NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC2799GR

UP CONVERTOR FOR CABLE MODEM

DESCRIPTION

The μPC2799GR is Silicon monolithic IC designed for use as up-converter for cable modem. This IC consists of local oscillator, AGC amplifier, mixer and so on. μPC1686GV and μPC2798GR are also available as for kit-use with this IC.

So, these devices contribute to make RF block small.

The package is 20-pin SSOP (shrink small outline package) suitable for surface mount.

FEATURES

- On-chip low distortion AGC amplifier, mixer
- Low phase noise OSC transistor
- Packaged in 20-pin SSOP suitable for high-density surface mounting

ORDERING INFORMATION

PART NUMBER	PACKAGE	PACKAGE STYLE
μPC2799GR-E1	20-pin plastic SSOP (225 mil)	Embossed tape 12 mm wide. 2.5 k/REEL Pin 1 indicates pull-out direction of tape

For evaluation sample order, please contact your local NEC office. (Part number for sample order: μPC2799GR)

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.

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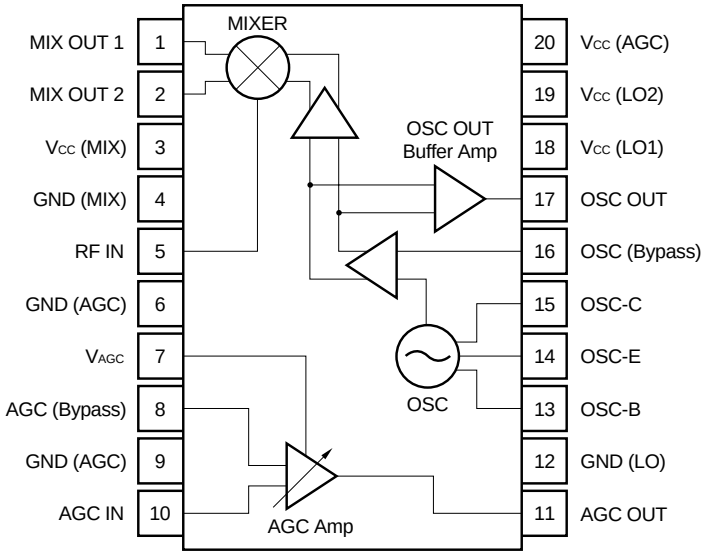
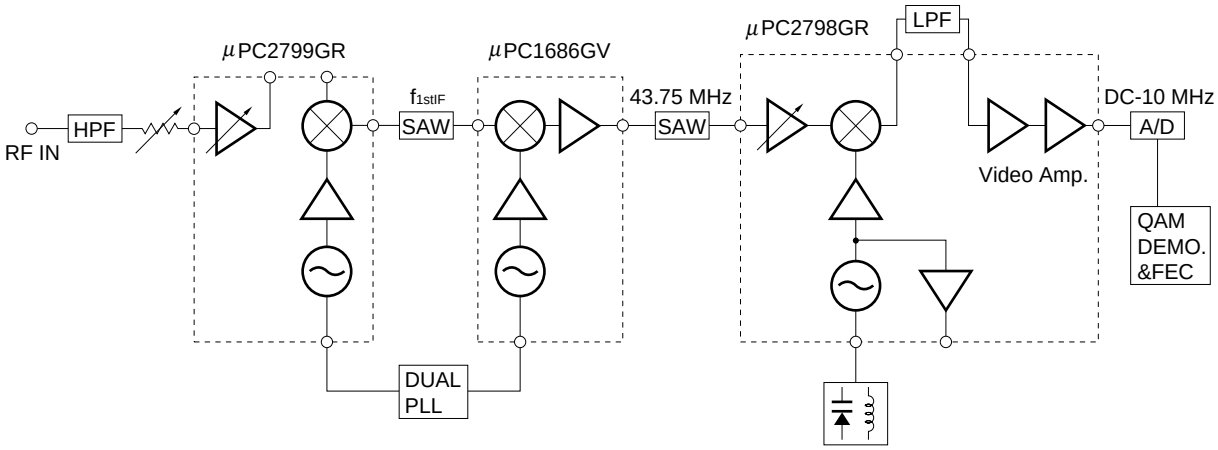
Date Published October 1999 N CP(K)
Printed in Japan

The mark ★ shows major revised points.

