NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3211GR

AGC AMPLIFIER FOR DIGITAL CATV RETURN PASS

DESCRIPTION

The μPC3211GR is a silicon monolithic integrated circuit designed as AGC amplifier for digital CATV systems. This IC is the AGC amplifier with 55 dB gain control range which is packaged in 20-pin SSOP. The device is able to use for digital QPSK system, therefore it contributes to make design of transmission system simplicity.

FEATURES

- Wide gain control range 55 dB TYP.
- Low distortion IM_3 = 57 dBc TYP. @P_{out} = –10 dBm
  IM_2 = 44 dBc TYP. @P_{out} = –10 dBm
- Supply Voltage 9 V
- Packaged in 20-pin SSOP suitable for high-density surface mount.

ORDERING INFORMATION

Part Number	Package	Supplying Form
μPC3211GR-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: μPC3211GR)

Caution electro-static sensitive device

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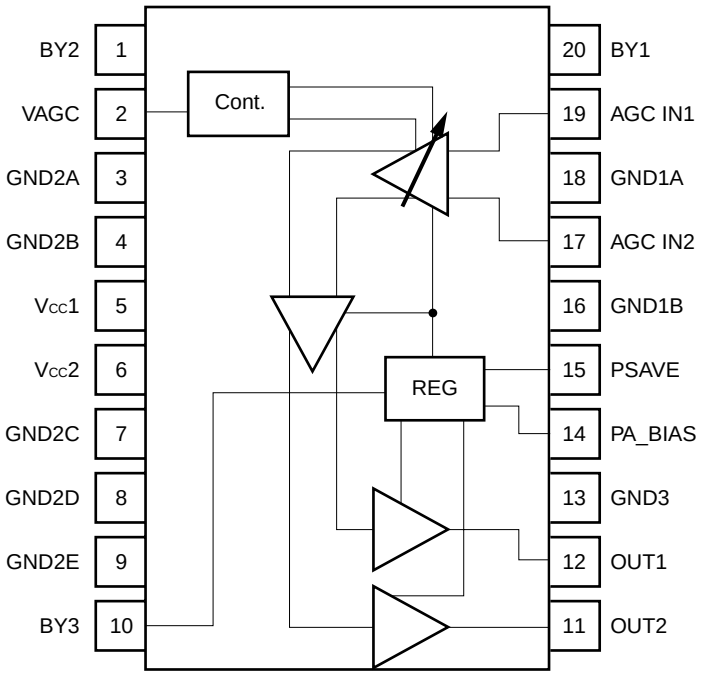
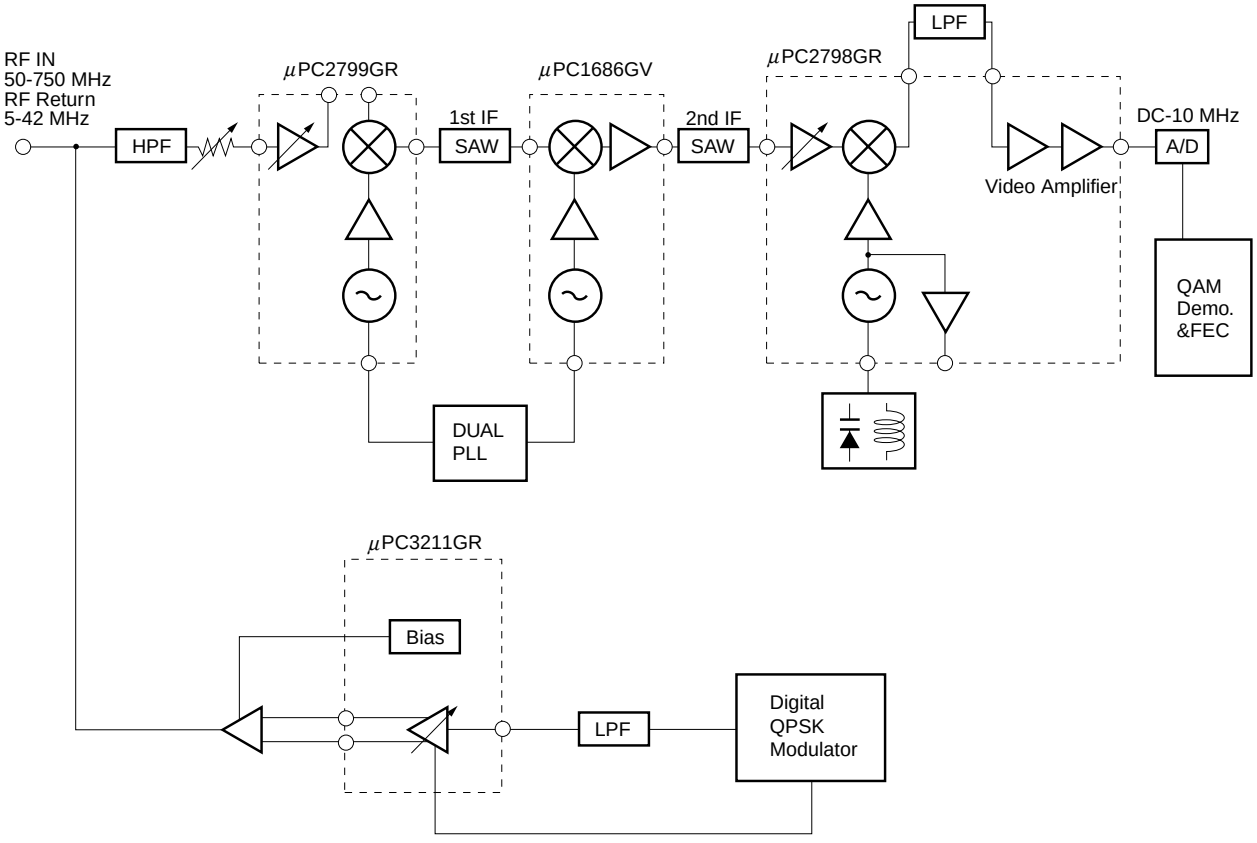
Date Published October 1999 N CP(K)
Printed in Japan

The mark ★ shows major revised points.

