

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

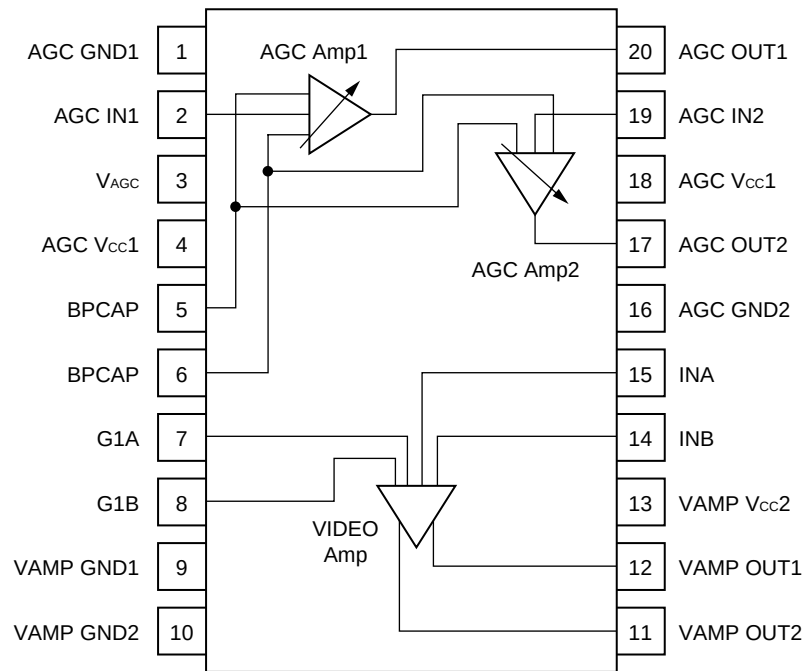
Part Number	Package	Supplying Form
μ PC3206GR-E1	20-pin plastic SSOP (225 mil)	Embossed tape 12 mm wide. Pin 1 indicates pull-out direction of tape. Qty 2.5 kp/reel.

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

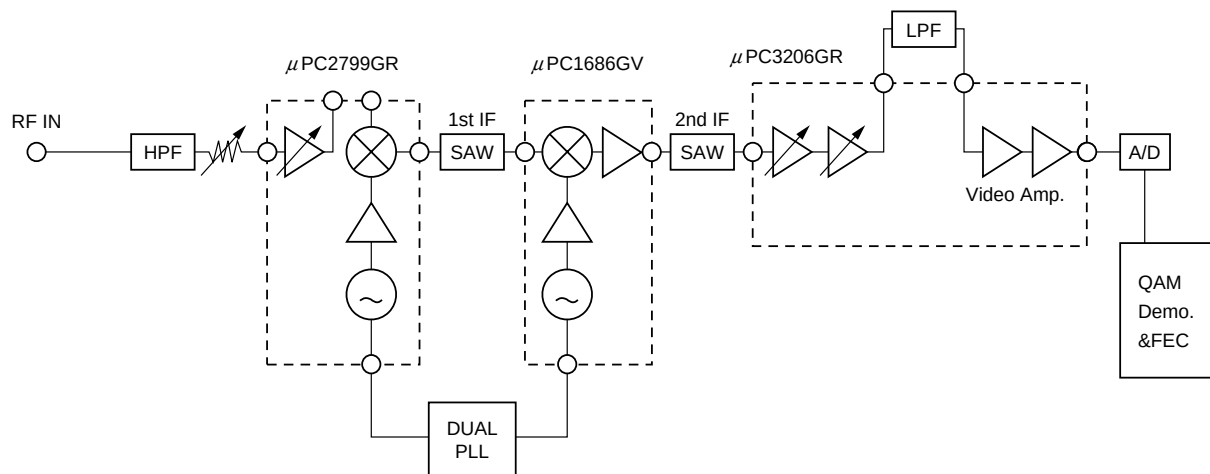
Caution electro-static sensitive device

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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	Signal input pin to AGC amplifier.	
		1.02		
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 k Ω).	
4	AGC V _{cc} 1	5	Power supply pin of AGC amplifier1. Must be connected bypass capacitor to minimize ground impedance.	
5	BPCAP4 <small>Note 1</small>	2.61	Bypass pin of AGC amplifier1 and 2.	Refer to Equivalent circuit of pin1 and pin2.
		2.61		
6	BPCAP2 <small>Note 1</small>	2.84		
		2.49		
7	G1A <small>Note 2</small>	1.72	Gain control pin of video amplifier. Maximum gain at G1A – G1B = short. Minimum gain at G1A – G1B = open.	Refer to Equivalent circuit of pin14 and pin15.
		3.34		
8	G1B <small>Note 2</small>	1.72		
		3.34	Gain is able to adjust by inserting arbitrary resistor between 7pin and 8pin.	
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	Signal output pin of video amplifier. In case of $R_L = 1\text{ k}\Omega$, single-end output voltage equal 2V _{P-P} .	
		4.92		
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 4.13	Signal input pin to video amplifier.	
15	INA ^{Note 2}	2.49 4.13		
16	AGC GND2	0		
17	AGC OUT2 ^{Note 1}	1.69 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 1.01	Signal input pin of AGC amplifier2.	
20	AGC OUT1 ^{Note 1}	1.71 3.35	Signal output pin of AGC amplifier1.	

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 k Ω)						
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 k Ω)						
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 k Ω , single-ended)						
Bandwidth 1	BW _{G1}	G1A-G1B pins:short Note 2, 5	–	100	–	MHz

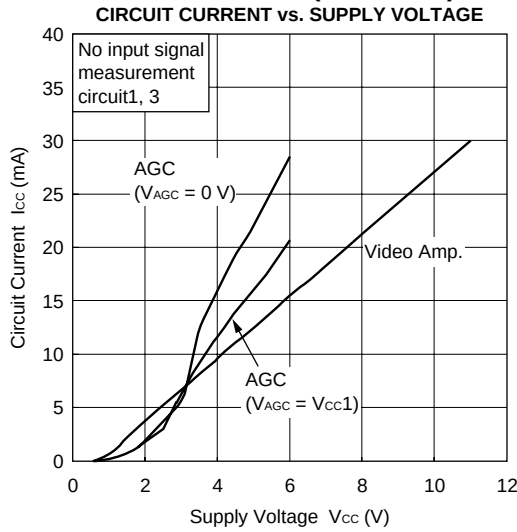
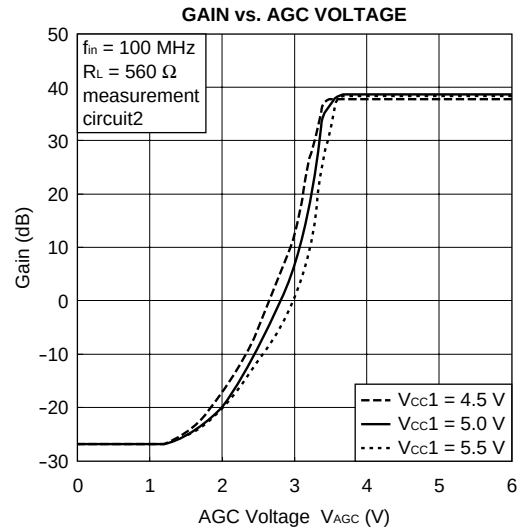
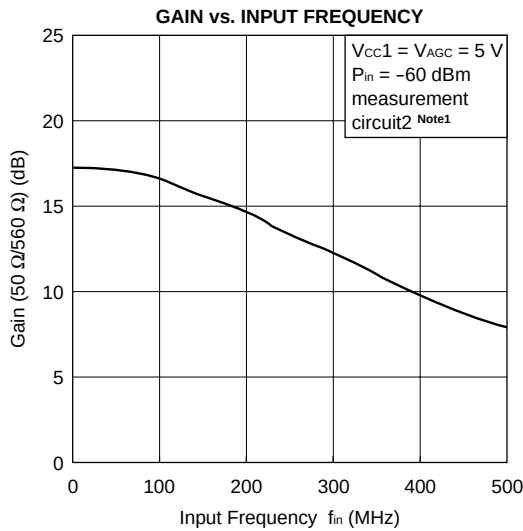
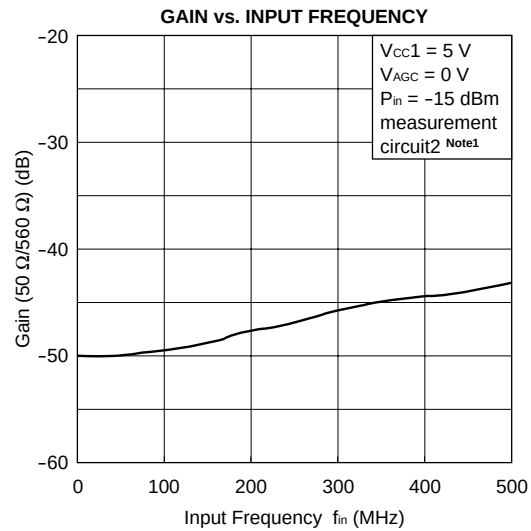
- Notes**
1. By measurement circuit 1
 2. -3 dB down from gain at 5 MHz
 3. By measurement circuit 2
 4. By measurement circuit 3
 5. By measurement circuit 4

STANDARD CHARACTERISTICS (FOR REFERENCE) ($T_A = 25\text{ }^\circ\text{C}$)

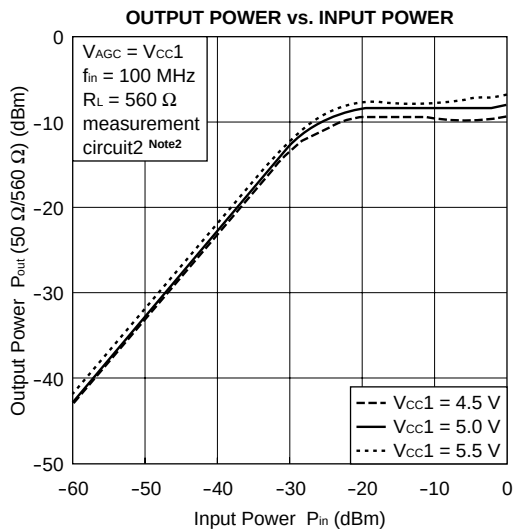
Parameter	Symbol	Test Conditions	Reference Values	Unit
AGC Amplifier Block ($V_{CC1} = 5\text{ V}$, $f_{in} = 100\text{ MHz}$, $R_L = 560\text{ }\Omega$)				
Noise Figure	NF	Maximum Gain ($V_{AGC} = 5\text{ V}$) Note 1	5.5	dB
Output Intercept Point	OIP ₃	$f_{in2} = 106\text{ MHz}$, Maximum Gain ($V_{AGC} = 5\text{ V}$) Note 2	+4.5	dBm
Video Amplifier Block ($V_{CC2} = 9\text{ V}$, $f_{in} = 100\text{ MHz}$, $R_L = 1\text{ k}\Omega$)				
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	$f_{in2} = 106\text{ MHz}$, G1A-G1B pins:short Note 3	-16	dBm
Input Intercept Point 2	IIP ₃₂	$f_{in2} = 106\text{ MHz}$, G1A-G1B pins:open Note 3	4	dBm
Video Amplifier Block ($V_{CC2} = 5\text{ V}$, $f_{in} = 100\text{ MHz}$, $R_L = 1\text{ k}\Omega$)				
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	$f_{in2} = 106\text{ MHz}$, G1A-G1B pins:short Note 3	-15	dBm
Input Intercept Point 4	IIP ₃₄	$f_{in2} = 106\text{ MHz}$, G1A-G1B pins:open Note 3	2	dBm
Total Block ($V_{CC1} = 5\text{ V}$, $f_{in} = 100\text{ MHz}$, $R_L = 1\text{ k}\Omega$)				
Maximum Gain 2	G _{MAX2}	$V_{AGC} = 5\text{ V}$, $V_{CC2} = 5\text{ V}$, G1A-G1B pins:short Note 4	76	dB
Maximum Gain 3	G _{MAX3}	$V_{AGC} = 5\text{ V}$, $V_{CC2} = 5\text{ V}$, G1A-G1B pins:open Note 4	62	dB
Minimum Gain 2	G _{MIN2}	$V_{AGC} = 0\text{ V}$, $V_{CC2} = 5\text{ V}$, G1A-G1B pins:short Note 4	10	dB
Maximum Gain 4	G _{MAX4}	$V_{AGC} = 5\text{ V}$, $V_{CC2} = 9\text{ V}$, G1A-G1B pins:short Note 4	80	dB
Maximum Gain 5	G _{MAX5}	$V_{AGC} = 5\text{ V}$, $V_{CC2} = 9\text{ V}$, G1A-G1B pins:open Note 4	63	dB
Minimum Gain 3	G _{MIN3}	$V_{AGC} = 0\text{ V}$, $V_{CC2} = 9\text{ V}$, 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

