

FEATURES

- **WIDEBAND OPERATION**
- **BROADBAND AGC DYNAMIC RANGE:**
50 dB MIN
- **SUPPLY VOLTAGE:**
V_{cc} = 5 V
- **PACKAGED IN 20 PIN SSOP SUITABLE FOR HIGH-DENSITY SURFACE MOUNT**

DESCRIPTION

The UPC3206GR is a Silicon RFIC designed for digital DBS and digital CATV receivers. This IC consists of a two stage gain control amplifier and a wide band linear video amplifier. This IC is packaged in a 20 pin SSOP package, making it ideal for reducing system size.

NEC's stringent quality assurance and test procedures ensure the highest reliability and performance.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE			UPC3206GR S20		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
Total Block (V _{cc1} = 5 V, V _{cc2} = 5 V, f _{IN} = 100 MHz, R _L = 1 k Ω)					
G _{MAX1}	Maximum Gain 1, V _{AGC} = 5.0 V, pins G1A - G1B shorted	dB		76	
G _{MAX2}	Maximum Gain 2, V _{AGC} = 5.0 V, pins G1A - G1B open	dB		62	
G _{MIN1}	Minimum Gain 1, V _{AGC} = 0 V, pins G1A - G1B shorted	dB		10	
Total Block (V _{cc1} = 5 V, V _{cc2} = 9 V, f _{IN} = 100 MHz, R _L = 1 k Ω)					
G _{MAX3}	Maximum Gain 3, V _{AGC} = 5.0 V, pins G1A - G1B shorted	dB		80	
G _{MAX4}	Maximum Gain 4, V _{AGC} = 5.0 V, pins G1A - G1B open	dB		63	
G _{MIN2}	Minimum Gain 2, V _{AGC} = 0 V, pins G1A - G1B shorted	dB		14	
AGC Amplifier Block (V _{cc1} = 5 V, f _{IN} = 100 MHz, R _L = 560 Ω)					
I _{CC1}	Circuit Current 1 (no input signal), V _{AGC} = 5 V	mA	11	16	22
I _{CC2}	Circuit Current 2 (no input signal), V _{AGC} = 0 V	mA	15	22	32
BW1	Bandwidth 1, V _{AGC} = 5 V, P _{IN} = -60 dBm	MHz	100	220	
BW2	Bandwidth 2, V _{AGC} = 0 V, P _{IN} = -15 dBm	MHz	500		
G _{MAX5}	Maximum Gain 5, V _{AGC} = 5.0 V, P _{IN} = -60 dBm	dB	36	38.5	41
G _{MIN3}	Minimum Gain 3, V _{AGC} = 0 V, P _{IN} = -15 dBm	dB		-28	-15
GCR	Gain Control Range, V _{AGC} = 0 to 5.0 V, P _{IN} = -35 dBm	dB	50	60	
P _{O(SAT)}	Maximum Output Power, V _{AGC} = 5.0 V	dBm	0	2	
NF	Noise Figure, V _{AGC} = 5.0 V	dB		5.5	
OIP ₃	Output Intercept Point, V _{AGC} = 5 V, f _{IN 2} = 106 MHz,	dBm		+4.5	
Video Amplifier Block, (V _{cc2} = 9 V, f _{IN} = 100 MHz, R _L = 1k Ω)					
I _{CC3}	Circuit Current 3 (no input signal)	mA	16	24	34.5
V _{OUT}	Output Voltage, Single Ended	V _{P-P}		2.0	
G ₁	Differential Gain 1, pins G1A and G1B shorted,	V/V	160	260	400
G ₂	Differential Gain 2, pins G1A and G1B open	V/V	22	25	30
A _{VS1}	Single End Gain 1, pins G1A and G1B shorted	V/V		130	
A _{VS2}	Single End Gain 2, pins G1A and G1B open	V/V		12	
IIP ₃₁	Input Intercept Point 1, pins G1A and G1B shorted, f _{IN 2} = 106 MHz	dBm		-16	
IIP ₃₂	Input Intercept Point 2, pins G1A and G1B open, f _{IN 2} = 106 MHz	dBm		+4	
Video Amplifier Block, (V _{cc2} = 5 V, f _{IN} = 100 MHz, R _L = 1k Ω)					
I _{CC4}	Circuit Current 4 (no input signal)	mA	8	12.5	18
G ₃	Differential Gain 3, pins G1A and G1B shorted	V/V	80	140	230
G ₄	Differential Gain 4, pins G1A and G1B open	V/V	16	22	30
A _{VS3}	Single End Gain 1, pins G1A and G1B shorted	V/V		70	
A _{VS4}	Single End Gain 2, pins G1A and G1B open	V/V		11	
IIP ₃₃	Input Intercept Point 3, pins G1A and G1B shorted, f _{IN 2} = 106 MHz	dBm		-15	
IIP ₃₄	Input Intercept Point 4, pins G1A and G1B open, f _{IN 2} = 106 MHz	dBm		+2	
Video Amplifier Block, (V _{cc2} = 5 V, 9 V Common, f _{IN} = 100 MHz, R _L = 1k Ω, single-ended)					
BWG1	Bandwidth 1, pins G1A and G1B shorted, 3 dB down from Gain @ 5 MHz	MHz		100	

ABSOLUTE MAXIMUM RATINGS¹

(T_A = 25°C, unless otherwise specified)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{CC1}	Supply Voltage 1	V	6.0
V _{CC2}	Supply Voltage 2	V	10.0
P _{D1}	Power Dissipation ² , T _A = 85°C	mW	433
T _{OP1}	Operating Temp. Range	°C	-40 to +85
T _{STG}	Storage Temperature	°C	-50 to +150
P _{IN} (MAX)	Maximum Input Power	dBm	+10

Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on a 50 x 50 x 1.6 mm double epoxy glass board.

