Voltage 2	V _{CC2}	Video Amp Block	6.0	V
AGC Control Voltage	V _{AGC}		6.0	V
Maximum Input Power	P _{in} (MAX.)		+10	dBm
Power Dissipation	P _D	T _A = 85 °C ^{Note}	433	mW
Operating Ambient Temperature	T _A		-40 to +85	°C
Storage Temperature	T _{stg}		-55 to +150	°C

Parameter	Symbol	Conditions	Rating	Unit
Supply Voltage 1	V _{CC1}	MIXER Block	6.0	V
Supply Voltage 2	V _{CC2}	Video Amp Block	11.0	V
AGC Control Voltage	V _{AGC}		6.0	V
Maximum Input Power	P _{in} (MAX.)		+10	dBm
Power Dissipation	P _D	T _A = 75 °C ^{Note}	500	mW
Operating Ambient Temperature	T _A		-40 to +75	°C
Storage Temperature	T _{stg}		-55 to +150	°C

Note Mounted on 50 × 50 × 1.6 mm double epoxy glass board.

RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage 1	V _{CC1}	4.5	5.0	5.5	V
Supply Voltage 2	V _{CC2}	4.5	9.0	10.0	V
Operating Ambient Temperature 1 ^{Note 1}	T _{A1}	-40	+25	+85	°C
Operating Ambient Temperature 2 ^{Note 2}	T _{A2}	-40	+25	+75	°C

- Notes**
1. V_{CC1} = V_{CC2} = 4.5 to 5.5 V
 2. V_{CC1} = 4.5 to 5.5 V, V_{CC2} = 4.5 to 10 V

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
AGC Amplifier Block (V _{cc1} = 5 V, f _{in} = 100 MHz, R _L = 560 Ω)						
Circuit Current 1	I _{cc1}	no input signal, V _{AGC} = 5 V Note 1	11	16	22	mA
Circuit Current 2	I _{cc2}	no input signal, V _{AGC} = 0 V Note 1	15	22	32	mA
Bandwidth 1	BW1	Maximum gain (V _{AGC} = 5 V), Pin = -60 dBm Note 2, 3	100	220	-	MHz
Bandwidth 2	BW2	Minimum gain (V _{AGC} = 0 V), Pin = -15 dBm Note 3	500	-	-	MHz
Maximum Gain 1	G _{MAX1}	Pin = -60 dBm, V _{AGC} = 5 V Note 3	36	38.5	41	dB
Minimum Gain 1	G _{MIN2}	Pin = -15 dBm, V _{AGC} = 0 V Note 3	-	-28	-15	dB
Gain Control Range	GCR	Pin = -35 dBm, V _{AGC} = 0 to 5V Note 3	50	-	-	dB
Maximum Output Power	P _{o (sat)}	V _{AGC} = 5 V, Pin = 0 dBm Note 3	0	2	-	dBm
Video Amplifier Block (V _{cc2} = 9 V, f _{in} = 100 MHz, R _L = 1 kΩ)						
Circuit Current 3	I _{cc3}	no input signal Note 4	16	24	34.5	mA
Differential Gain 1	G1	G1A-G1B pins:short Note 5	160	260	400	V/V
Differential Gain 2	G2	G1A-G1B pins:open Note 5	22	25	30	V/V
Video Amplifier Block (V _{cc2} = 5 V, f _{in} = 100 MHz, R _L = 1 kΩ)						
Circuit Current 4	I _{cc4}	no input signal Note 4	8	12.5	18	mA
Differential Gain 3	G3	G1A-G1B pins:short Note 5	80	140	230	V/V
Differential Gain 4	G4	G1A-G1B pins:open Note 5	16	22	30	V/V
Video Amplifier Block (V _{cc2} = 5 V, 9 V Common, f _{in} = 100 MHz, R _L = 1 kΩ, single-ended)						
Bandwidth 1	BW _{G1}	G1A-G1B pins:short Note 2, 5	-	100	-	MHz

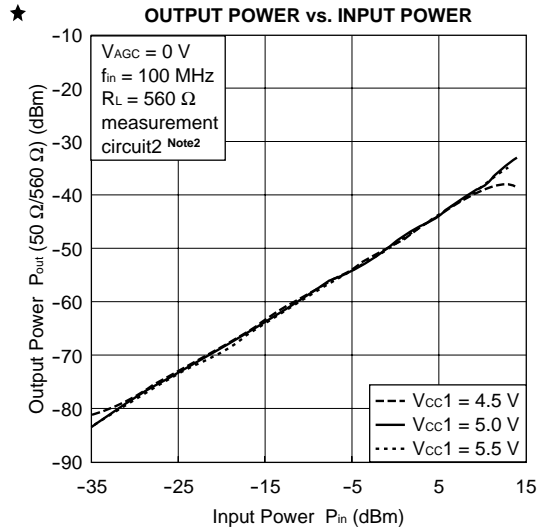
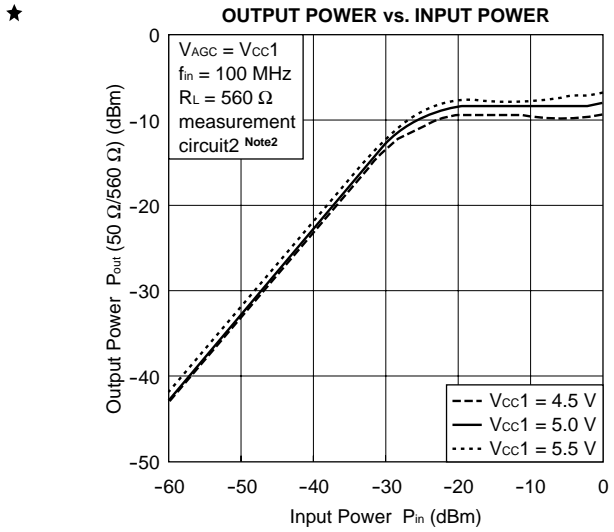
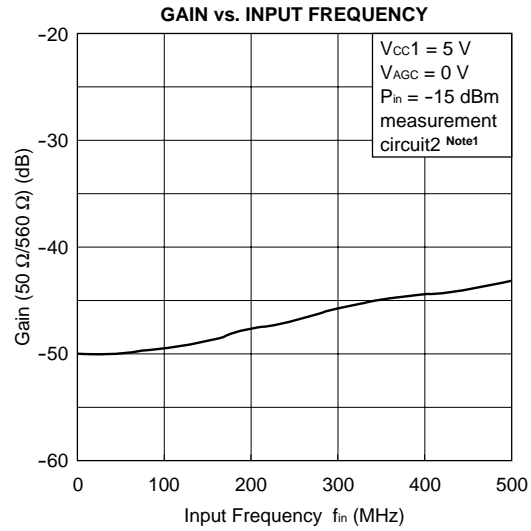
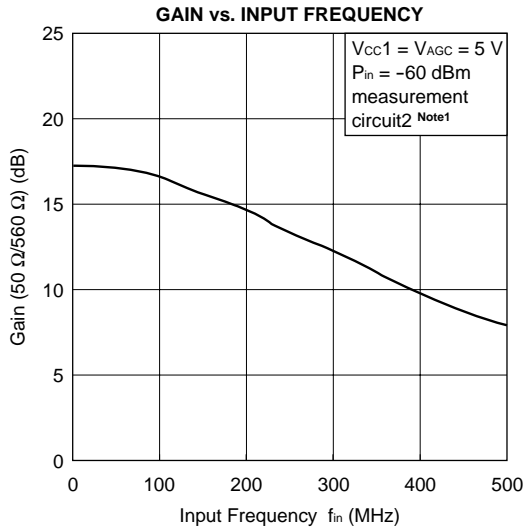
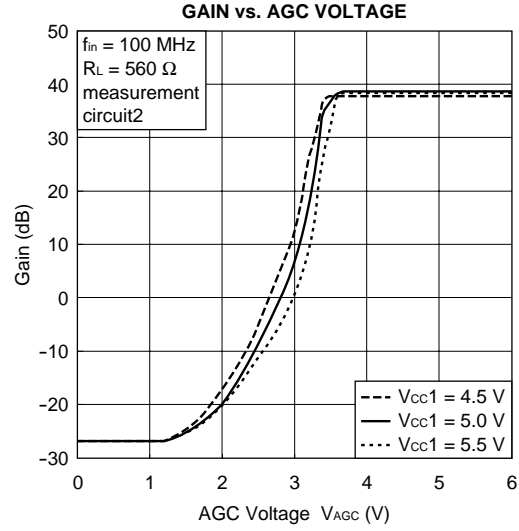
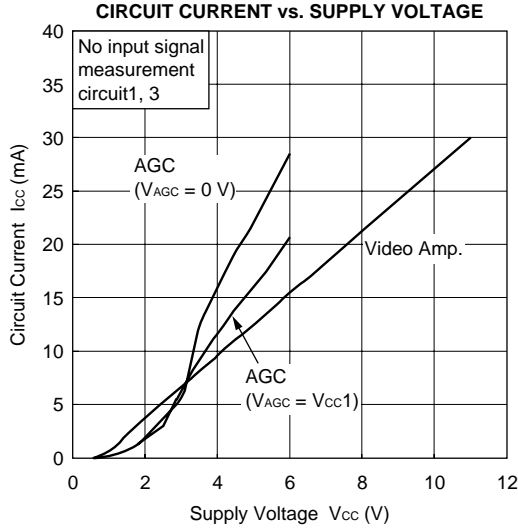
- Notes**
1. By measurement circuit 1
 2. -3 dB down from gain at 5 MHz
 3. By measurement circuit 2
 4. By measurement circuit 3
 5. By measurement circuit 4

STANDARD CHARACTERISTICS (FOR REFERENCE) (T_A = 25 °C)

Parameter	Symbol	Test Conditions	Reference Values	Unit
AGC Amplifier Block (V _{cc1} = 5 V, fin = 100 MHz, R _L = 560 Ω)				
Noise Figure	NF	Maximum Gain (V _{AGC} = 5 V) Note 1	5.5	dB
Output Intercept Point	OIP ₃	fin2 = 106 MHz, Maximum Gain (V _{AGC} = 5 V) Note 2	+4.5	dBm
Video Amplifier Block (V _{cc2} = 9 V, fin = 100 MHz, R _L = 1 kΩ)				
Output Voltage	Vout	single-ended Note 3	2	V _{P-P}
Single-end Gain 1	Avs1	G1A-G1B pins:short Note 3	130	V/V
Single-end Gain 2	Avs2	G1A-G1B pins:open Note 3	12	V/V
Input Intercept Point 1	IIP ₃₁	fin2 = 106 MHz, G1A-G1B pins:short Note 3	-16	dBm
Input Intercept Point 2	IIP ₃₂	fin2 = 106 MHz, G1A-G1B pins:open Note 3	4	dBm
Video Amplifier Block (V _{cc2} = 5 V, fin = 100 MHz, R _L = 1 kΩ)				
Single-end Gain 3	Avs3	G1A-G1B pins:short Note 3	70	V/V
Single-end Gain 4	Avs4	G1A-G1B pins:open Note 3	11	V/V
Input Intercept Point 3	IIP ₃₃	fin2 = 106 MHz, G1A-G1B pins:short Note 3	-15	dBm
Input Intercept Point 4	IIP ₃₄	fin2 = 106 MHz, G1A-G1B pins:open Note 3	2	dBm
Total Block (V _{cc1} = 5 V, fin = 100 MHz, R _L = 1 kΩ)				
Maximum Gain 2	G _{MAX2}	V _{AGC} = 5 V, V _{cc2} = 5 V, G1A-G1B pins:short Note 4	76	dB
Maximum Gain 3	G _{MAX3}	V _{AGC} = 5 V, V _{cc2} = 5 V, G1A-G1B pins:open Note 4	62	dB
Minimum Gain 2	G _{MIN2}	V _{AGC} = 0 V, V _{cc2} = 5 V, G1A-G1B pins:short Note 4	10	dB
Maximum Gain 4	G _{MAX4}	V _{AGC} = 5 V, V _{cc2} = 9 V, G1A-G1B pins:short Note 4	80	dB
Maximum Gain 5	G _{MAX5}	V _{AGC} = 5 V, V _{cc2} = 9 V, G1A-G1B pins:open Note 4	63	dB
Minimum Gain 3	G _{MIN3}	V _{AGC} = 0 V, V _{cc2} = 9 V, G1A-G1B pins:short Note 4	14	dB