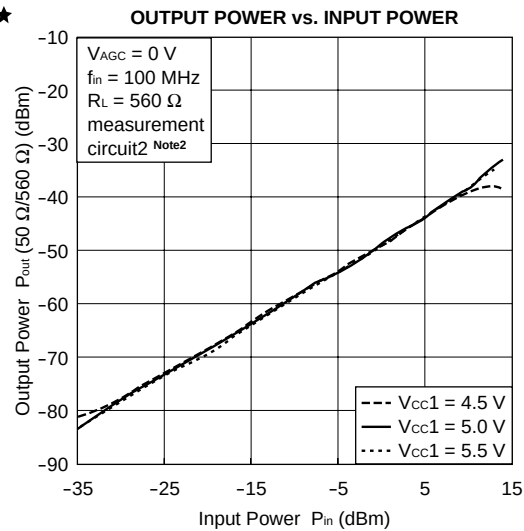
TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)



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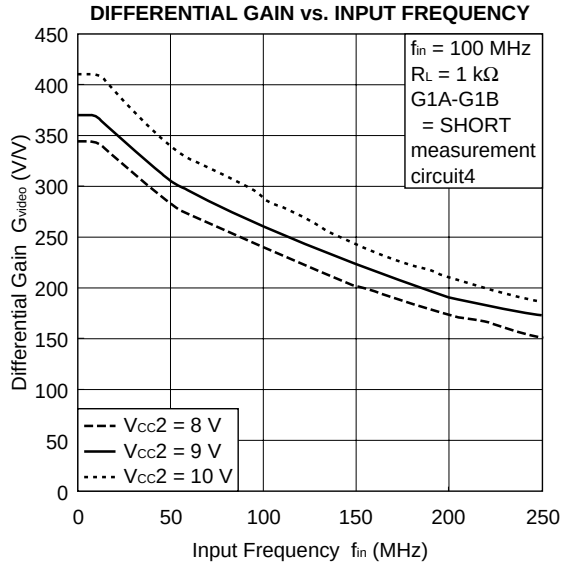
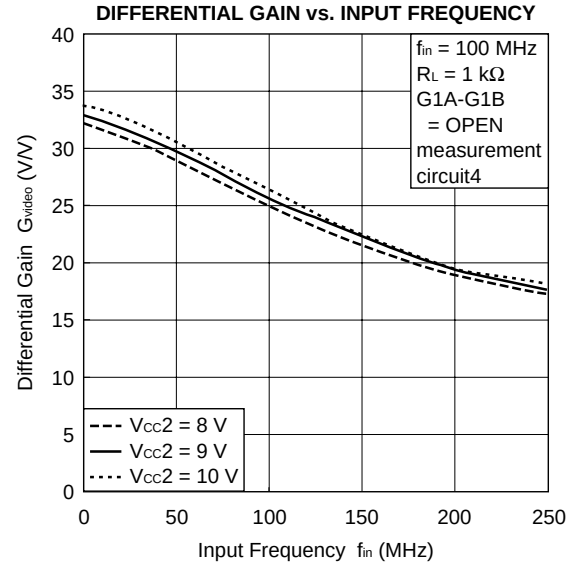
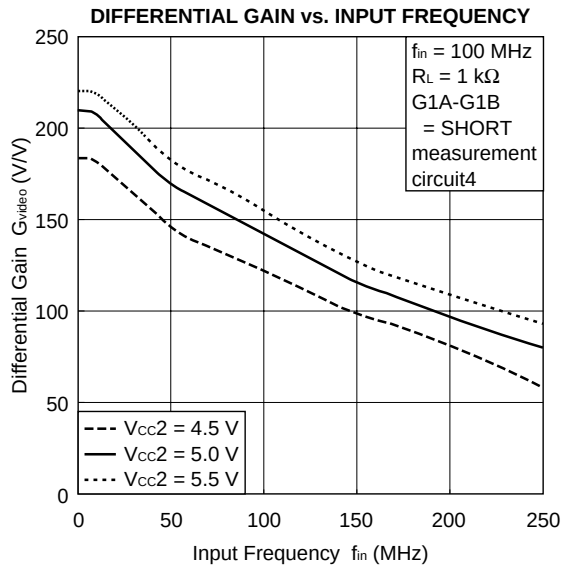
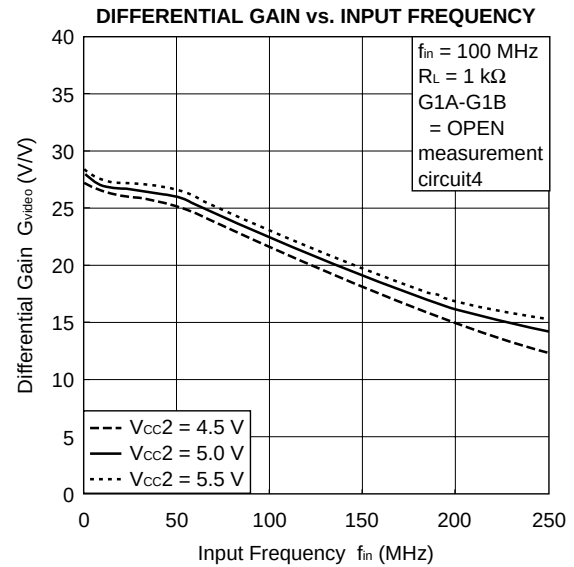
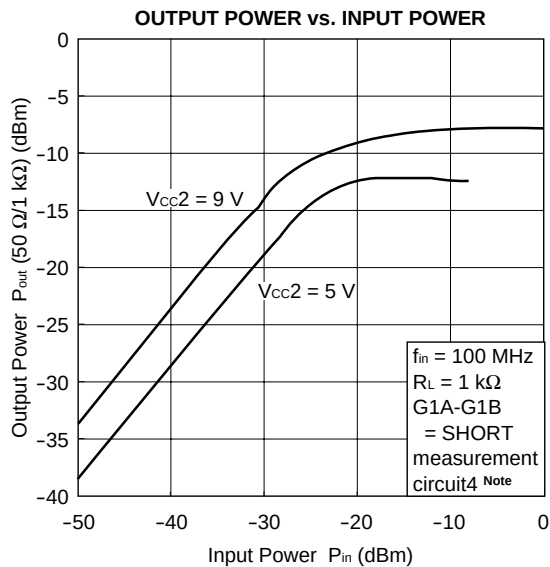
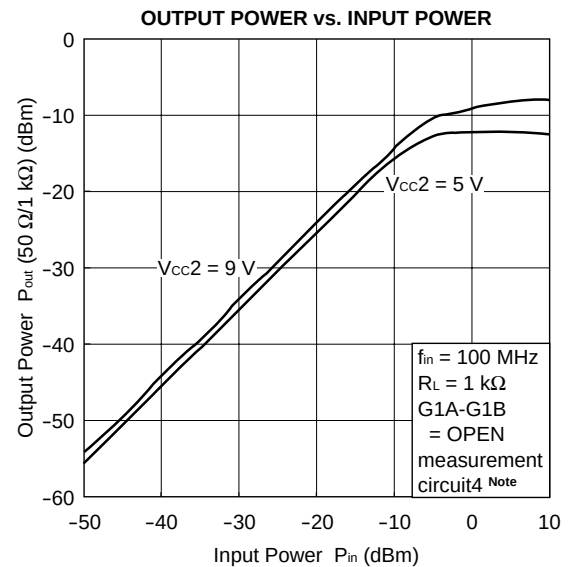


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- Notes**
1. Gain = (Gain at Spectrum Analyzer) + 20 log (560 Ω /50 Ω)
 2. Output Power = (Output Power at Spectrum Analyzer) + 10 log (560 Ω /50 Ω)

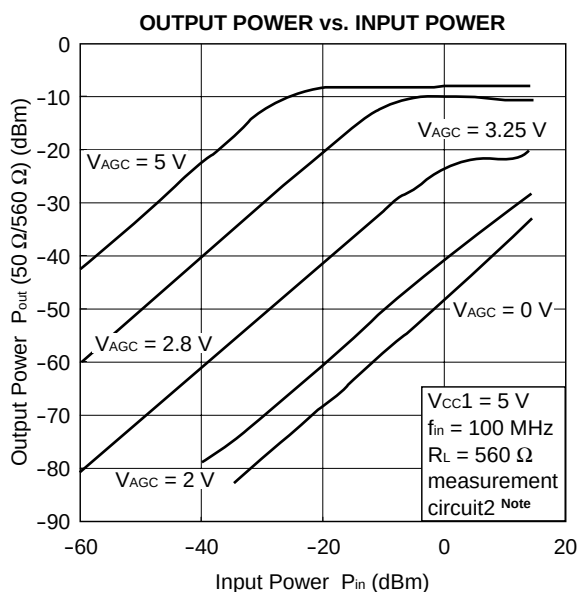
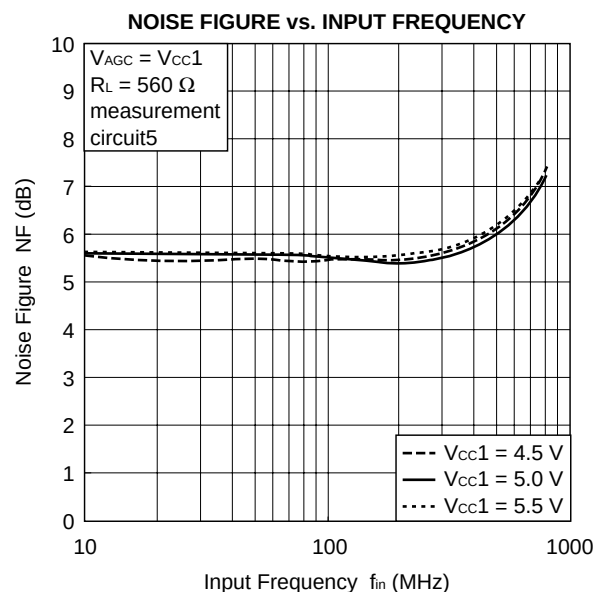
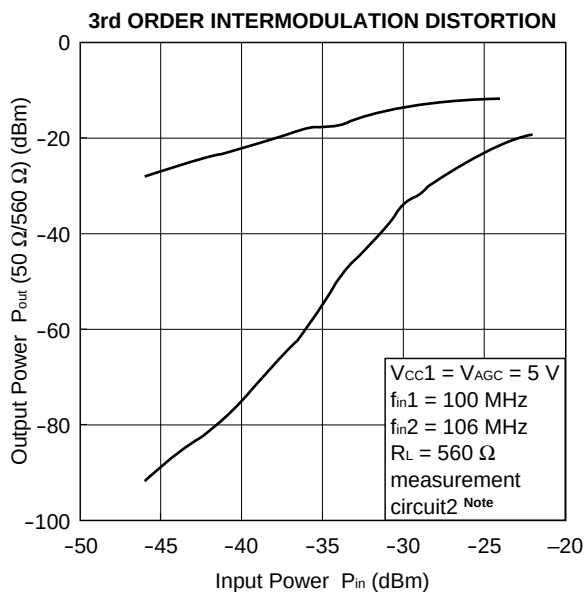
TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)