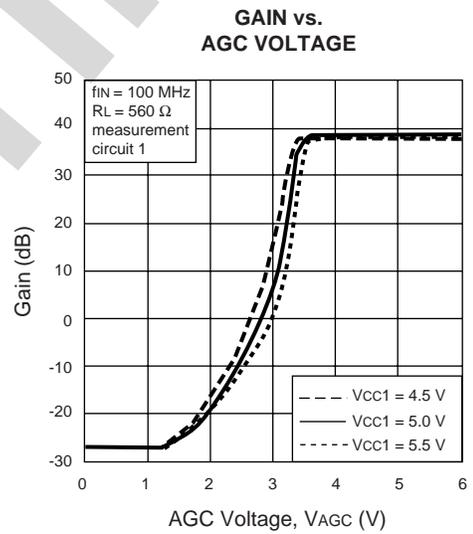
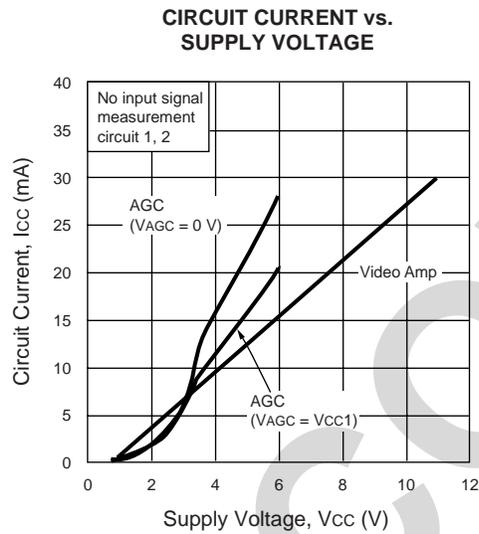
RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	UNITS	MIN	TYP	MAX
V _{CC1}	Supply Voltage 1	V	4.5	5.0	5.5
V _{CC2}	Supply Voltage 2	V	4.5	9.0	10.0
T _{OP1} ¹	Operating Temp. Range 1	°C	-40	+25	+85
T _{OP2} ²	Operating Temp. Range 2	°C	-40	+25	+75

Notes:

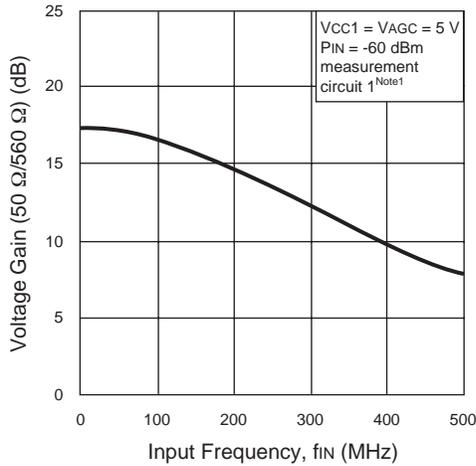
1. V_{CC1} = V_{CC2} = 4.5 to 5.5 V.
2. V_{CC1} = 4.5 to 5.5 V, V_{CC2} = 4.5 to 10 V.

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

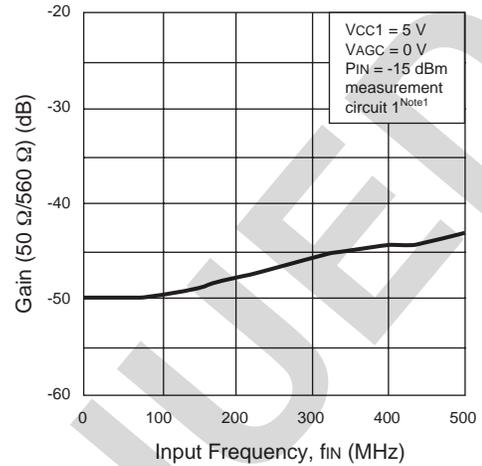


TYPICAL PERFORMANCE CURVES (TA = 25°C)

