

BIPOLAR ANALOG INTEGRATED CIRCUIT $\mu PC3206GR$

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
μPC3206GR-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.

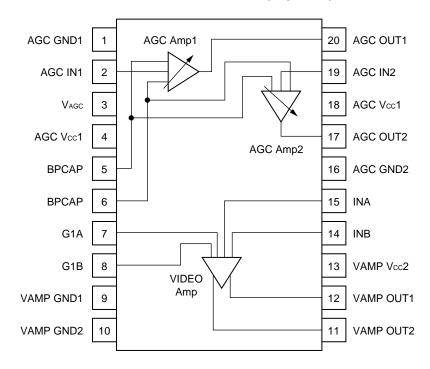
To order evaluation samples, please contact your local NEC office. (Part number for sample order : μ PC3206GR)

Caution electro-static sensitive device

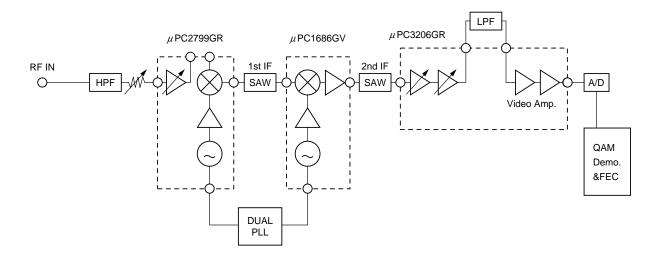
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Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

INTERNAL BLOCK DIAGRAM AND PIN CONFIGULATION (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.	4
2	AGC IN 1	1.02	Signal input pin to AGC amplifier.	AGC 5 6
		1.02		(2)
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).	AGC Control
4	AGC Vcc1	5	Power supply pin of AGC amplifier1. Must be connected bypass capacitor to minimize ground impedance.	
5	BPCAP4	2.61	Bypass pin of AGC amplifier1 and 2.	Refer to Equivalent circuit of pin1 and
	Note 1	2.61		pin2.
6	BPCAP2	2.84		
	Note 1	2.49		
7	G1A Note 2	1.72	Gain control pin of video amplifier.	Refer to Equivalent circuit of pin14
		3.34	Maximum gain at G1A – G1B = short. Minimum gain at G1A – G1B = open.	and pin15.
8	G1B ^{Note 2}	1.72	Gain is able to adjust by inserting arbitrary	
		3.34	resistor between 7pin and 8pin.	
9	VAMP GND1	0	Ground pin of video amplifier. Form a ground pattern as wide as possible to	13
10	VAMP GND2	0	maintain the minimum impedance.	
11	VAMP	2.52	Signal output pin of video amplifier.	12 11
	OUT2 Note 2	4.92	In case of R _L = 1 k Ω , single-end output voltage equal 2V _{P-P} .	REG
12	VAMP OUT1	2.52		
	Note 2	4.92		///

Notes 1. above : VAGC = VCC1 below : VAGC = 0 V **2.** above : VCC2 = 5 V below : VCC2 = 9 V

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Pin No.	Pin Name	Pin Voltage TYP.(V)	Function and Explanation	Equivalent Circuit
13	VAMP Vcc2	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.	7 (15) (13) (14) (8)
		4.13		
15	INA Note 2	2.49		
		4.13		REG
16	AGC GND2	0	Ground pin of AGC amplifier2. Form a ground pattern as wide as possible to maintain the minimum impedance.	18
17	AGC OUT2 Note 1	1.69	Signal output pin of AGC amplifier2.	17
18	AGC V∞1	5	Power supply pin of AGC amplifier2. Must be connected bypass capacitor to minimize ground impedance.	(18)
19	AGC IN2	1.01	Signal input pin of AGC amplifier2.	AGC Control 5 6
		1.01		<i>"</i>
20	AGC OUT1 Note 1	1.71	Signal output pin of AGC amplifier1.	4
		3.35		20

Notes 1. above : $V_{AGC} = V_{CC1}$ below : $V_{AGC} = 0 V$

2. above : Vcc2 = 5 V below : Vcc2 = 9 V



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

Parameter	Symbol	Conditions	Rating	Unit
Supply Voltage 1	Vcc1	MIXER Block	6.0	V
Supply Voltage 2	Vcc2	Video Amp Block	6.0	V
AGC Control Voltage	Vagc		6.0	V
Maximum Input Power	Pin (MAX.)		+10	dBm
Power Dissipation	Po	TA = 85 °C Note	433	mW
Operating Ambient Temperature	TA		-40 to +85	°C
Storage Temperature	Tstg		-55 to +150	°C

Parameter	Symbol	Conditions	Rating	Unit
Supply Voltage 1	Vcc1	MIXER Block	6.0	٧
Supply Voltage 2	Vcc2	Video Amp Block	11.0	٧
AGC Control Voltage	Vagc		6.0	V
Maximum Input Power	Pin (MAX.)		+10	dBm
Power Dissipation	Po	T _A = 75 °C Note	500	mW
Operating Ambient Temperature	TA		-40 to +75	°C
Storage Temperature	Tstg		-55 to +150	°C

Note Mounted on $50 \times 50 \times 1.6$ mm double epoxy glass board.

RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage 1	Vcc1	4.5	5.0	5.5	V
Supply Voltage 2	Vcc2	4.5	9.0	10.0	V
Operating Ambient Temperature 1 Note 1	T _A 1	-40	+25	+85	°C
Operating Ambient Temperature 2 Note 2	T _A 2	-40	+25	+75	°C

Notes 1. Vcc1 = Vcc2 = 4.5 to 5.5 V

2. Vcc1 = 4.5 to 5.5 V, Vcc2 = 4.5 to 10 V

Data Sheet P13710EJ3V0DS00



ELECTRICAL CHARACTERISTICS (TA = 25 °C)

Parameter	Symbol	Test Conditions		MIN.	TYP.	MAX.	Unit
AGC Amplifier Block (Vcc1 = 5 V, fin = 100 MHz, R _L = 560 Ω)							
Circuit Current 1	Icc1	no input signal, V _{AGC} = 5 V	Note 1	11	16	22	mA
Circuit Current 2	Icc2	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 (VAGC = 0 V), Pin = -15 dBm	Note 3	500	-	-	MHz
Maximum Gain 1	Gмах1	Pin = -60 dBm, Vagc = 5 V	Note 3	36	38.5	41	dB
Minimum Gain 1	Gміn2	Pin = -15 dBm, Vagc = 0 V	Note 3	-	-28	-15	dB
Gain Control Range	GCR	Pin = -35 dBm, Vagc = 0 to 5	V Note 3	50	-	1	dB
Maximum Output Power	Po (sat)	Vagc = 5 V, Pin = 0 dBm	Note 3	0	2	I	dBm
Video Amplifier Block (Vcc2 = 9 V, f	in = 100 MHz	, R∟ = 1 kΩ)					
Circuit Current 3	Icc3	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 (Vcc2 = 5 V, f	in = 100 MHz	r, RL = 1 kΩ)					
Circuit Current 4	Icc4	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 (Vcc2 = 5 V, 9	Video Amplifier Block (Vcc2 = 5 V, 9 V Common, fin = 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) (TA = 25 °C)

Parameter	Symbol	Test Conditions		Reference Values	Unit
	1			Reference values	Unit
AGC Amplifier Block (Vcc1 = 5 V, fi	n = 100 MHz,	R _L = 560 Ω)			
Noise Figure	NF	Maximum Gain (VAGC = 5 V) No	ote 1	5.5	dB
Output Intercept Point	OIP ₃	fin2 = 106 MHz, Maximum Gain (V _{AGC} = 5 V) No	ote 2	+4.5	dBm
Video Amplifier Block (Vcc2 = 9 V, 1	in = 100 MHz	, R _L = 1 kΩ)	-		
Output Voltage	Vout	single-ended No	ote 3	2	V _{P-P}
Single-end Gain 1	Avs1	G1A-G1B pins:short No	ote 3	130	V/V
Single-end Gain 2	Avs2	G1A-G1B pins:open No	ote 3	12	V/V
Input Intercept Point 1	IIP31	fin2 = 106 MHz, G1A-G1B pins:short No	ote 3	-16	dBm
Input Intercept Point 2	IIP ₃ 2	fin2 = 106 MHz, G1A-G1B pins:open No	ote 3	4	dBm
Video Amplifier Block (Vcc2 = 5 V, 1	in = 100 MHz	, R∟ = 1 kΩ)			
Single-end Gain 3	Avs3	G1A-G1B pins:short No	ote 3	70	V/V
Single-end Gain 4	Avs4	G1A-G1B pins:open No	ote 3	(11)	V/V
Input Intercept Point 3	IIP₃3	fin2 = 106 MHz, G1A-G1B pins:short No	ote 3	-15	dBm
Input Intercept Point 4	IIP ₃ 4	fin2 = 106 MHz, G1A-G1B pins:open No	ote 3	2	dBm
Total Block (Vcc1 = 5 V, fin = 100 M	1Hz, R∟ = 1 kΩ	2)			
Maximum Gain 2	Gмах2	Vagc = 5 V, Vcc2 = 5 V, G1A-G1B pins:short No	ote 4	76	dB
Maximum Gain 3	G мах 3	Vagc = 5 V, Vcc2 = 5 V, G1A-G1B pins:open No	ote 4	62	dB
Minimum Gain 2	Gміn2	V _{AGC} = 0 V, V _{CC} 2 = 5 V, G1A-G1B pins:short No	ote 4	10	dB
Maximum Gain 4	G мах 4	V _{AGC} = 5 V, V _{CC} 2 = 9 V, G1A-G1B pins:short No	ote 4	80	dB
Maximum Gain 5	Gмах5	V _{AGC} = 5 V, V _{CC} 2 = 9 V, G1A-G1B pins:open No	ote 4	63	dB
Minimum Gain 3	Gміn3	Vagc = 0 V, Vcc2 = 9 V, G1A-G1B pins:short No	ote 4	14	dB