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

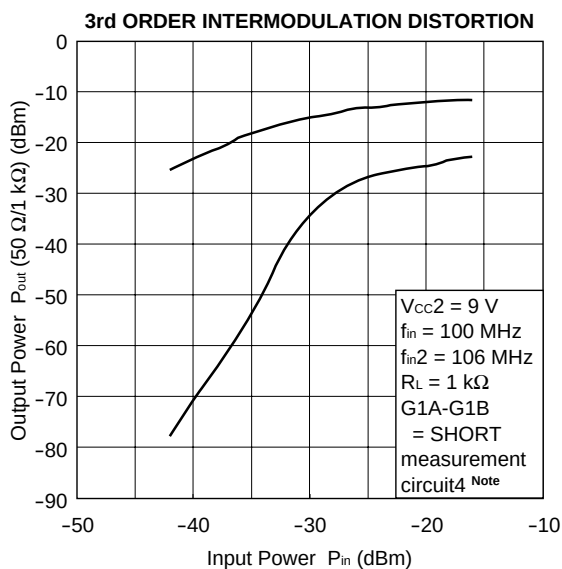
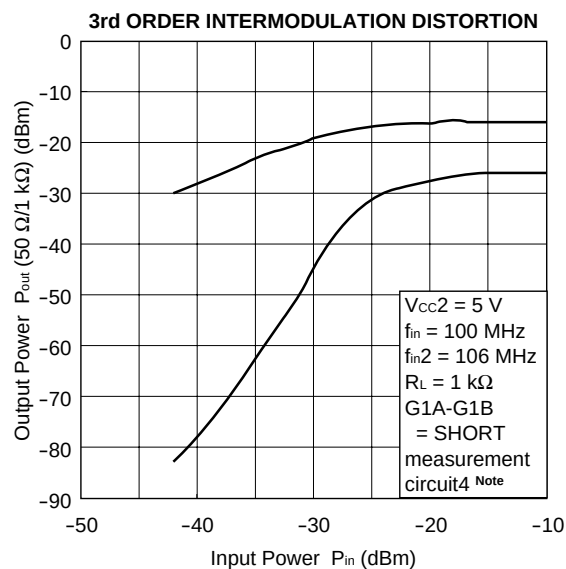
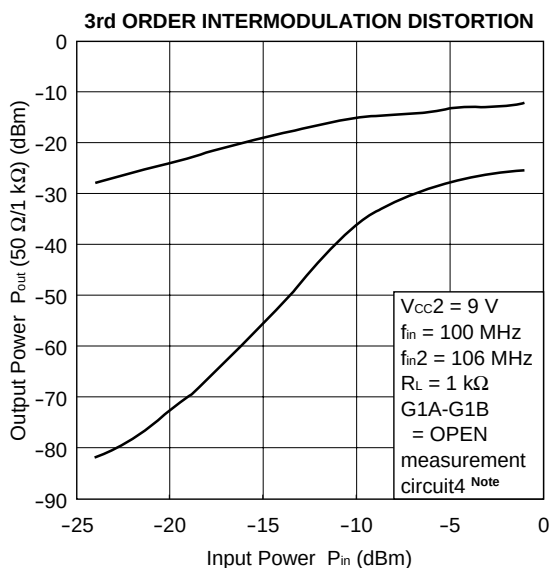
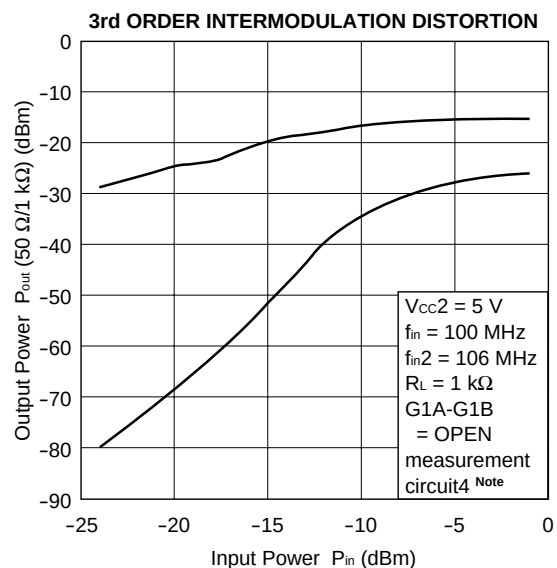
STANDARD CHARACTERISTICS (T_A = 25 °C)

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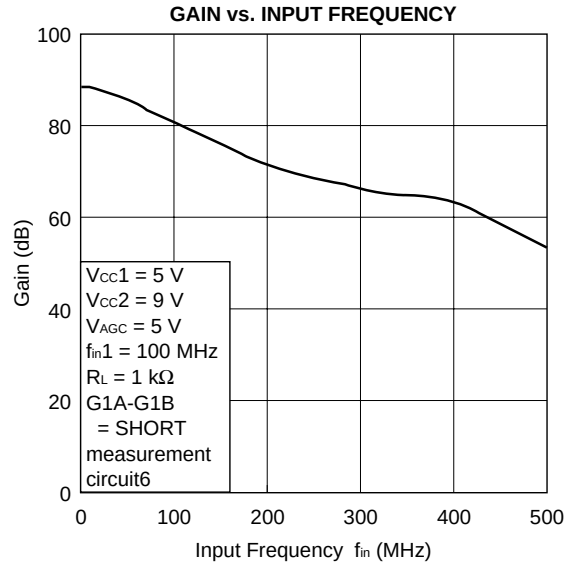
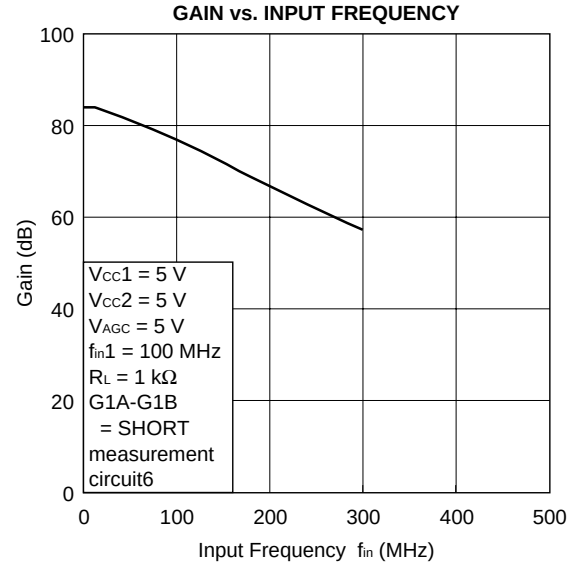
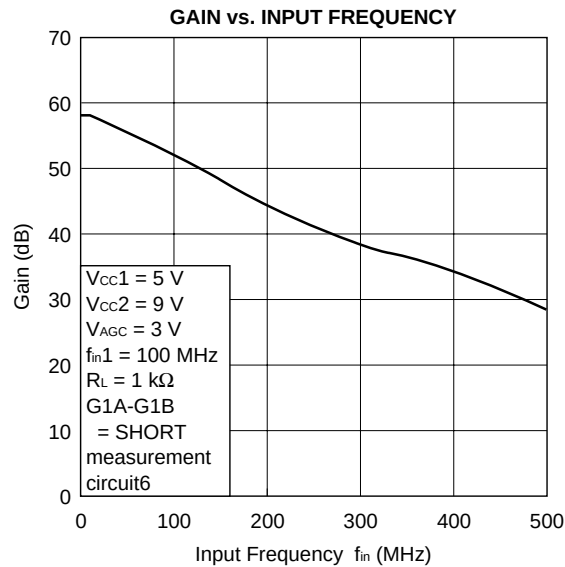
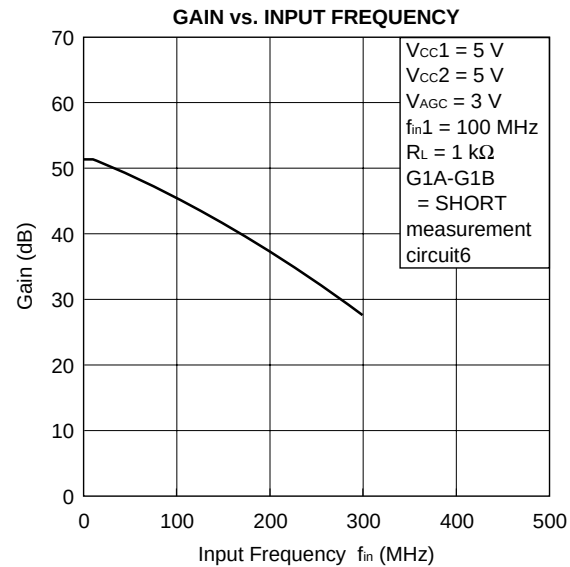
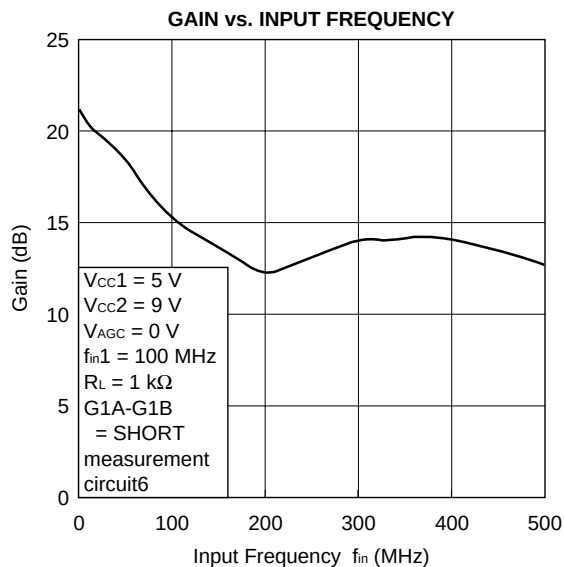
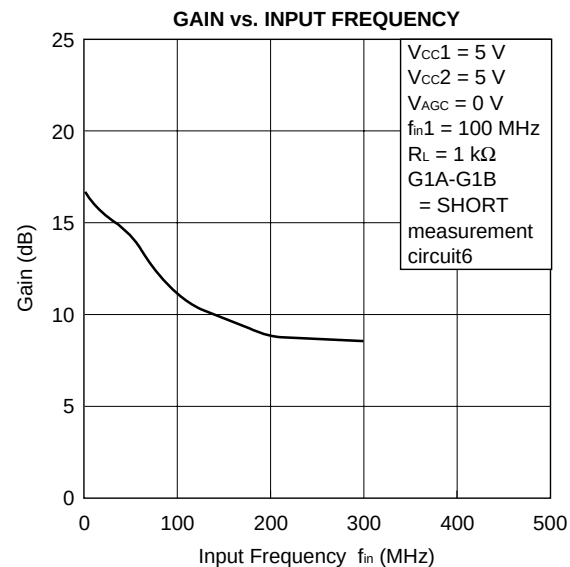
Note Output Power = (Output Power at Spectrum Analyzer) + 10 log (560 Ω /50 Ω)

STANDARD CHARACTERISTICS (T_A = 25 °C)

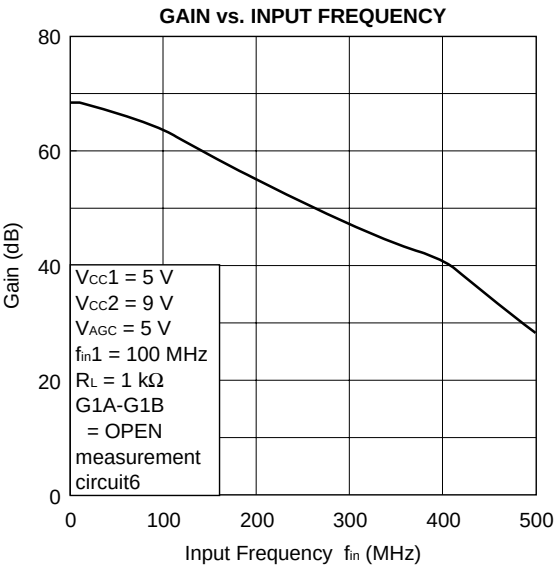
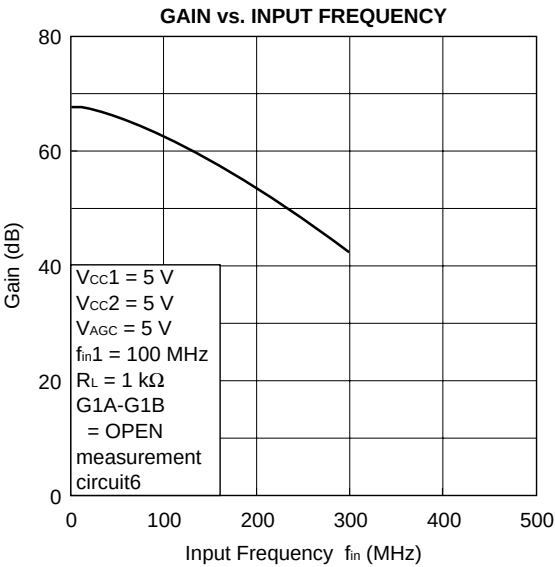
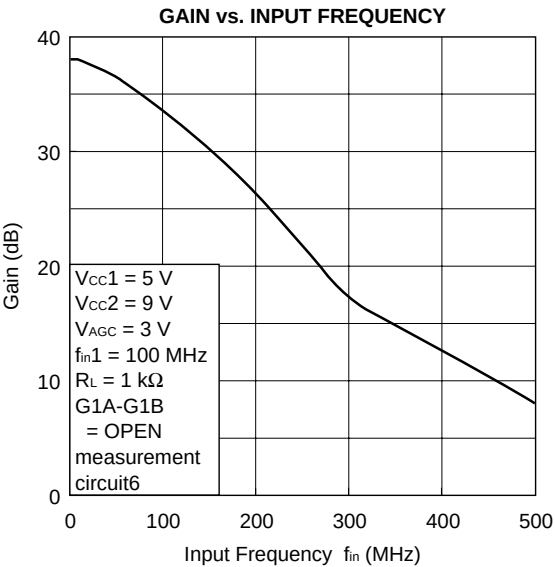
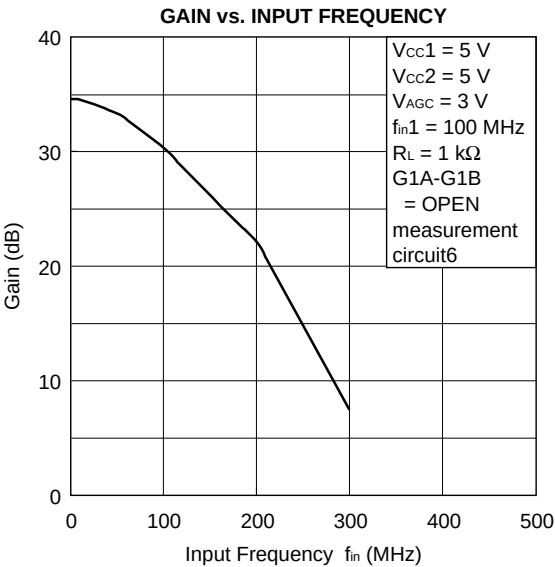