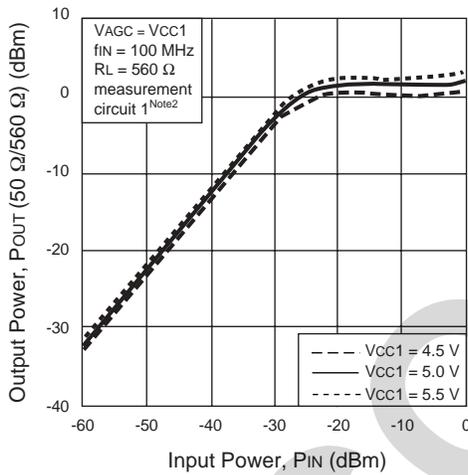
VOLTAGE GAIN vs. INPUT FREQUENCY



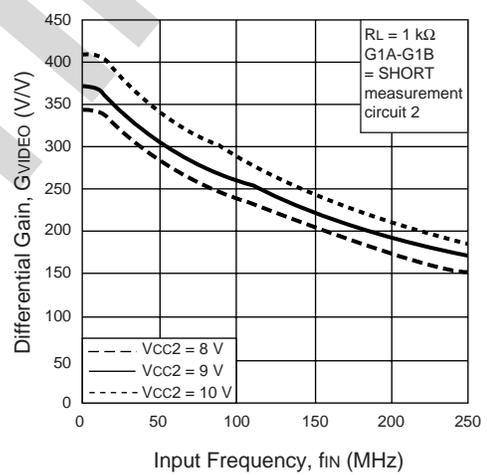
GAIN vs. INPUT FREQUENCY



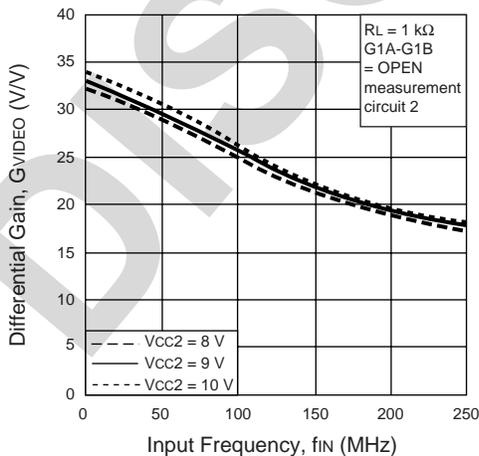
OUTPUT POWER vs. INPUT POWER



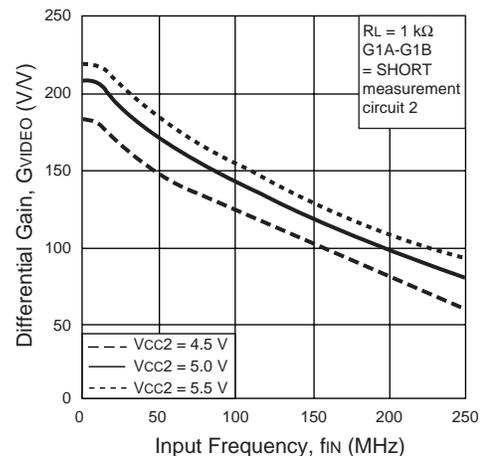
DIFFERENTIAL GAIN vs. INPUT FREQUENCY



DIFFERENTIAL GAIN vs. INPUT FREQUENCY



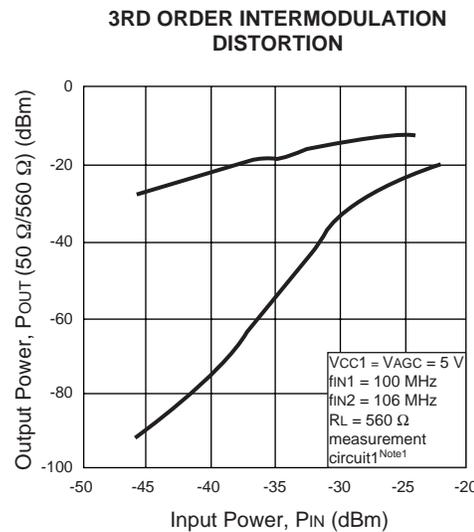
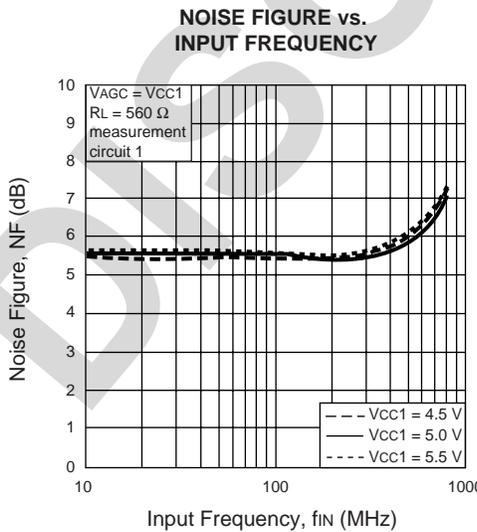
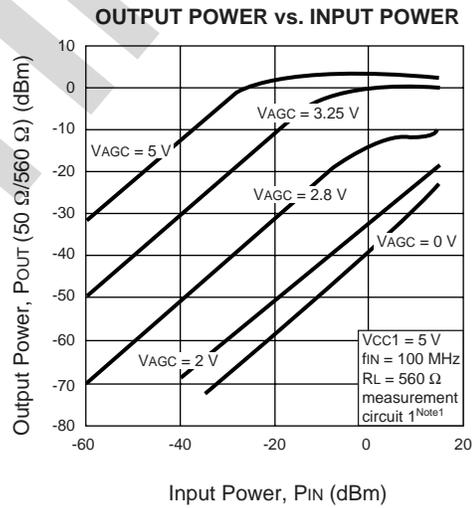
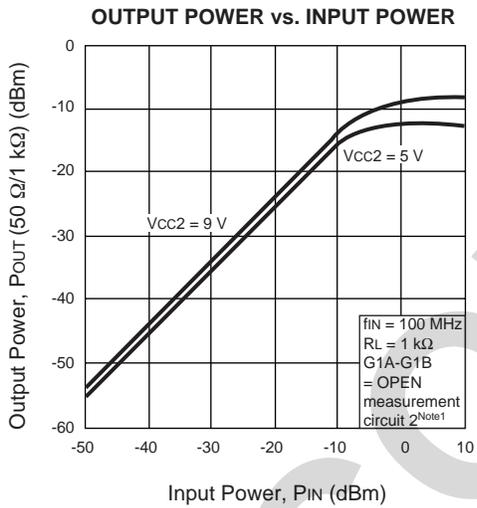
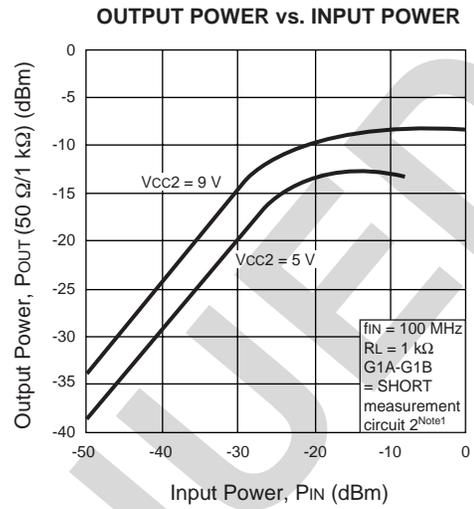
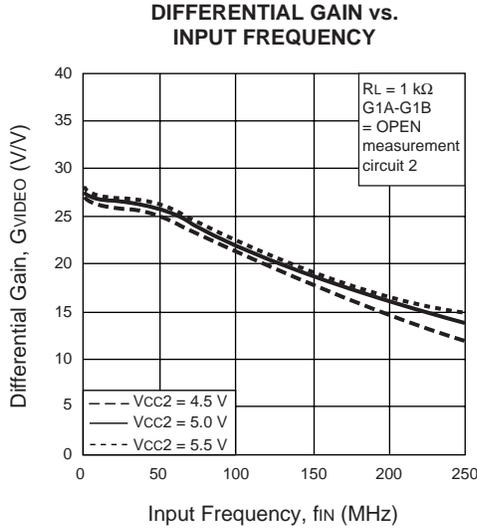
DIFFERENTIAL GAIN vs. INPUT FREQUENCY



