NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC8116GR

500 MHz, AM/ASK RECEIVER IC

DESCRIPTION

μPC8116GR is a Silicon monolithic IC designed for AM/ASK receiver. This IC consists of mixer, oscillator, IF amplifier, Limitter amplifier, OP Amp., and builts in power save function and RSSI function.

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

FEATURES

- Broadband operation : f_{RF} = 100 to 500 MHz
- Low power dissipation : 12.3 mW at V_{CC} = 3 V, 23.5 mW at V_{CC} = 5 V
- On-chip power save function : $I_{P/S} \leq 1$ μA
- Packaged in 20 pin SSOP suitable for high-density surface mount.

ORDERING INFORMATION

PART NUMBER	PACKAGE	PACKAGE STYLE
μPC8116GR-E1	20 pins plastic SSOP (225mil)	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. (Order name: μPC8116GR)

Please refer to “Quality grade on NEC Semiconductor Devices” (Document number C11531E) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

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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The mark ★ shows major revised points.

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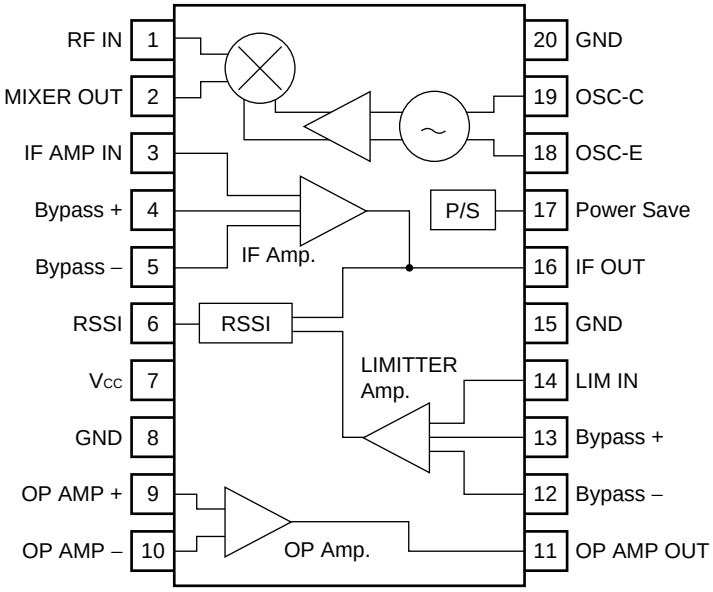
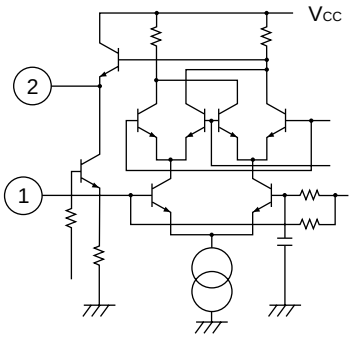
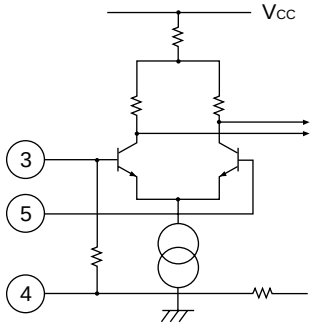
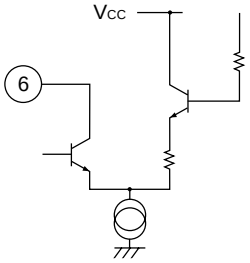
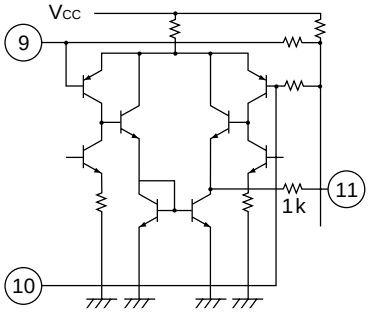
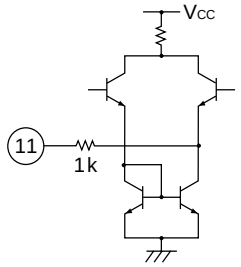
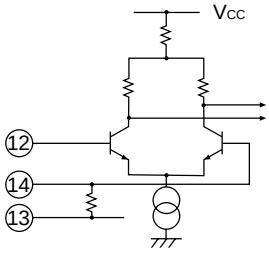
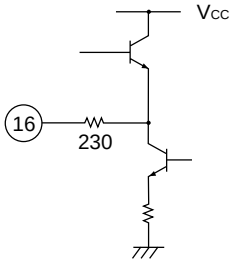
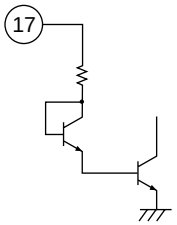
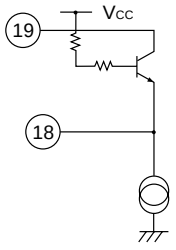
INETRNAL BLOCK DIAGRAM AND PIN CONFIGURATION (Top View)