Note Output Power = (Output Power at Spectrum Analyzer) + 10 log (1 k Ω /50 Ω)

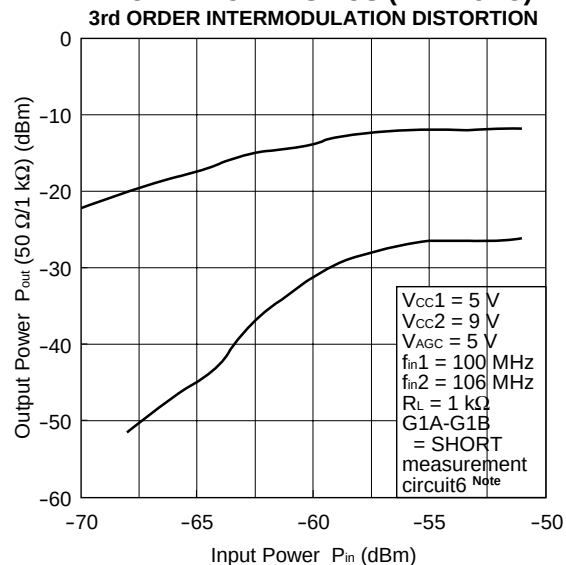
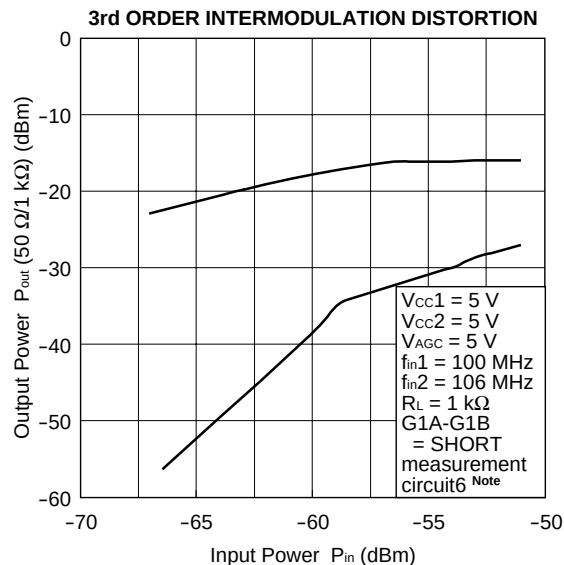
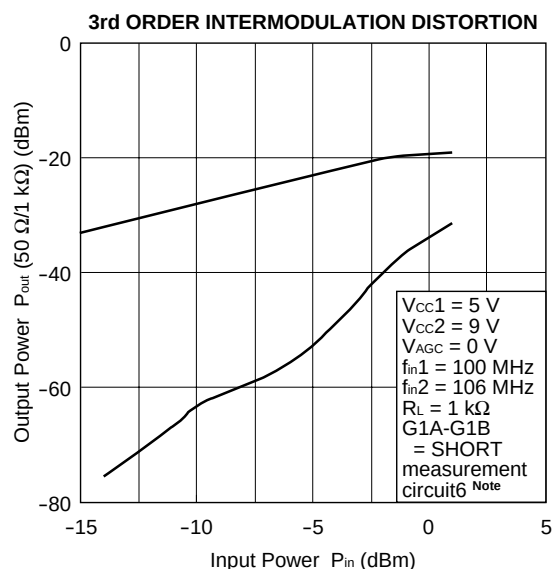
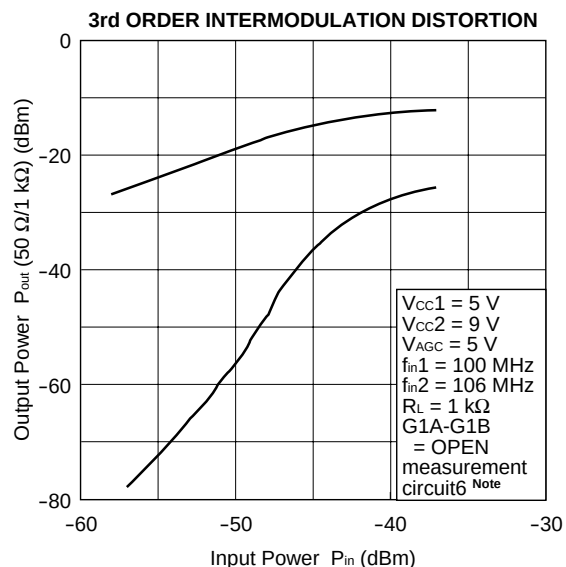
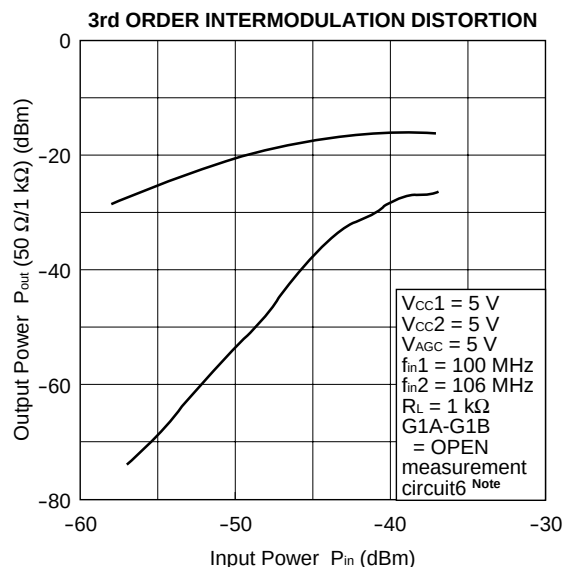
STANDARD CHARACTERISTICS (T_A = 25 °C)



STANDARD CHARACTERISTICS (T_A = 25 °C)

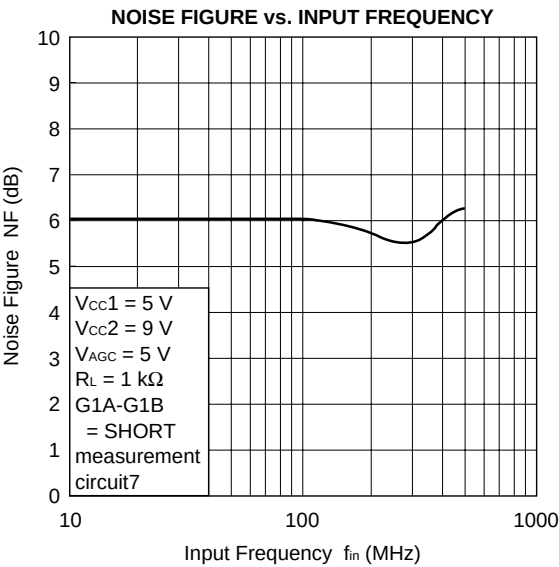
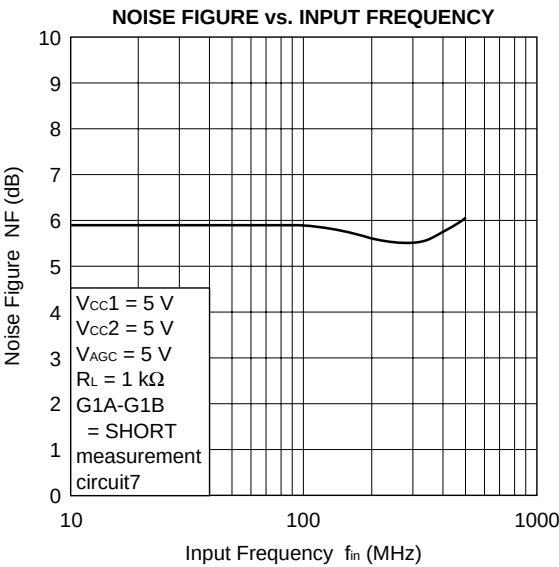
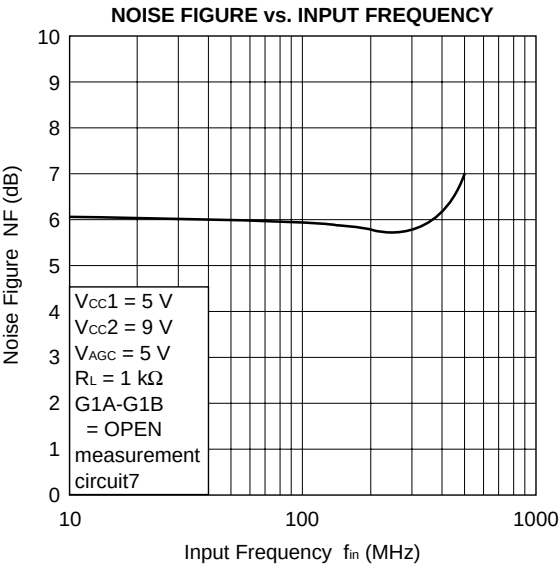
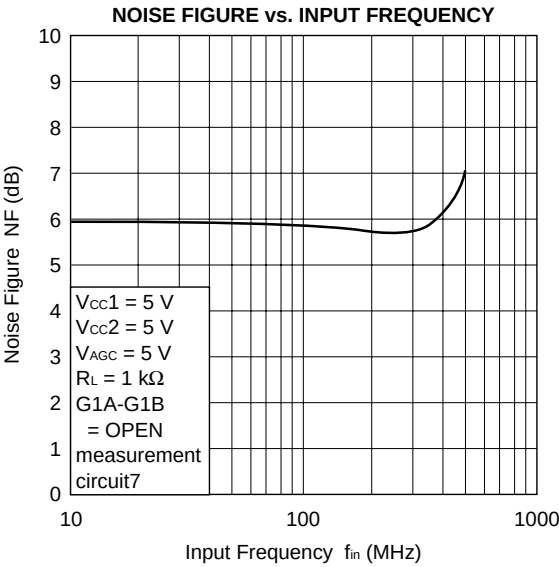


STANDARD CHARACTERISTICS (T_A = 25 °C)