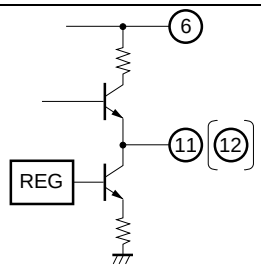
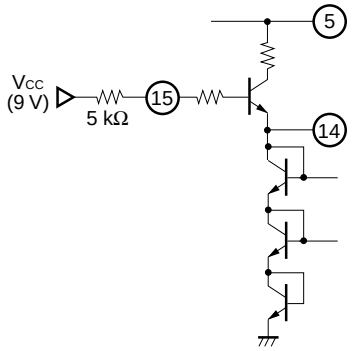
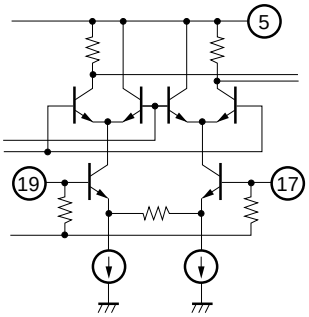
INTERNAL BLOCK DIAGRAM AND PIN CONFIGURATION (TOP VIEW)



TYPICAL APPLICATION



PIN FUNCTIONS

Pin No.	Pin Name	Pin Voltage TYP. (V)	Function and Explanation	Equivalent Circuit
1	BY2	–	Non Connection pin. This pin should be opened.	
2	VAGC	0 to 3	Automatic gain control pin.	
3	GND2A	0.0	Ground pins of differential amplifier.	
4	GND2B	0.0		
5	$V_{cc}1$	9.0	Power supply pin of AGC amplifier block.	
6	$V_{cc}2$	9.0	Power supply pin of differential amplifier and output block.	
7	GND2C	0.0	Ground pins of differential amplifier.	
8	GND2D	0.0		
9	GND2E	0.0		
10	BY3	1.64	Bypass pin of regulator block.	
11	OUT2	6.9	Signal output pins. This pins feature low-impedance because of its emitter-follower output port. The pin that is not used should be grounded through 50 ohm resistor.	
12	OUT1	6.9		
13	GND3	0.0	Ground pin of output block.	
14	PA_BIAS	2.45	This is the pin to feed base bias in case of connection to transistor as power amplifier.	
15	Psave	9.0 (+5 kΩ)	Power-save pin. V_{cc} : ON GND : SLEEP The 5 kΩ resistor should be connected between 15 pin and V_{cc}.	
16	GND1B	0.0	Ground pin of AGC amplifier block.	
18	GND1A	0.0		
17	AGC IN2	2.43	Signal input pin. In the case of single input, 17 or 19 pin should be grounded through capacitor.	
19	AGC IN1	2.43		
20	BY1	–	Non Connection pin. This pin should be opened.	

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

Parameter	Symbol	Test Condition	Rating	Unit
Supply Voltage	V_{CC}		11.0	V
Power-save Voltage	V (Psave)	**Note 1**	11.0	V
AGC Voltage	V_{AGC}		3.6	V
Power Dissipation	P_D	T_A = +75°C **Note 2**	500	mW
Operating Ambient Temperature	T_A		–40 to +75	°C
Storage Temperature	T_{stg}		–55 to +150	°C
Maximum Input Level	P_{in} (MAX)		+5	dBm

Notes 1. Bias to 15 pin through 5 kΩ resistor.

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

RECOMMENDED OPERATING RANGE

Parameter	Symbol	Test Condition	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}		8.0	9.0	10.0	V
Power-save Voltage	V (Psave)	**Note**	0	–	10.0	V
AGC Control Voltage	V_{AGC}		0	–	3.3	V
Operating Ambient Temperature	T_A		–40	+25	+75	°C
Input Frequency	f_{in}		5	–	100	MHz
Maximum Input Level	P_{in} (MAX)		–	–	0	dBm

Note Bias to 15 pin through 5 kΩ resistor.

ELECTRICAL CHARACTERISTICS (T_A = +25°C, V_{CC} = 9 V, V_{AGC} = 0 V, V (Psave) = 9 V (+5 kΩ), unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current 1	$I_{CC}1$	No input signal **Note 1**	29	38	51	mA
Maximum Gain	G_{MAX}	f_{in} = 65 MHz, P_{in} = –20 dBm **Note 2**	14	16	18	dB
Gain Control Range	GCR	f_{in} = 65 MHz, P_{in} = –20 dBm, V_{AGC} = 0 to 3 V **Note 2**	47	55	–	dB
Isolation at sleep mode	Isol	f_{in} = 65 MHz, P_{in} = –20 dBm, V (Psave) = 0 V (+5 kΩ) **Note 2**	60	65	–	dB
2nd order intermodulation distortion	IM_2	$f_{in}1$ = 65 MHz, $f_{in}2$ = 66.8 MHz, P_{out} = –10 dBm **Note 2**	–	–44	–40	dBc
3rd order intermodulation distortion	IM_3	$f_{in}1$ = 65 MHz, $f_{in}2$ = 66.8 MHz, P_{out} = –10 dBm **Note 2**	–	–57	–50	dBc

Notes 1. By measurement circuit 1

2. By measurement circuit 2

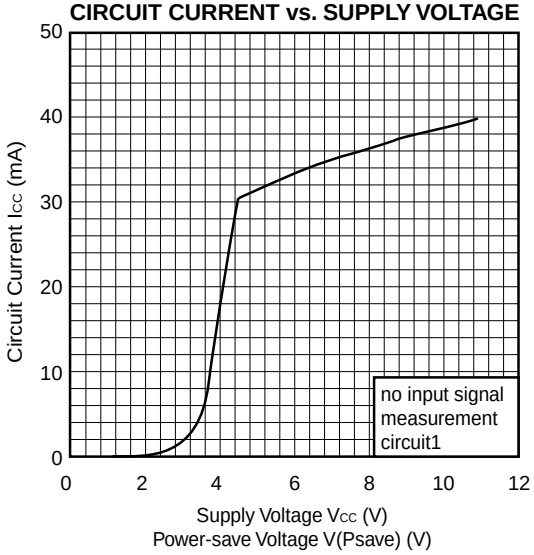
STANDARD CHARACTERISTICS (T_A = +25°C, V_{CC} = 9 V, V_{AGC} = 0 V, V (Psave) = 9 V (+5 kΩ), unless otherwise specified)

Parameter	Symbol	Test Conditions	Reference Value	Unit
Maximum Output Power	$P_{O\ (sat)}$	f_{in} = 65 MHz, P_{in} = –5 dBm **Note 1**	+5	dBm
Circuit Current at Power-save mode	I_{CC} (P/S)	No input signal, V (Psave) = 0 V (+5 kΩ) **Note 2**	3	mA
Noise Figure	NF	f_{in} = 65 MHz **Note 3**	10	dB
Output Intercept Point	OIP_3	$f_{in}1$ = 65 MHz, $f_{in}2$ = 66.8 MHz **Note 1**	+16	dBm
Gain Flatness	G_{flat}	f_{in} = 5 to 100 MHz, 6 MHz Band width P_{in} = –20 dBm **Note 1**	±0.1	dB
Circuit Current 2	$I_{CC}2$	No input signal, V_{AGC} = 3 V **Note 2**	43	mA
ON Time	t_{ON}	f_{in} = 65 MHz, V (Psave) = 0 → 9 V (+5 kΩ) **Note 4**	200	μsec
OFF Time	t_{OFF}	f_{in} = 65 MHz, V (Psave) = 9 → 0 V (+5 kΩ) **Note 4**	1.7	msec