Notes:

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

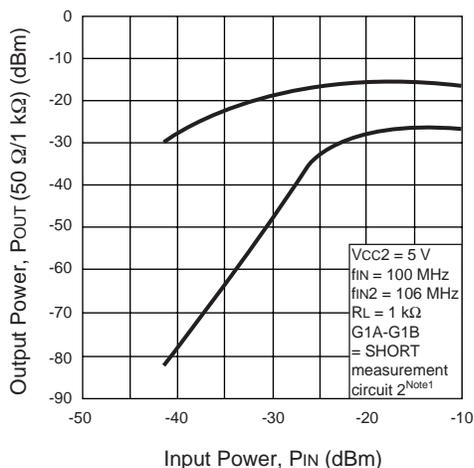
TYPICAL PERFORMANCE CURVES (TA = 25°C)



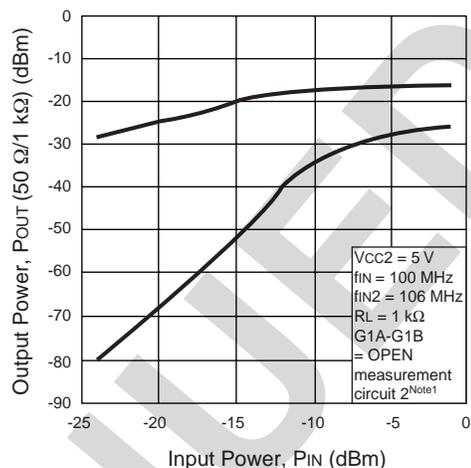
Notes:
 1. Output Power = (Output Power at Spectrum Analyzer) +10 log (560 Ω /50 Ω).

TYPICAL PERFORMANCE CURVES (TA = 25°C)