PIN EXPLANATION

Pin No	SYMBOL	Pin Volt TYP. (V)	Function and Explanation	Equivalent circuit
1	MIX IN	1.95	RF signal input pin.	
2	MIX OUT	2.1	Output pin of Mixer. This pin is assigned for emitter follower output with Low-impedance	
3	IF IN	2.38	IF signal input pin.	
4	BYPASS + (IF)	2.38	Bypass pin for IF Amplifier. Capacitor for filter should be connected between 4 pin and 5 pin.	
5	BYPASS – (IF)	2.38		
6	RSSI OUT	0.9	RSSI signal output pin.	
7	Vcc	3.0	Power supply pin.	
8	GND	0.0	Ground pin for OP-Amp.	
9	0P Amp +	2.1	Input pin of OP-Amp. In case of single input, 9 pin or 10 pin should be grounded through capacitor.	
10	0P Amp –	2.1		

Pin No	SYMBOL	Pin Volt TYP. (V)	Function and Explanation	Equivalent circuit
11	OP Amp OUT	0.77	Output pin of OP-Amp. This pin is assigned for emitter follower output.	
12	BYPASS –	2.38	Bypass pin for OP-Amp. Capacitor for filter should be connected between 12 pin and 13 pin.	
13	BYPASS +	2.38		
14	LIM IN	2.38	Input pin of Limitter Amplifier.	
15	GND	0.0	Ground pin for Limitter Amp., RSSI, and regulator.	
16	IF OUT	1.55	IF signal output pin. Generally, Crystal filter is connected between 16 pin and 14 pin.	
17	Power Save	0 to 3	Power save control pin can be controlled ON/SLEEP state with bias as follows; VP/S (V) / STATE VCC / ON GND / SLEEP	
18	OSC-E	1.31	Oscillator signal input pins. Oscillator circuit should be connected between 18 pin and 19 pin.	
19	OSC-C	3.0		
20	GND	0.0	Ground pin for MIXER, IF Amplifier, and Oscillator.	

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	430	mW
Operation Temperature Range	T_A		–40 to +85	°C
Storage Temperature Range	T_{stg}		–55 to +150	°C

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

RECOMMENDED OPERATING RANGE

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V_{CC}	2.7	3.0	5.5	V
Operation Temperature Range	T_A	–40	+25	+85	°C

ELECTRICAL CHARACTERISTICS (T_A = 25 °C, V_{CC} = Vp/s = 3 V)

PARAMETER	Symbol	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Total Block						
Circuit Current	I_{CC}	2.6	4.1	5.7	mA	no input signal
RSSI Sensitivity	RSSIsen	–	–95	–90	dBm	f_{RF} = 315 MHz, f_{OSC} = 304.3 MHz, P_{OSC} = –10 dBm, Δ V_{RSSI} ≥ 3 mV/dB *2
Powersave Current	Ip/s	–	–	1.0	μA	17 pin = GND *2
Mixer Block						
RF Input Frequency Range	BW_{RF}	100	–	500	MHz	f_{IF} = 10.7 MHz, f_{RF} > f_{OSC}, –3 dB down *3
LO Input Frequency Range	BW_{LO}	100	–	500	MHz	f_{IF} = 10.7 MHz, f_{RF} > f_{OSC}, –3 dB down *3
Mixer Gain	G_{MIX}	8	11	14	dB	f_{RF} = 315 MHz, P_{RF} = –50 dBm, f_{OSC} = 304.3MHz, P_{osc} = –10 dBm, Input:LC matching *2
IF Amp Block						
IF Output Frequency Range	BW_{IF}	0.3	–	15	MHz	Pin = –80 dBm, –3dB down *3
OP Amp Block						
OP Amp Input Frequency Range	BW_{OP}	1	–	–	MHz	Pin = –50 dBm, –3dB down *3
OP Amp Gain	G_{OP}	50	57	–	dB	fin = 200 kHz, Pin = –50 dBm *3

