DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC8116GR

500 MHz, AM/ASK RECEIVER IC

DESCRIPTION

The 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 20-pin plastic SSOP package is suitable for high-density surface mounting.

This IC is manufactured using NEC's 20 GHz f_T NESAT™III silicon bipolar process. This process uses direct silicon nitride passivation film and gold electrodes. These materials can protect the chip surface from pollution and prevent corrosion/migration. Thus, this IC realizes excellent performance, uniformity and reliability.

FEATURES

- Supply voltage : V_{CC} = 2.7 to 5.5 V
- Low current consumption : I_{CC} = 4.1 mA TYP.@V_{CC} = V_{PS} = 3.0 V
- Wideband response : f_{RF} = 100 to 500 MHz
- Power save function : I_{CCPS} = 1 μA MAX. @V_{CC} = 3.0 V, PS = 0 V
- High-density surface mounting : 20-pin plastic SSOP (6.7 × 4.4 × 1.5 mm)

ORDERING INFORMATION

Part Number	Package	Supplying Form
μPC8116GR-E1	20-pin plastic SSOP (5.72 mm (225))	Embossed tape 12 mm wide. Pin 1 is in tape pull-out direction. QTY 2.5 kpcs/reel.

Remark To order evaluation samples, please contact your local NEC sales office. (Part number for sample order: μPC8116GR)

Caution Electro-static sensitive devices

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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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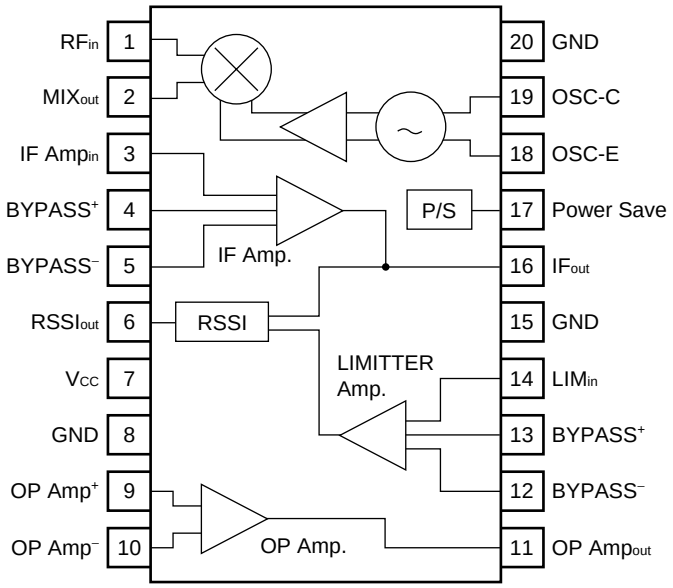
Printed in Japan

The mark ★ shows major revised points.

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM

(Top View)



ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C	6.0	V
Power Dissipation	P_D	Mounted on double-sided copper clad 50 × 50 × 1.6 mm epoxy glass PWB at T_A = +85°C	430	mW
Operating Ambient Temperature	T_A		–40 to +85	°C
Storage Temperature	T_{stg}		–55 to +150	°C

RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}	2.7	3.0	5.5	V
Operating Ambient Temperature	T_A	–40	+25	+85	°C

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25°C, V_{CC} = $V_{P/S}$ = 3 V)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Total Block						
Circuit Current	I_{CC}	no signals **Note 1**	2.6	4.1	5.7	mA
RSSI Sensitivity	$RSSI_{sen}$	f_{RF} = 315 MHz, f_{OSC} = 304.3 MHz, P_{OSC} = –10 dBm, Δ V_{RSSI} ≥ 3 mV/dB **Note 1**	–	–95	–90	dBm
Powersave Current	I_{PS}	17 pin = GND **Note 1**	–	–	1.0	μA
Mixer Block						
RF Input Band Width	BW_{RF}	f_{IF} = 10.7 MHz, f_{RF} > f_{OSC}, –3 dB down **Note 2**	100	–	500	MHz
LO Input Band Width	BW_{LO}	f_{IF} = 10.7 MHz, f_{RF} > f_{OSC}, –3 dB down **Note 2**	100	–	500	MHz
Mixer Gain	G_{MIX}	f_{RF} = 315 MHz, P_{RF} = –50 dBm, f_{OSC} = 304.3MHz, P_{osc} = –10 dBm, Input:LC matching **Note 1**	8	11	14	dB
IF Amp. Block						
IF Output Band Width	BW_{IF}	P_{in} = –80 dBm, –3dB down **Note 2**	0.3	–	15	MHz
OP Amp. Block						
OP Amp. Band Width	BW_{OP}	P_{in} = –50 dBm, –3dB down **Note 2**	1	–	–	MHz
OP Amp. Gain	G_{OP}	f_{in} = 200 kHz, P_{in} = –50 dBm **Note 2**	50	57	–	dB