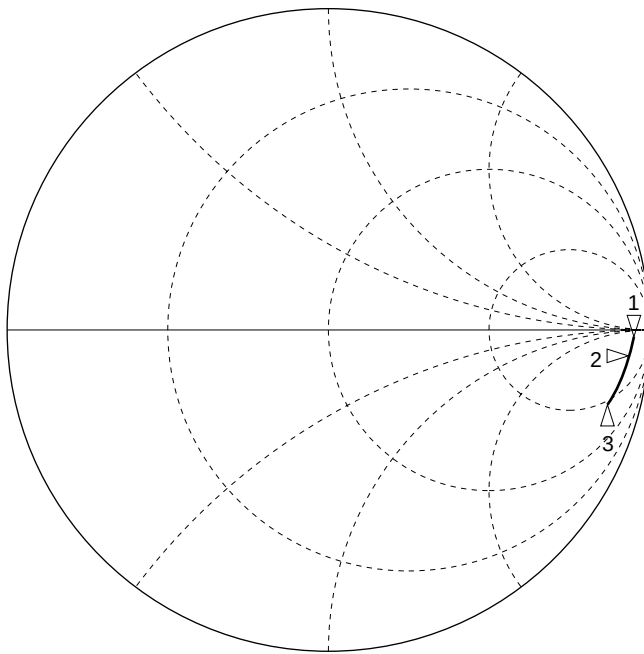


Note Output Power = (Output Power at Spectrum Analyzer) + 10 log (1 k Ω /50 Ω)

STANDARD CHARACTERISTICS (T_A = 25 °C)



INPUT IMPEDANCE (2 PIN)

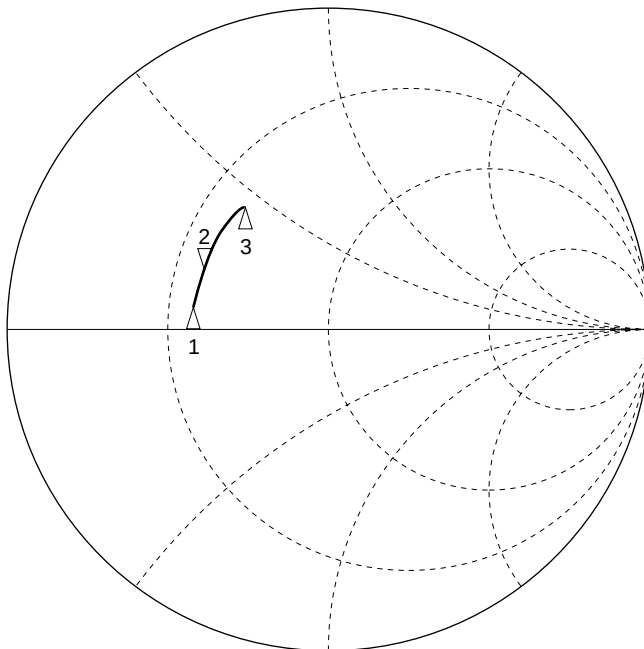


START 0.045000000 GHz
STOP 0.250000000 GHz

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)

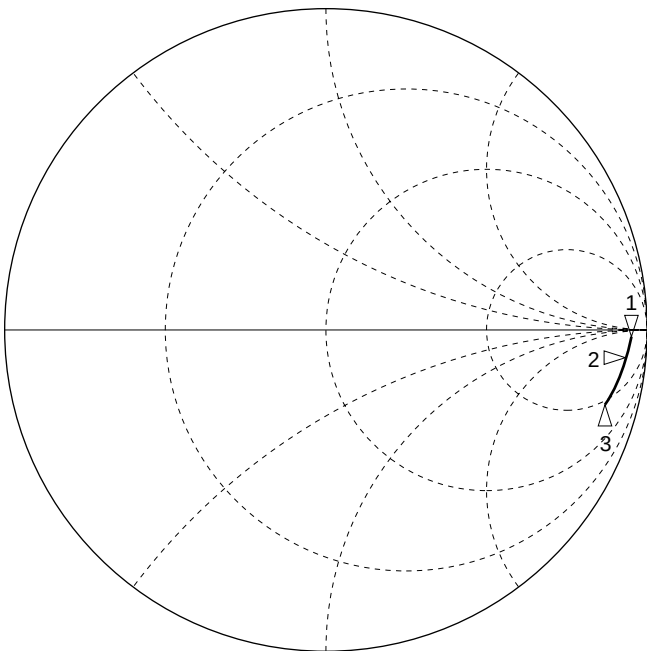


START 0.045000000 GHz
STOP 0.250000000 GHz

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)

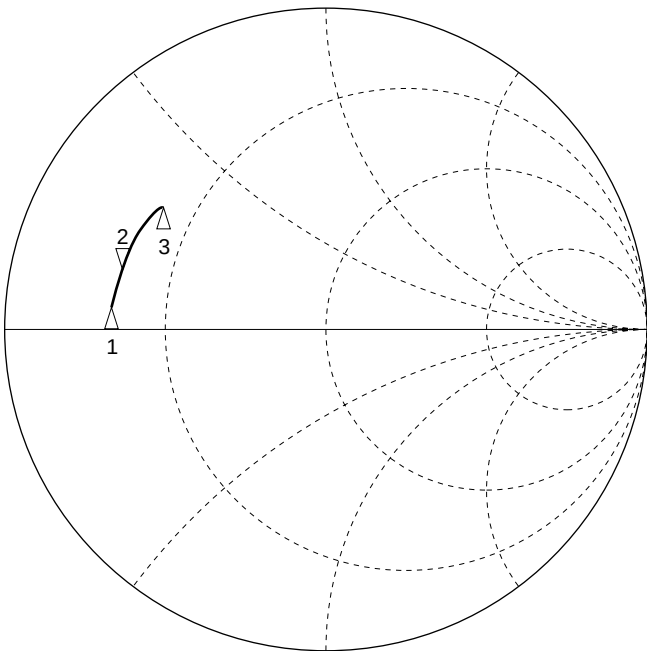


START 0.045000000 GHz
STOP 0.250000000 GHz

MARKER		Z _{in}
1	45 MHz	965.8 Ω – j601.2 Ω
2	100 MHz	446.6 Ω – j661.8 Ω
3	250 MHz	126.8 Ω – j312.4 Ω

Conditions T_A = 25°C
V_{cc1} = 5 V

OUTPUT IMPEDANCE (17 PIN)



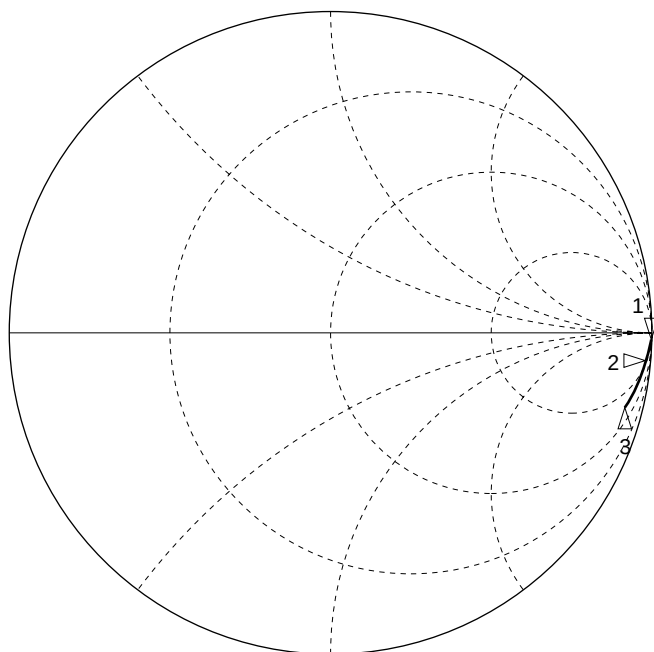
START 0.045000000 GHz
STOP 0.250000000 GHz

MARKER		Z _{out}
1	45 MHz	10.32 Ω + j2.88 Ω
2	100 MHz	10.86 Ω + j6.42 Ω
3	250 MHz	12.67 Ω + j15.39 Ω

Conditions T_A = 25°C
V_{cc1} = 5 V

INPUT IMPEDANCE (15 PIN)

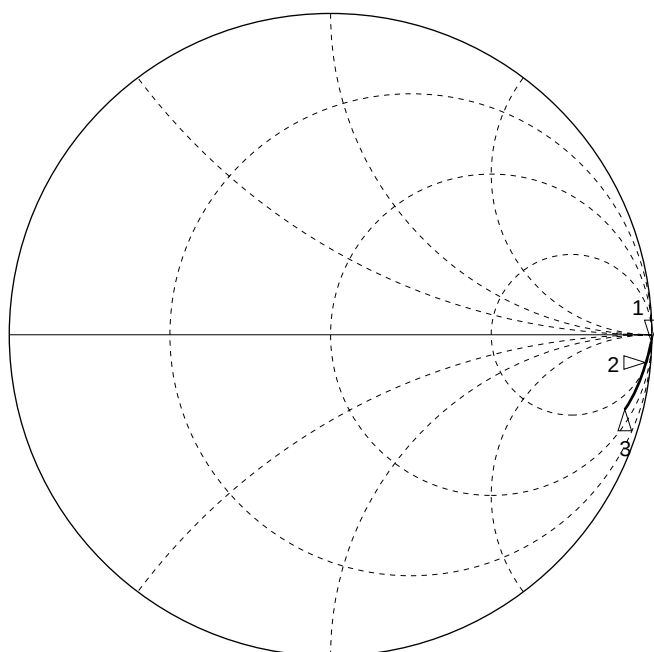
(i) $T_A = 25^{\circ}\text{C}$, $V_{CC2} = 5\text{ V}$



START 0.045000000 GHz
STOP 0.250000000 GHz

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

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

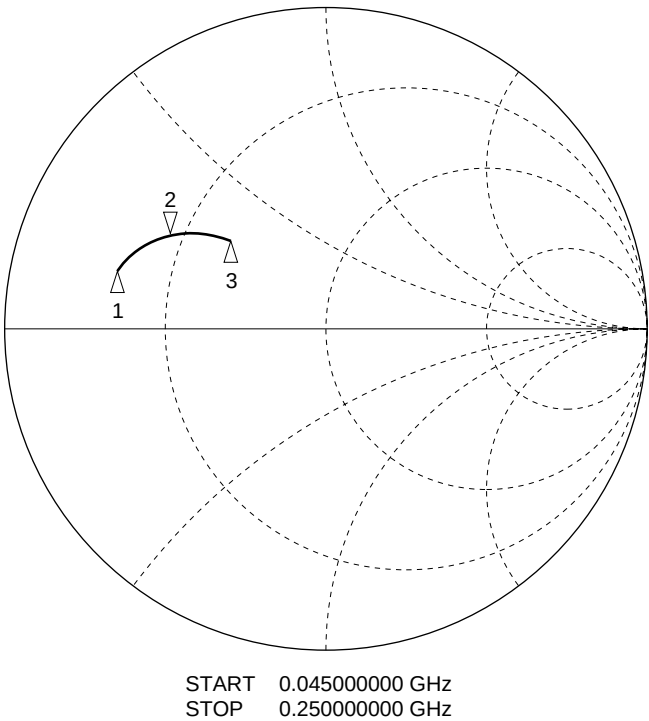


START 0.045000000 GHz
STOP 0.250000000 GHz

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

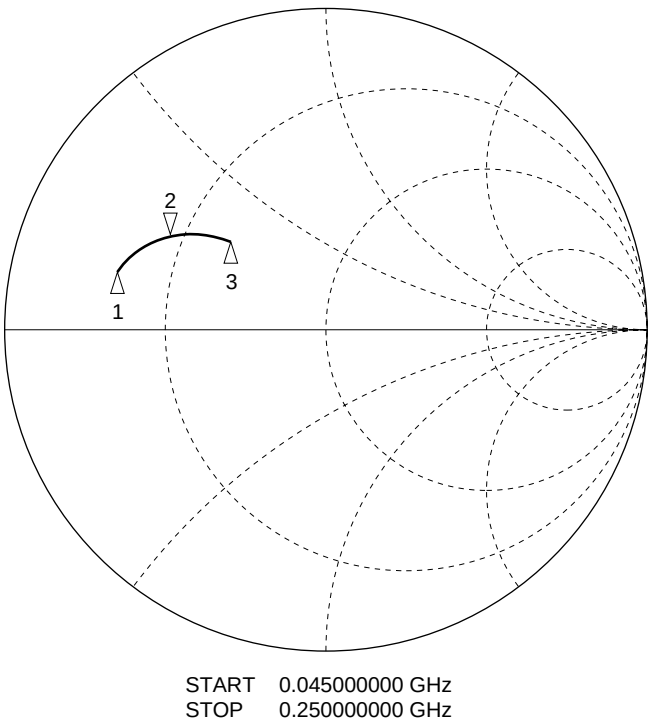
OUTPUT IMPEDANCE (12 PIN)

(i) $T_A = 25^{\circ}\text{C}$, $V_{CC2} = 5\text{ V}$, 11 pin is grounded through $50\ \Omega$ resistor.