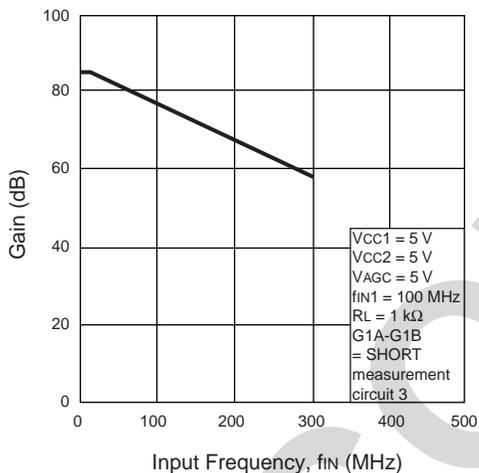
3RD ORDER INTERMODULATION DISTORTION



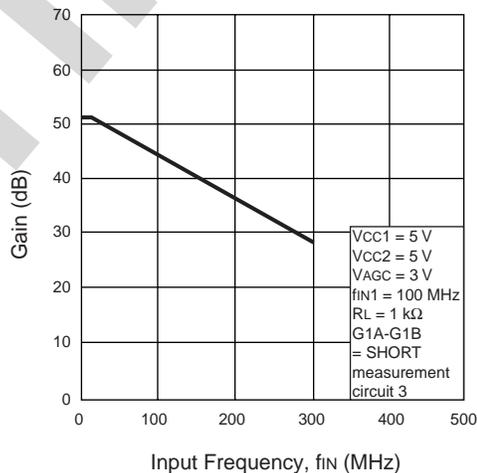
3RD ORDER INTERMODULATION DISTORTION



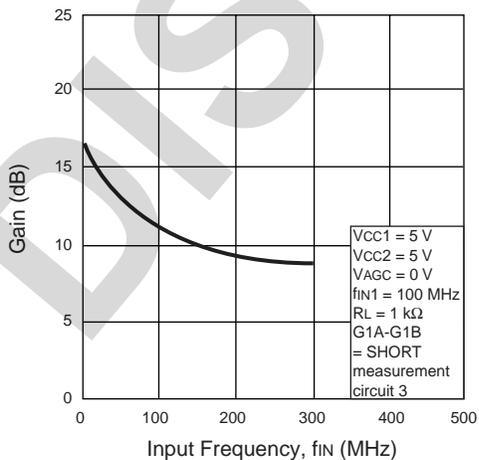
GAIN vs. INPUT FREQUENCY



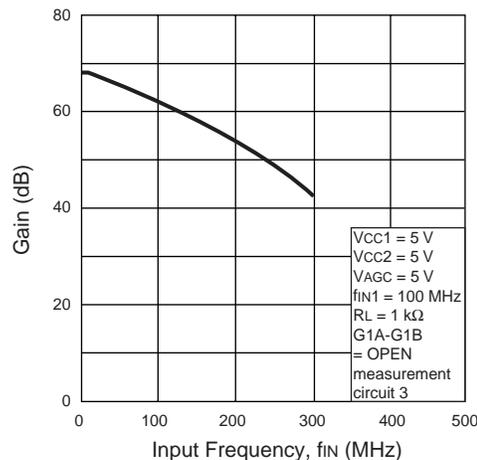
GAIN vs. INPUT FREQUENCY



GAIN vs. INPUT FREQUENCY



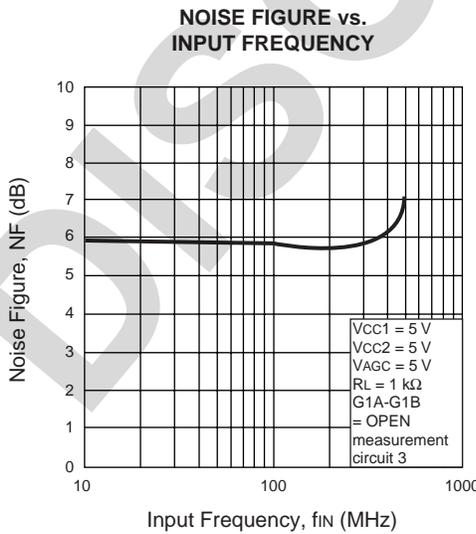
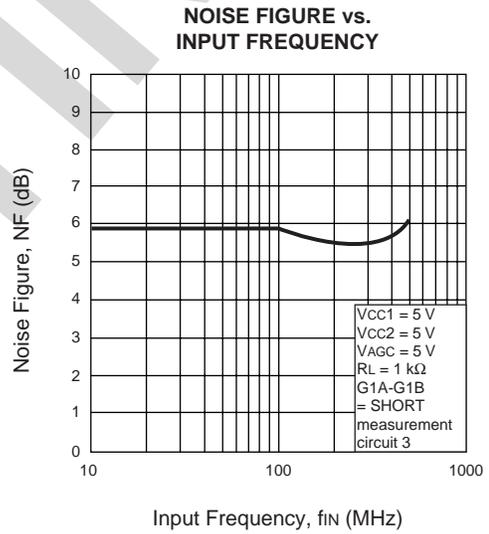
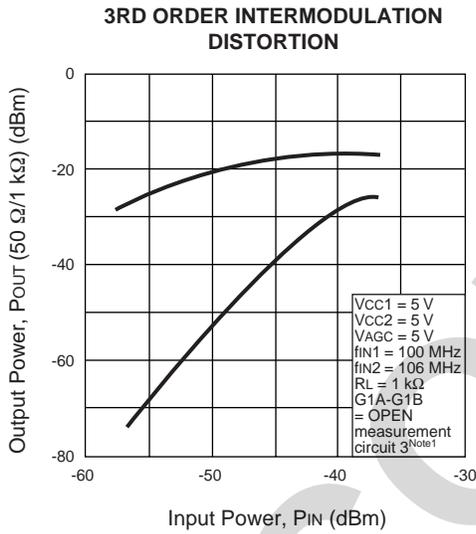
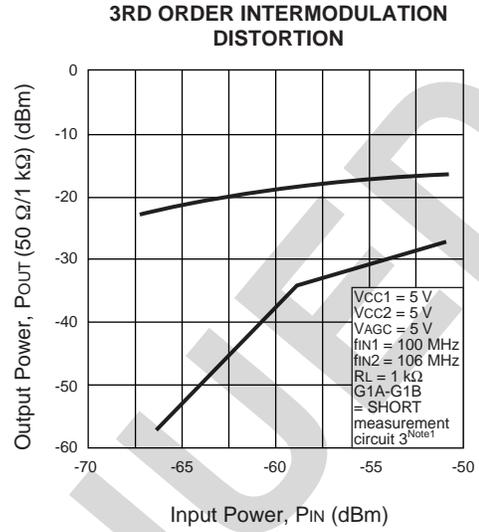
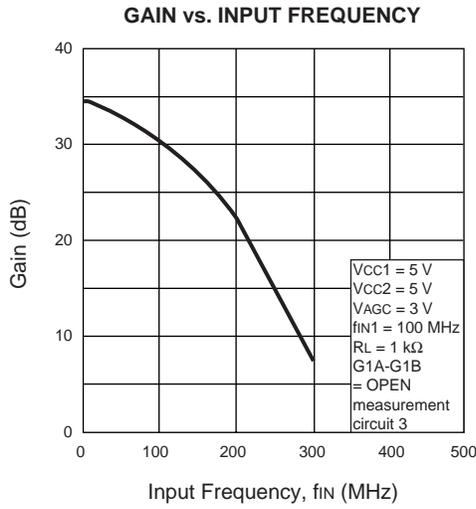
GAIN vs. INPUT FREQUENCY



Notes:

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

TYPICAL PERFORMANCE CURVES (TA = 25°C)

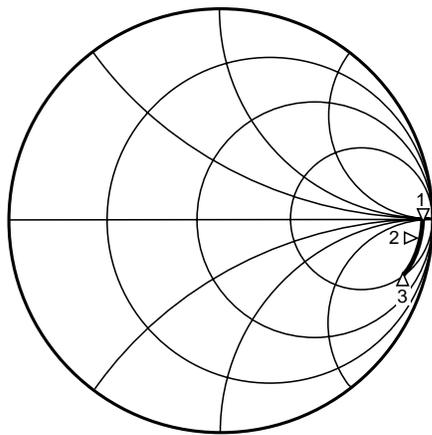


Notes:

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

STANDARD PERFORMANCE CURVES (TA = 25°C)