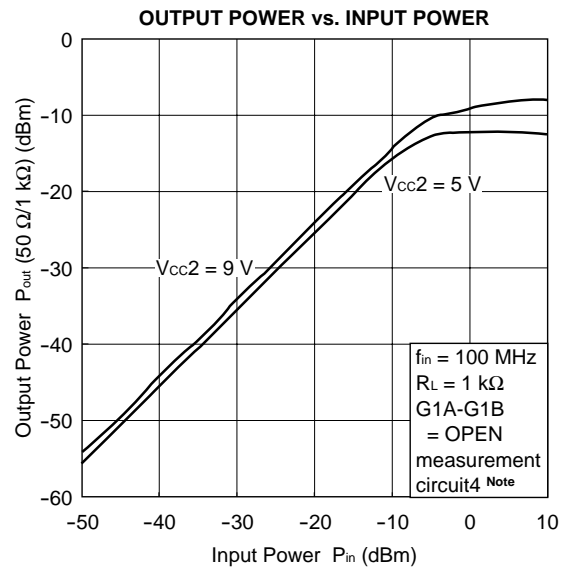
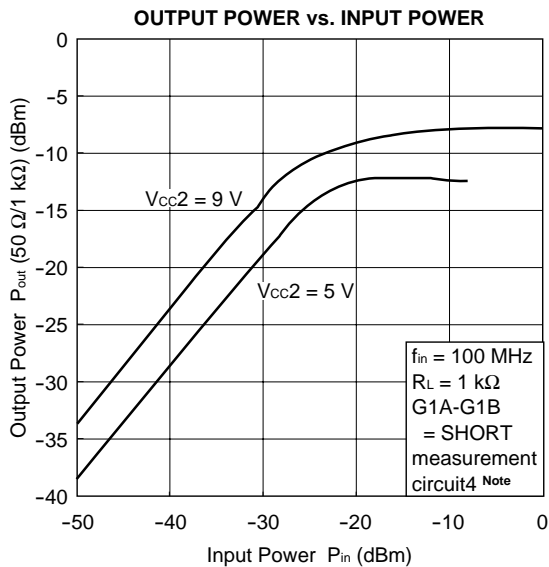
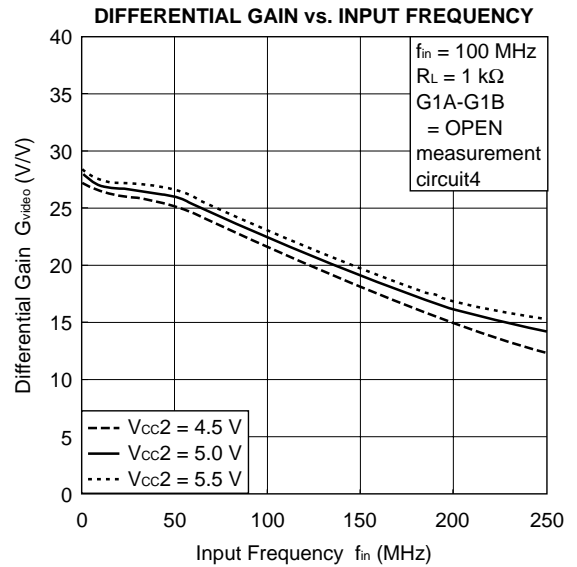
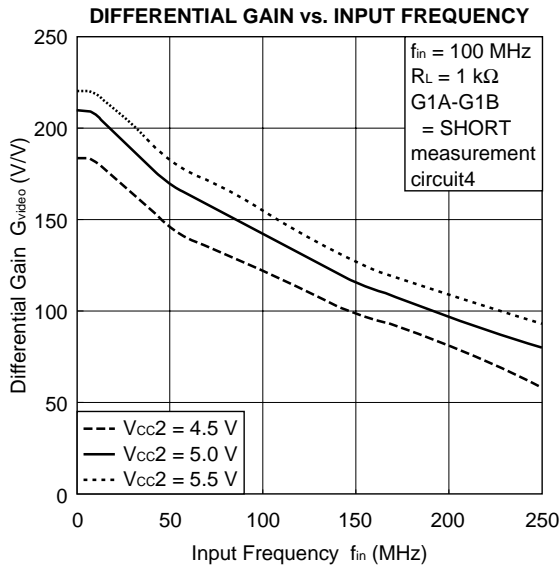
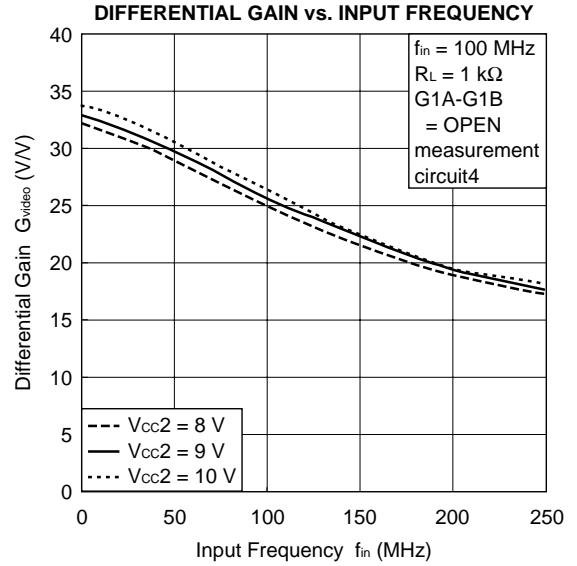
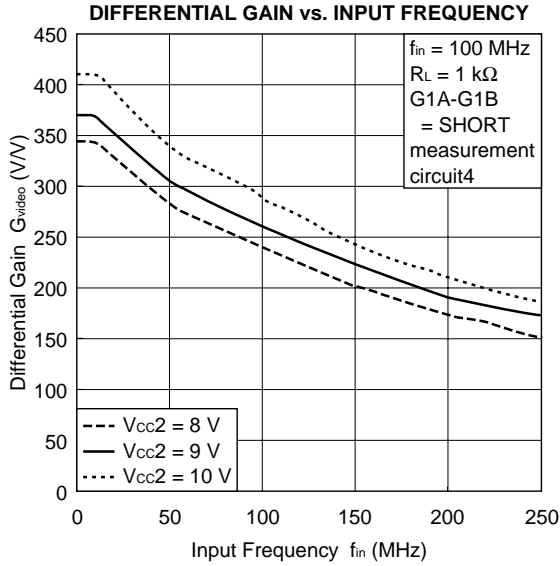
- Notes**
1. By measurement circuit 5
 2. By measurement circuit 2
 3. By measurement circuit 4
 4. By measurement circuit 6

TYPICAL CHARACTERISTICS (T_A = 25 °C)



- Notes 1. Gain = (Gain at Spectrum Analyzer) + 20 log (560 Ω/50 Ω)
2. Output Power = (Output Power at Spectrum Analyzer) + 10 log (560 Ω/50 Ω)

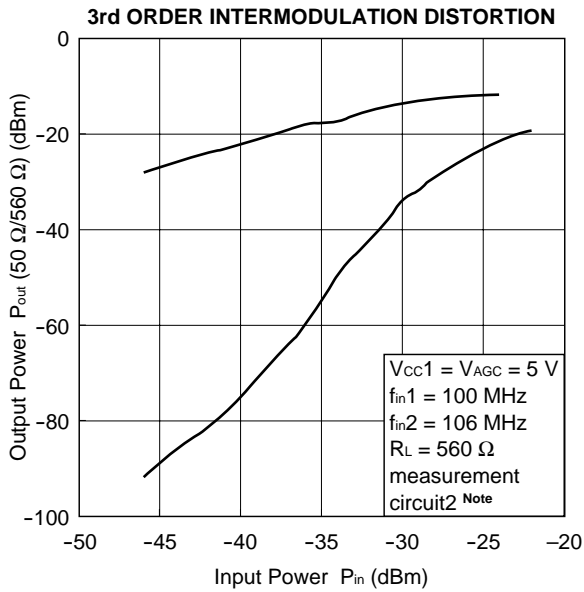
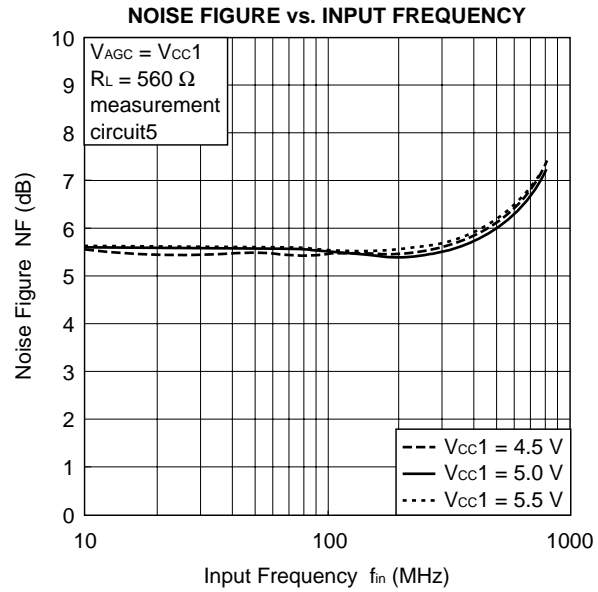
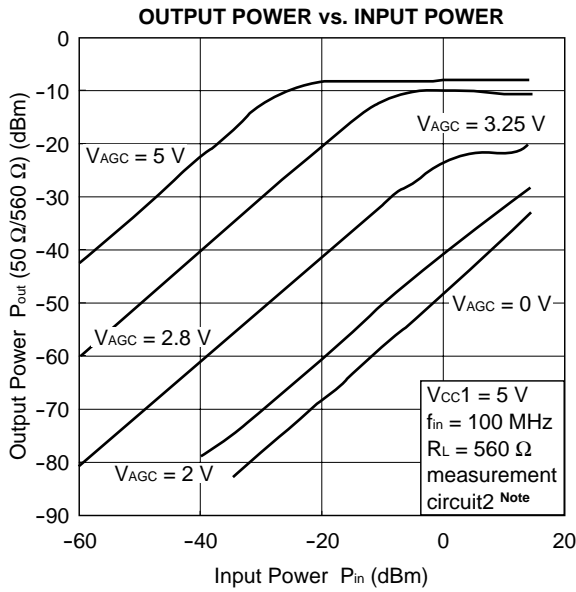
TYPICAL CHARACTERISTICS (T_A = 25 °C)



Note Output Power = (Output Power at Spectrum Analyzer) + 10 log (1 kΩ/50 Ω)