STANDARD CHARACTERISTICS (T_A = 25 °C, V_{CC} = Vp/s = 3 V;[*2])

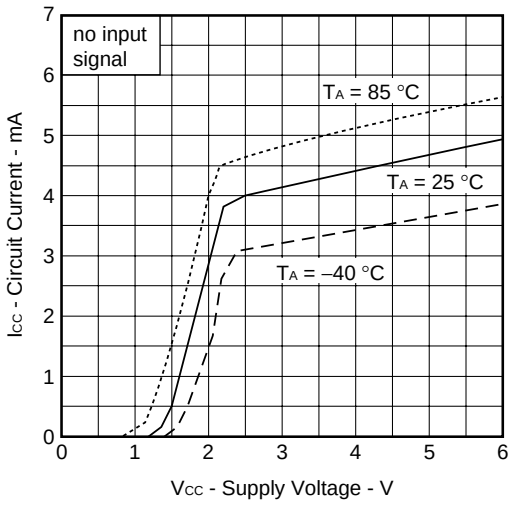
PARAMETER	Symbol	Value for reference	UNIT	TEST CONDITION
IF Amplifier Gain	G_{IF}	55	dB	fin = 10.7 MHz, Pin = –100 dBm, Input:LC Matching ***2**
RSSI Linearity	$\Delta RSSI/\Delta P_{RF}$	±3	dB	f_{RF} = 315 MHz, f_{OSC} = 304.3 MHz, P_{OSC} = –10 dBm, P_{RF} = –30 to –90 dBm ***2**
LO to RF Isolation	LO-RFiso	–50	dBm	f_{OSC} = 304.3 MHz/–10 dBm ***2**
RF to LO Isolation	RF-LOiso	–50	dBm	f_{RF} = 315 MHz/–30 dBm ***2**

***2** By Measurement Circuit 1

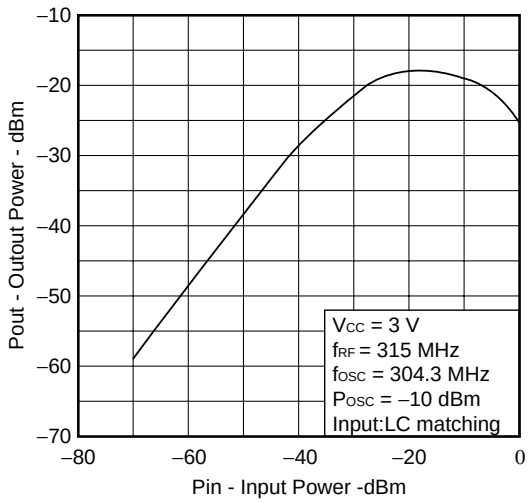
***3** By Measurement Circuit 2

TYPICAL CHARACTERISTICS (T_A = 25 °C)