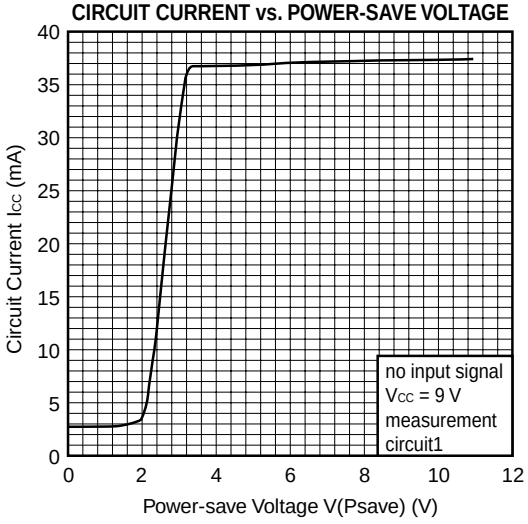
Notes 1. By measurement circuit 2
2. By measurement circuit 1
3. By measurement circuit 3
4. By measurement circuit 4

TYPICAL CHARACTERISTICS (T_A = +25°C)

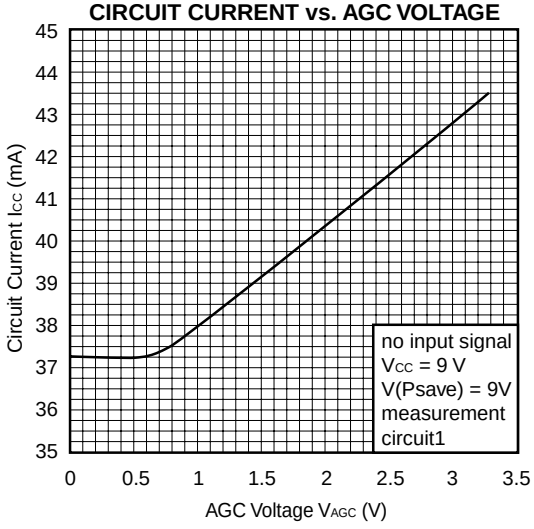
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