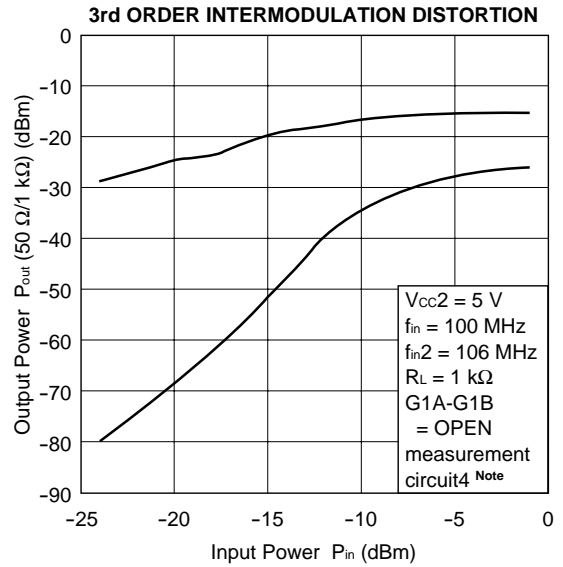
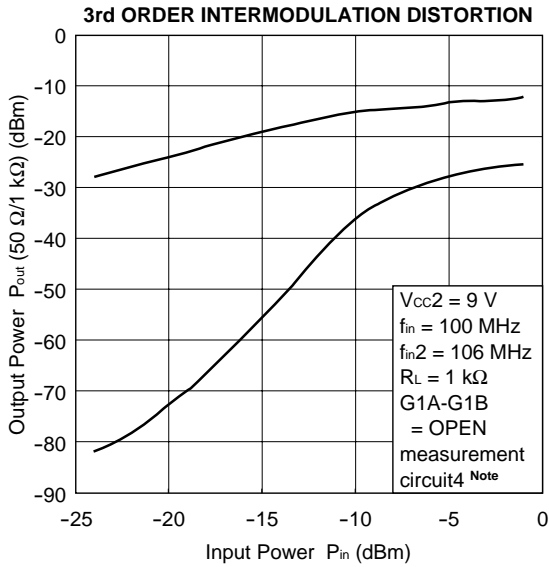
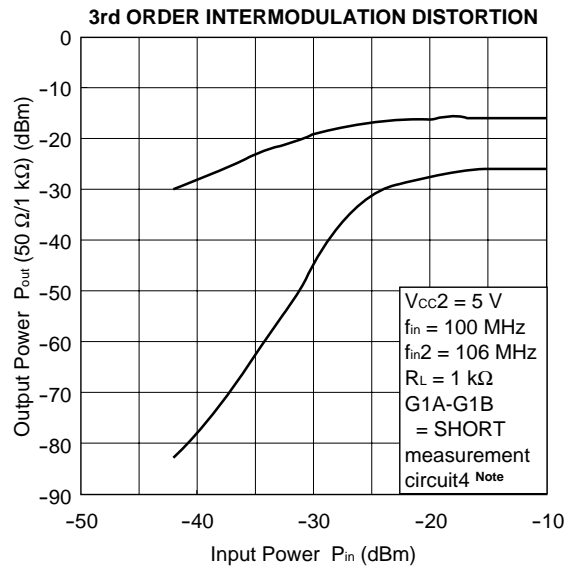
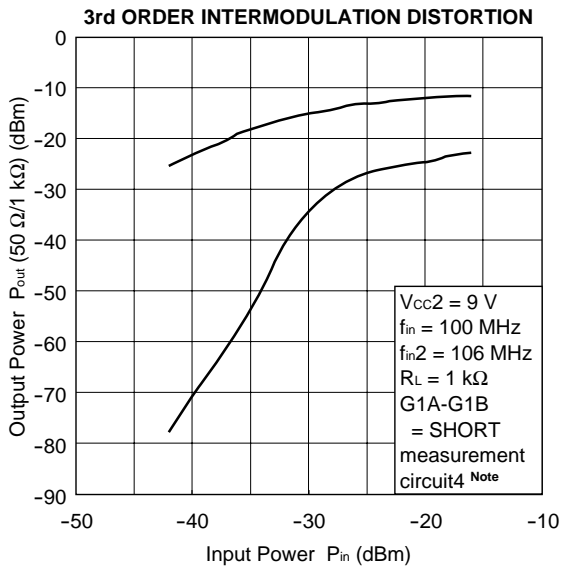
STANDARD CHARACTERISTICS (T_A = 25 °C)

★



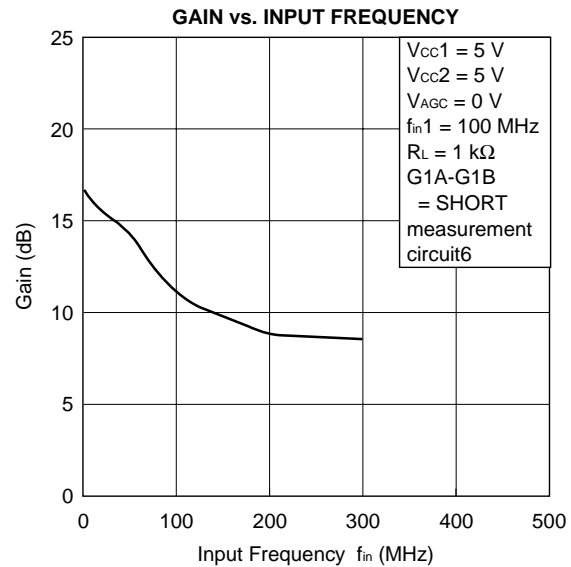
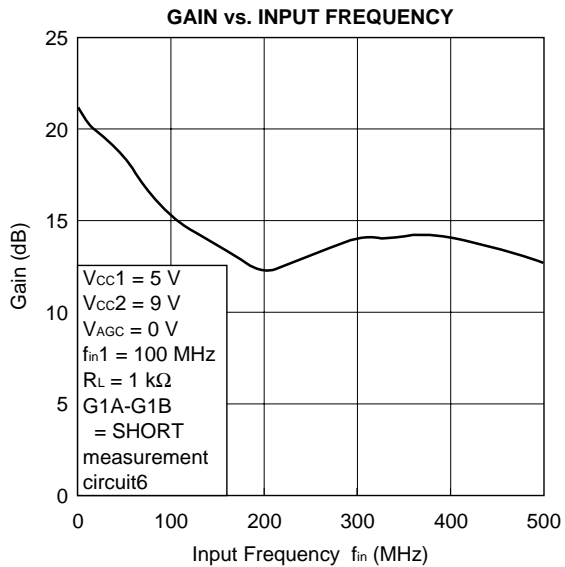
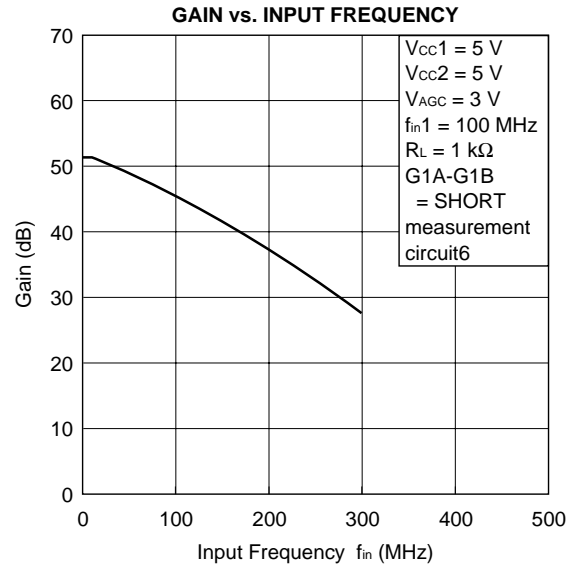
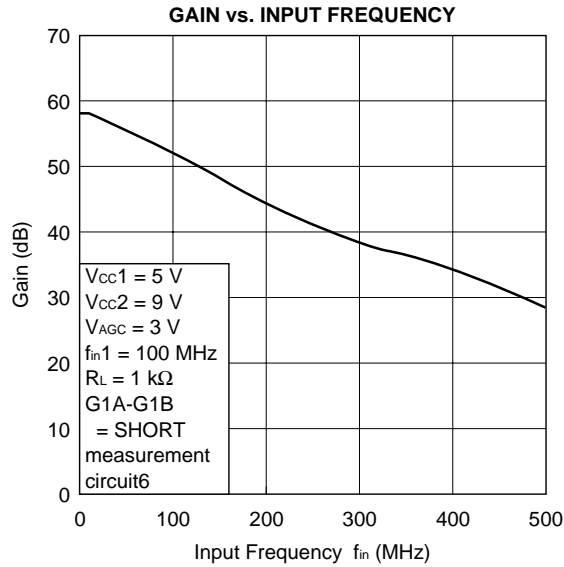
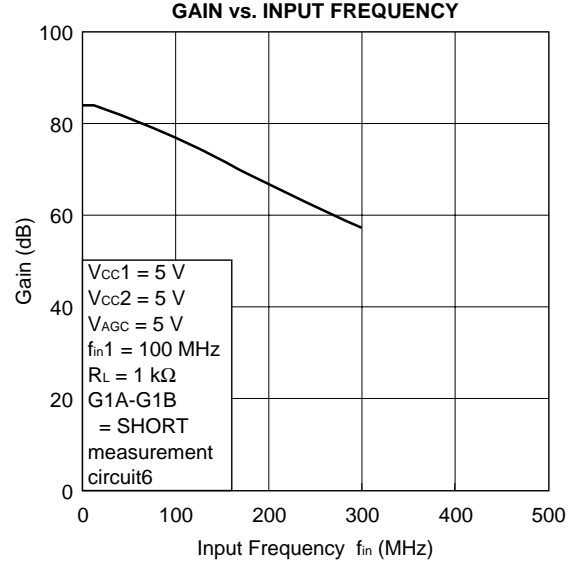
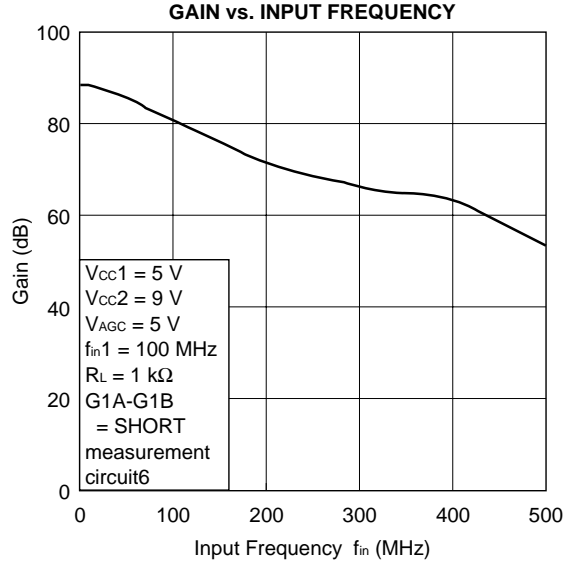
Note Output Power = (Output Power at Spectrum Analyzer) + 10 log (560 Ω /50 Ω)

STANDARD CHARACTERISTICS (T_A = 25 °C)

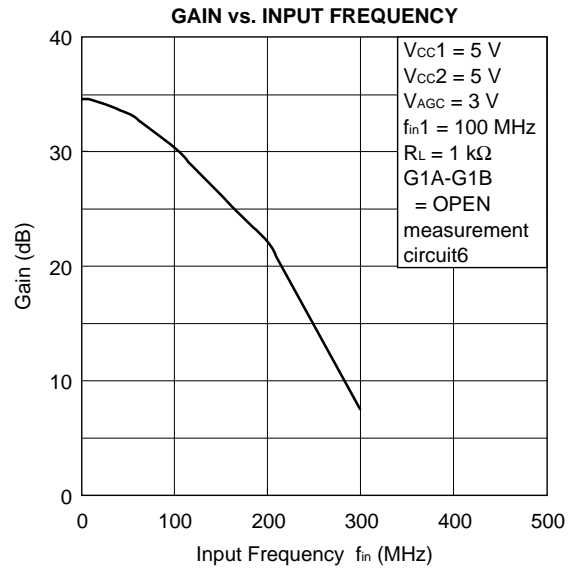
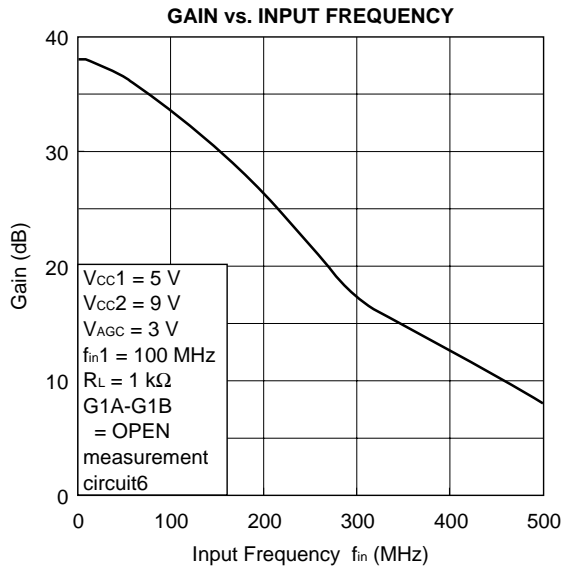
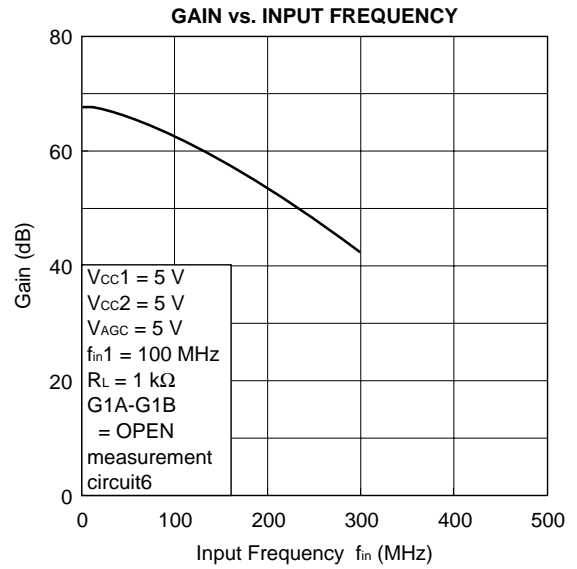
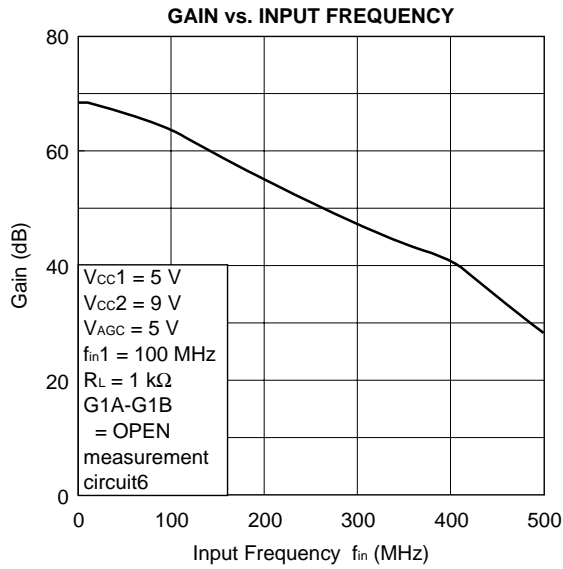