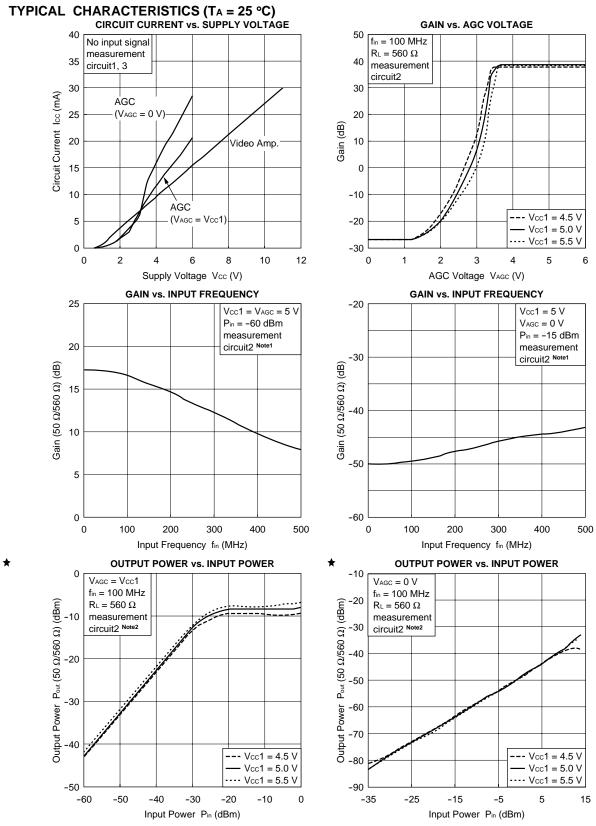
Notes 1. By measurement circuit 5

2. By measurement circuit 2

3. By measurement circuit 4

4. By measurement circuit 6

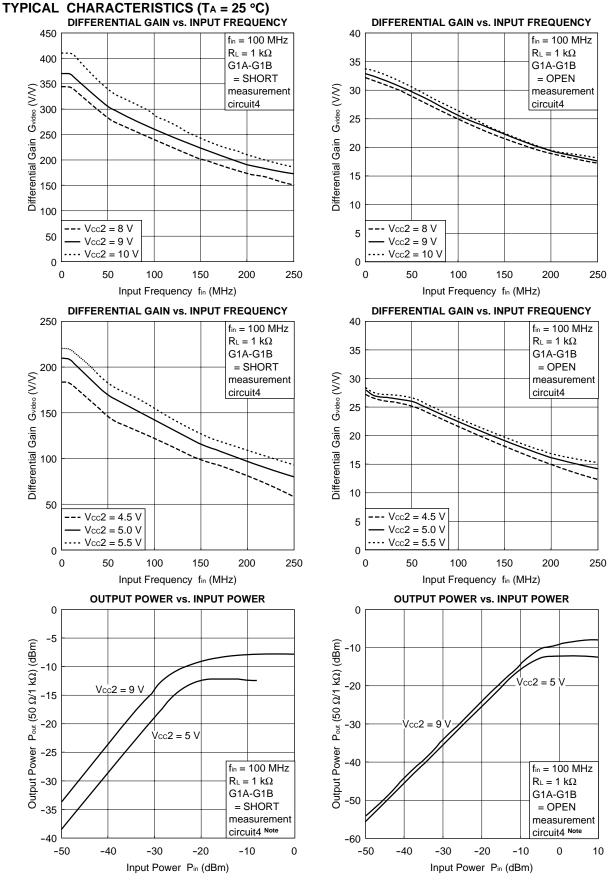
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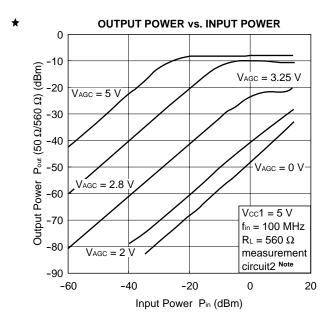
Notes 1. Gain = (Gain at Spectrum Analyzer) + 20 log (560 Ω /50 Ω)

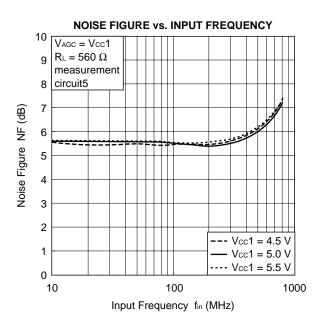
2. Output Power = (Output Power at Spectrum Analyzer) + 10 log (560 Ω /50 Ω)

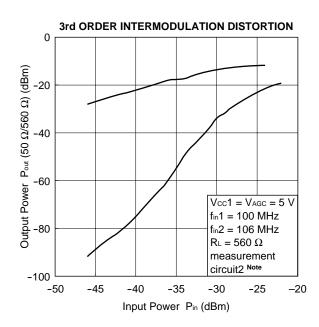




Note Output Power = (Output Power at Spectrum Analyzer) + 10 log (1 k Ω /50 Ω)