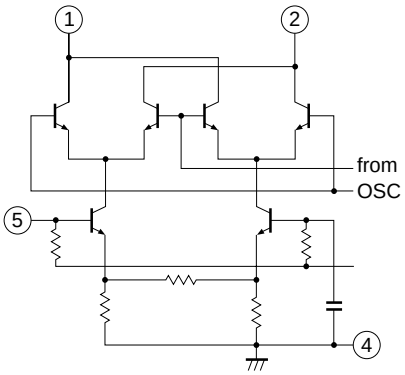
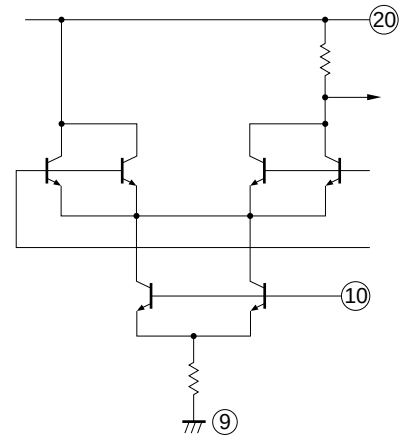
INTERNAL BLOCK DIAGRAM AND PIN CONFIGURATION (Top View)

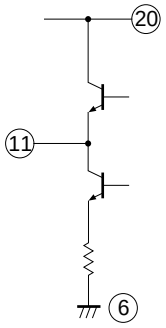
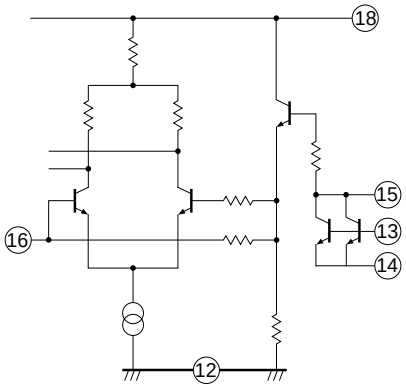
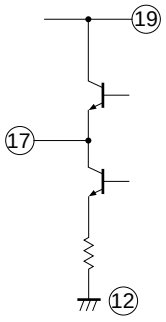


EXAMPLE FOR SYSTEM APPLICATION (CABLE MODEM)



PIN EXPLANATIONS

Pin No.	Symbol	Pin Voltage (V, TYP.)	Explanation	Equivalent Circuit
1	MIX OUT	–	Output pin of mixer. This pin is assigned for the open collector output with high impedance dependent on external inductance.	
2	MIX OUT	–		
3	V_{CC} (MIX)	5	Power supply pin of mixer block. Must be connected bypass capacitor to minimize ground impedance.	
4	GND (MIX)	0	Ground pin of mixer block. Must be connected to the system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible.	
5	RF IN	1.89	Input pin of RF signal.	
6	GND (AGC)	0	Ground pin of AGC block. Must be connected to the system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible.	
7	V_{AGC}	0 to 5	Automatic gain control pin. This pin's bias govern the AGC output level. Minimum gain at V_{AGC} = 0 V Maximum gain at V_{AGC} = 5 V Recommend to use by deviding AGC voltage with externally resistor (ex. 100 kΩ).	
8	AGC (bypass)	2.58	Bypass pin for AGC amplifier. Grounded through 2200 pF capacitor.	
9	GND (AGC)	0	Ground pin of AGC block. Must be connected to the system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible.	
10	AGC IN	1.10	Signal input pin of AGC amplifier.	

Pin No.	Symbol	Pin Voltage (V, TYP.)	Explanation	Equivalent Circuit
11	AGC OUT	2.5	Output pin of AGC amplifier. This pin features low-impedance because of its emitter-follower output port.	
12	GND (LO)	0	Ground pin of AGC block. Must be connected to the system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible.	
13	OSC base	–		
14	OSC emitter	–		
15	OSC collector	–		
16	OSC (bypass)	3.18	Bypass pin of OSC amplifier. Grounded through 100 pF capacitor.	
17	OSC OUT	3.2	Output pin of Oscillator frequency. Connected to PLL synthesizer IC's input pin.	
18	V_{CC} (LO1)	5	Power supply pin of local block. Must be connected bypass capacitor to minimize ground impedance.	
19	V_{CC} (LO2)	5		
20	V_{CC} (AGC)	5	Power supply pin of AGC block. Must be connected bypass capacitor to minimize ground impedance.	