Note Output Power = (Output Power at Spectrum Analyzer) + 10 log (1 k Ω /50 Ω)

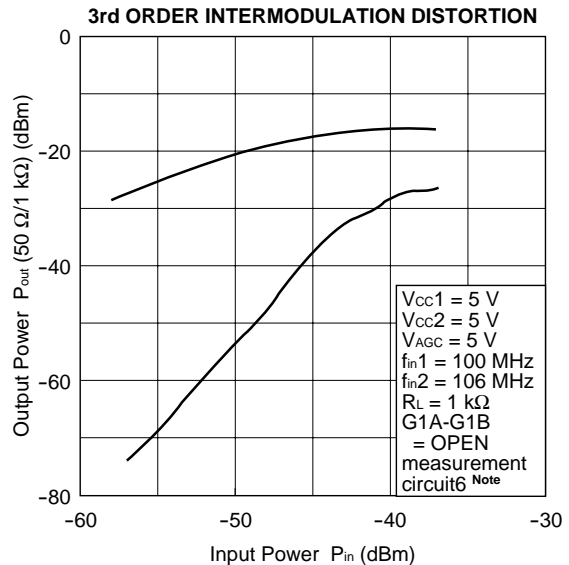
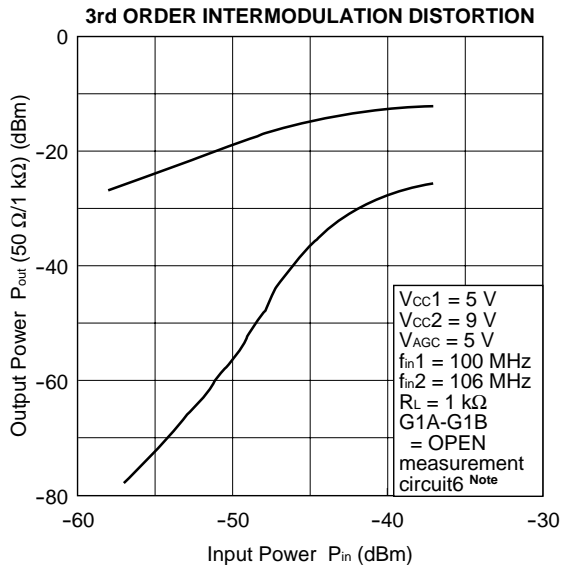
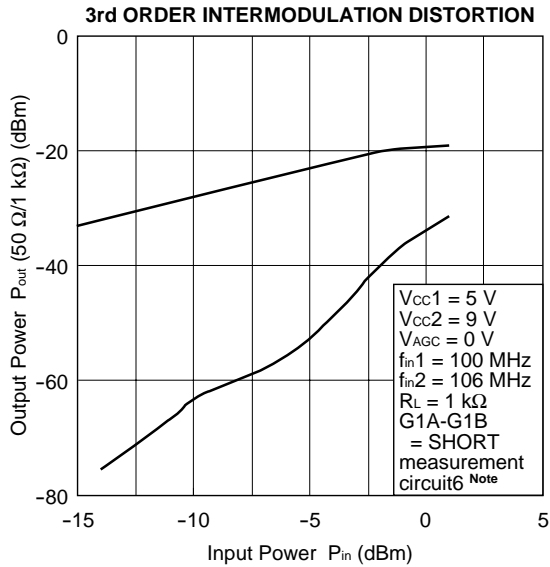
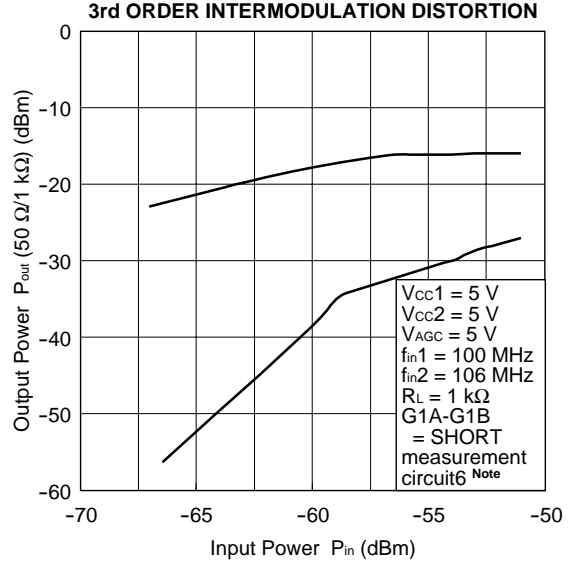
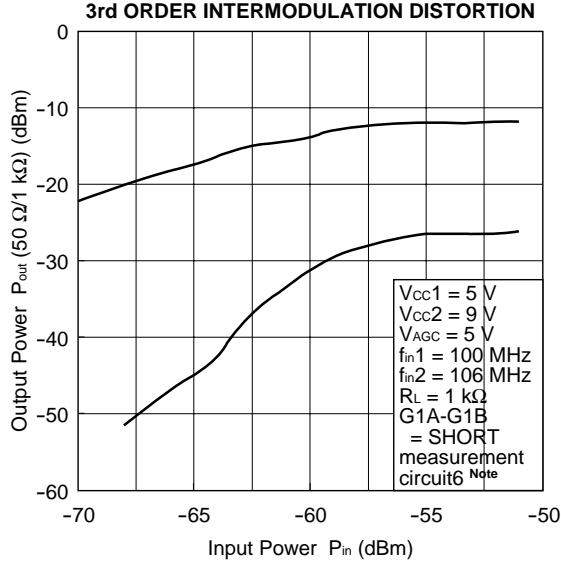
STANDARD CHARACTERISTICS (T_A = 25 °C)



STANDARD CHARACTERISTICS (T_A = 25 °C)

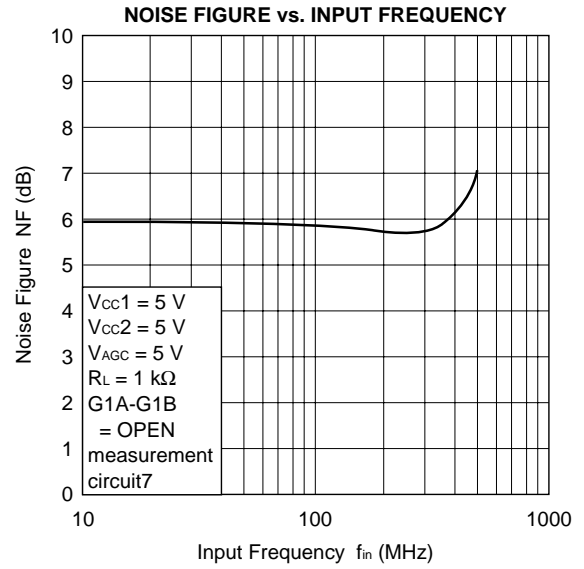
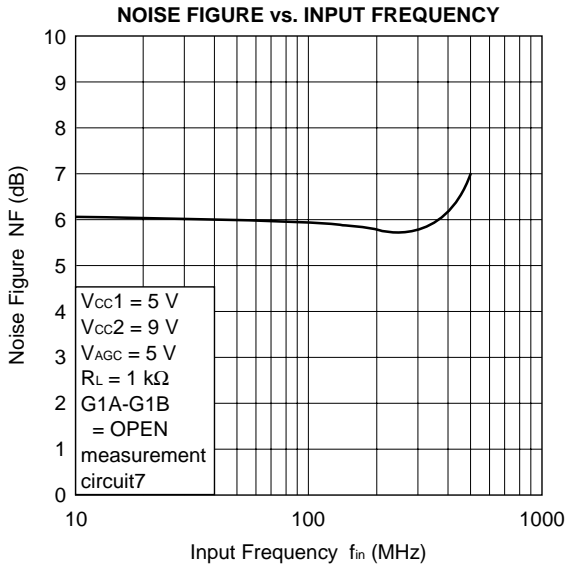
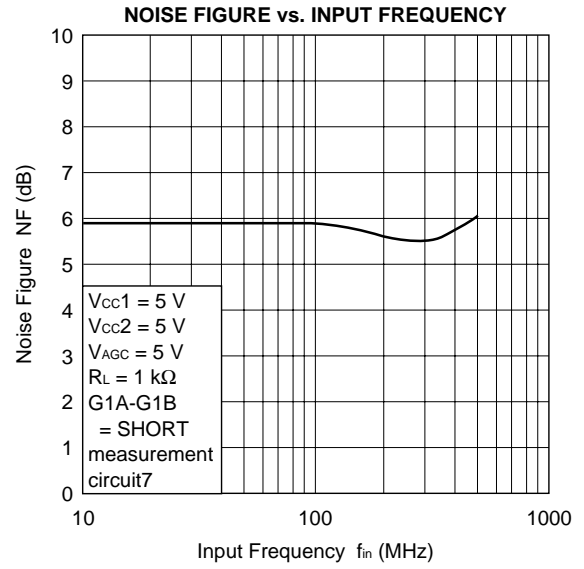
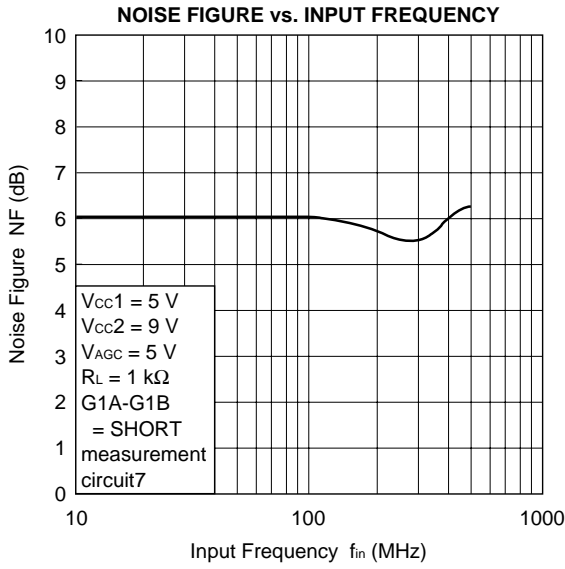


STANDARD CHARACTERISTICS (T_A = 25 °C)

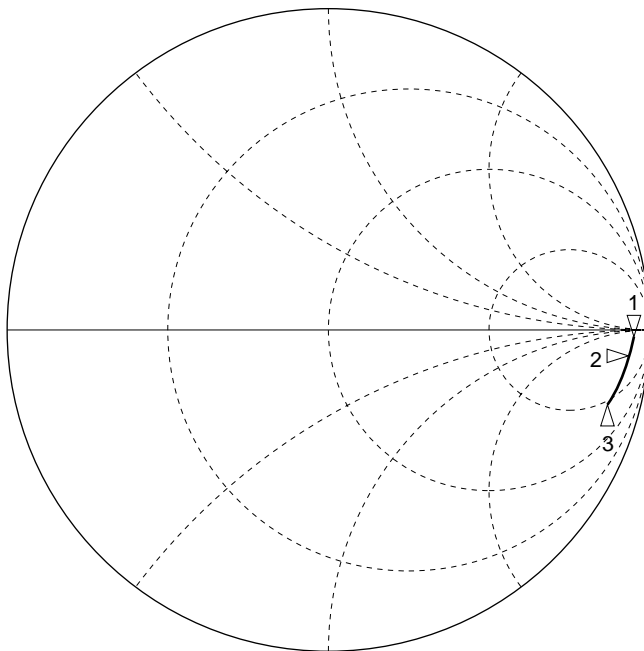


Note Output Power = (Output Power at Spectrum Analyzer) + 10 log (1 kΩ/50 Ω)

STANDARD CHARACTERISTICS (T_A = 25 °C)



INPUT IMPEDANCE (2 PIN)