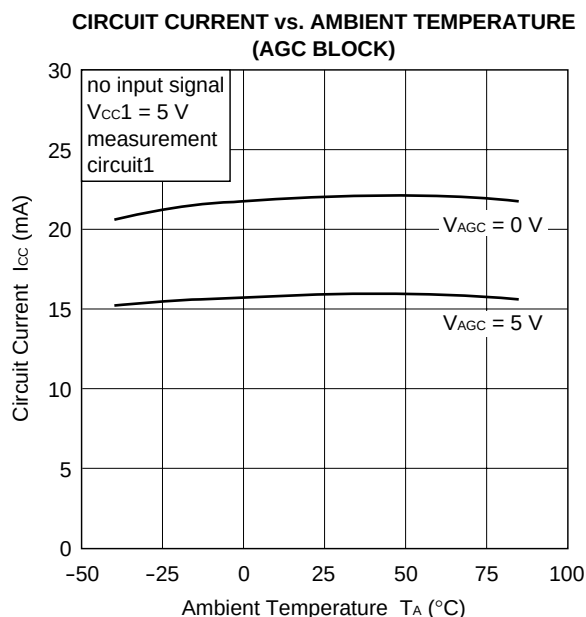
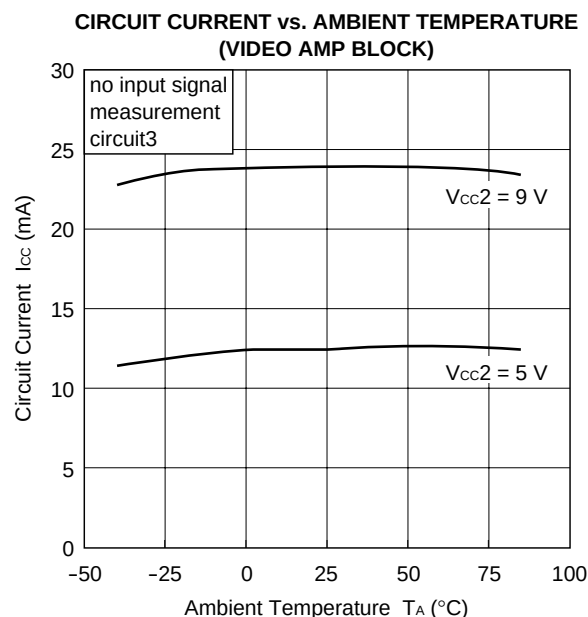
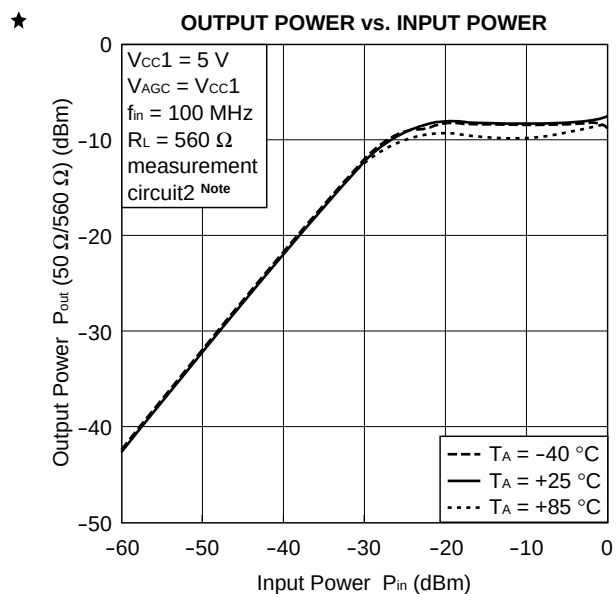
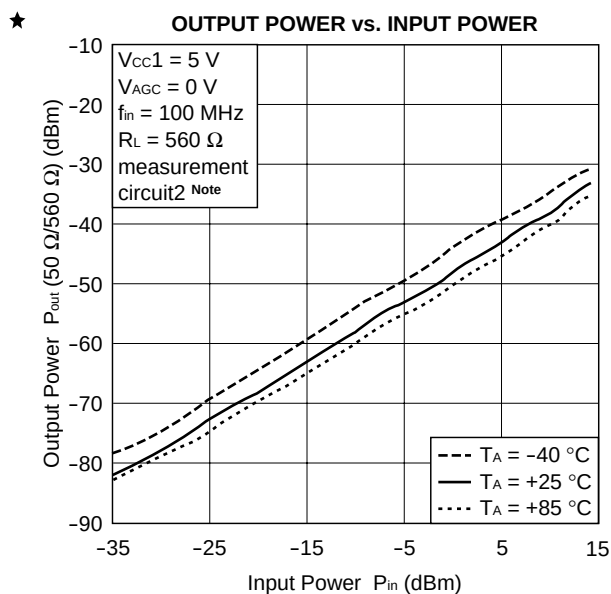
MARKER		Z_{out}
1	45 MHz	$9.88\ \Omega + j6.25\ \Omega$
2	100 MHz	$14.21\ \Omega + j11.78\ \Omega$
3	250 MHz	$23.64\ \Omega + j15.73\ \Omega$

(ii) $T_A = 25^{\circ}\text{C}$, $V_{CC2} = 9\text{ V}$, 11 pin is grounded through $50\ \Omega$ resistor.



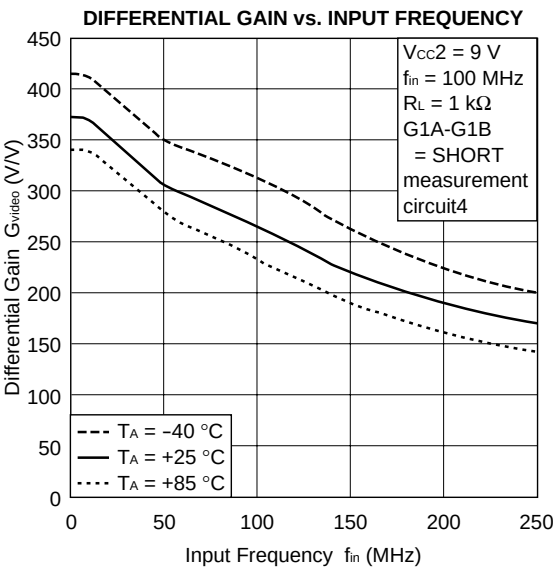
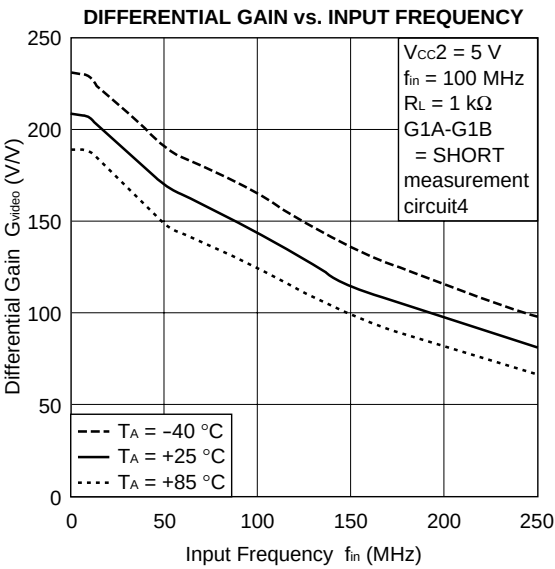
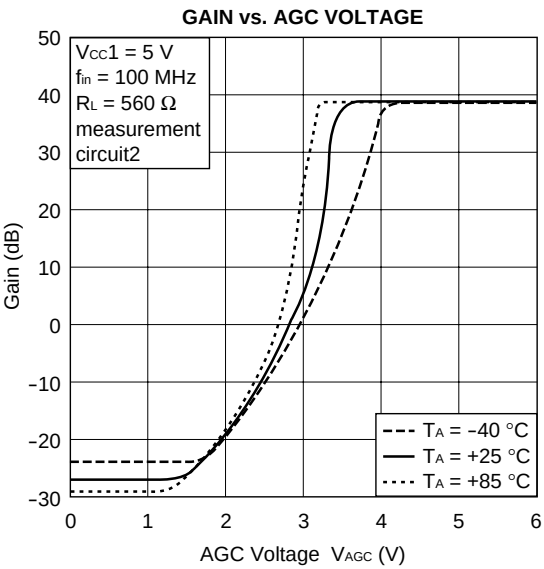
MARKER		Z_{out}
1	45 MHz	$7.36\ \Omega + j4.85\ \Omega$
2	100 MHz	$10.50\ \Omega + j9.58\ \Omega$
3	250 MHz	$19.37\ \Omega + j13.70\ \Omega$

THERMAL CHARACTERISTICS (FOR REFERENCE)

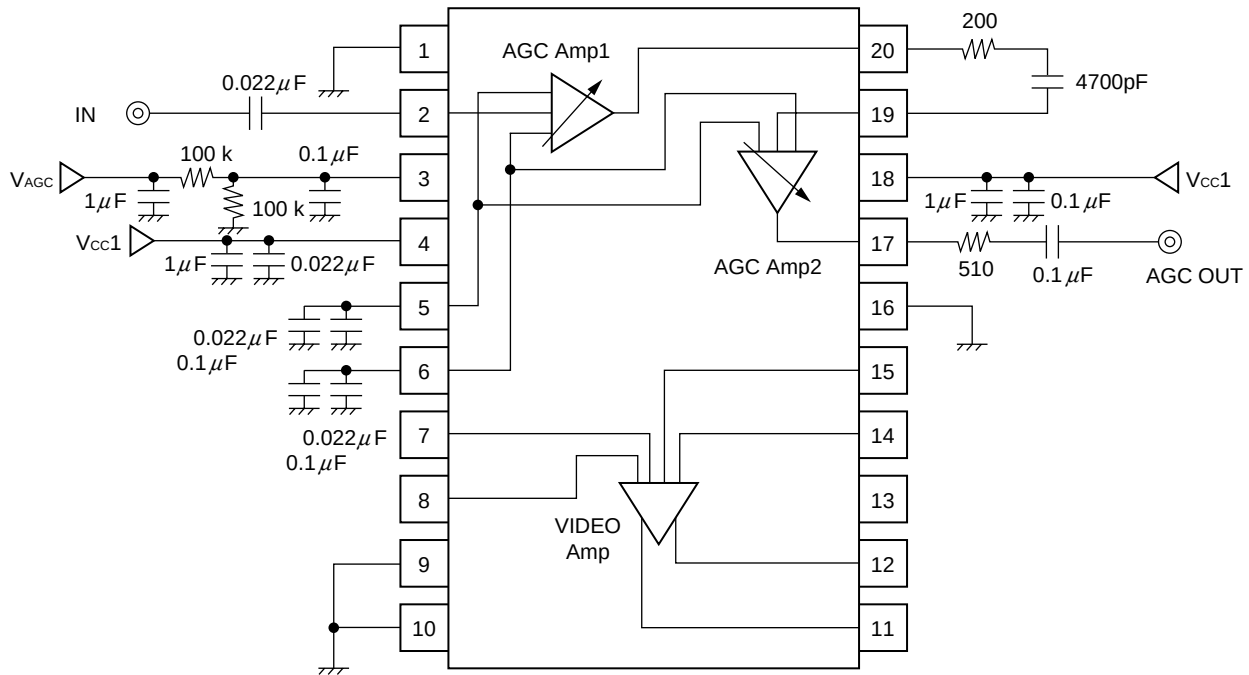


Note Output Power = (Output Power at Spectrum Analyzer) + 10 log (560 Ω /50 Ω)