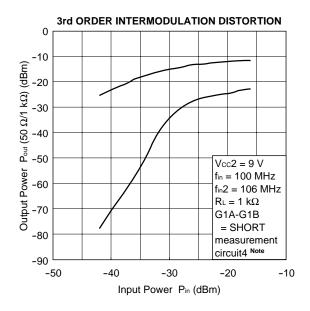


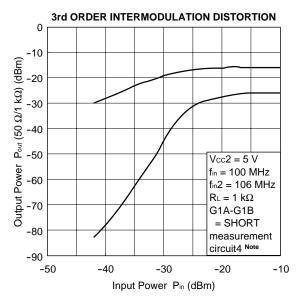


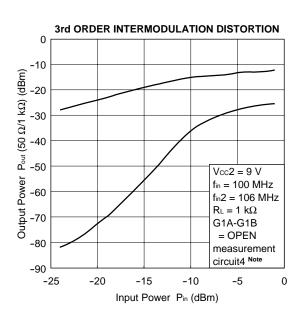


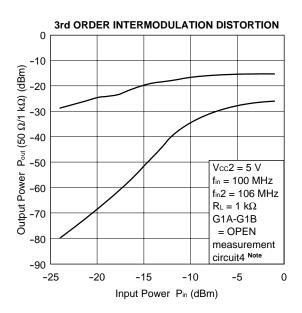
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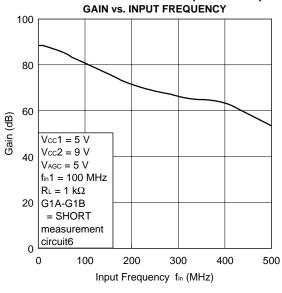


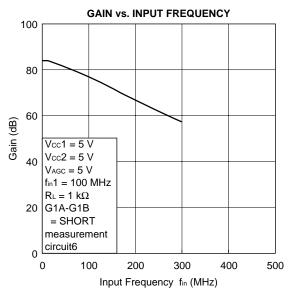


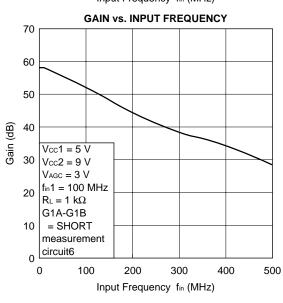
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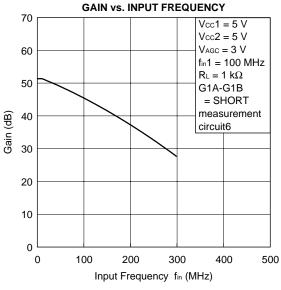
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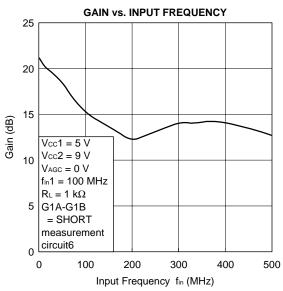


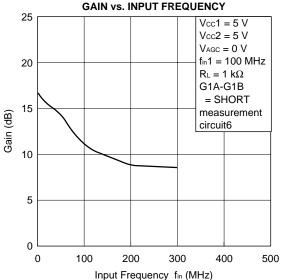




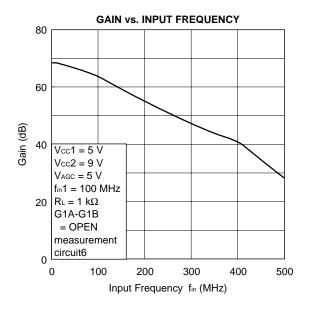


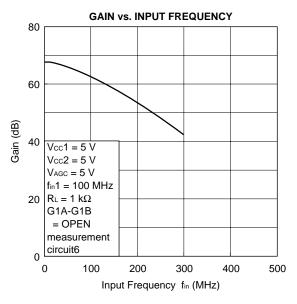


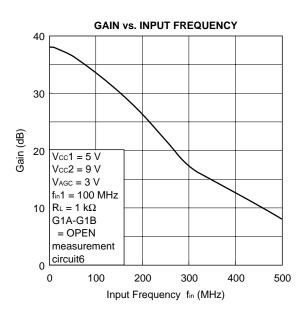


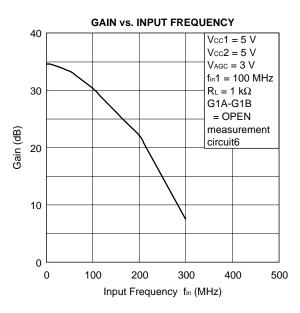




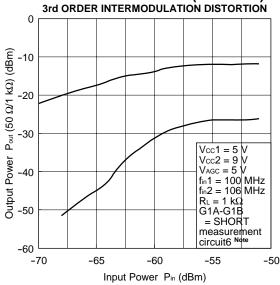


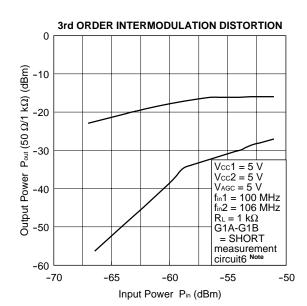


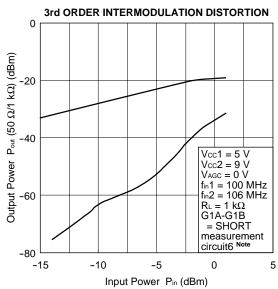


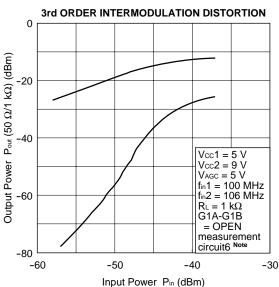


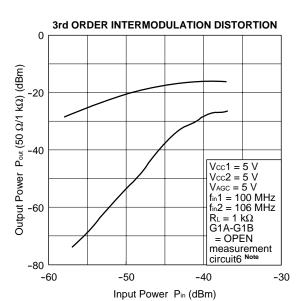
STANDARD CHARACTERISTICS (T_A = 25 °C)