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

PARAMETER	SYMBOL	TEST CONDITION	RATING	UNIT
Supply Voltage	V_{CC}		6.0	V
Power Dissipation	P_D	T_A = 85 °C[*1]	433	mW
Operating Ambient Temperature	T_A		–40 to +85	°C
Storage Temperature Range	T_{stg}		–55 to +150	°C
OSC Collector Current	I_{OSC}		48	mA
OSC Collector to Base Voltage	V_{CBO}		6.0	V
OSC Collector to Emitter Voltage	V_{CEO}		4.0	V
OSC Emitter to Base Voltage	V_{EBO}		2.5	V

***1.** Mounted on 50 × 50 × 1.6 mm double epoxy glass board.

RECOMMENDED OPERATING RANGE

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage	Vcc	4.5	5.0	5.5	V
Operating Ambient Temperature	T_A	–40	+25	+85	°C
RF Input Frequency Range	f_{RF}	250	–	850	MHz
AGC Voltage	V_{AGC}	0	–	V_{CC}	V

ELECTRICAL CHARACTERISTICS (T_A = 25 °C, V_{CC} = 5 V, V_{AGC} = 5 V, f_{RF} = 500 MHz, P_{RF} = –20 dBm, P_{MIX}in = –15 dBm, f_{OSC} = 1415 MHz, P_{OSC} = –10 dBm, f_{IF} = 915 MHz, unless otherwise specified)

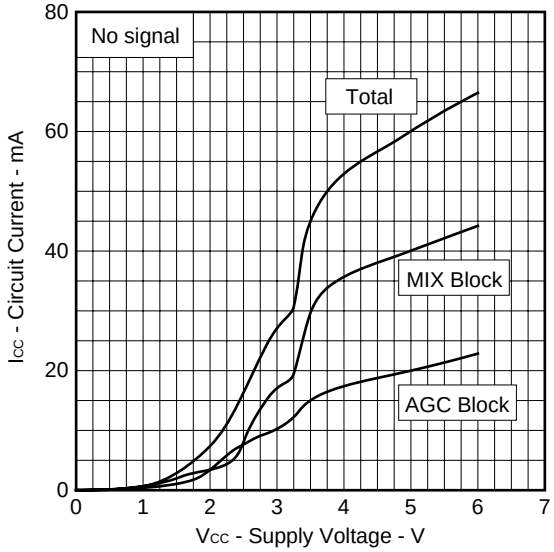
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
TOTAL						
Circuit Current	Icc	–	60	78	mA	no input signal
AGC AMPLIFIER BLOCK						
AGC Maximum Gain	G_{AGCMAX}	12.5	15.0	17.5	dB	
AGC Minimum Gain	G_{AGCMIN}	–	0.5	–	dB	V_{AGC} = 0 V
Gain Control Range	GCR	10	14.5	–	dB	V_{AGC} = 0 to 5 V
Maximum Output Power 1	P_O (sat) 1	3.0	6.0	–	dBm	P_{RF} = 0 dBm
Maximum Output Power 2	P_O (sat) 2	–	–9.0	–	dBm	V_{AGC} = 0 V, P_{RF} = 0 dBm
MIXER BLOCK						
Conversion Gain	CG	1.5	4.5	7.5	dB	
Maximum Output Power 3	P_O (sat) 3	–1.5	1.5	–	dBm	P_{MIX}in = 0 dBm

STANDARD CHARACTERISTICS (FOR REFERENCE) (T_A = 25 °C, V_{CC} = 5 V, V_{AGC} = 5 V, f_{RF} = 500 MHz, f_{OSC} = 1415 MHz, P_{OSC} = –10 dBm, f_{IF} = 915 MHz, unless otherwise specified)