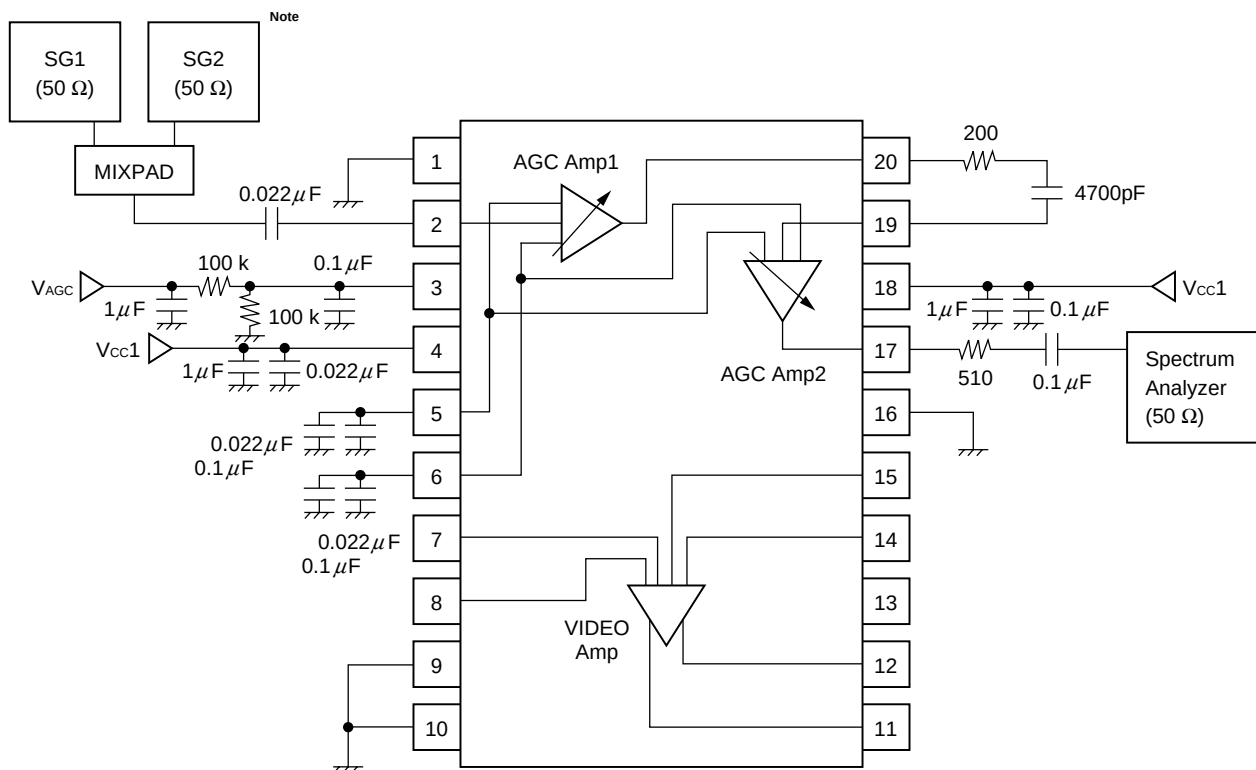
THERMAL CHARACTERISTICS (FOR REFERENCE)