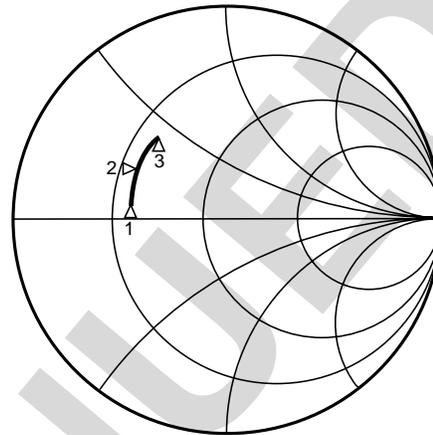
AGC IN 1 IMPEDANCE (PIN 2)



MARKER	Z _{IN}
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

Start: 45 MHz
Stop: 250 MHz
Conditions: TA = 25° C, Vcc1 = 5 V

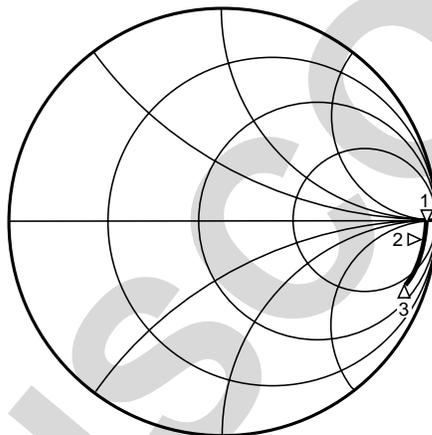
AGC OUT 1 IMPEDANCE (PIN 20)



MARKER	Z _{IN}
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

Start: 45 MHz
Stop: 250 MHz
Conditions: TA = 25° C, Vcc1 = 5 V

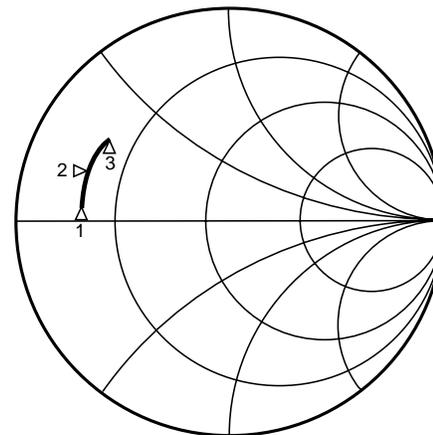
AGC IN 2 IMPEDANCE (PIN 19)



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

Start: 45 MHz
Stop: 250 MHz
Conditions: TA = 25° C, Vcc1 = 5 V

AGC OUT 2 IMPEDANCE (PIN 17)

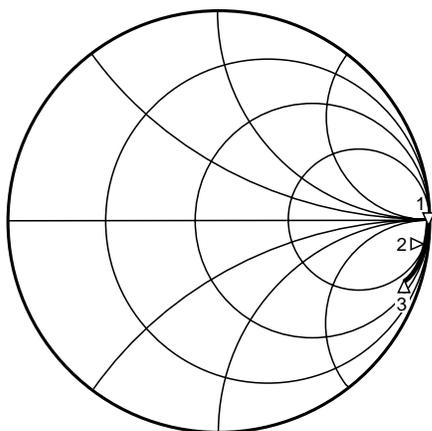


MARKER	Z _{IN}
1	45 MHz 10.32 Ω + j2.88 Ω
2	100 MHz 10.86 Ω + j6.42 Ω
3	250 MHz 12.67 Ω + j15.39 Ω

Start: 45 MHz
Stop: 250 MHz
Conditions: TA = 25° C, Vcc1 = 5 V

STANDARD PERFORMANCE CURVES (TA = 25°C)

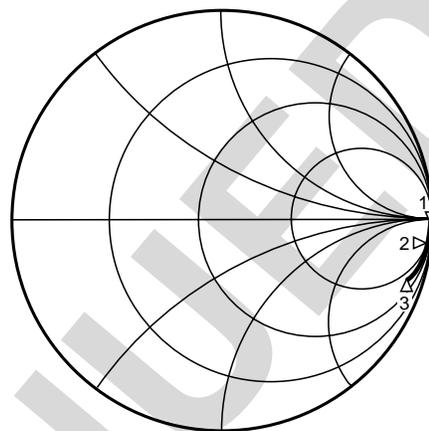
VIDEO AMP INPUT IMPEDANCE (PIN 15)



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

Start: 45 MHz
 Stop: 250 MHz
 Conditions: TA = 25° C, Vcc2 = 5 V

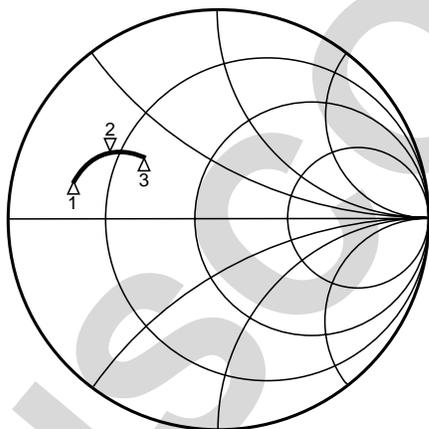
VIDEO AMP INPUT IMPEDANCE (PIN 15)



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

Start: 45 MHz
 Stop: 250 MHz
 Conditions: TA = 25° C, Vcc2 = 9 V

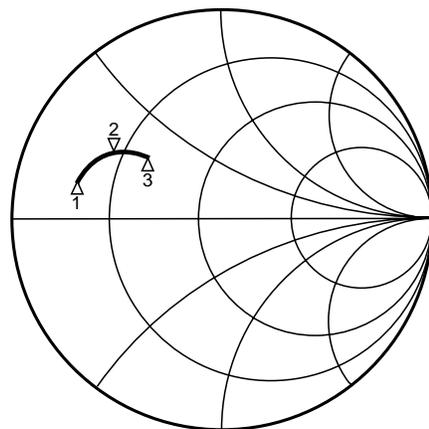
VIDEO AMP OUTPUT IMPEDANCE (PIN 12)



MARKER	ZIN	
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

Start: 45 MHz
 Stop: 250 MHz
 Conditions: TA = 25° C, Vcc2 = 5 V, 11 pin is grounded through 50 Ω resistor.