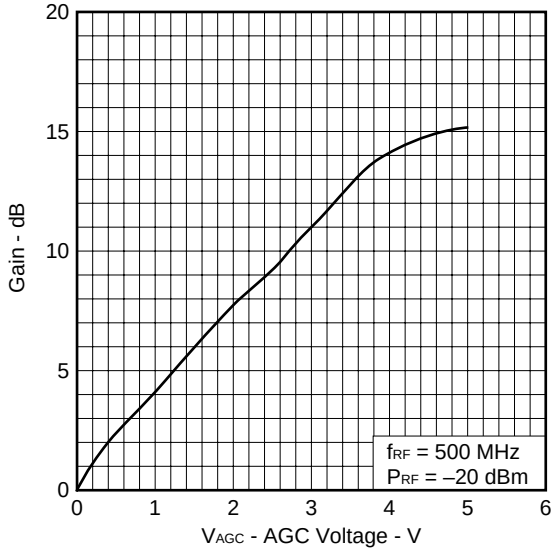
PARAMETER	SYMBOL	REFERENCE VALUES	UNIT	TEST CONDITIONS
AGC AMPLIFIER BLOCK				
Noise Figure 1	NF1	8.5	dB	
Input Intercept Point 1	$IIP_3$1	+0.5	dBm	f_{RF}1 = 499 MHz, f_{RF}2 = 501 MHz
Input Intercept Point 2	$IIP_3$2	–2	dBm	f_{RF}1 = 499 MHz, f_{RF}2 = 501 MHz, V_{AGC} = 0 V
MIXER BLOCK				
Noise Figure 2	NF2	17	dB	DSB, P_{OSC} = –10 dBm
Noise Figure 3	NF3	13	dB	DSB, P_{OSC} = 0 dBm
Input Intercept Point 3	$IIP_3$3	+5	dBm	f_{RF}1 = 499 MHz, f_{RF}2 = 501 MHz

TYPICAL CHARACTERISTICS (AGC block, T_A = 25 °C, V_{CC} = 5 V, unless otherwise specified)