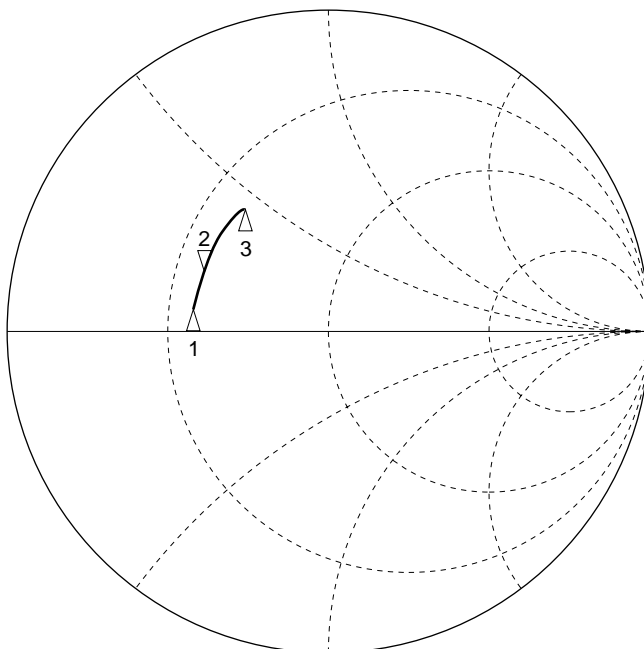


START 0.045000000 GHz
STOP 0.250000000 GHz

MARKER		Z_{in}
1	45 MHz	$938.4 \Omega - j604.8 \Omega$
2	100 MHz	$434.7 \Omega - j573.8 \Omega$
3	250 MHz	$122.5 \Omega - j324.9 \Omega$

Conditions $T_A = 25^\circ\text{C}$
 $V_{cc1} = 5\text{ V}$

OUTPUT IMPEDANCE (20 PIN)

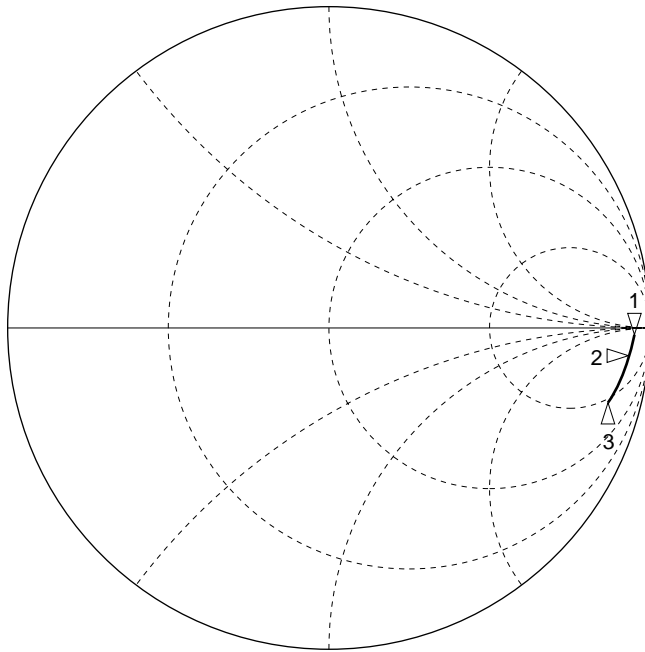


START 0.045000000 GHz
STOP 0.250000000 GHz

MARKER		Z_{out}
1	45 MHz	$19.86 \Omega + 3.83 \Omega$
2	100 MHz	$20.28 \Omega + 9.26 \Omega$
3	250 MHz	$22.28 \Omega + 22.48 \Omega$

Conditions $T_A = 25^\circ\text{C}$
 $V_{cc1} = 5\text{ V}$

INPUT IMPEDANCE (19 PIN)

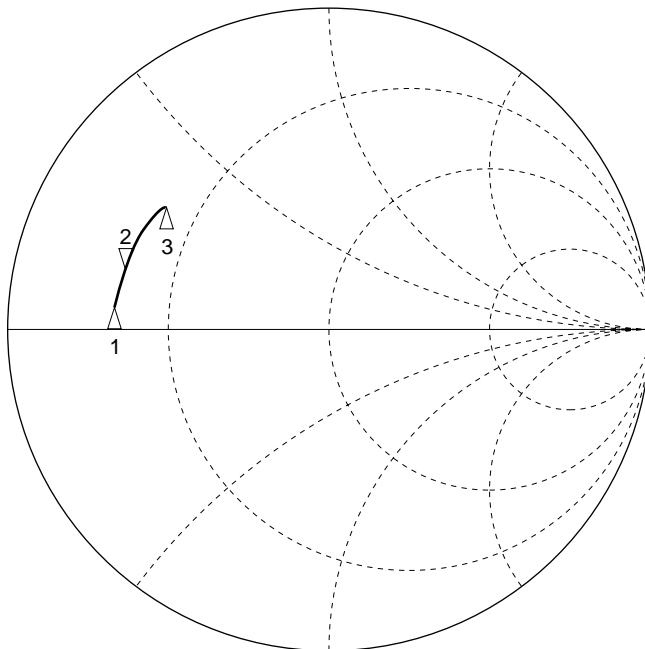


START 0.045000000 GHz
STOP 0.250000000 GHz

MARKER		Z_{in}
1	45 MHz	$965.8 \Omega - j601.2 \Omega$
2	100 MHz	$446.6 \Omega - j661.8 \Omega$
3	250 MHz	$126.8 \Omega - j312.4 \Omega$

Conditions $T_A = 25^\circ\text{C}$
 $V_{cc1} = 5 \text{ V}$

OUTPUT IMPEDANCE (17 PIN)



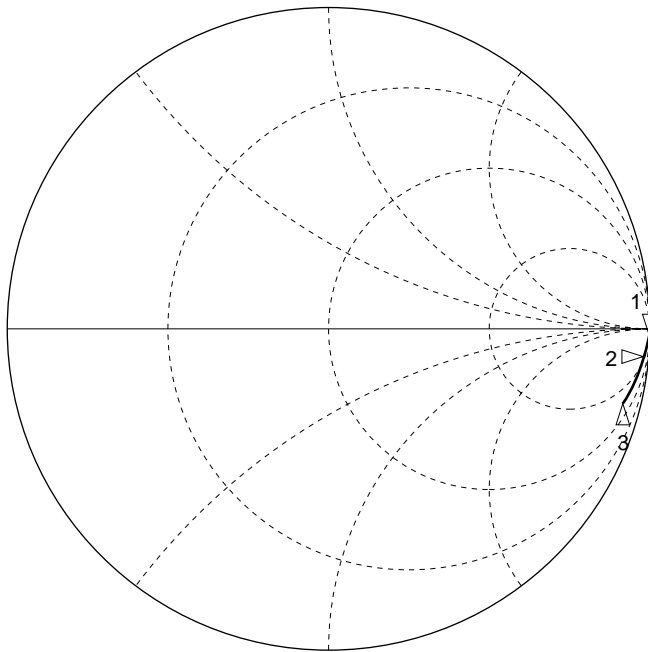
START 0.045000000 GHz
STOP 0.250000000 GHz

MARKER		Z_{out}
1	45 MHz	$10.32 \Omega + j2.88 \Omega$
2	100 MHz	$10.86 \Omega + j6.42 \Omega$
3	250 MHz	$12.67 \Omega + j15.39 \Omega$

Conditions $T_A = 25^\circ\text{C}$
 $V_{cc1} = 5 \text{ V}$

INPUT IMPEDANCE (15 PIN)

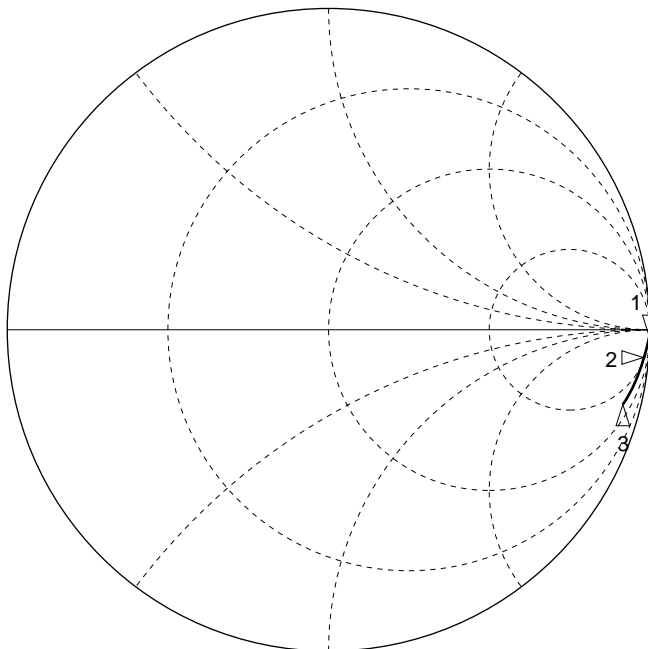
(i) $T_A = 25^\circ\text{C}$, $V_{CC2} = 5\text{ V}$



MARKER		Z_{in}
1	45 MHz	$840.0\ \Omega - j2560\ \Omega$
2	100 MHz	$50.19\ \Omega - j1259\ \Omega$
3	250 MHz	$52.03\ \Omega - j475.6\ \Omega$

START 0.045000000 GHz
STOP 0.250000000 GHz

(ii) $T_A = 25^\circ\text{C}$, $V_{CC2} = 9\text{ V}$

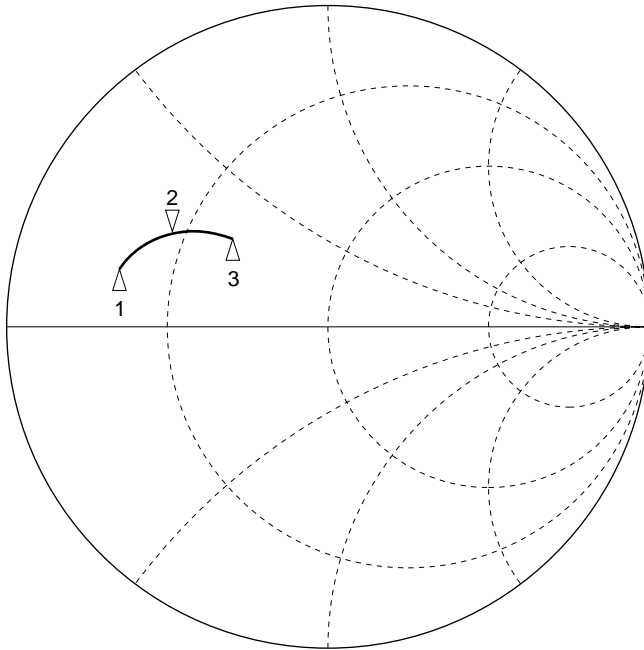


MARKER		Z_{in}
1	45 MHz	$478.3\ \Omega - j3091\ \Omega$
2	100 MHz	$106.13\ \Omega - j1368\ \Omega$
3	250 MHz	$55.11\ \Omega - j501.3\ \Omega$

START 0.045000000 GHz
STOP 0.250000000 GHz

OUTPUT IMPEDANCE (12 PIN)

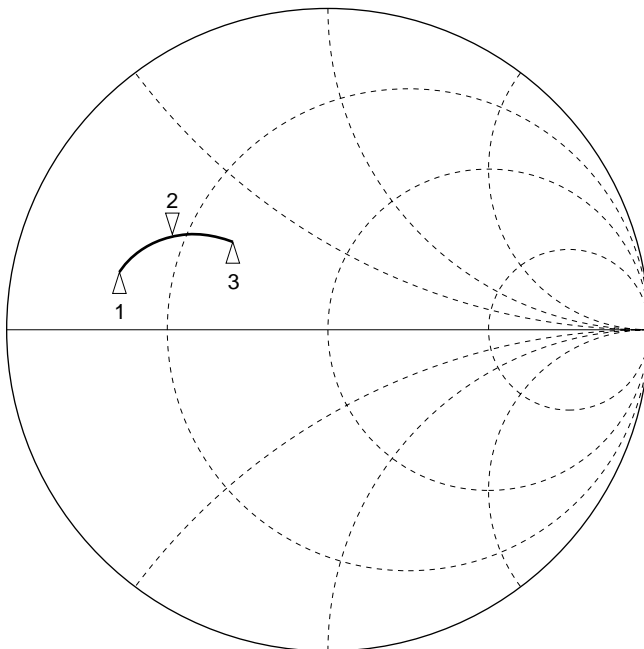
(i) $T_A = 25^\circ\text{C}$, $V_{cc2} = 5\text{ V}$, 11 pin is grounded through $50\ \Omega$ resistor.