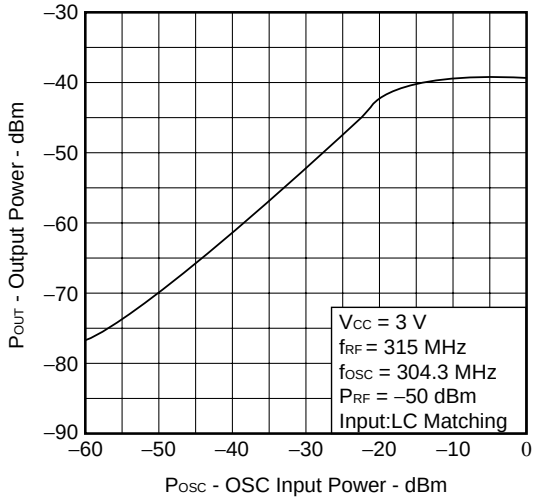
V_{CC} vs. I_{CC}



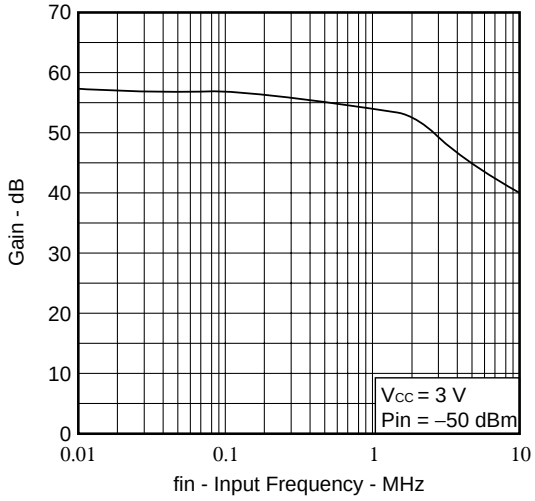
Pin vs. Pout



P_{OSC} vs. P_{OUT}

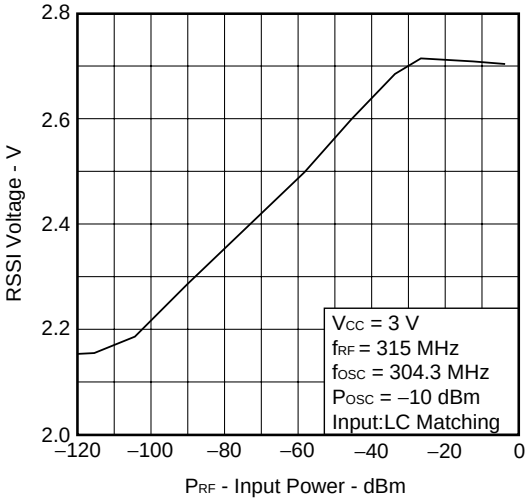


f_{in} vs. Gain (OP Amp)

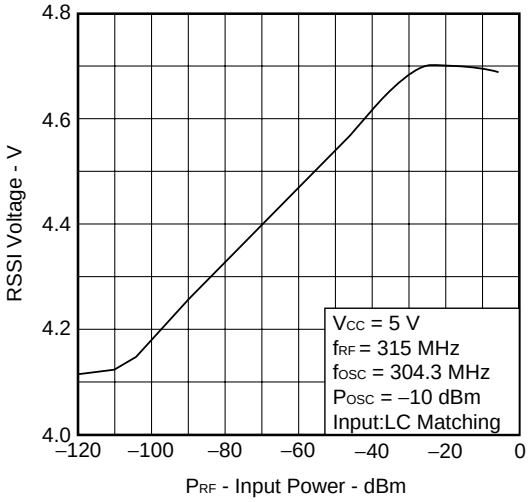


STANDARD CHARACTERISTICS (T_A = 25 °C)