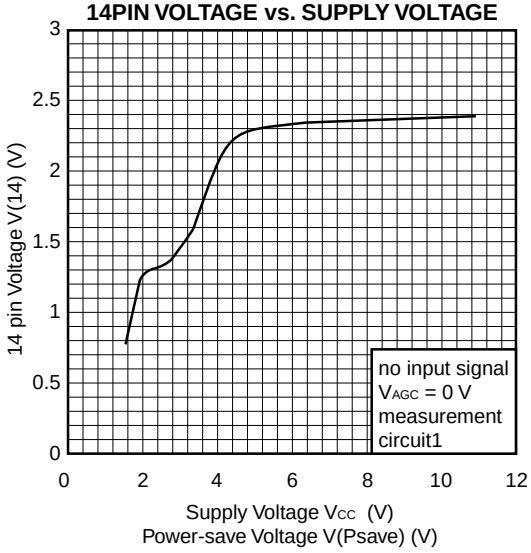
CIRCUIT CURRENT vs. POWER-SAVE VOLTAGE



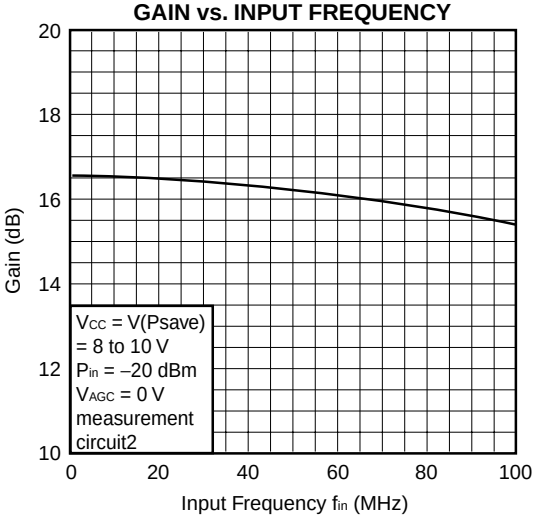
CIRCUIT CURRENT vs. AGC VOLTAGE



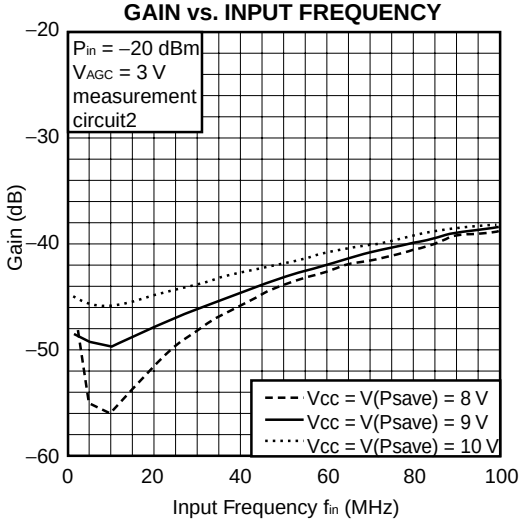
14PIN VOLTAGE vs. SUPPLY VOLTAGE



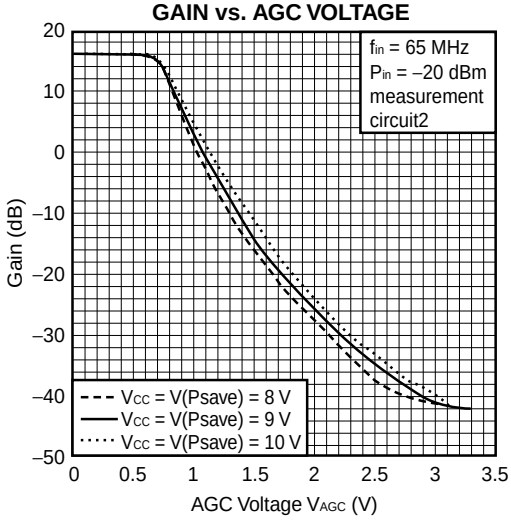
GAIN vs. INPUT FREQUENCY



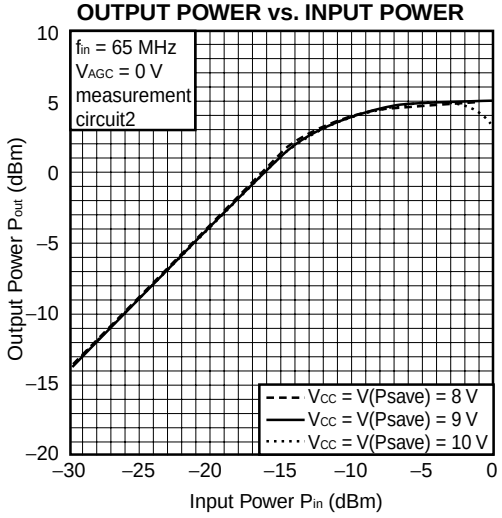
GAIN vs. INPUT FREQUENCY



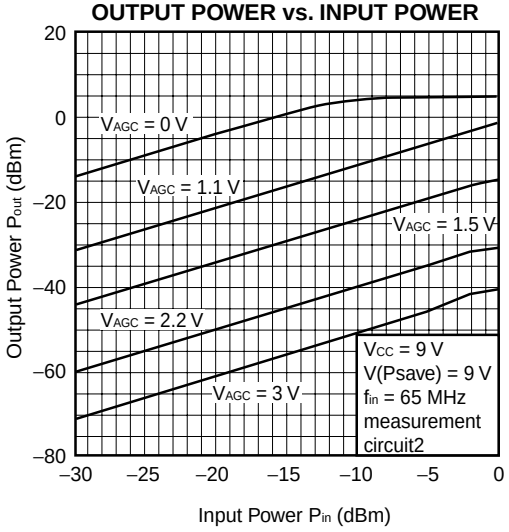
GAIN vs. AGC VOLTAGE



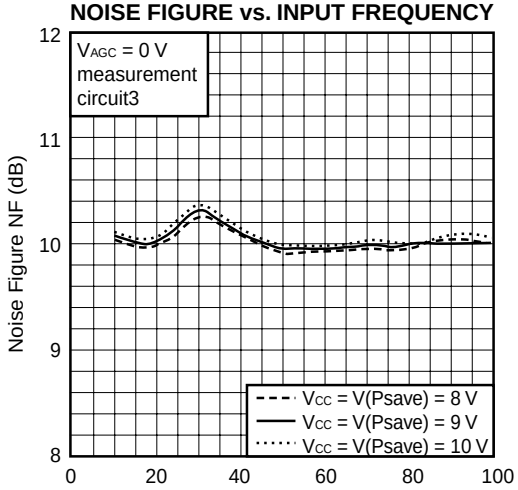
OUTPUT POWER vs. INPUT POWER



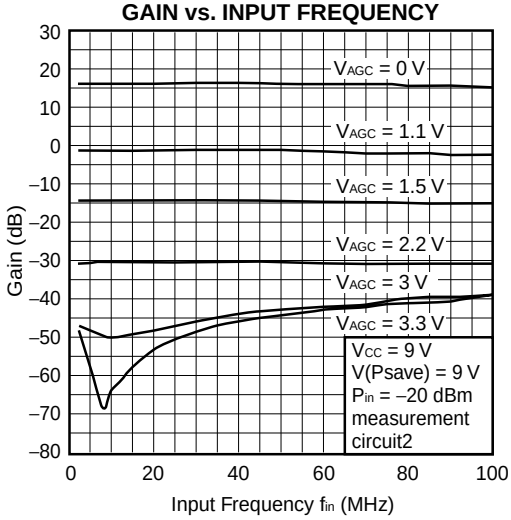
OUTPUT POWER vs. INPUT POWER



NOISE FIGURE vs. INPUT FREQUENCY

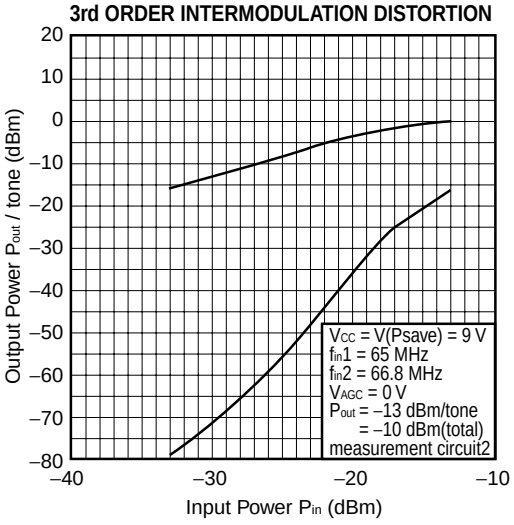


GAIN vs. INPUT FREQUENCY

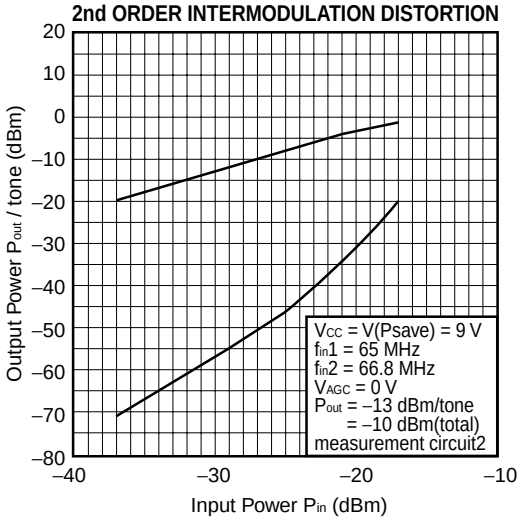


STANDARD CHARACTERISTICS (T_A = +25°C)