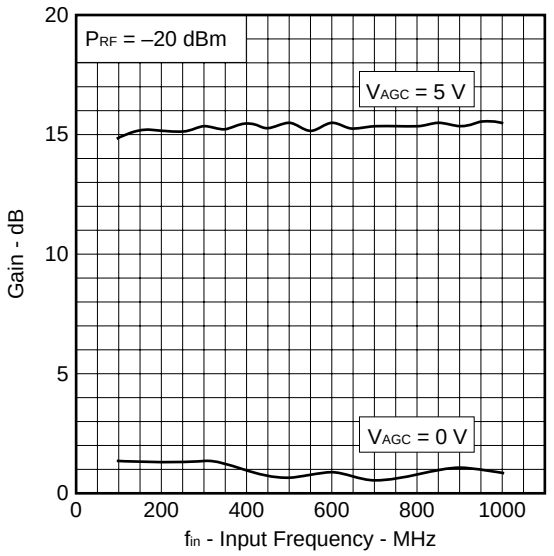
CIRCUIT CURRENT VS. SUPPLY VOLTAGE



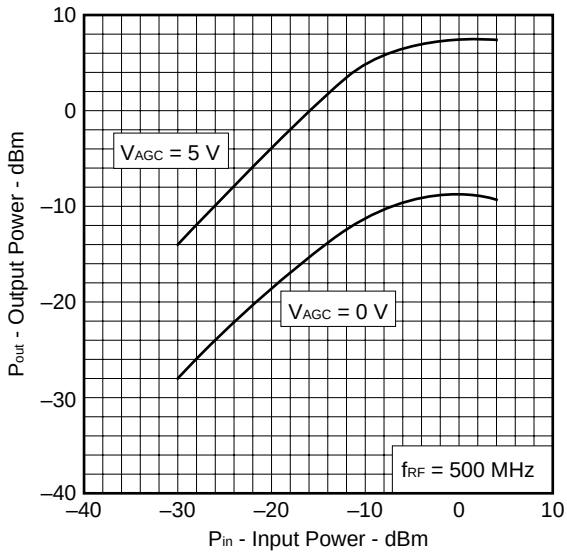
GAIN VS. AGC VOLTAGE



GAIN VS. INPUT FREQUENCY

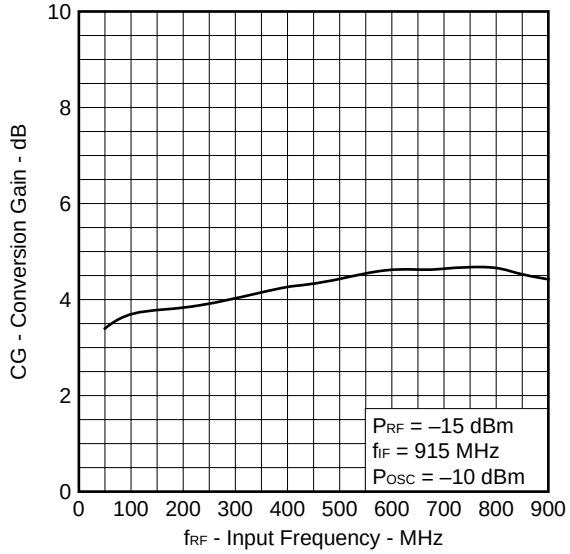


OUTPUT POWER VS. INPUT POWER

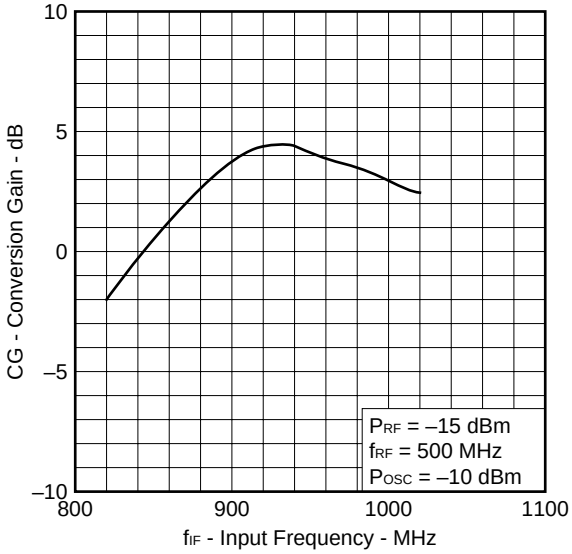


TYPICAL CHARACTERISTICS (MIX block, T_A = 25 °C, V_{CC} = 5 V, unless otherwise specified)