P_{RF} vs. RSSI Voltage

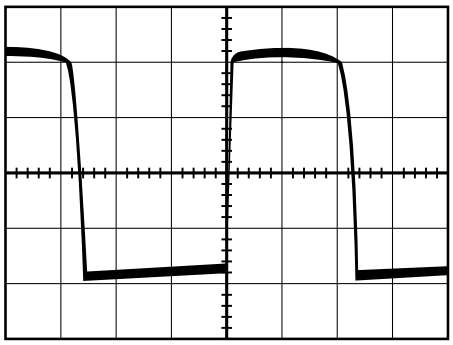


P_{RF} vs. RSSI Voltage



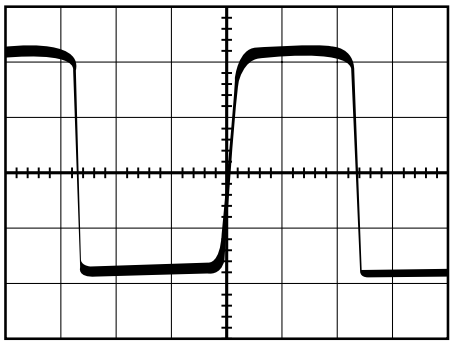
OP Amplifier Output

Pin = –60 dBm



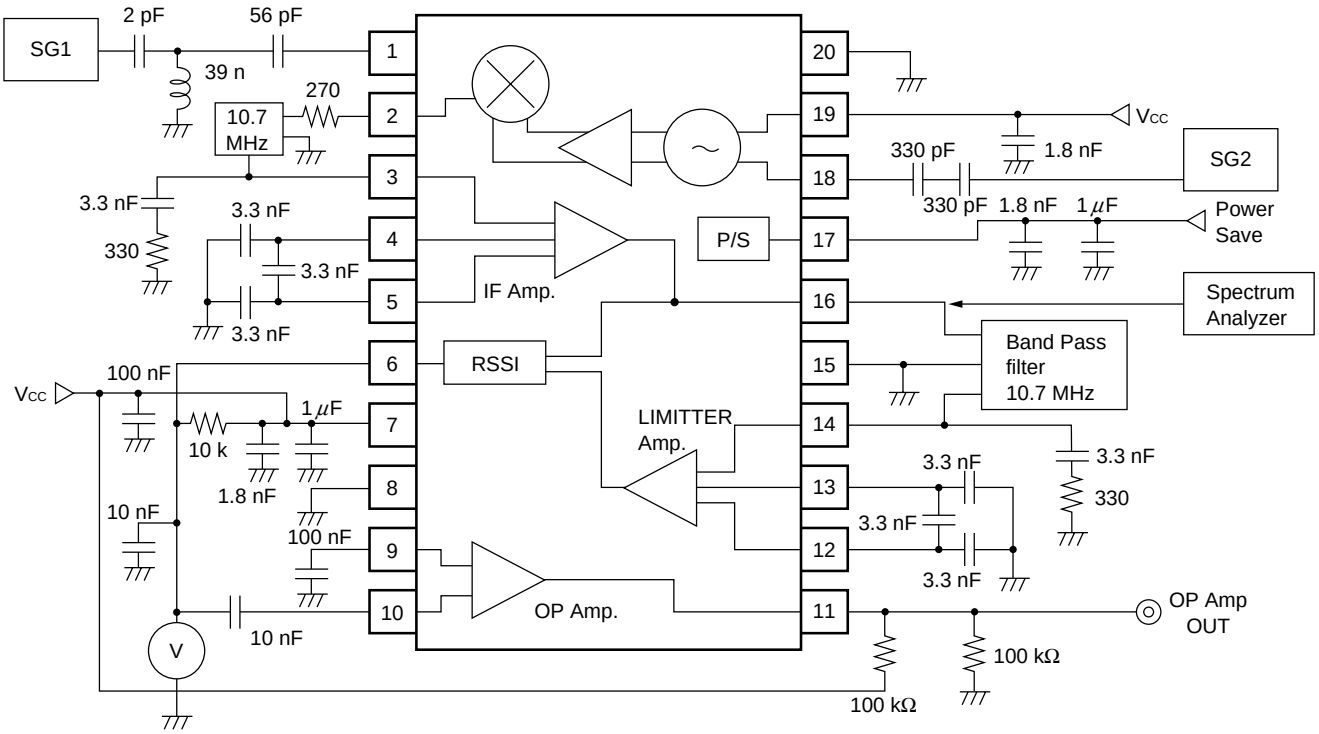
Test Conditions
f_{RF} = 315 MHz
f_{OSC} = 304.3 MHz
AM : 1 kHz, 90 %
V_{CC} = 3 V