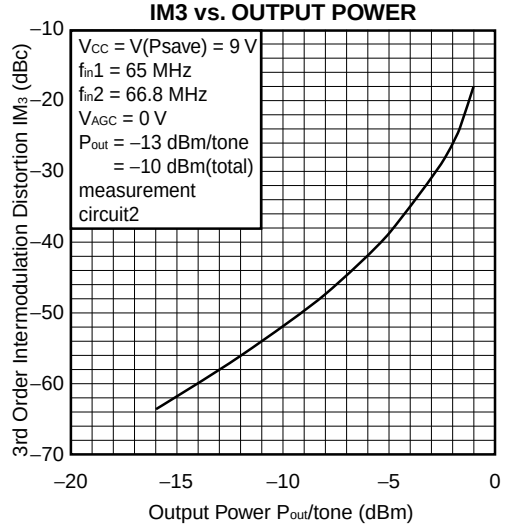
3rd ORDER INTERMODULATION DISTORTION



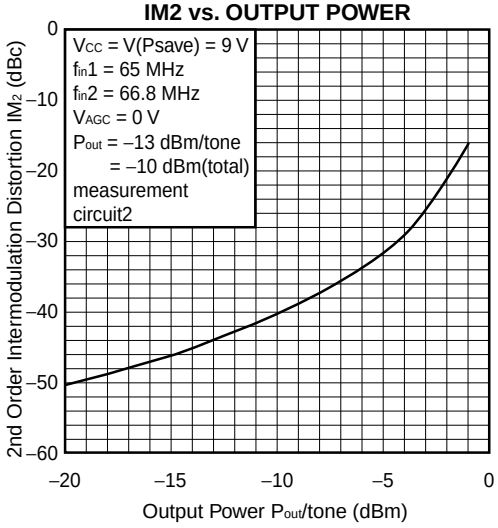
2nd ORDER INTERMODULATION DISTORTION



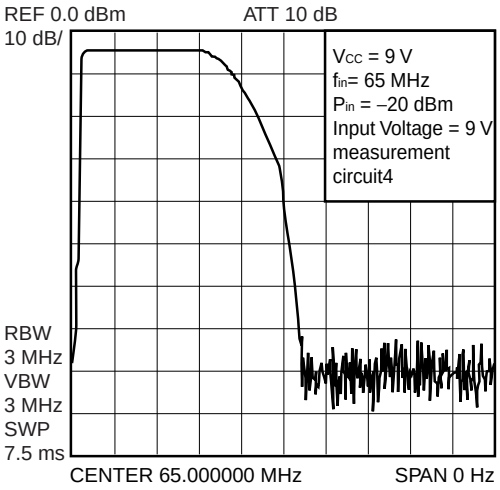
IM3 vs. OUTPUT POWER



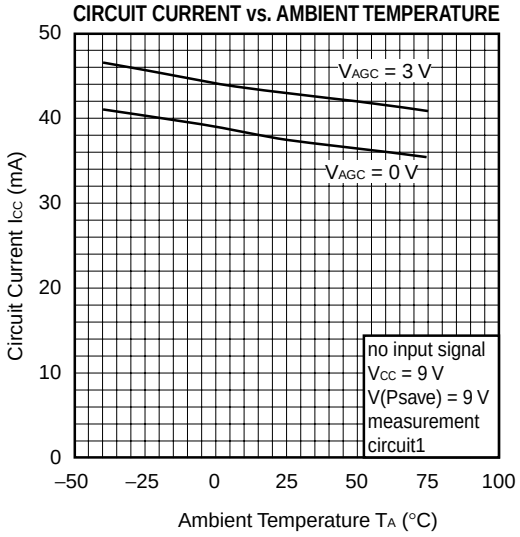
IM2 vs. OUTPUT POWER

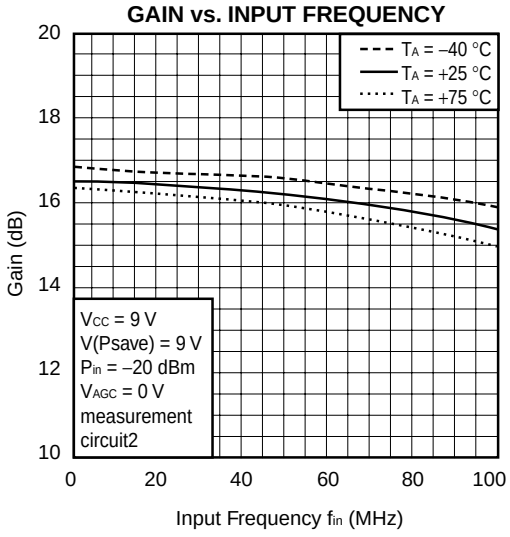


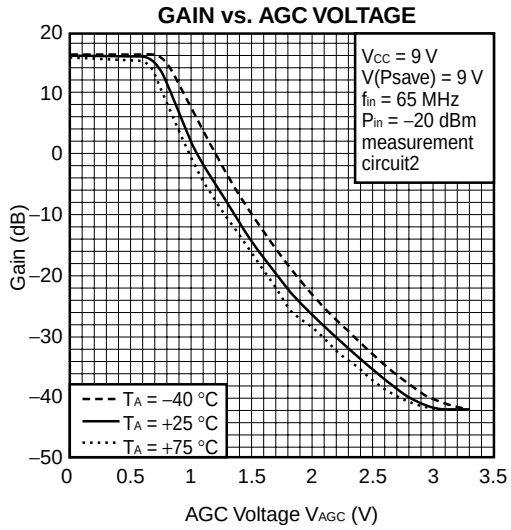
ON/OFF TIME OF POWERSAVE



THERMAL CHARACTERISTICS (FOR REFERENCE)

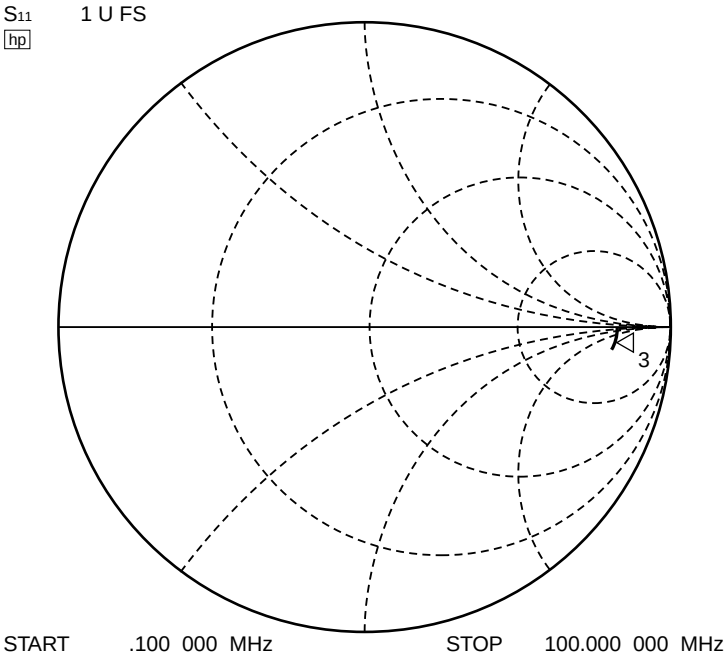






STANDARD CHARACTERISTICS

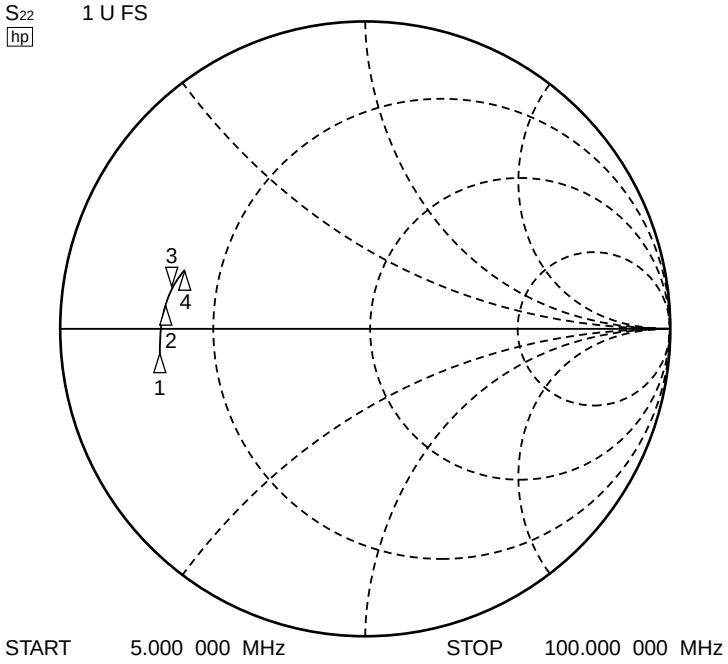
INPUT IMPEDANCE (19 PIN)