Notes 1. By test circuit 1

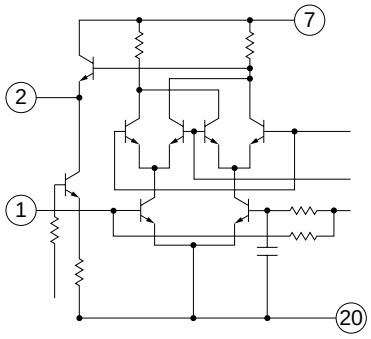
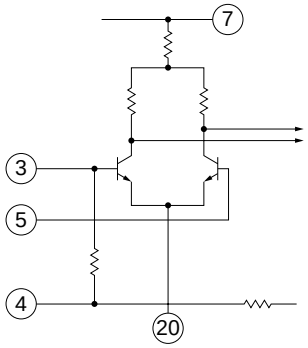
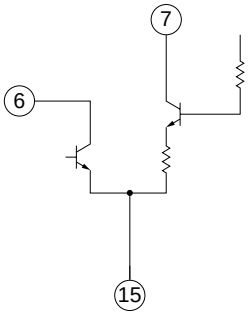
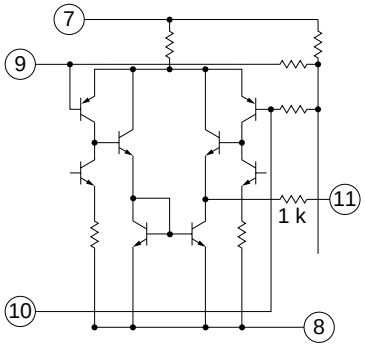
2. By test circuit 2

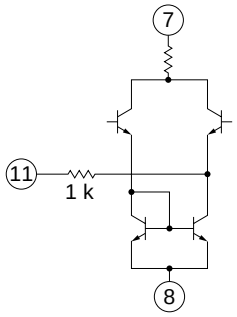
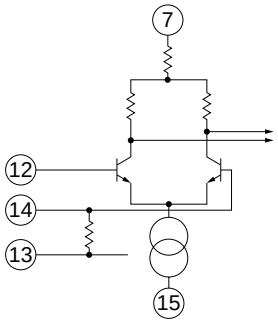
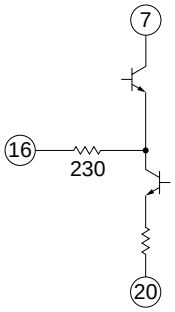
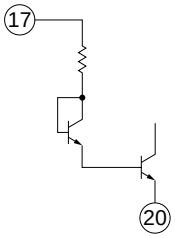
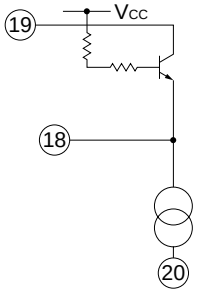
STANDARD CHARACTERISTICS (Unless otherwise specified, T_A = +25°C, V_{CC} = $V_{P/S}$ = 3.0 V)

Parameter	Symbol	Test conditions	Value for reference	Unit
IF Amplifier Gain	G_{IF}	f_{in} = 10.7 MHz, P_{in} = –100 dBm, Input:LC Matching **Note**	55	dB
RSSI Linearity	ΔRSSI/ ΔP_{RF}	f_{RF} = 315 MHz, f_{OSC} = 304.3 MHz, P_{OSC} = –10 dBm, P_{RF} = –30 to –90 dBm **Note**	±3	dB
LO to RF Isolation	LO-RF_{ISL}	f_{OSC} = 304.3 MHz/–10 dBm **Note**	–50	dBm
RF to LO Isolation	RF-LO_{ISL}	f_{RF} = 315 MHz/–30 dBm **Note**	–50	dBm