Pin = –90 dBm



500 mV/DIV
200 μsec/DIV

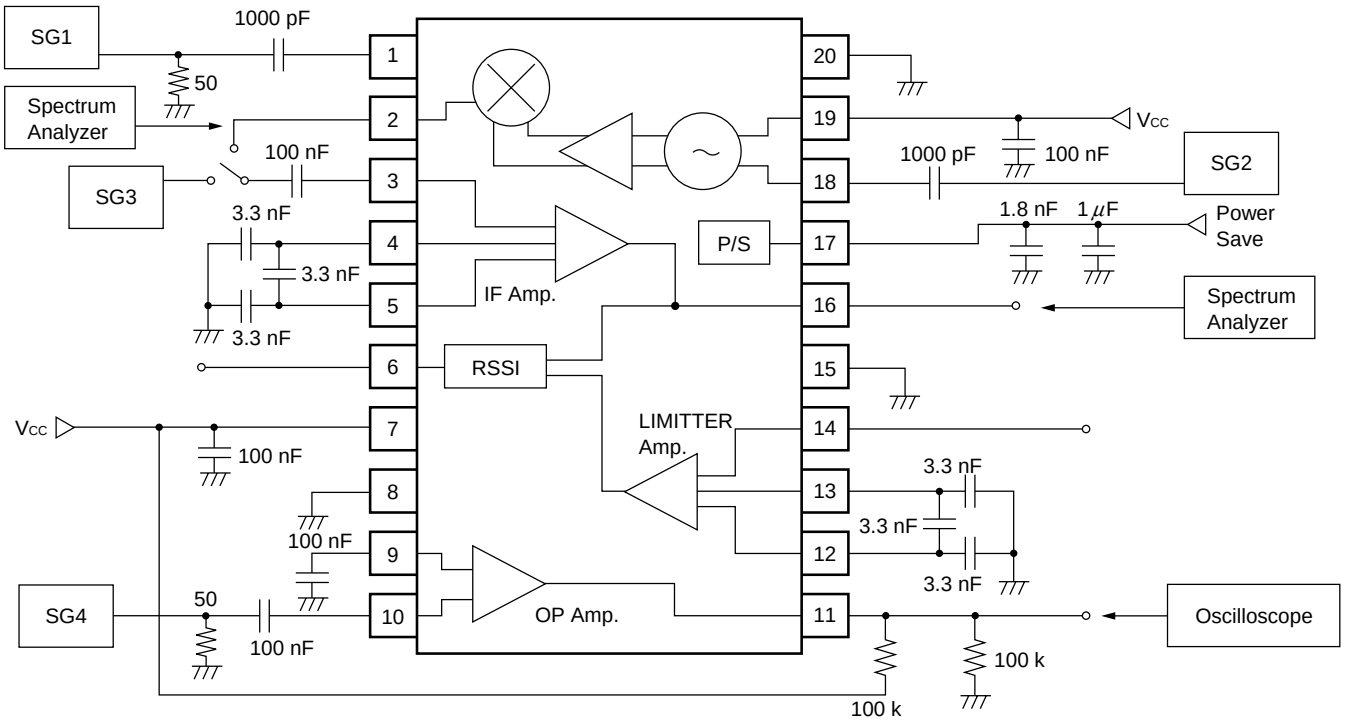
MEASUREMENT CIRCUIT1



*****: • Measured by High-impedance Probe (1 MHz, 1.5pF)

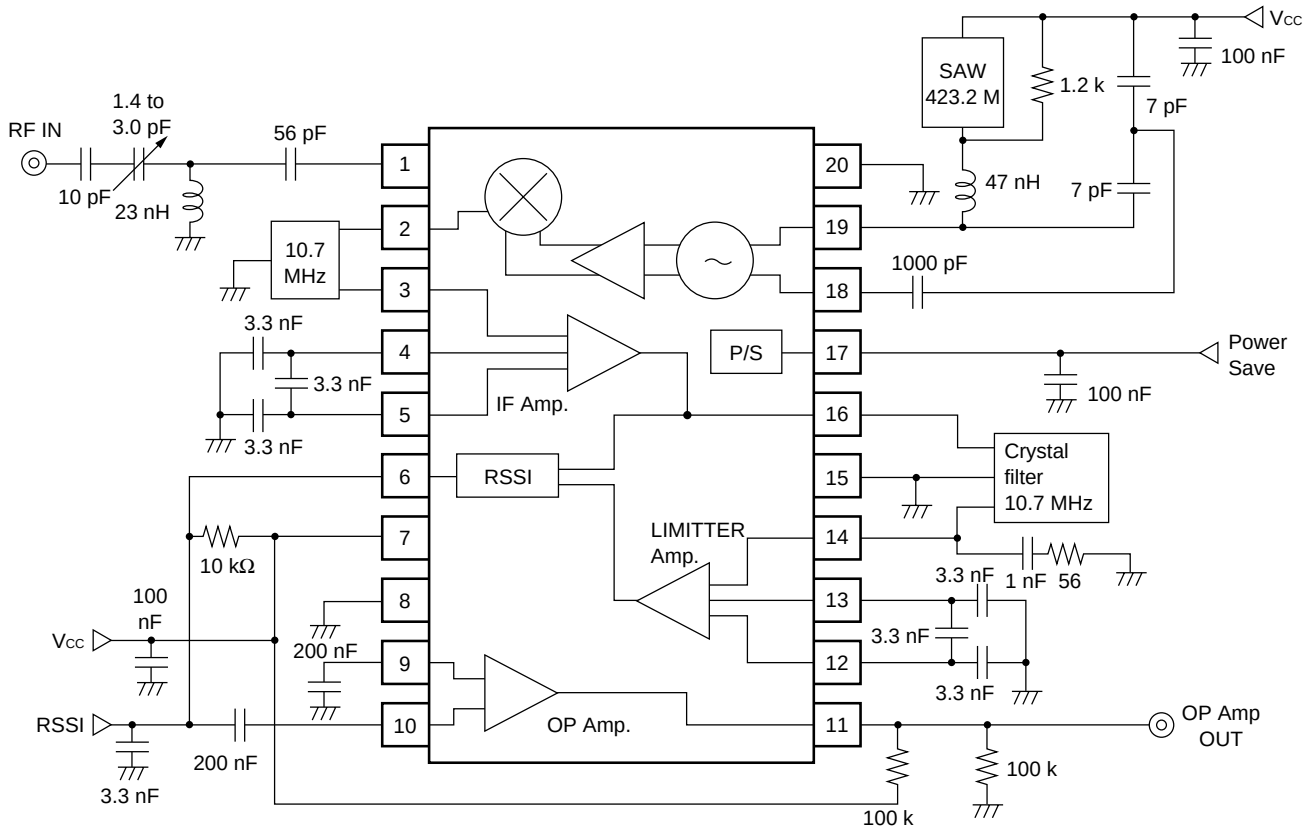
• 17 pin: GND, 11 pin: OPEN in case of measurement of powersave current