VIDEO AMP OUTPUT IMPEDANCE (PIN 12)



MARKER	ZIN	
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

Start: 45 MHz
 Stop: 250 MHz
 Conditions: TA = 25° C, Vcc2 = 9 V, 11 pin is grounded through 50 Ω resistor.

PIN FUNCTIONS

Pin No.	Symbol	Pin Voltage (V)	Description	Equivalent Circuit
1	AGC GND1	0	Ground pin of AGC amplifier 1. Form ground pattern as wide as possible to minimize ground impedance.	
2	AGC IN1 Note 1	1.02	Input pin to AGC amplifier 1.	
3	VAGC	0 to 5	Gain control pin. V_{AGC} up = gain up. It is recommended to use a 100k Ω voltage divider at this pin.	
4	AGC Vcc1	5	Power supply pin of AGC amplifier 1. This pin should be externally equipped with a bypass capacitor to minimize ground impedance.	
5	BPCAP4 Note 1	2.61	Bypass pins of AGC amplifier 1 and 2. These pins should be externally equipped with bypass capacitors to ground.	Refer to Equivalent circuit of pin 1 and pin 2.
		2.61		
6	BPCAP2 Note 1	2.84		
		2.49		
7	G1A Note 2	1.72	Gain control pins of the video amplifier. The gain may be adjusted by varying the value of the resistor between pins 7 and 8. Maximum gain = short. Minimum gain = open.	Refer to Equivalent circuit of pin 14 and pin 15.
		3.34		
8	G1B Note 2	1.72		
		3.34		
9	VAMP GND1	0	Ground pins of the video amplifier. Form ground pattern as wide as possible to minimize ground impedance.	
10	VAMP GND2	0		
11	VAMP OUT2 Note 2	2.52	Output pins of the video amplifier. With $R_L = 1k\Omega$, the single-ended output voltage is 2 Vp-p. OUT1 and INA are in phase. OUT2 and INB are in phase. In the case of a single-ended output, bypass the unused pin to ground through a capacitor.	
		4.92		
12	VAMP OUT1 Note 2	2.52		
		4.92		

Notes:

1. Top: $V_{AGC} = V_{cc1}$ Bottom: $V_{AGC} = 0V$ 2. Top: $V_{cc2} = 5V$ Bottom: $V_{cc2} = 9V$

PIN FUNCTIONS

Pin No.	Symbol	Pin Voltage (V)	Description	Equivalent Circuit
13	VAMP Vcc2	5 to 9	Power supply pin of the video amplifier. This pin should be externally equipped with a bypass capacitor to minimize ground impedance.	
14	INB Note 2	2.49 4.13	Input pins to the video amplifier. In the case of a single-ended input, bypass the unused pin to ground through a capacitor.	
15	INA Note 2	2.49 4.13		
16	AGC GND2	0	Ground pin of AGC amplifier 2. Form ground pattern as wide as possible to minimize ground impedance.	
17	AGC OUT2 Note 1	1.69 3.31	Output pin of AGC amplifier 2.	
18	AGC Vcc1	5	Power supply pin of AGC amplifier 2. This pin should be externally equipped with a bypass capacitor to minimize ground impedance.	
19	AGC IN2 Note 1	1.01 1.01	Input pin to AGC amplifier 2.	
20	AGC OUT1 Note 1	1.71 3.35	Output pin to AGC amplifier 1.	

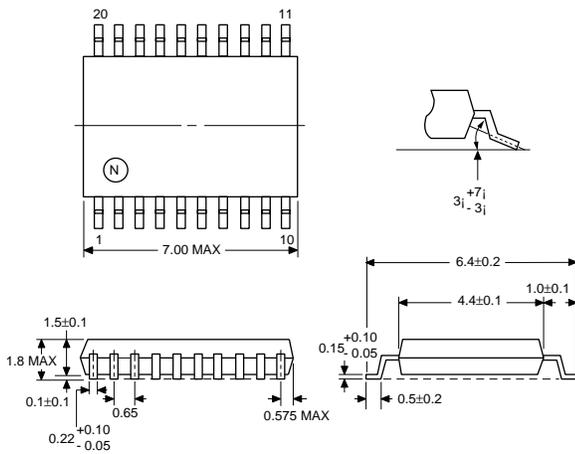
Notes:

- 1. Top: V_{AGC} = V_{cc1}
- 2. Top: V_{cc2} = 5 V

- Bottom: V_{AGC} = 0 V
- Bottom: V_{cc2} = 9 V

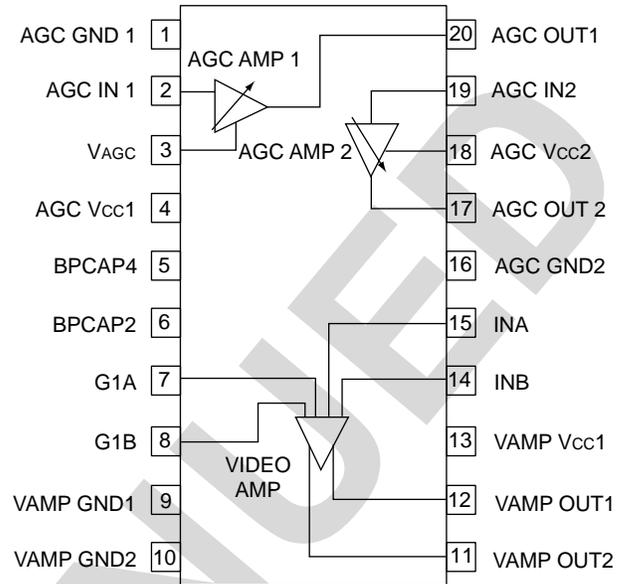
OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE S20