START 0.045000000 GHz
STOP 0.250000000 GHz

MARKER		Z_{out}
1	45 MHz	$9.88\ \Omega + j6.25\ \Omega$
2	100 MHz	$14.21\ \Omega + j11.78\ \Omega$
3	250 MHz	$23.64\ \Omega + j15.73\ \Omega$

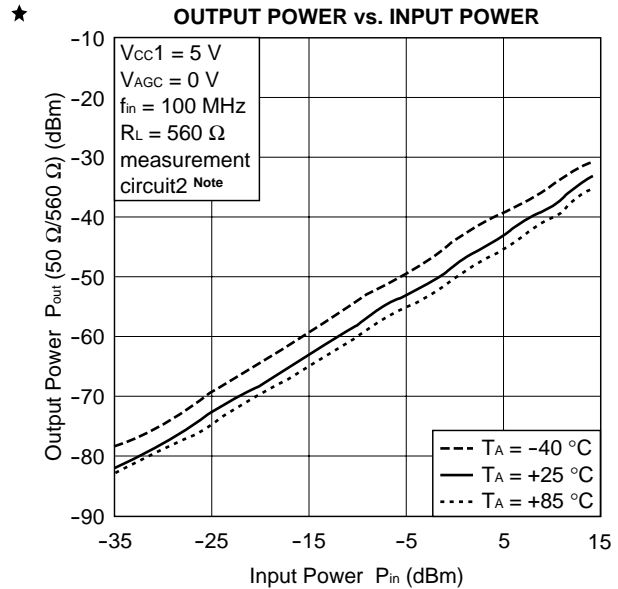
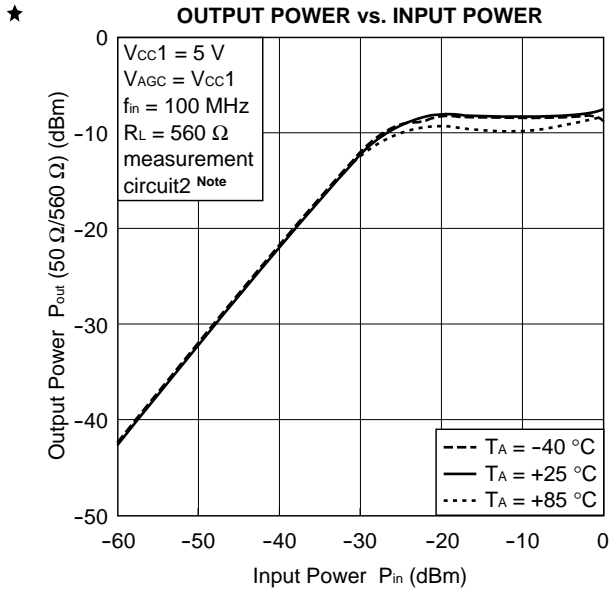
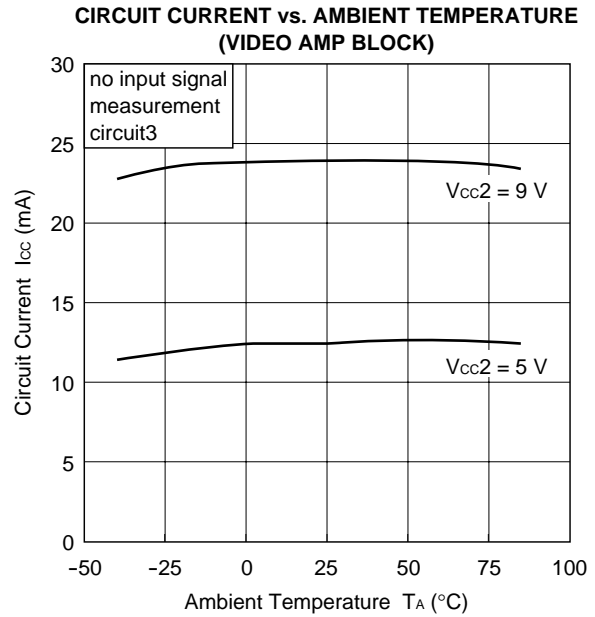
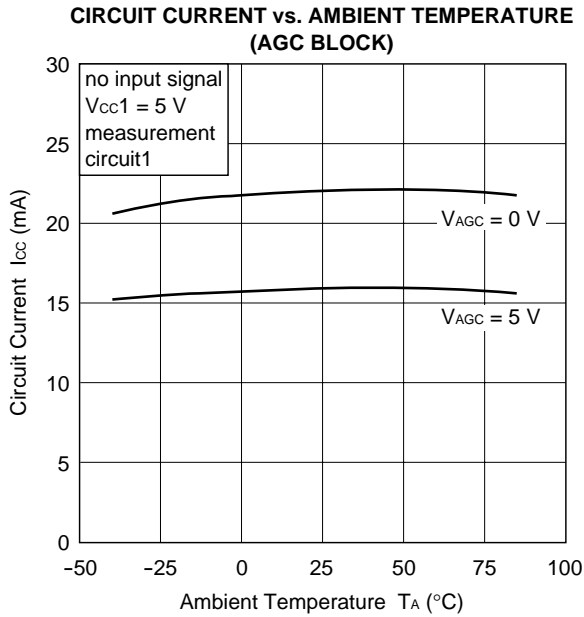
(ii) $T_A = 25^\circ\text{C}$, $V_{cc2} = 9\text{ V}$, 11 pin is grounded through $50\ \Omega$ resistor.



START 0.045000000 GHz
STOP 0.250000000 GHz

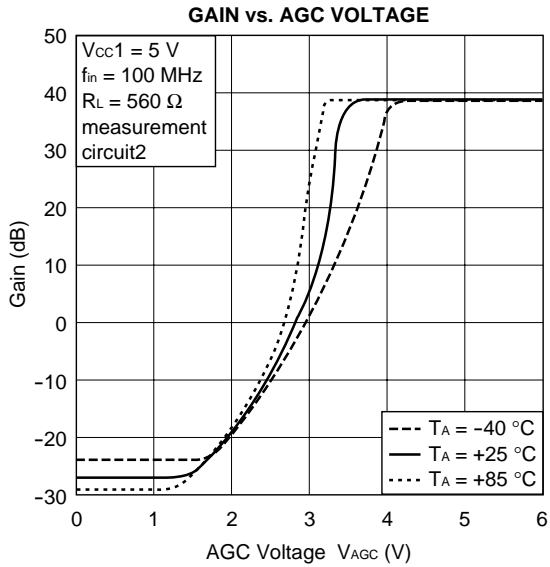
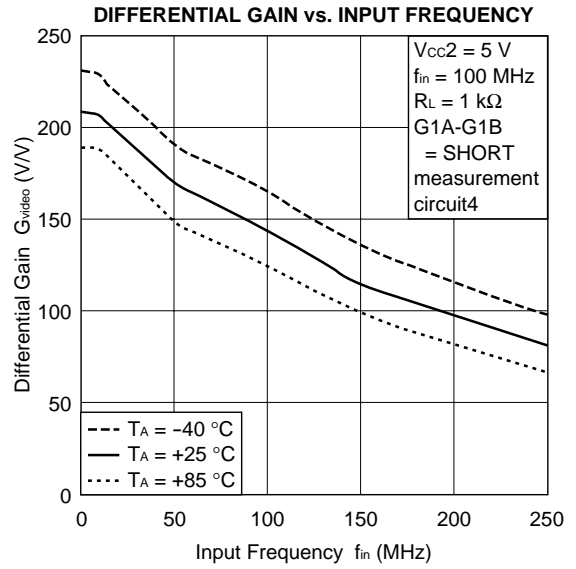
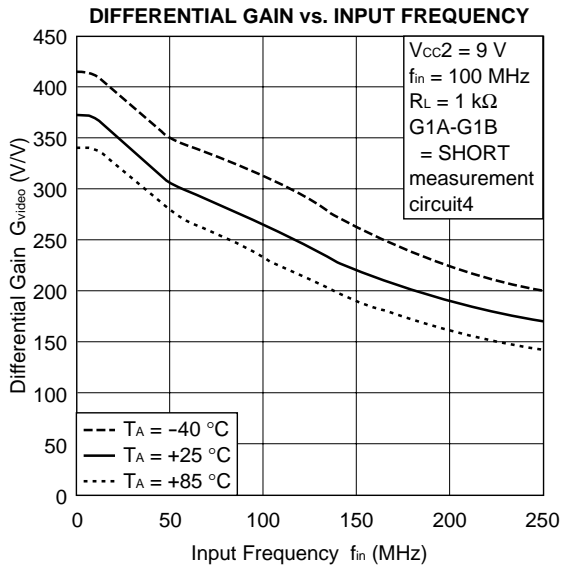
MARKER		Z_{out}
1	45 MHz	$7.36\ \Omega + j4.85\ \Omega$
2	100 MHz	$10.50\ \Omega + j9.58\ \Omega$
3	250 MHz	$19.37\ \Omega + j13.70\ \Omega$

THERMAL CHARACTERISTICS (FOR REFERENCE)

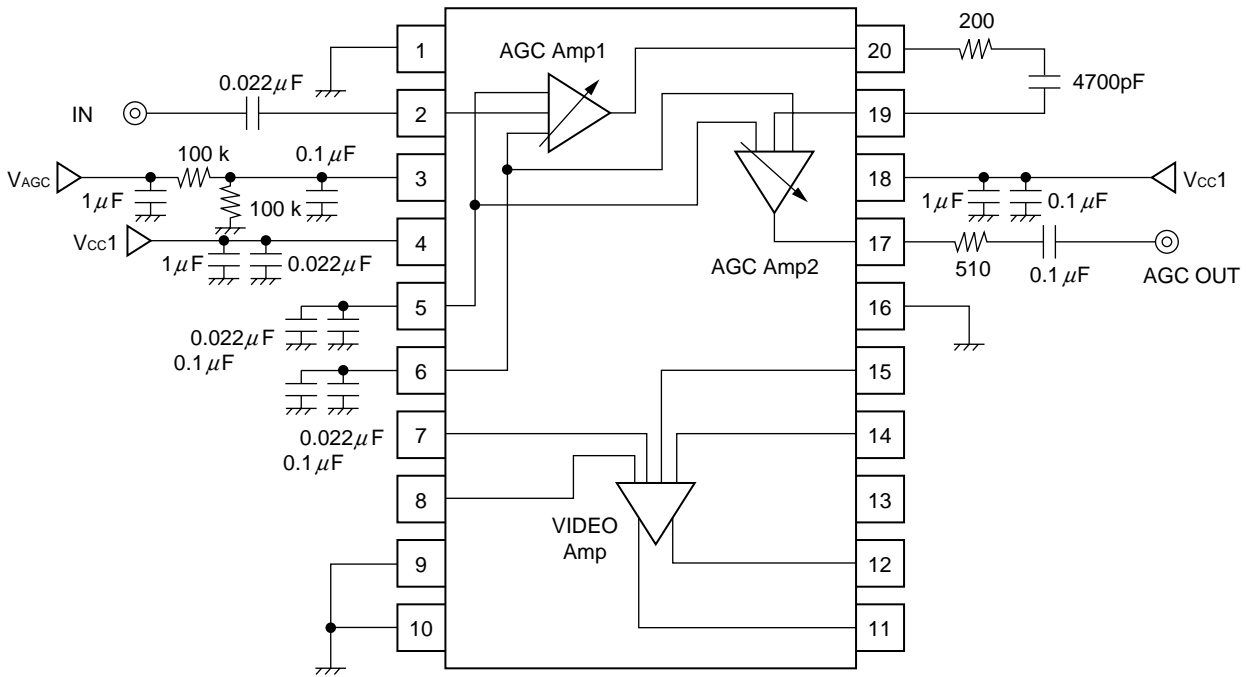


Note Output Power = (Output Power at Spectrum Analyzer) + 10 log (560 Ω/50 Ω)