MEASUREMENT CIRCUIT2



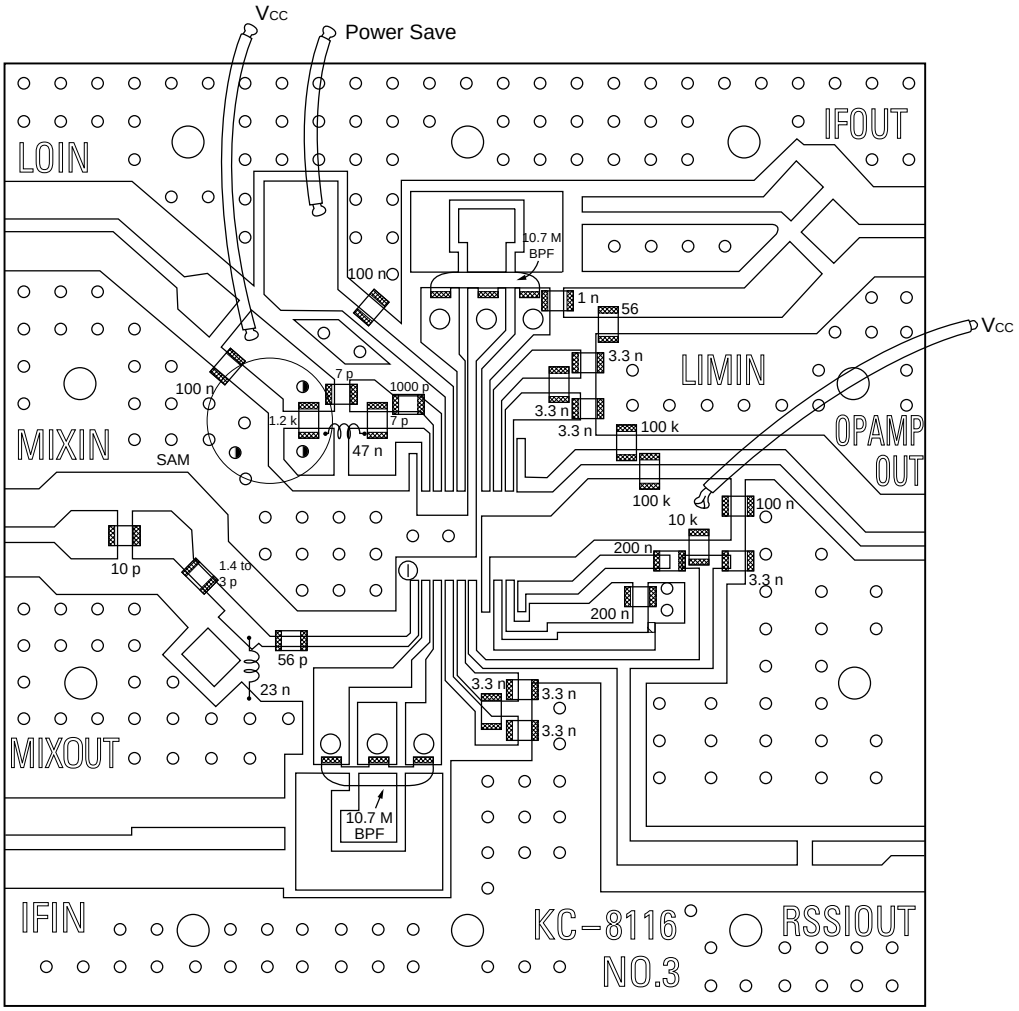
*****: •Measured by High-impedance Probe (1 MHz, 1.5pF)