Note By test circuit 1

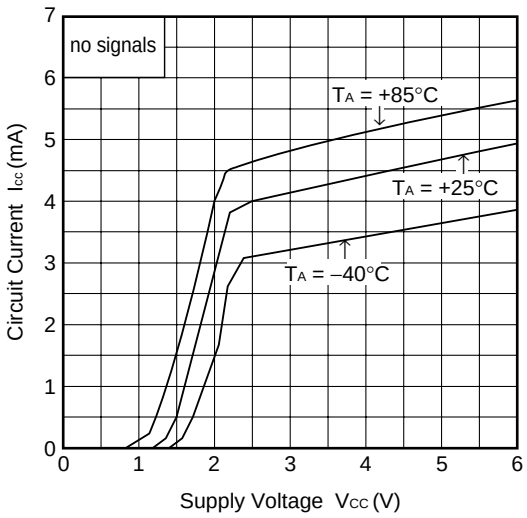
PIN EXPLANATION

Pin No.	Pin Name	Pin Voltage (V)	Function and Application	Internal Equivalent Circuit
1	RF_{in}	1.95	Input pin of RF Mixer.	
2	MIX_{out}	2.1	Output pin of Mixer. This pin is assigned for emitter follower output with Low-impedance.	
3	IF Amp_{in}	2.38	Input pin of IF Amplifier.	
4	$BYPASS^{+}$	2.38	Bypass pin for IF Amplifier. Capacitor for filter should be connected between 4 pin and 5 pin.	
5	$BYPASS^{-}$	2.38		
6	$RSSI_{out}$	0.9	RSSI signal output pin.	
7	V_{CC}	–	Supply voltage pin.	
8	GND	–	Ground pin of OP Amp Block.	
9	OP Amp^{+}	2.1	Input pin of OP Amp. In case of single input, 9 pin or 10 pin should be grounded through capacitor.	
10	OP Amp^{-}	2.1		

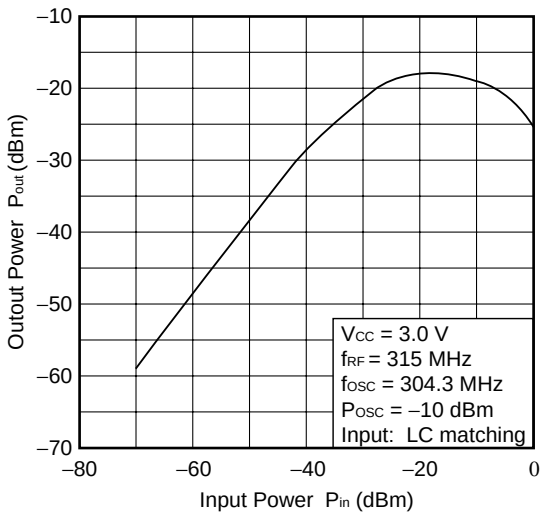
Pin No.	Pin Name	Pin Voltage (V)	Function and Application	Internal Equivalent Circuit
11	OP Amp_{out}	0.77	Output pin of OP Amp.	
12	$BYPASS^{-}$	2.38	Bypass pin for OP Amp. Capacitor for filter should be connected between 12 pin and 13 pin.	
13	$BYPASS^{+}$	2.38		
14	LIM_{in}	2.38	Input pin of Limitter Amplifier.	
15	GND	–	Ground pin of 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 3.0	Power save control pin can be controlled ON/SLEEP state with bias as follows; $V_{P/S}$ (V) / STATE V_{CC} / 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	–	Ground pin of Mixer, IF Amplifier, and Oscillator.	

TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25°C, V_{CC} = 3.0 V)

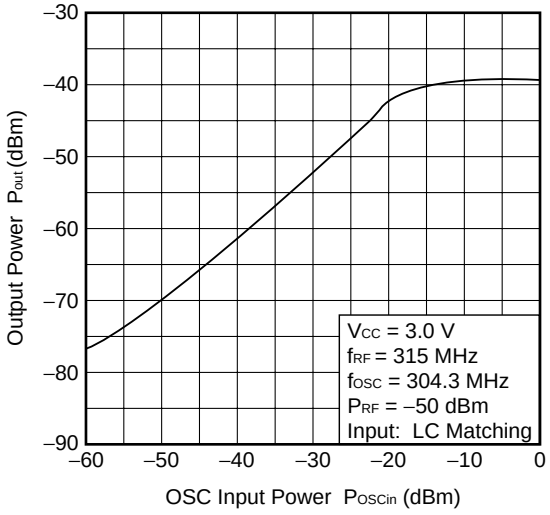
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



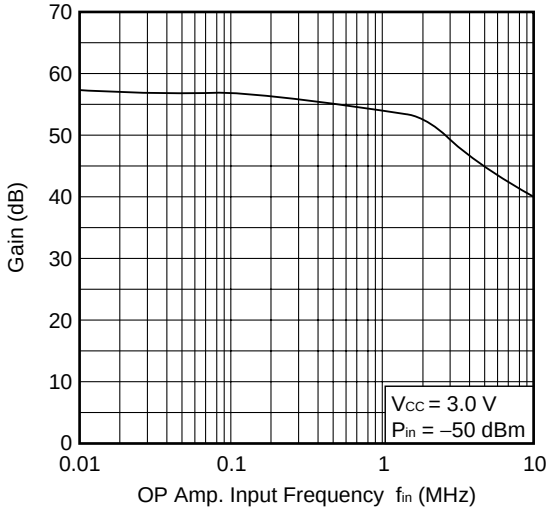
OUPTUT POWER vs. INPUT POWER



OUTPUT POWER vs. OSC INPUT POWER



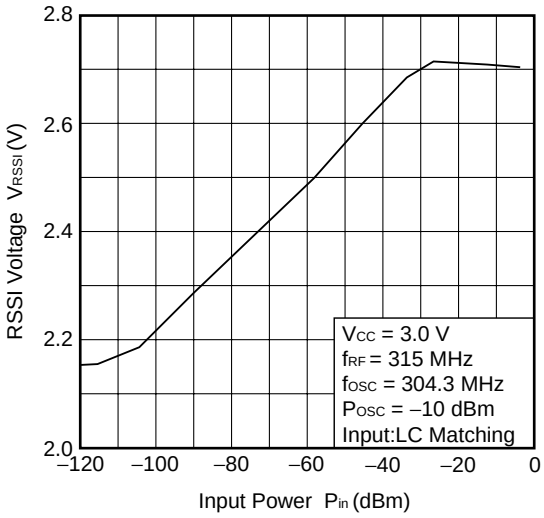
GAIN vs. OP AMP. INPUT FREQUNECY



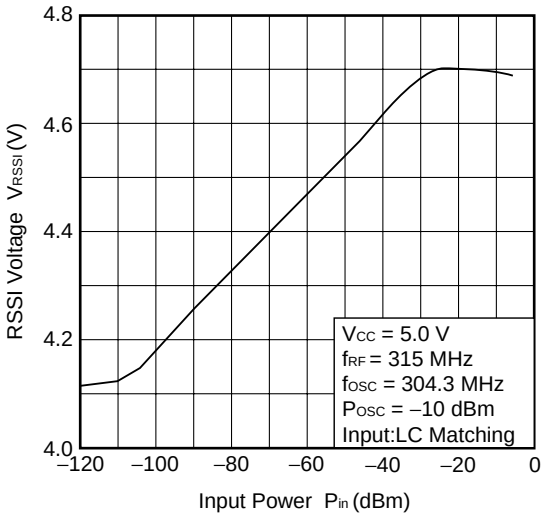
Remark The graphs indicate nominal characteristics.