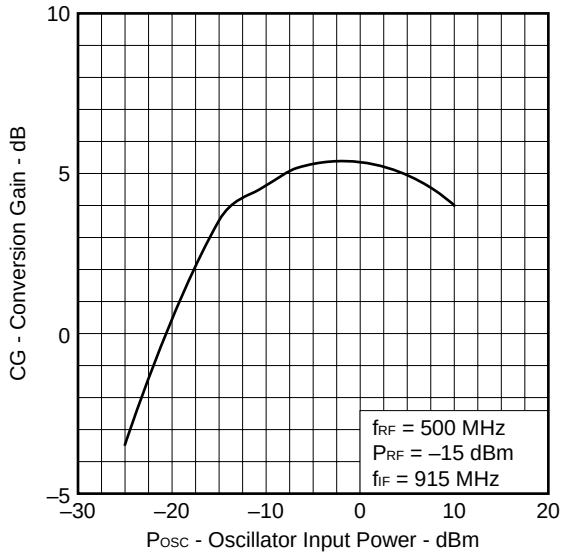
CONVERSION GAIN VS. INPUT FREQUENCY



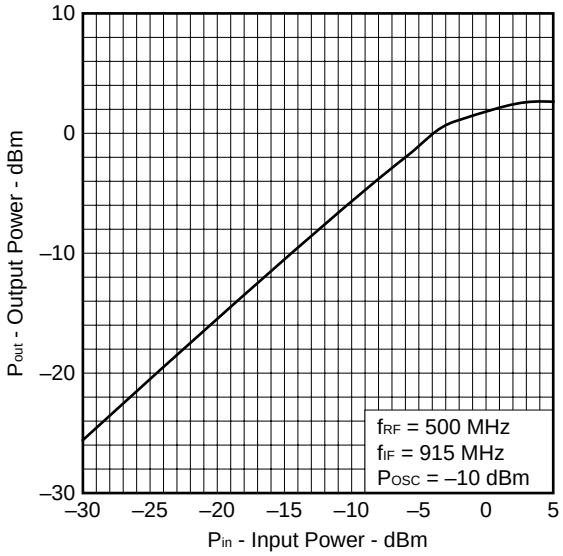
CONVERSION GAIN VS. IF FREQUENCY



CONVERSION GAIN VS. OSCILLATOR INPUT POWER

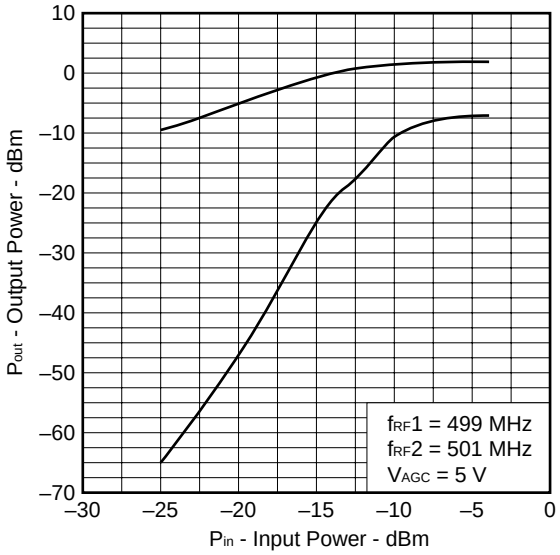


OUTPUT POWER VS. INPUT POWER

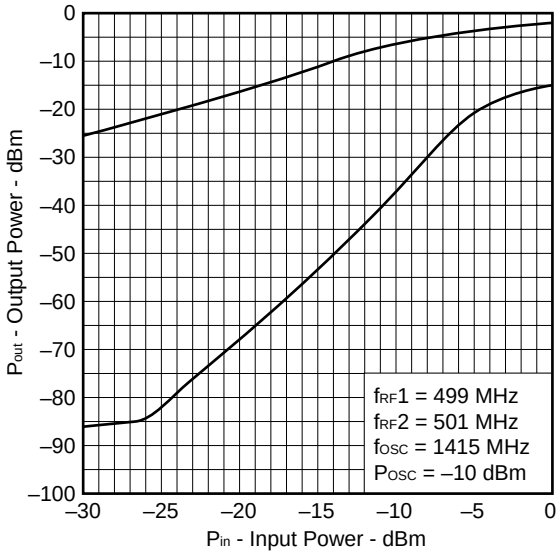


STANDARD CHARACTERISTICS (T_A = 25 °C, V_{CC} = 5 V, unless otherwise specified)