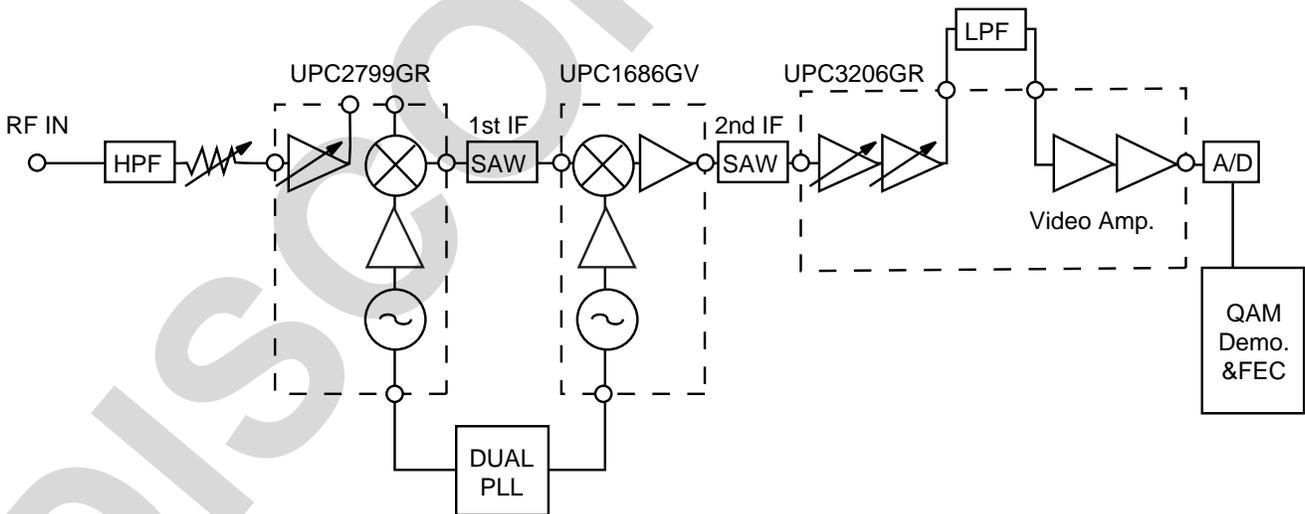


All dimensions are typical unless specified otherwise.

INTERNAL BLOCK DIAGRAM

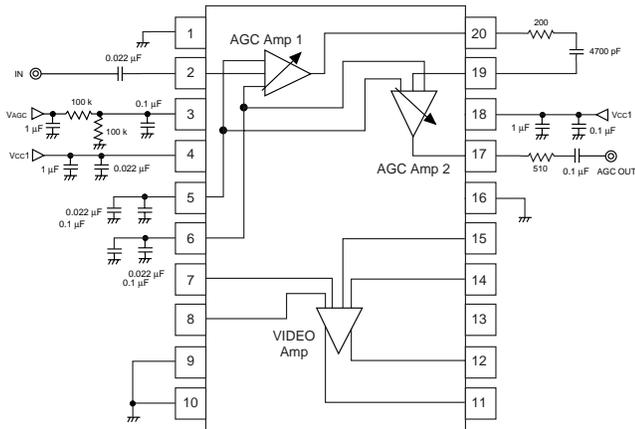


TYPICAL APPLICATION



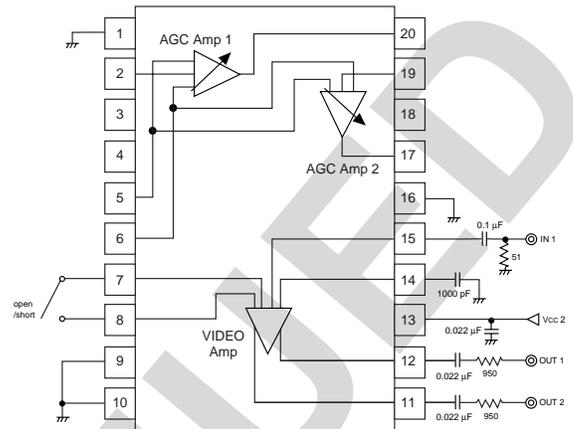
MEASUREMENT CIRCUIT 1

AGC AMP BLOCK



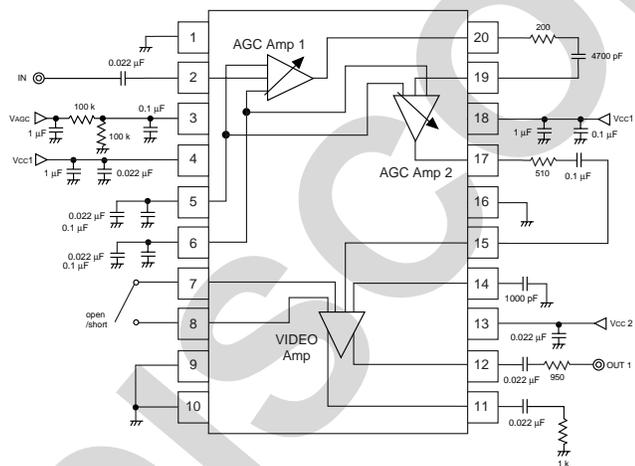
MEASUREMENT CIRCUIT 2

VIDEO AMP BLOCK



MEASUREMENT CIRCUIT 3

TOTAL BLOCK



ORDERING INFORMATION

PART NUMBER	QUANTITY
UPC3206GR-E1	2.5 k/Reel

Notes:
Embossed tape, 12 mm wide. Pin 1 indicates pull-out direction of tape.