APPLICATION CIRCUIT EXAMPLE (@f_{RF} = 433.6 MHz)



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

ILLUSTRATION OF THE APPLICATION CIRCUIT ASSEMBLED ON EVALUATION BOARD

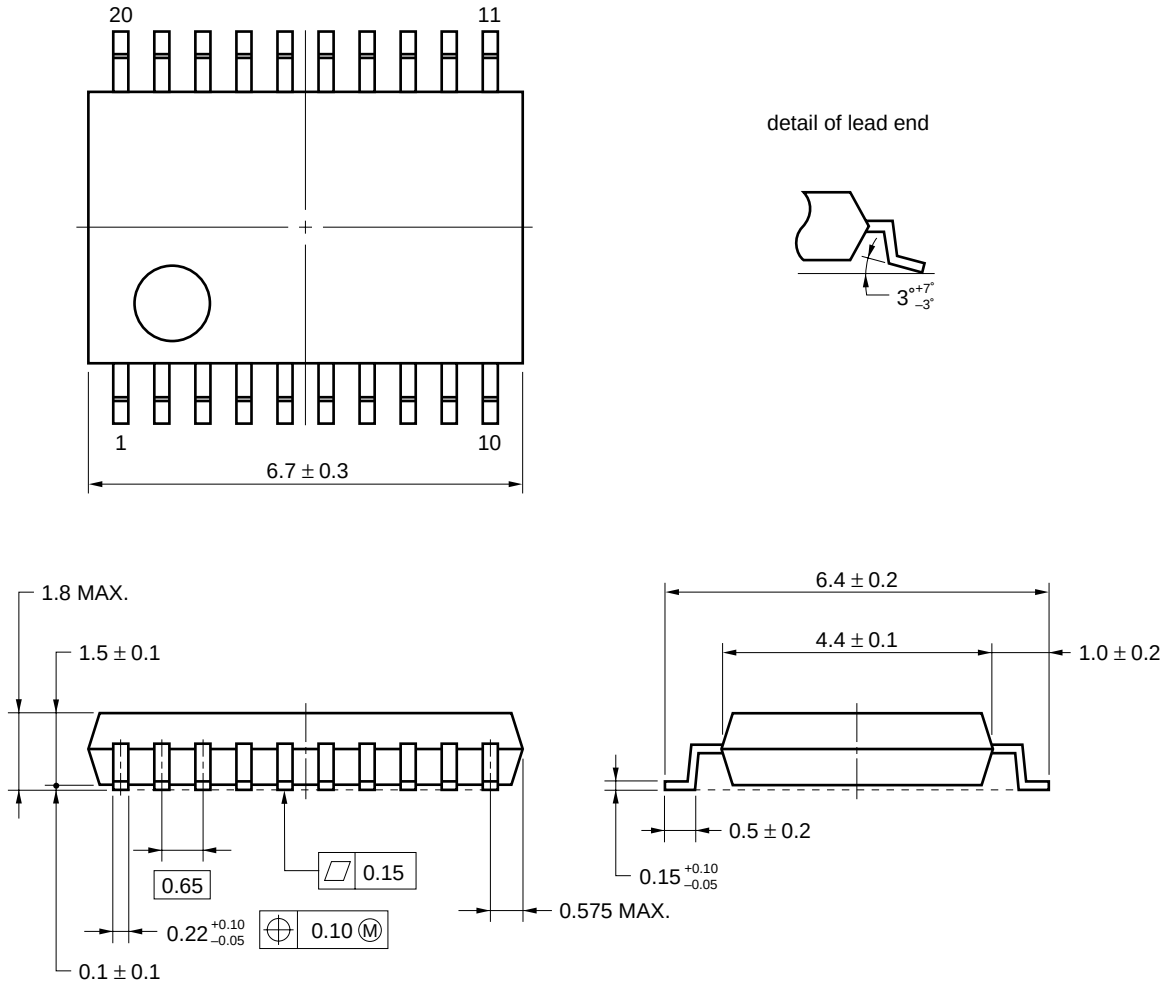


Notes

- ***1)*** ○◯ shows through holes
- ***2)*** ▨ pattern should be removed on this application
- ***3)*** ▧ shows short circuited strip for ground

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).

μPC8116GR

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
Wave soldering	Solder temperature: 260 °C or below, Reflow time: 10 seconds or below, Number of reflow process: 1, Exposure limit [Note]: None	WS60-00-1
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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