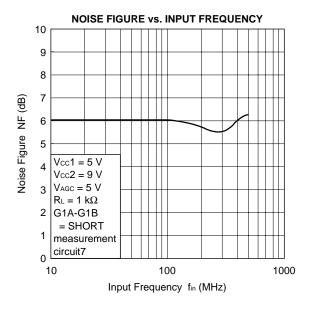


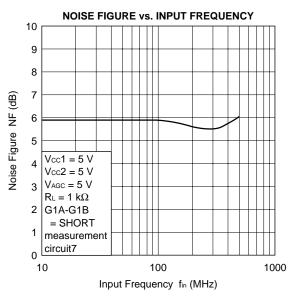


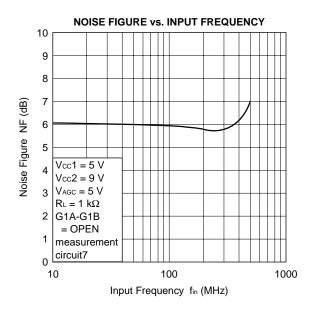


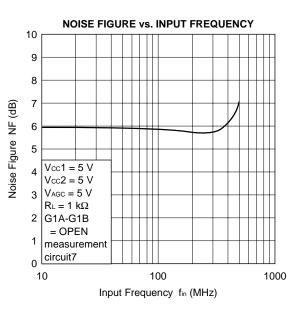
Note Output Power = (Output Power at Spectrum Analyzer) + 10 log (1 k Ω /50 Ω)



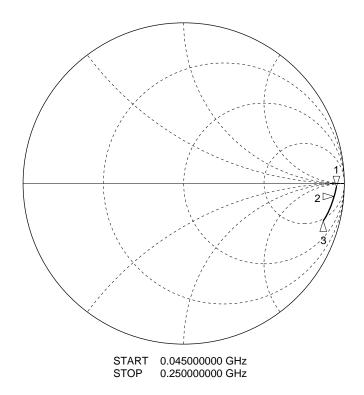








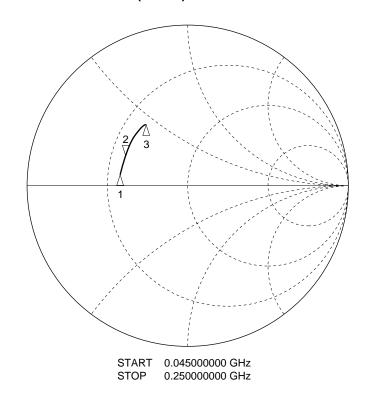
INPUT IMPEDANCE (2 PIN)



MARKER		Zin
1	45 MHz	938.4 Ω – j604.8 Ω
2	100 MHz	434.7 Ω – j573.8 Ω
3	250 MHz	122.5 Ω – j324.9 Ω

Conditions $T_A = 25$ °C $V_{CC1} = 5 \text{ V}$

OUTPUT IMPEDANCE (20 PIN)

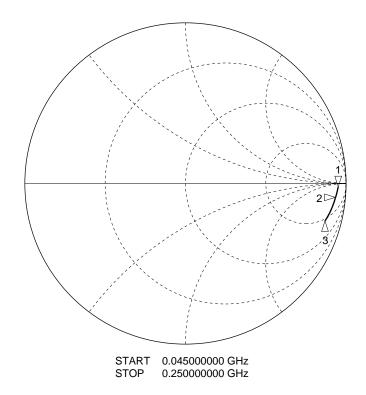


MARKER		Zout
1	45 MHz	19.86 Ω + 3.83 Ω
2	100 MHz	20.28 Ω + 9.26 Ω
3	250 MHz	22.28 Ω + 22.48 Ω

Conditions $T_A = 25$ °C $V_{CC}1 = 5 \text{ V}$



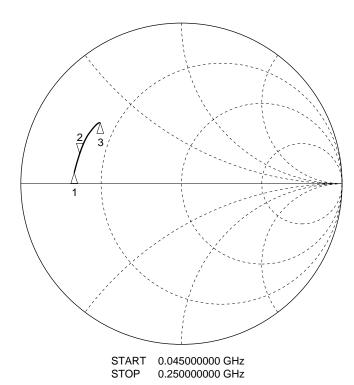
INPUT IMPEDANCE (19 PIN)



MARKER		Zin
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 $T_A = 25^{\circ}C$ Vcc1 = 5 V