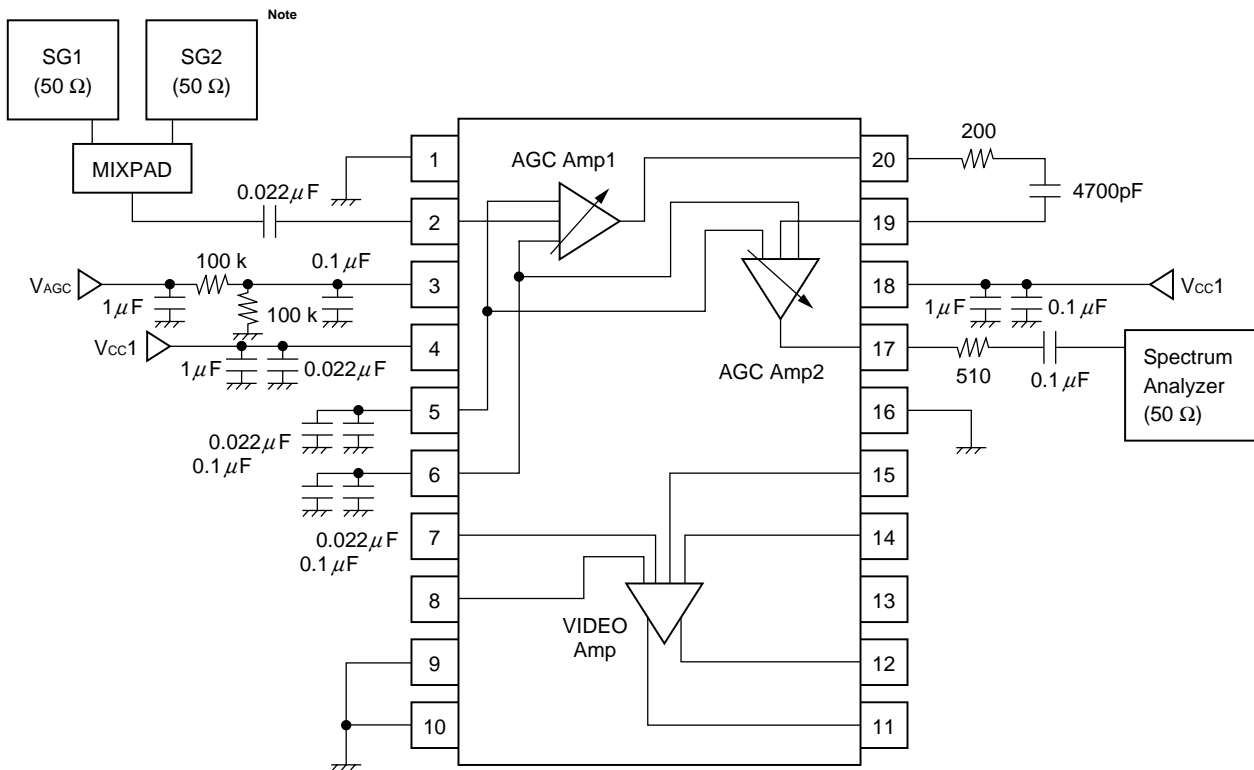
THERMAL CHARACTERISTICS (FOR REFERENCE)