Δ 1: 5 MHz
533.6 Ω
–16.4 Ω
Δ 2: 40 MHz
515.2 Ω
–81.4 Ω
Δ 3: 65 MHz
493.7 Ω
–123.3 Ω
Δ 4: 100 MHz
455.9 Ω
–190.3 Ω

T_A = +25°C
V_{CC} = 9 V
V (Psave) = 9 V
P_{in} = –20 dBm

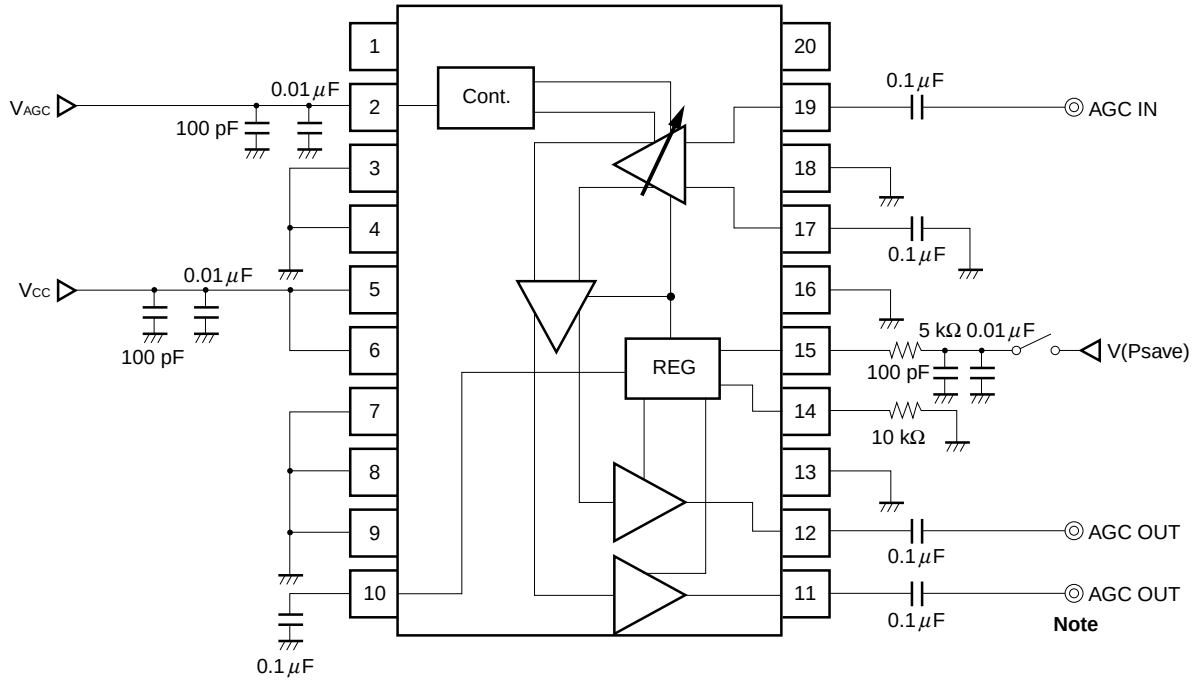
OUTPUT IMPEDANCE (11 PIN)



Δ 1: 5 MHz
9.779 Ω
–2.306 Ω
Δ 2: 40 MHz
10.066 Ω
3.033 Ω
Δ 3: 65 MHz
10.574 Ω
5.237 Ω
Δ 4: 100 MHz
11.88 Ω
7.805 Ω

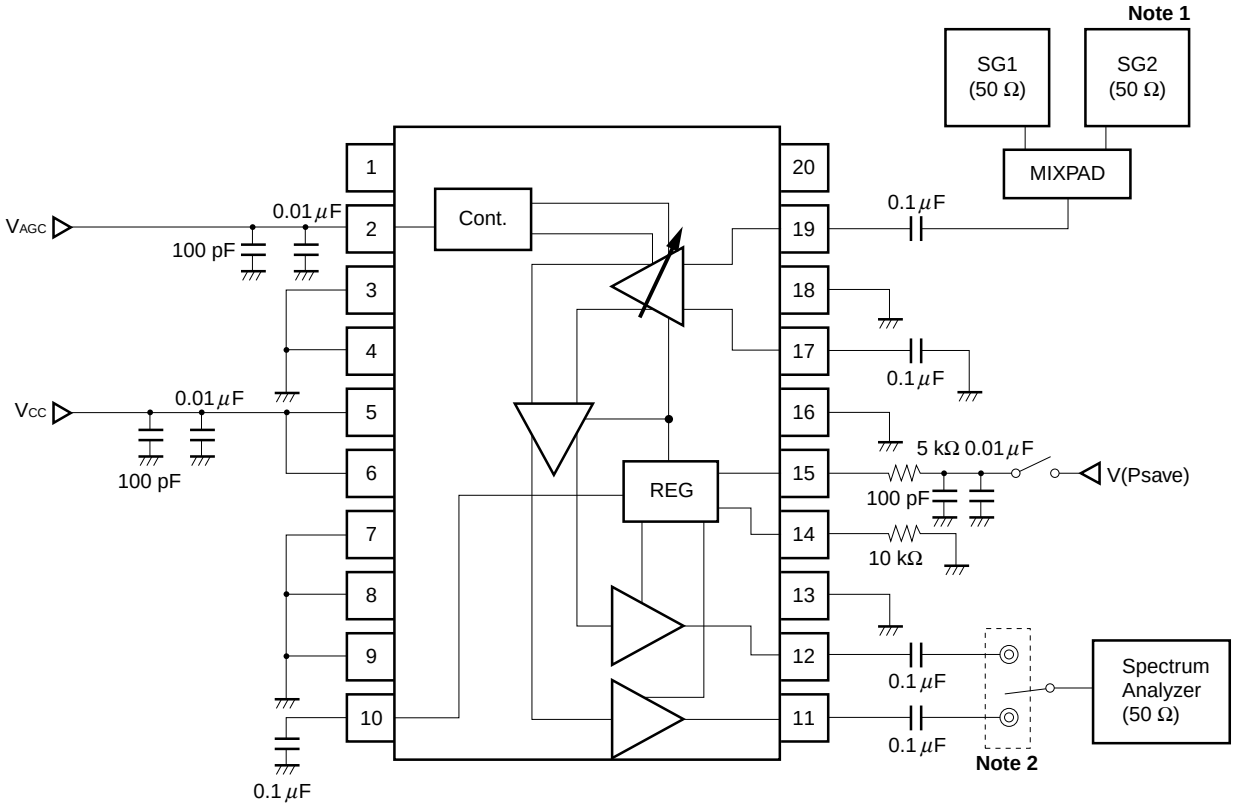
T_A = +25°C
V_{CC} = 9 V
V (Psave) = 9 V
P_{in} = –20 dBm

MEASUREMENT CIRCUIT 1



Note The pin that is not connected to Spectrum Analyzer should be grounded through 50 Ω resistor.