OUTPUT IMPEDANCE (17 PIN)

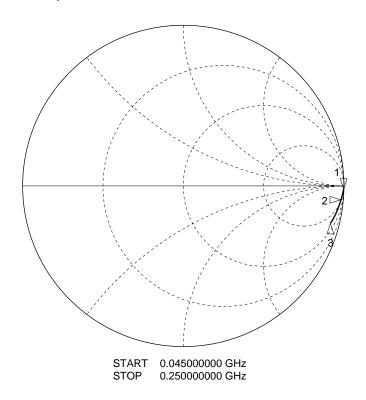


MARKER		Zоuт
1	45 MHz	10.32 Ω + j2.88 Ω
2	100 MHz	10.86 Ω + j6.42 Ω
3	250 MHz	12.67 Ω + j15.39 Ω

Conditions $T_A = 25$ °C $V_{CC1} = 5 \text{ V}$

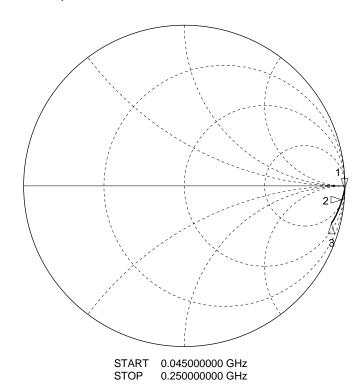
INPUT IMPEDANCE (15 PIN)

(i) $T_A = 25^{\circ}C$, $V_{CC}2 = 5 V$



MARKER		Zin	
1	45 MHz	840.0 Ω – j2560 Ω	
2	100 MHz	50.19 Ω – j1259 Ω	
3	250 MHz	52.03 Ω – j475.6 Ω	

(ii) T_A = 25°C, Vcc2 = 9 V

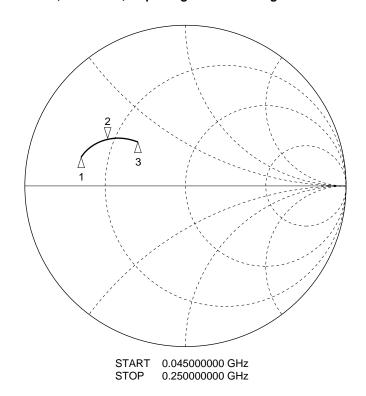


MARKER		Zin
1	45 MHz	478.3 Ω – j3091 Ω
2	100 MHz	106.13 $Ω$ – j1368 $Ω$
3	250 MHz	55.11 Ω – j501.3 Ω



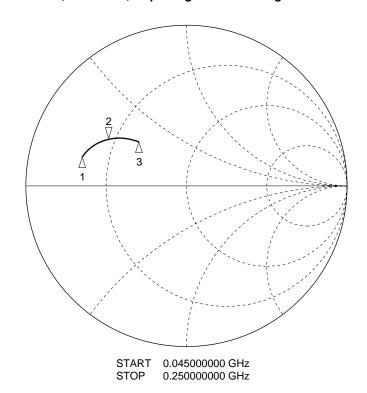
OUTPUT IMPEDANCE (12 PIN)

(i) $T_A = 25$ °C, Vcc2 = 5 V, 11 pin is grounded through 50 Ω resistor.



MARKER		Zout	
1	45 MHz	9.88 Ω + j6.25 Ω	
2	100 MHz	14.21 Ω + j11.78 Ω	
3	250 MHz	23.64 Ω + j15.73 Ω	

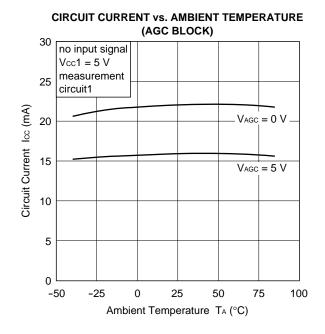
(ii) T_A = 25°C, Vcc2 = 9 V, 11 pin is grounded through 50 Ω resistor.

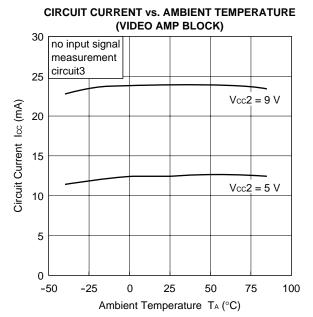


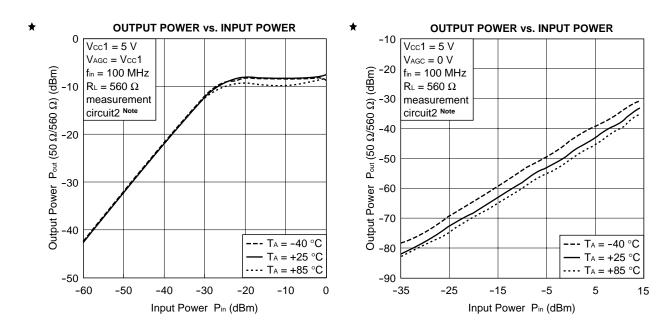
MARKER		Zout	
1	45 MHz	7.36 Ω + j4.85 Ω	
2	100 MHz	10.50 Ω + j9.58 Ω	
3	250 MHz	19.37 Ω + j13.70 Ω	