MEASUREMENT CIRCUIT 1

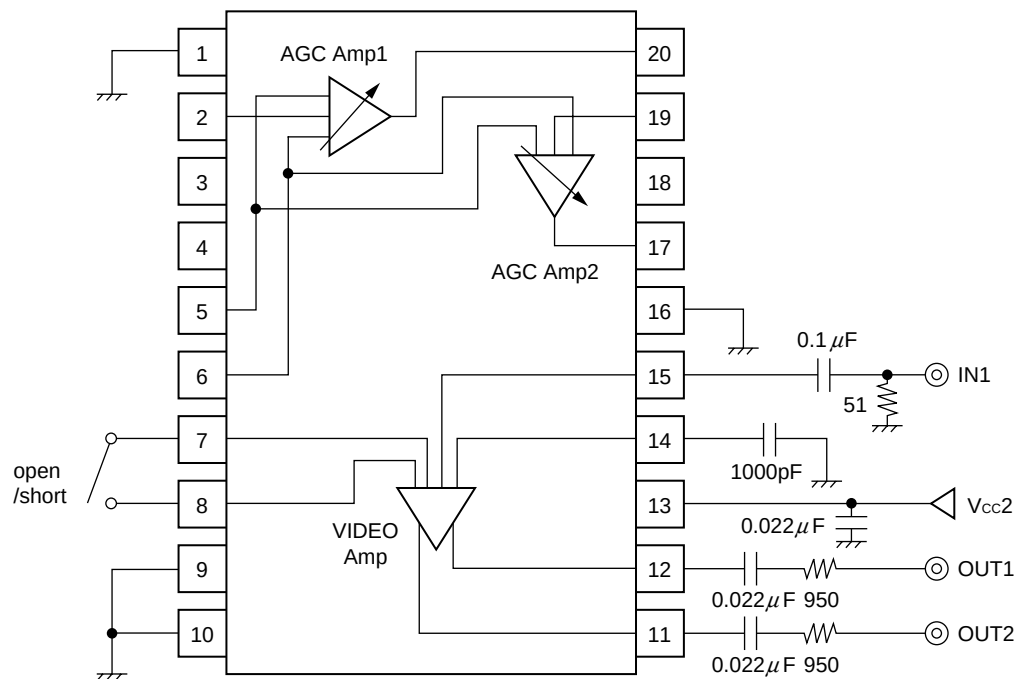


MEASUREMENT CIRCUIT 2

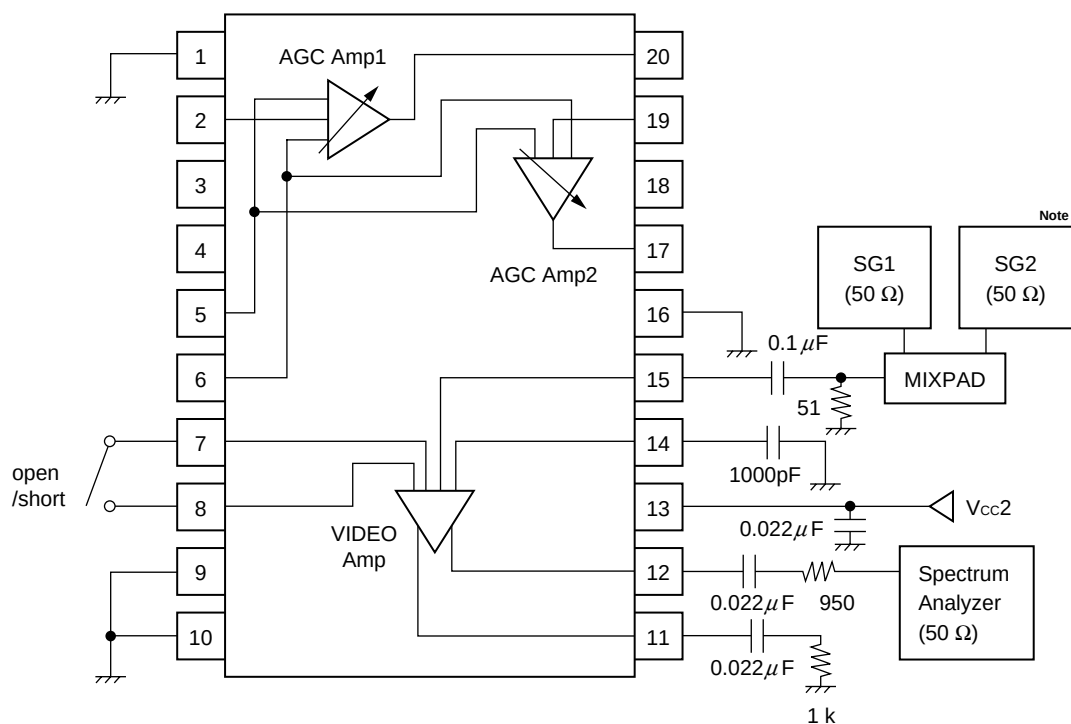


Note In the case of measurement of IM₃

MEASUREMENT CIRCUIT 3

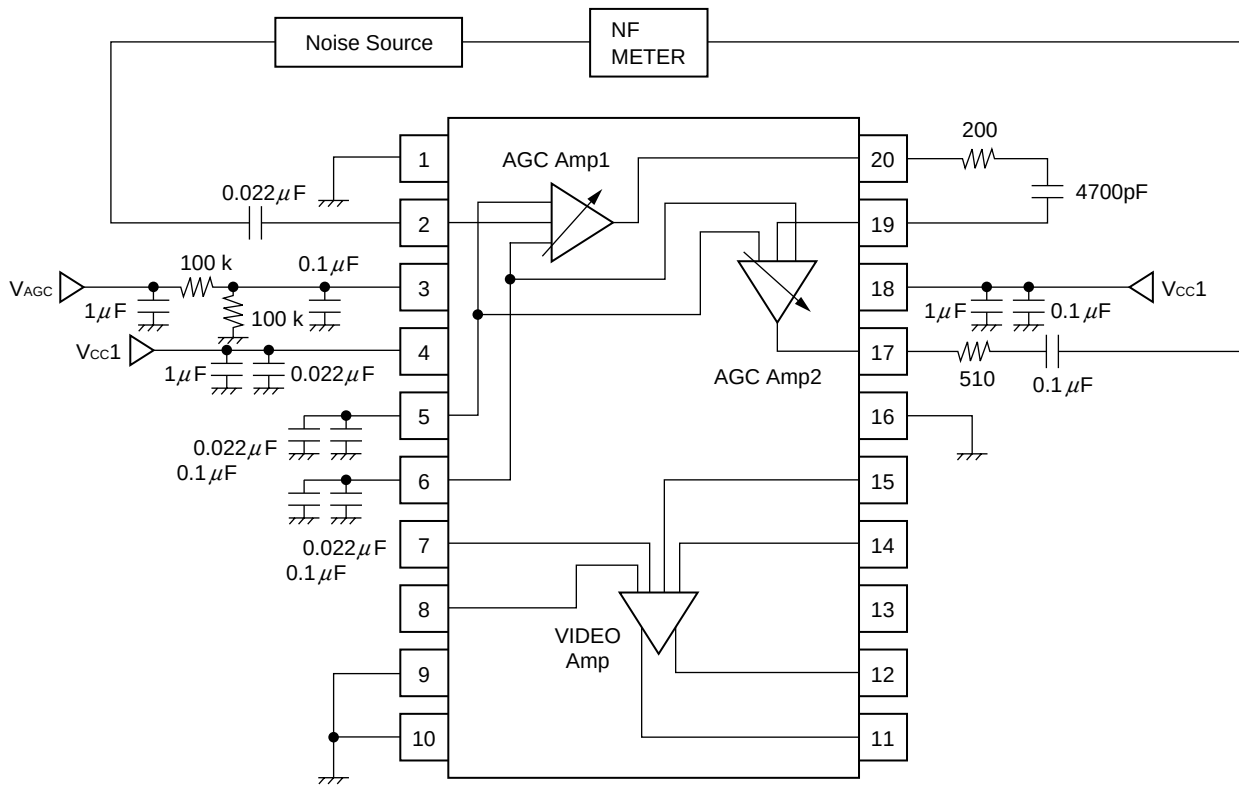


MEASUREMENT CIRCUIT 4

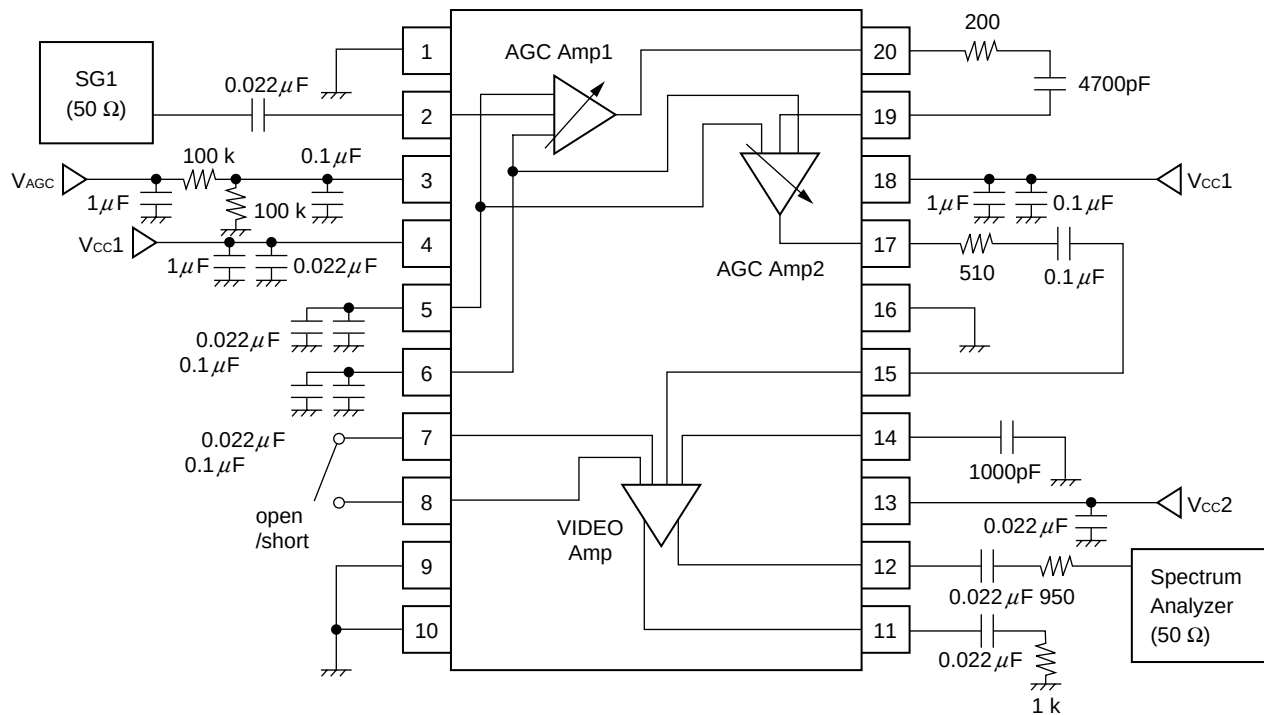


Note In the case of measurement of IM₃

MEASUREMENT CIRCUIT 5



MEASUREMENT CIRCUIT 6



MEASUREMENT CIRCUIT 7

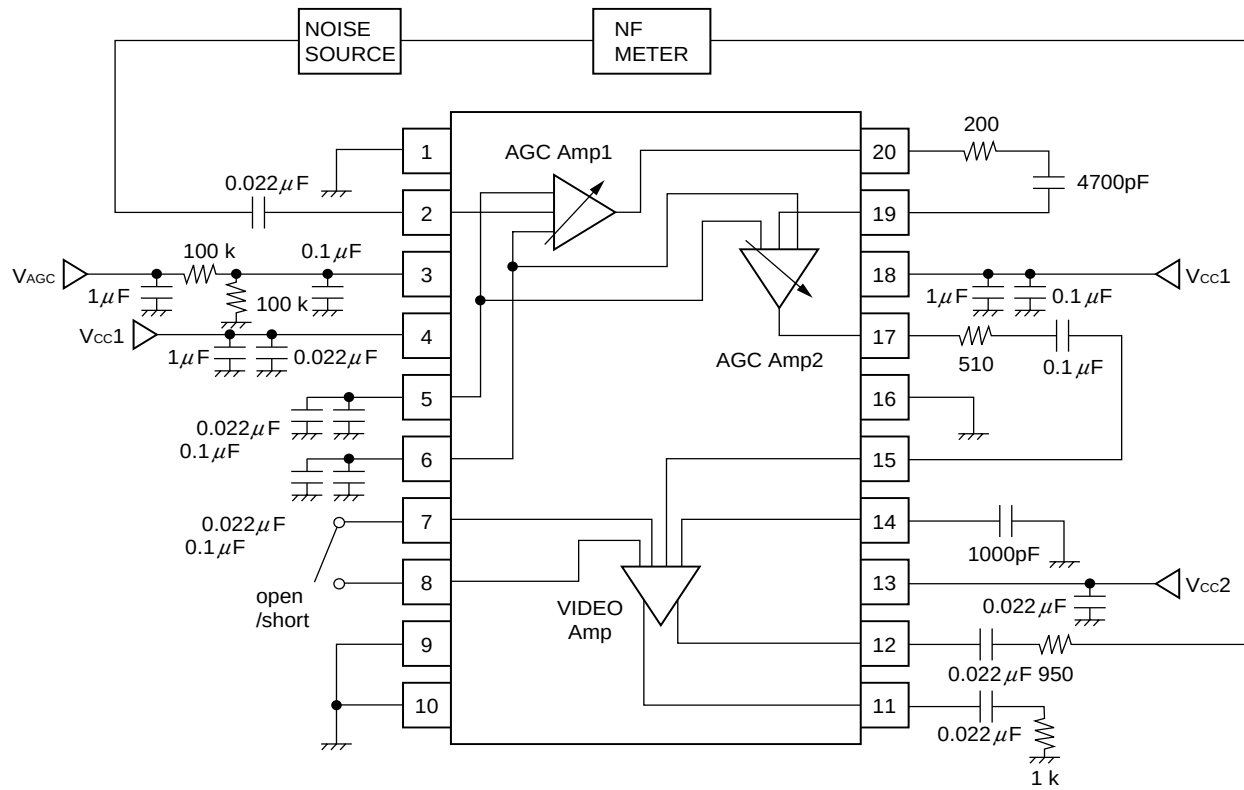
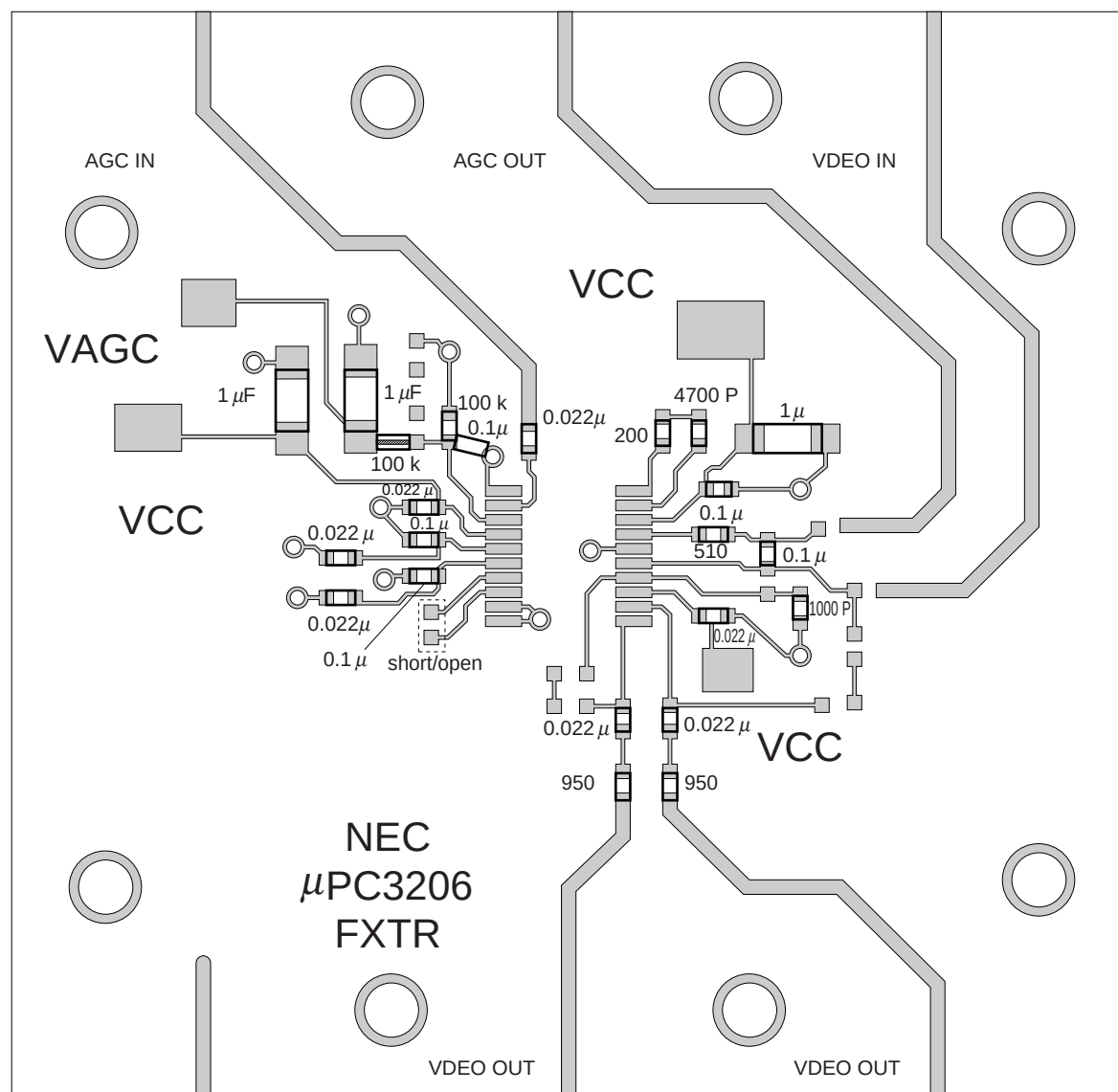


ILLUSTRATION OF THE EVALUATION BOARD FOR MEASUREMENT CIRCUIT6

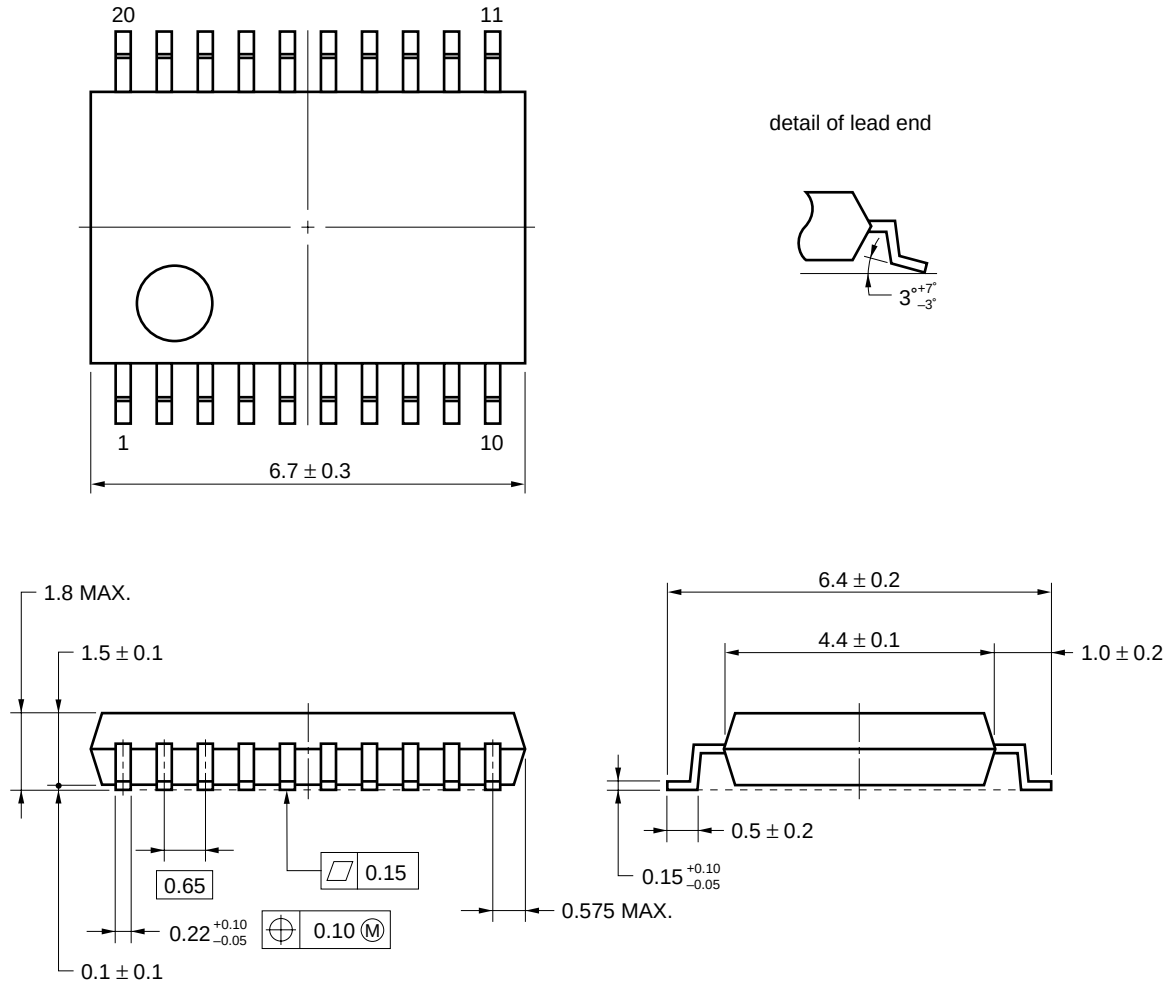


Notes on evaluation board

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

PACKAGE DIMENSIONS

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



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 undesired oscillation).
- (3) Keep the track length of the ground pins as short as possible.
- (4) A low pass filter must be attached to V_{CC} 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]

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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)
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