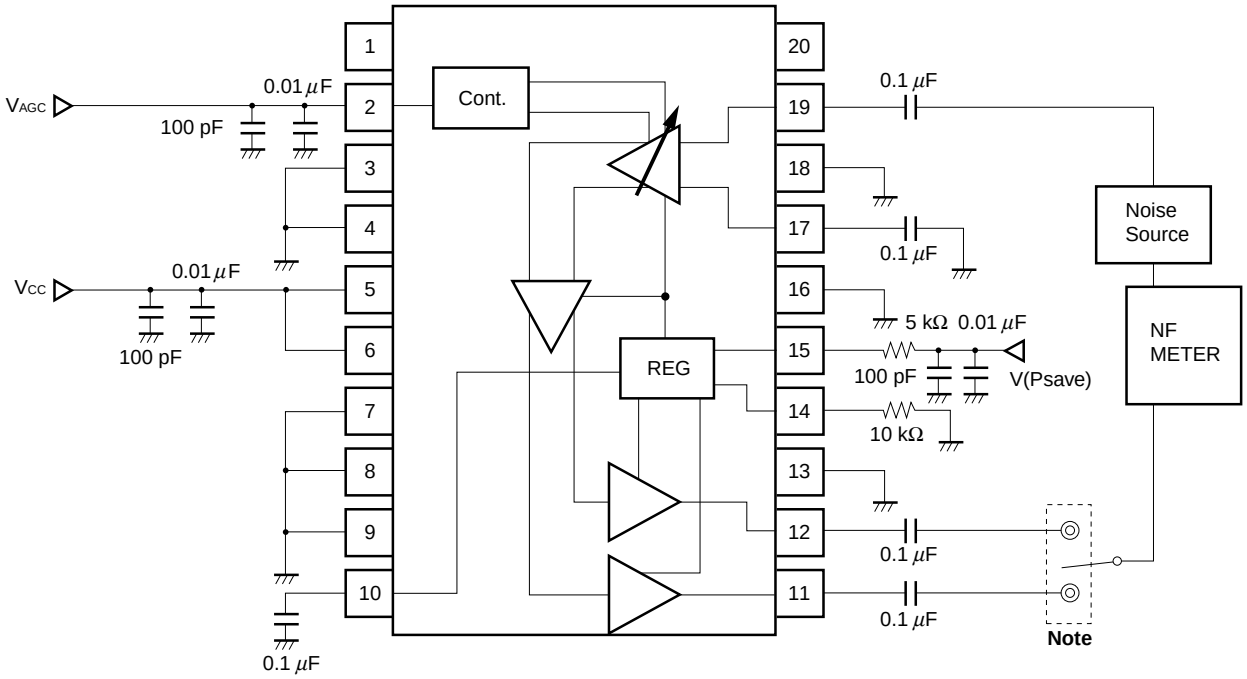
MEASUREMENT CIRCUIT 2



Notes 1. Connect in the case of measurement of IM_2/IM_3

2. The pin that is not connected to Spectrum Analyzer should be grounded through 50 Ω resistor.

MEASUREMENT CIRCUIT 3



Note The pin that is not connected to Spectrum Analyzer should be grounded through 50 Ω resistor.

MEASUREMENT CIRCUIT 4

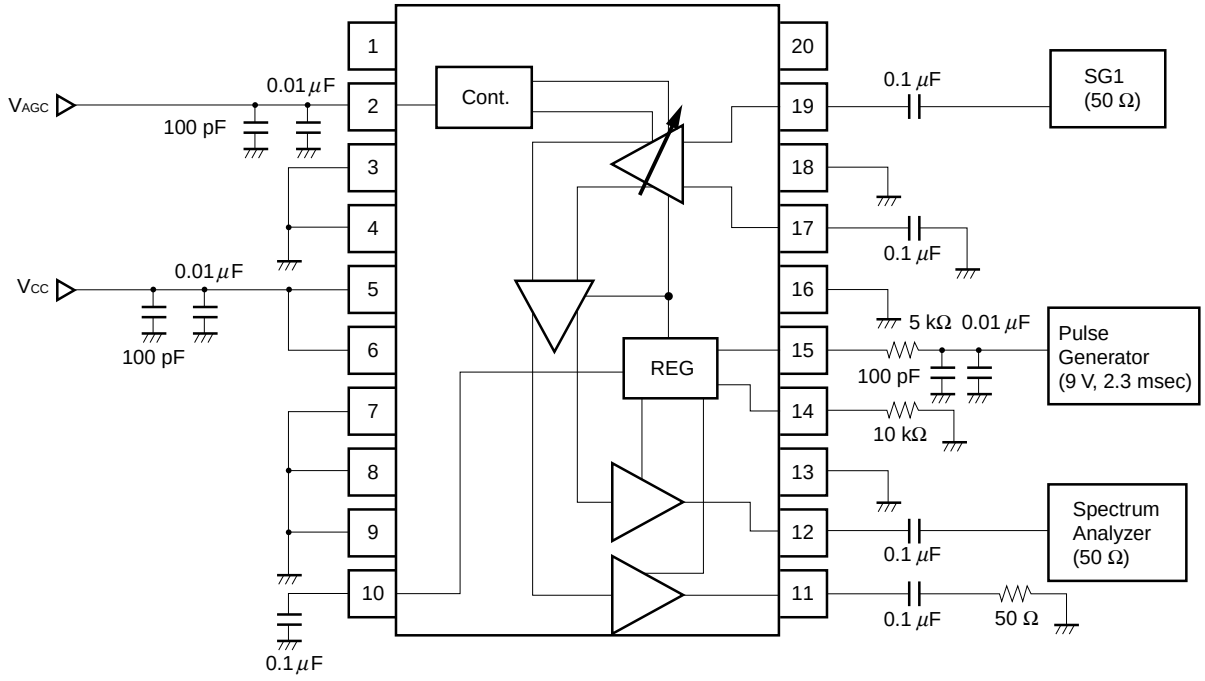
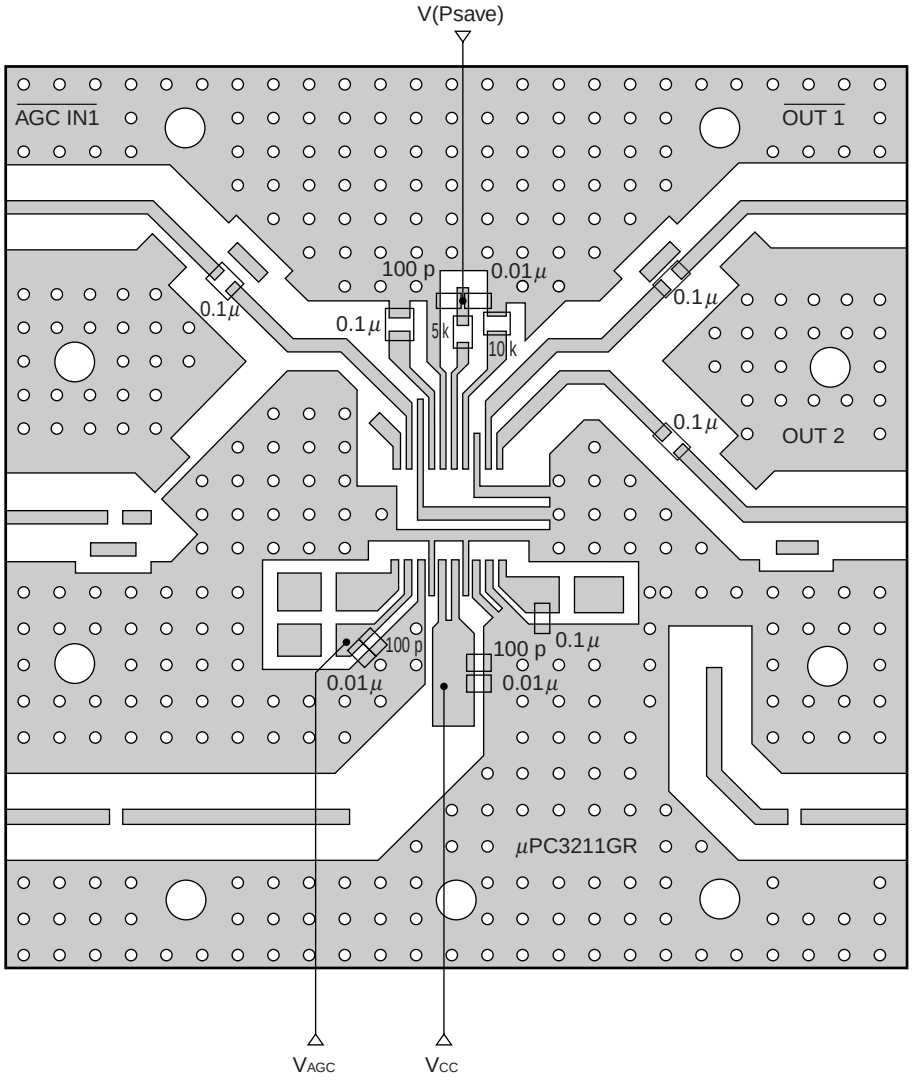