MEASUREMENT CIRCUIT 1

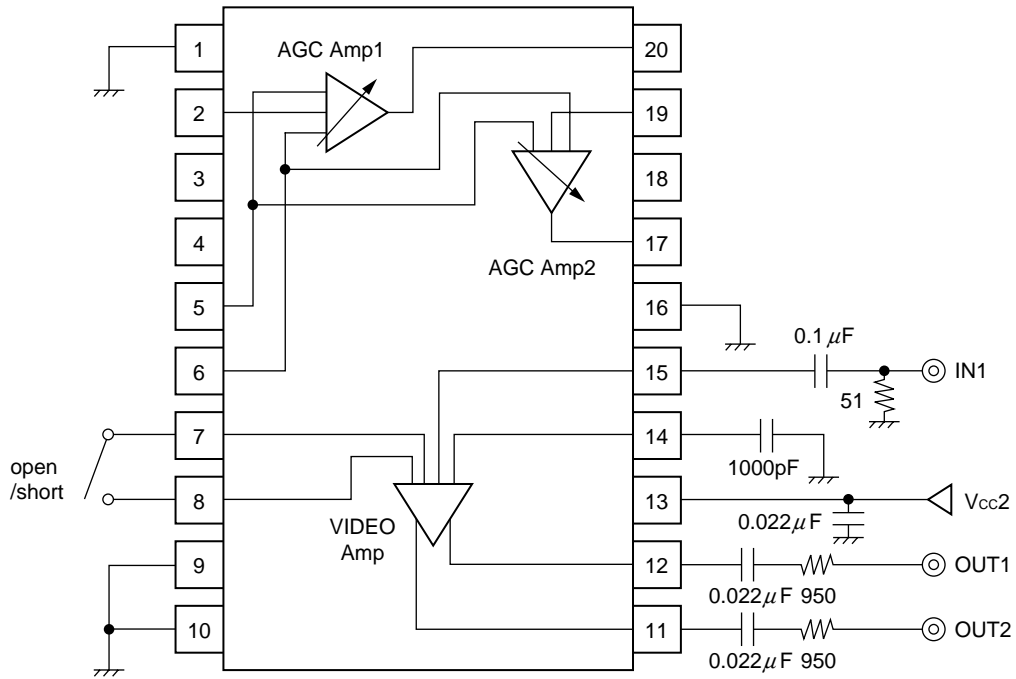


MEASUREMENT CIRCUIT 2

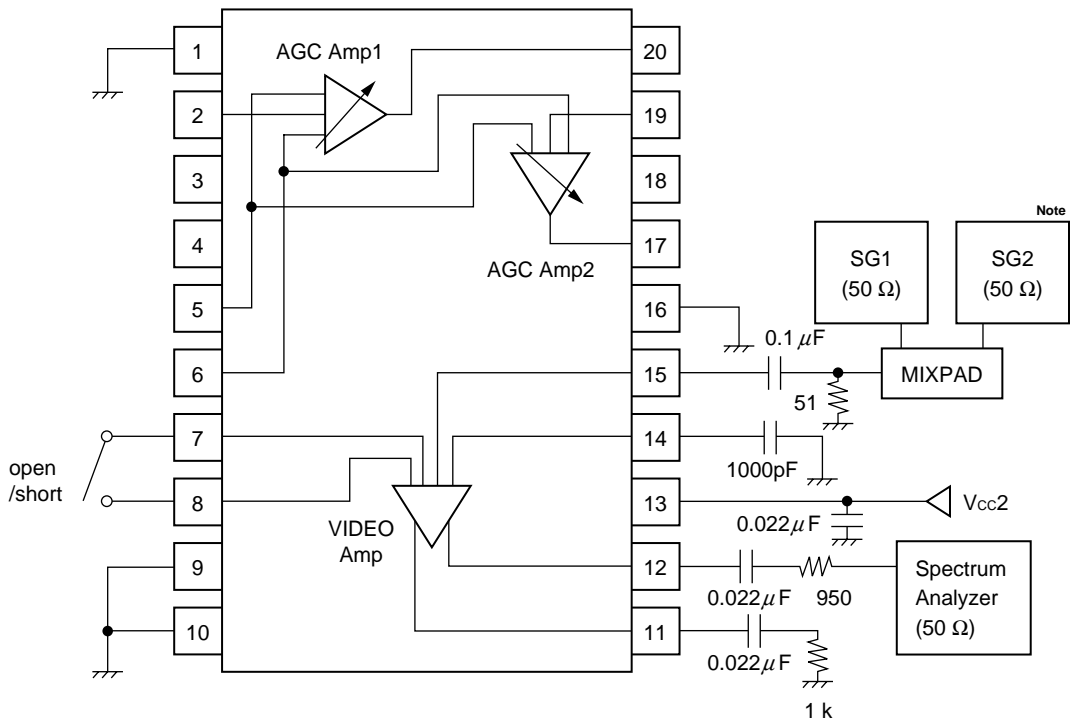


Note In the case of measurement of IM₃

MEASUREMENT CIRCUIT 3

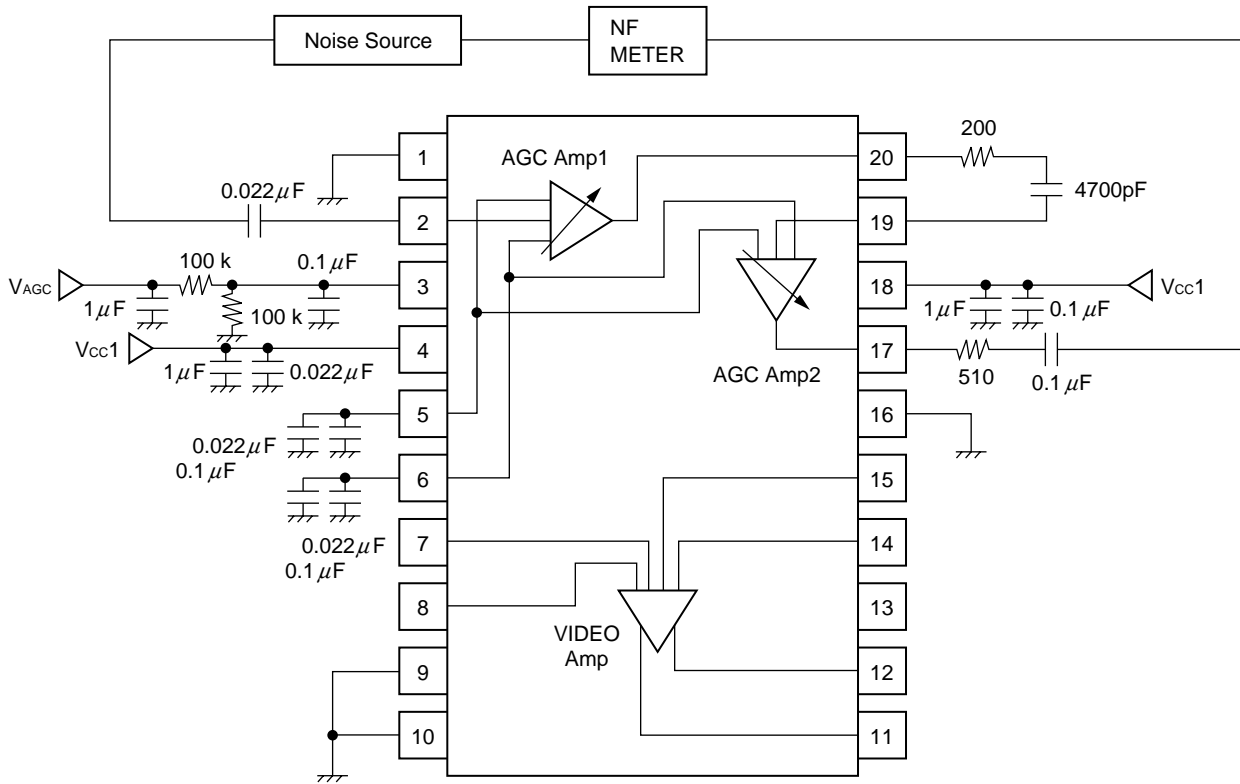


MEASUREMENT CIRCUIT 4

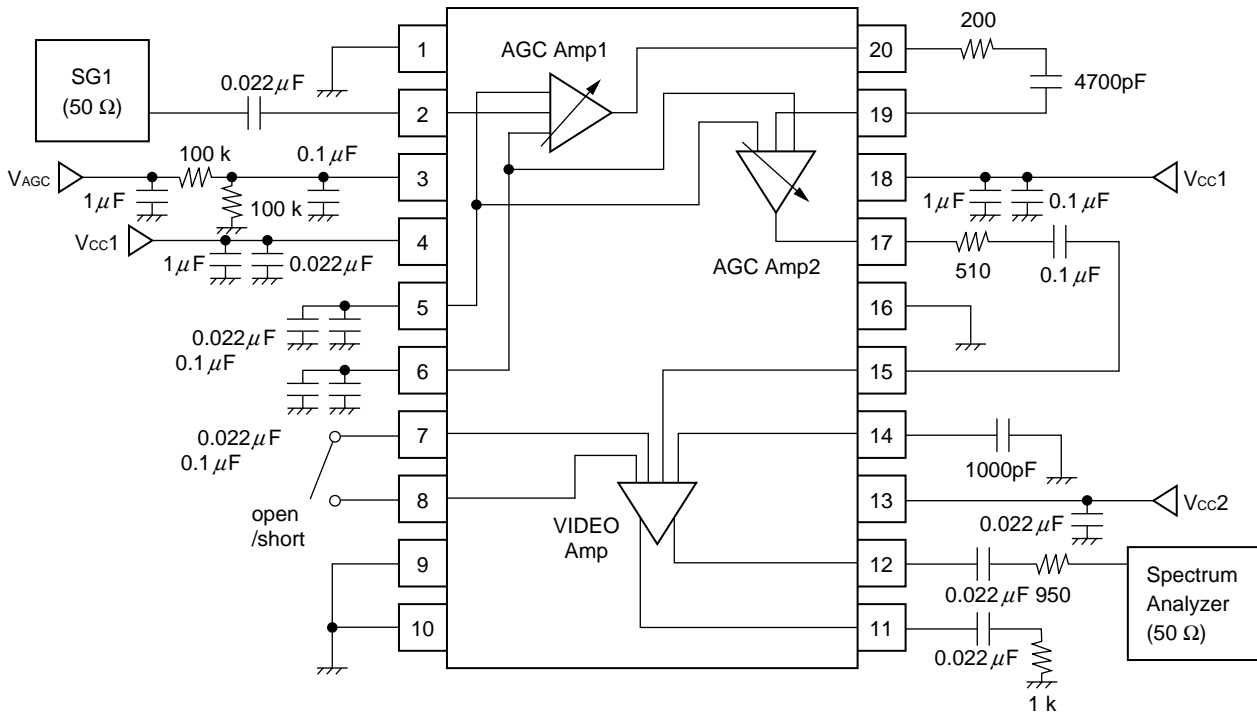


Note In the case of measurement of IM₃

MEASUREMENT CIRCUIT 5



MEASUREMENT CIRCUIT 6



MEASUREMENT CIRCUIT 7

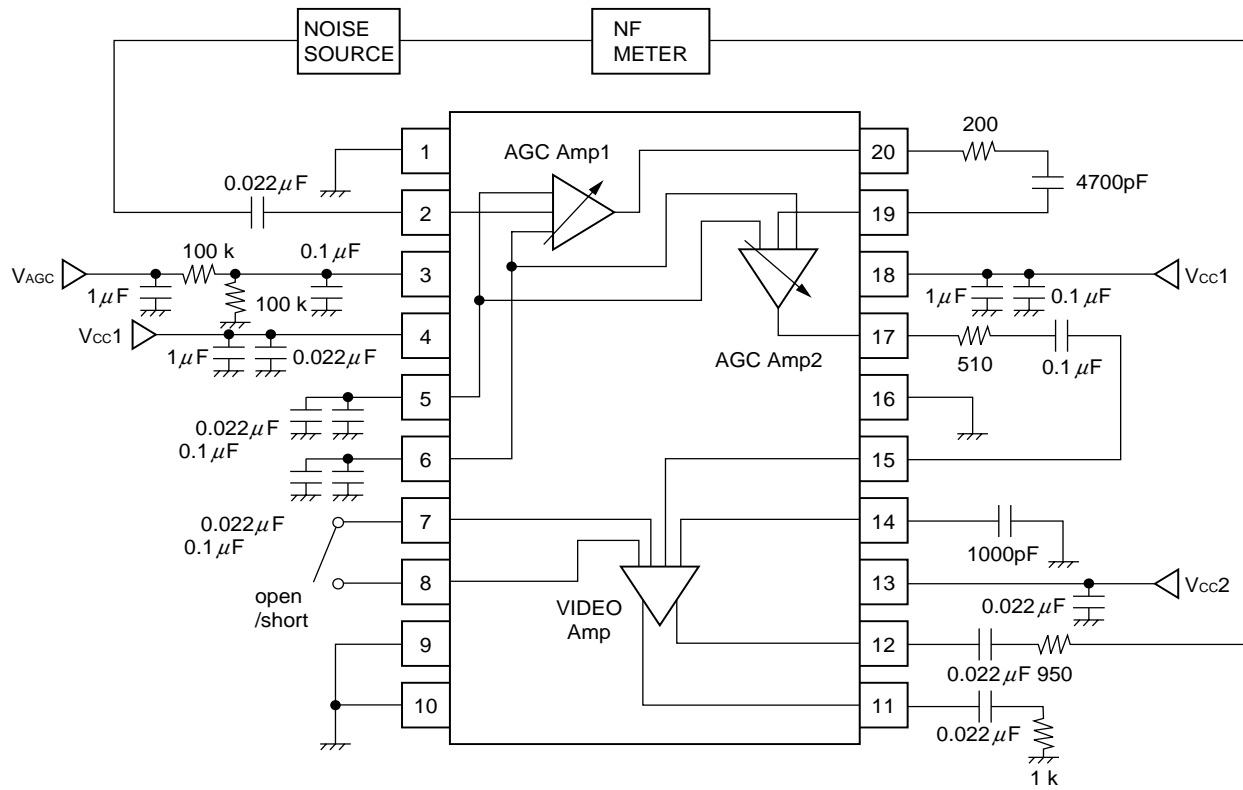
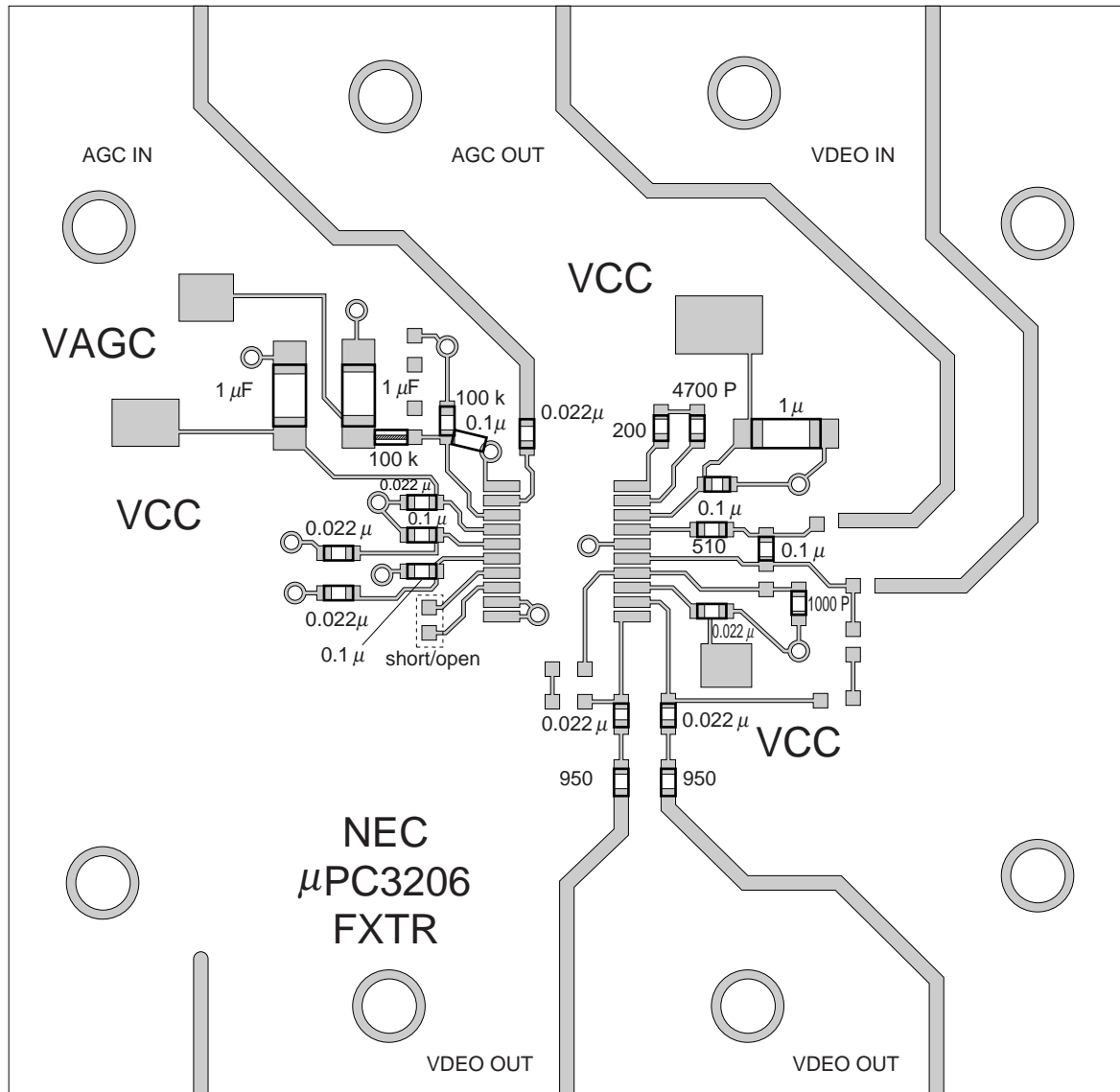


ILLUSTRATION OF THE EVALUATION BOARD FOR MEASUREMENT CIRCUIT6

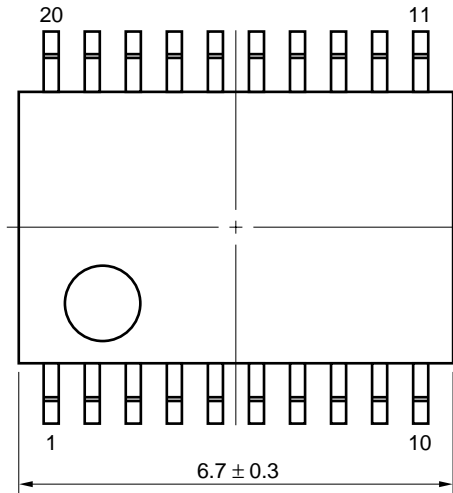


Notes on evaluation board

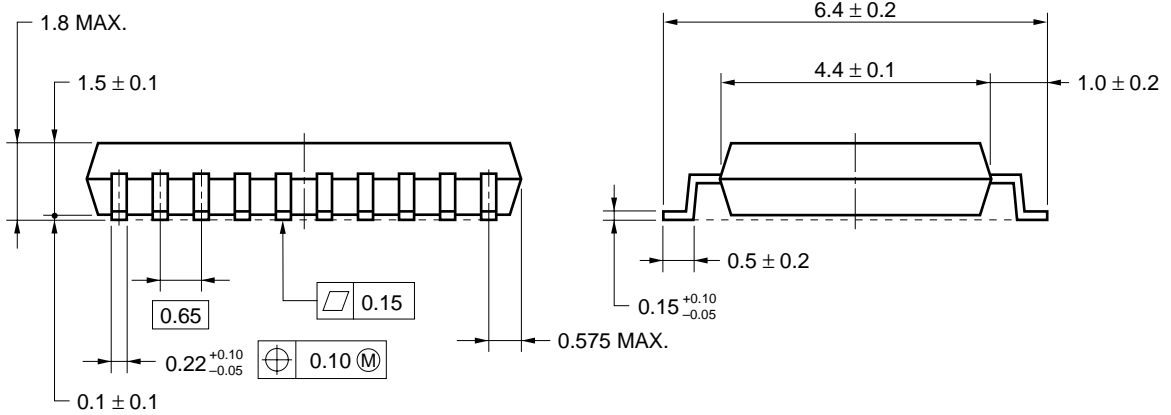
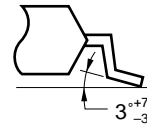
- (1) GND pattern on rear side
- (2) $\odot \ominus$: Through hole
- (3) : represents cutout

PACKAGE DIMENSIONS

★ 20 PIN PLASTIC SSOP (225 mil) (UNIT: mm)



detail of lead end



NOTE Each lead centerline is located within 0.10 mm of its true position (T.P.) at maximum material condition.

NOTE ON CORRECT USE

- (1) Observe precautions for handling because of electro-static sensitive devices.
- (2) Form a ground pattern as wide as possible to minimize ground impedance (to prevent undesires osillation).
- (3) Keep the track length of the ground pins as short as possible.
- (4) A low pass filter must be attached to Vcc line.
- (5) A matching circuit must be externally attached to output port.

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 Condition Symbol
Infrared Reflow	Package peak temperature: 235°C or below Time: 30 seconds or less (at 210°C) Count: 3, Exposure limit ^{Note} : None	IR35-00-3
VPS	Package peak temperature: 215°C or below Time: 40 seconds or less (at 200°C) Count: 3, Exposure limit ^{Note} : None	VP15-00-3
Partial Heating	Pin temperature: 300°C Time: 3 seconds or less (per side of device) Exposure limit ^{Note} : None	—

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

[MEMO]

[MEMO]

[MEMO]

- **The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.**
- No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.
- NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.
- Descriptions of circuits, software, and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software, and information in the design of the customer's equipment shall be done under the full responsibility of the customer. NEC Corporation assumes no responsibility for any losses incurred by the customer or third parties arising from the use of these circuits, software, and information.
- While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.
- NEC devices are classified into the following three quality grades:
"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.
 - 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 or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.