THERMAL CHARACTERISTICS (FOR REFERENCE)



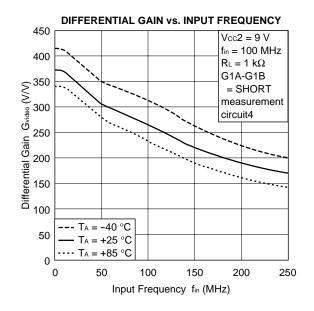


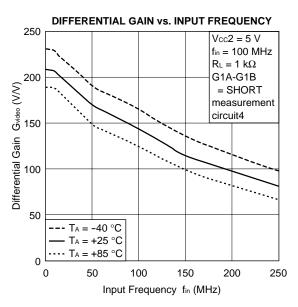


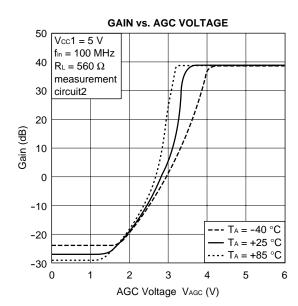
Note Output Power = (Output Power at Spectrum Analyzer) + 10 log (560 Ω /50 Ω)

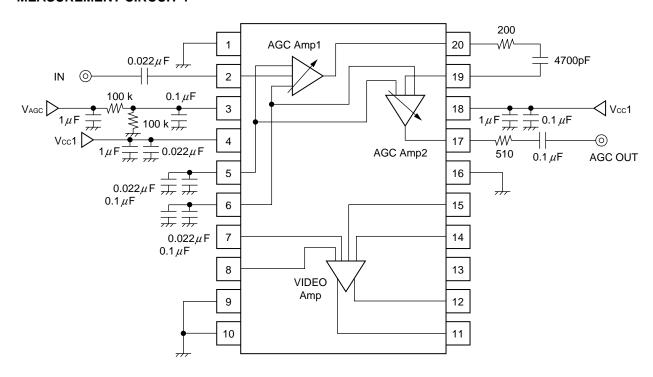


THERMAL CHARACTERISTICS (FOR REFERENCE)