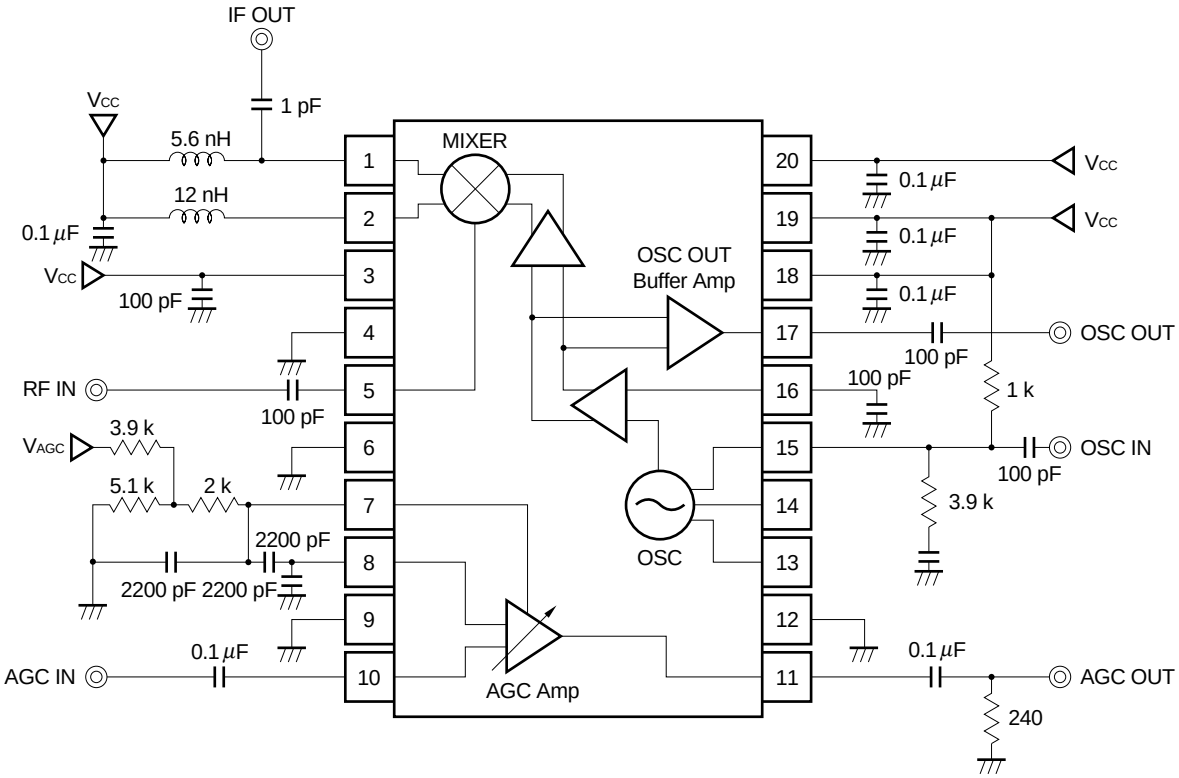
OUTPUT POWER VS. INPUT POWER



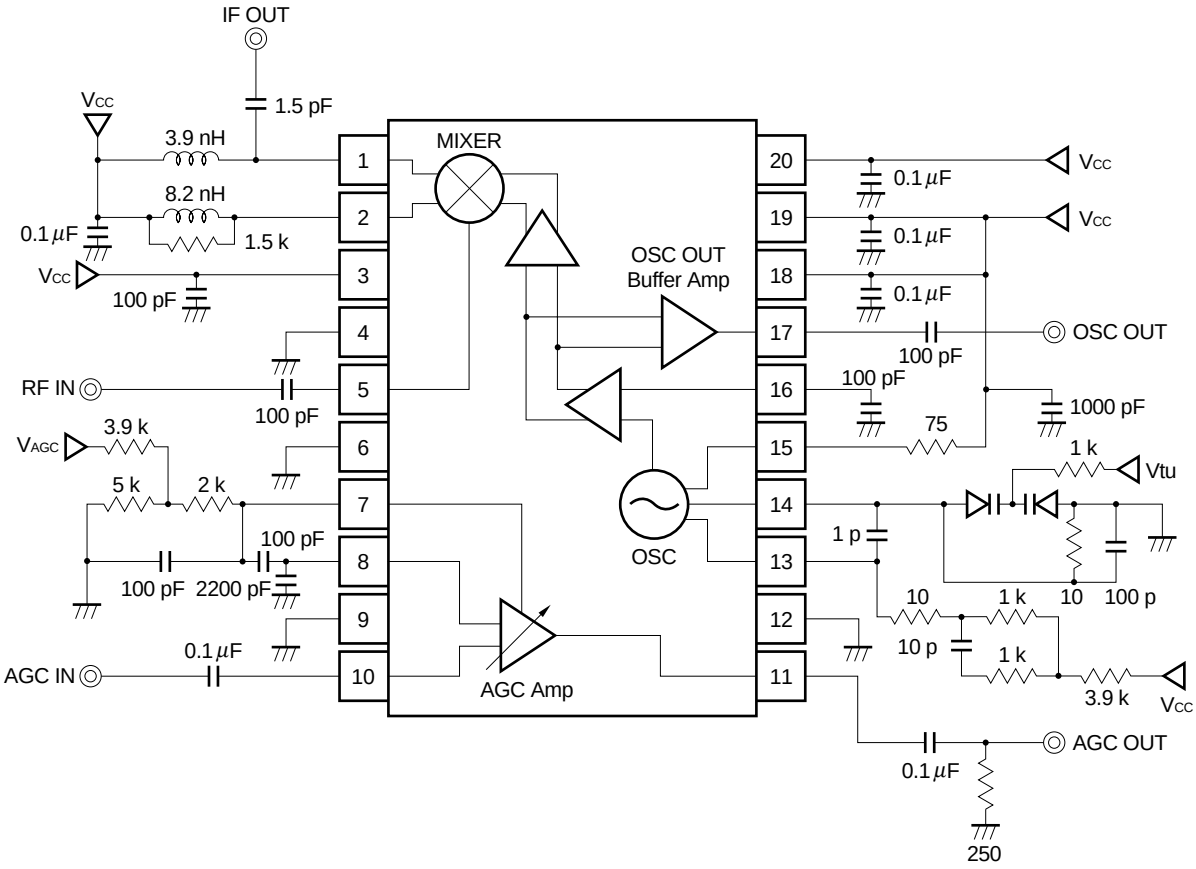
OUTPUT POWER VS. INPUT POWER



MEASUREMENT CIRCUIT



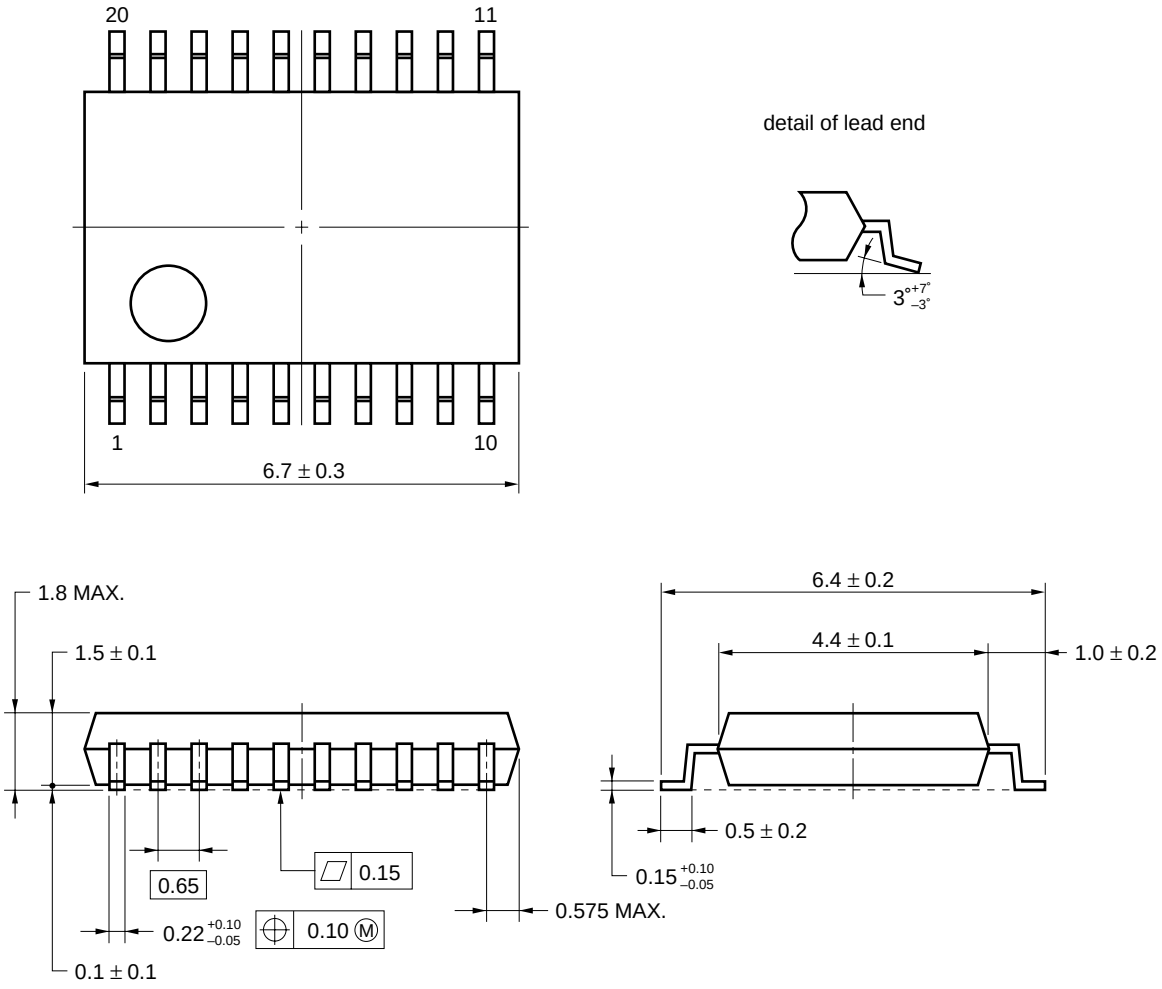
APPLICATION CIRCUIT EXAMPLE



The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

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

The following conditions (see table below) must be met when soldering this product.

Please consult with our sales officers in case other soldering process is used or in case soldering is done under different conditions.

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

μPC2799GR

Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak package's surface temperature: 235 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow process: 3, Exposure limit[Note]: None	IR35-00-3
VPS	Peak package's surface temperature: 215 °C or below, Reflow time: 40 seconds or below (200 °C or higher), Number of reflow process: 3, Exposure limit[Note]: None	VP15-00-3
Partial heating method	Terminal temperature: 300 °C or below, Flow time: 3 seconds or below, Exposure limit[Note]: None	

Note Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65% or less.

Caution Do not apply more than single process at once, except for "Partial heating method".

[MEMO]

[MEMO]

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  - 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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