ILLUSTRATION OF THE EVALUATION BOARD FOR MEASUREMENT CIRCUIT



Notes 1. 50 × 50 × 1.6 mm double sided copper clad polyimide board.

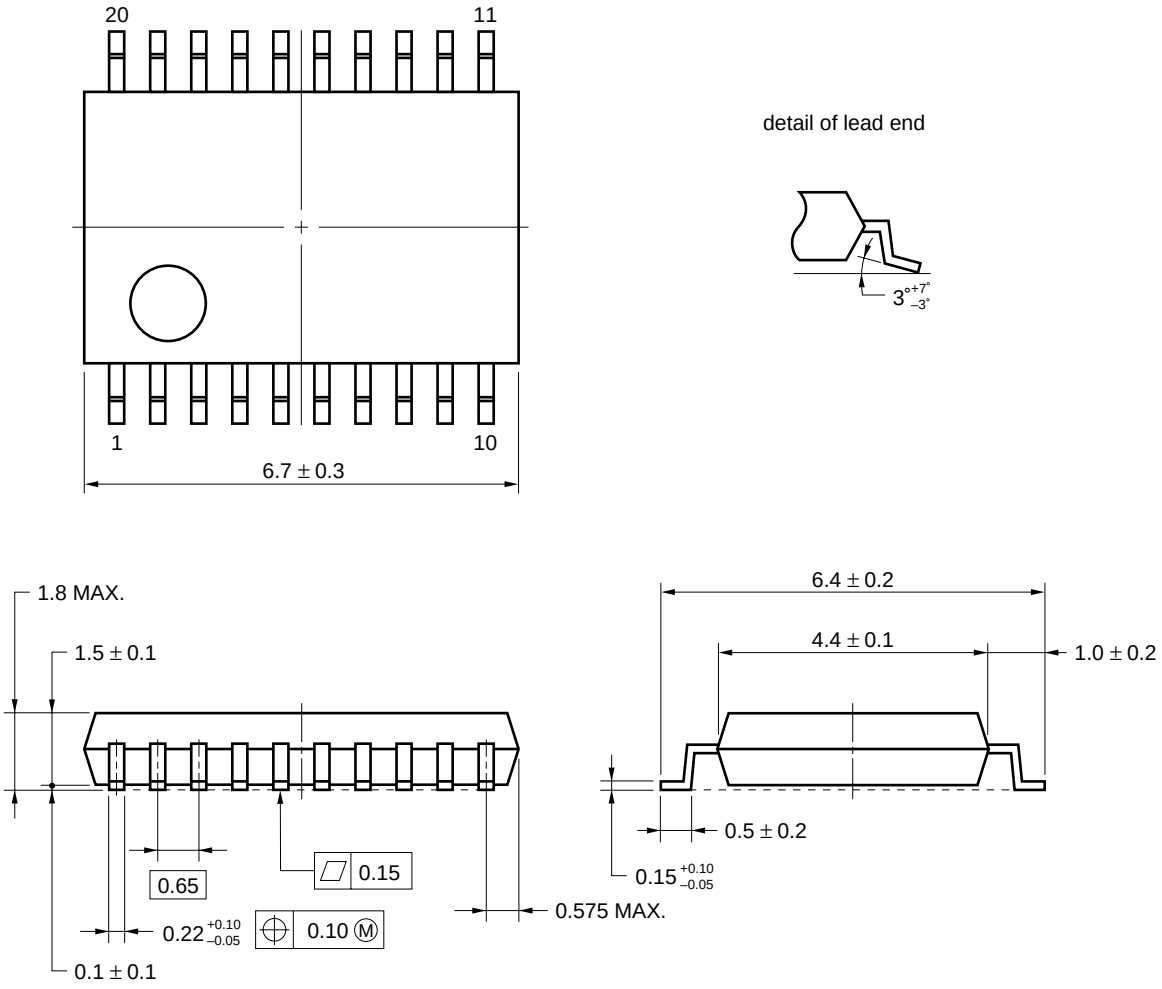
2. Back side: GND pattern

3. Solder plated on pattern

4. ○◯: Through holes

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.

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)**.

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M7 98.8