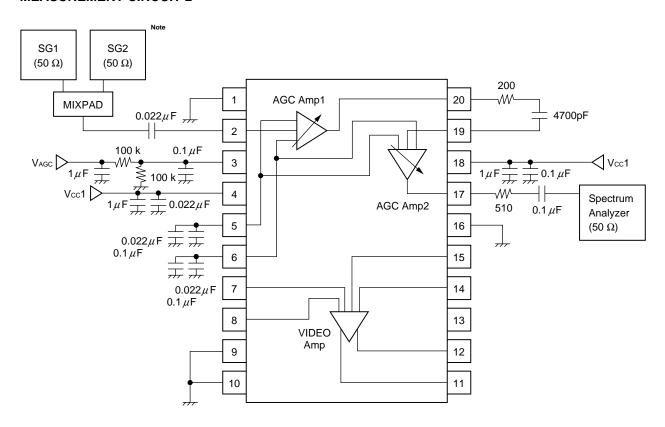






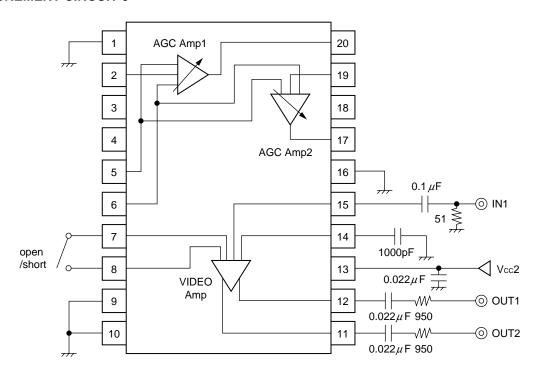


MEASUREMENT CIRCUIT 2

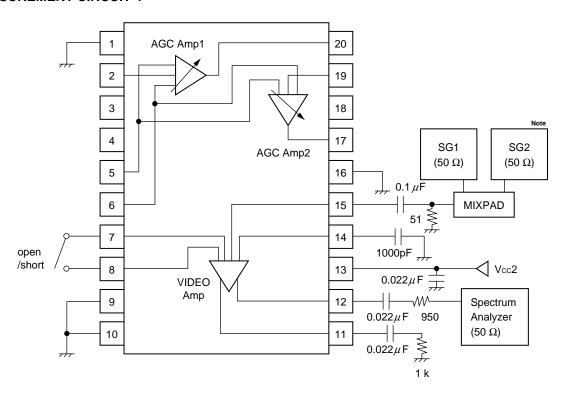


Note In the case of measurement of IM3



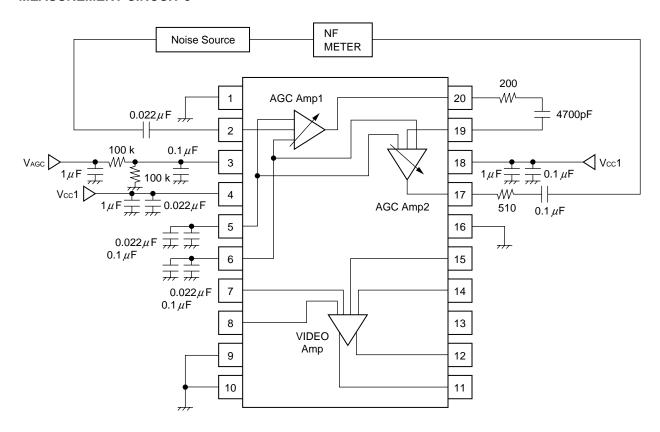


MEASUREMENT CIRCUIT 4

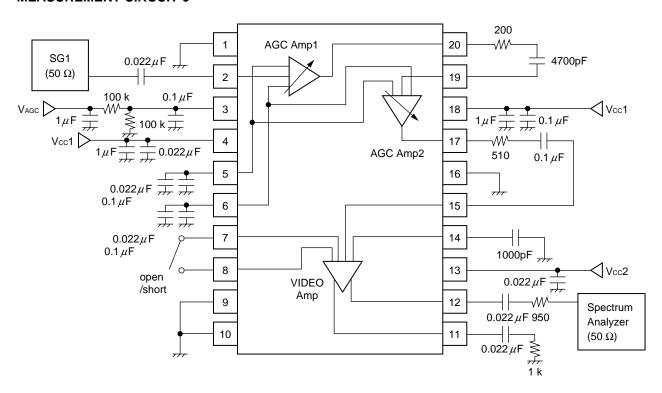


Note In the case of measurement of IM₃

Data Sheet P13710EJ3V0DS00



MEASUREMENT CIRCUIT 6





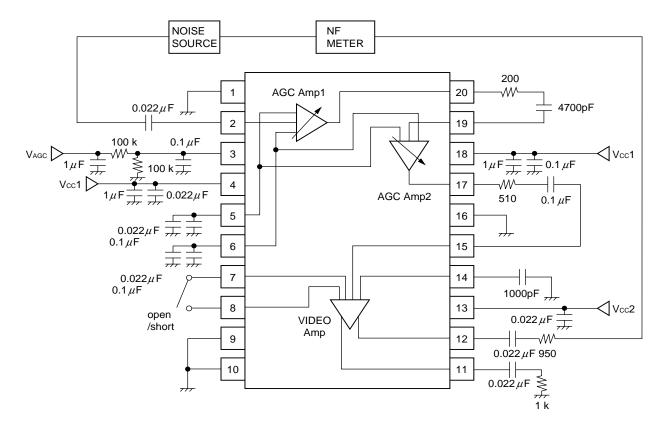
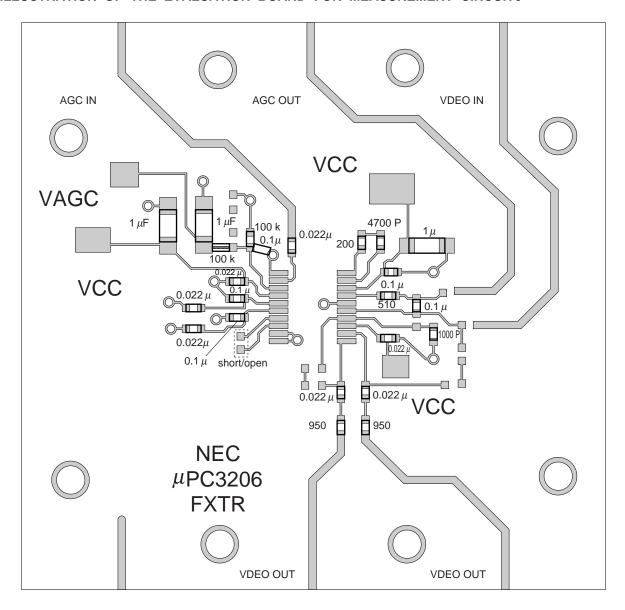


ILLUSTRATION OF THE EVALUATION BOARD FOR MEASUREMENT CIRCUIT6



Notes on evaluation board

(1) GND pattern on rear side

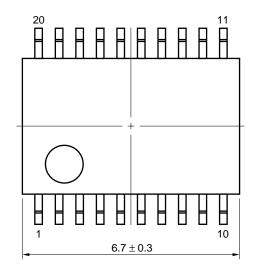
(2) ⊚ ⊚: Through hole

(3) : represents cutout



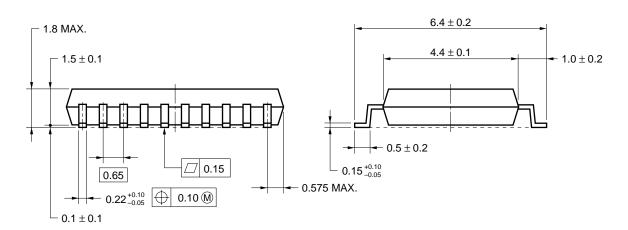
PACKAGE DIMENSIONS

★ 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]

NEC μ PC3206GR

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 - Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
 - Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
 - Specific: Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

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