STANDARD CHARACTERISTICS (Unless otherwise specified, T_A = +25°C)

RSSI VOLTAGE vs. INPUT POWER

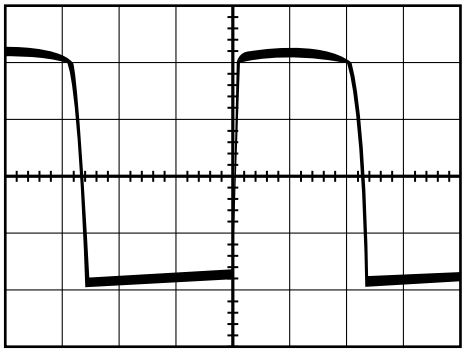


RSSI VOLTAGE vs. INPUT POWER



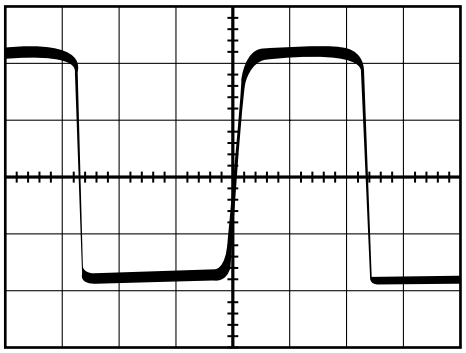
OP Amplifier Output

P_{in} = –60 dBm



Test Conditions: f_{RF} = 315 MHz
f_{OSC} = 304.3 MHz
AM : 1 kHz, 90%
V_{CC} = 3.0 V

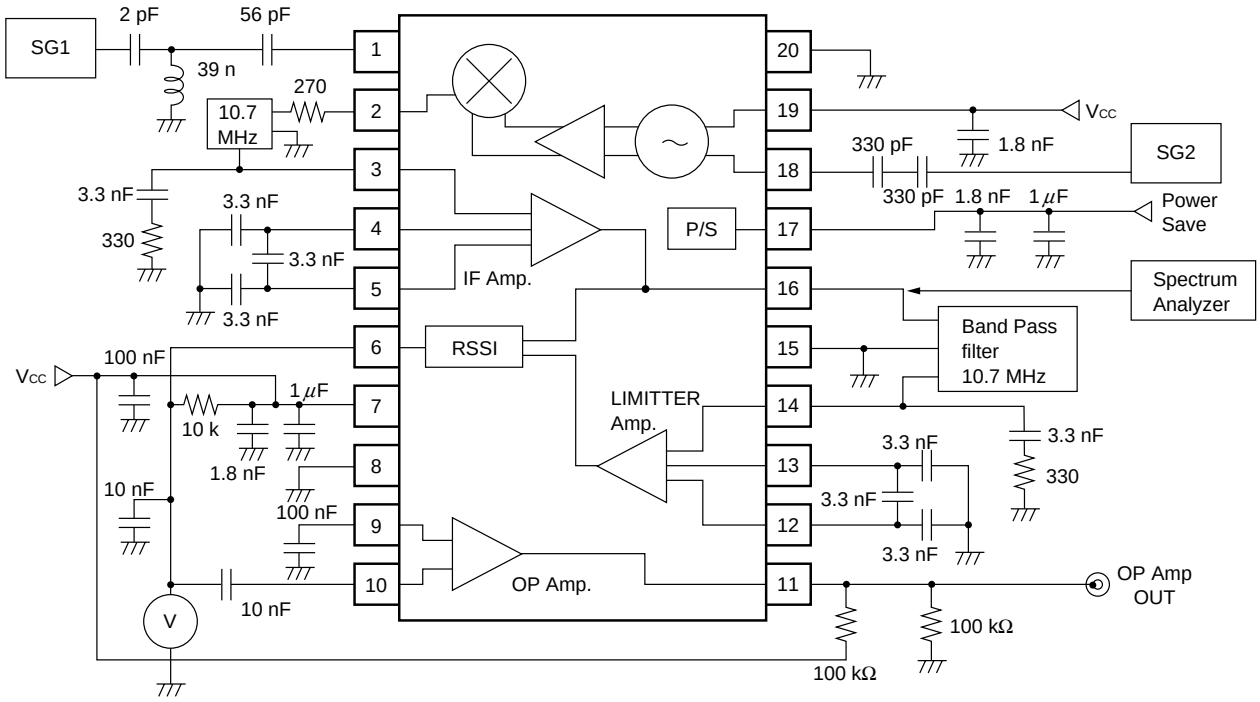
P_{in} = –90 dBm



500 mV/DIV
200 μsec/DIV

Remark The graphs indicate nominal characteristics.

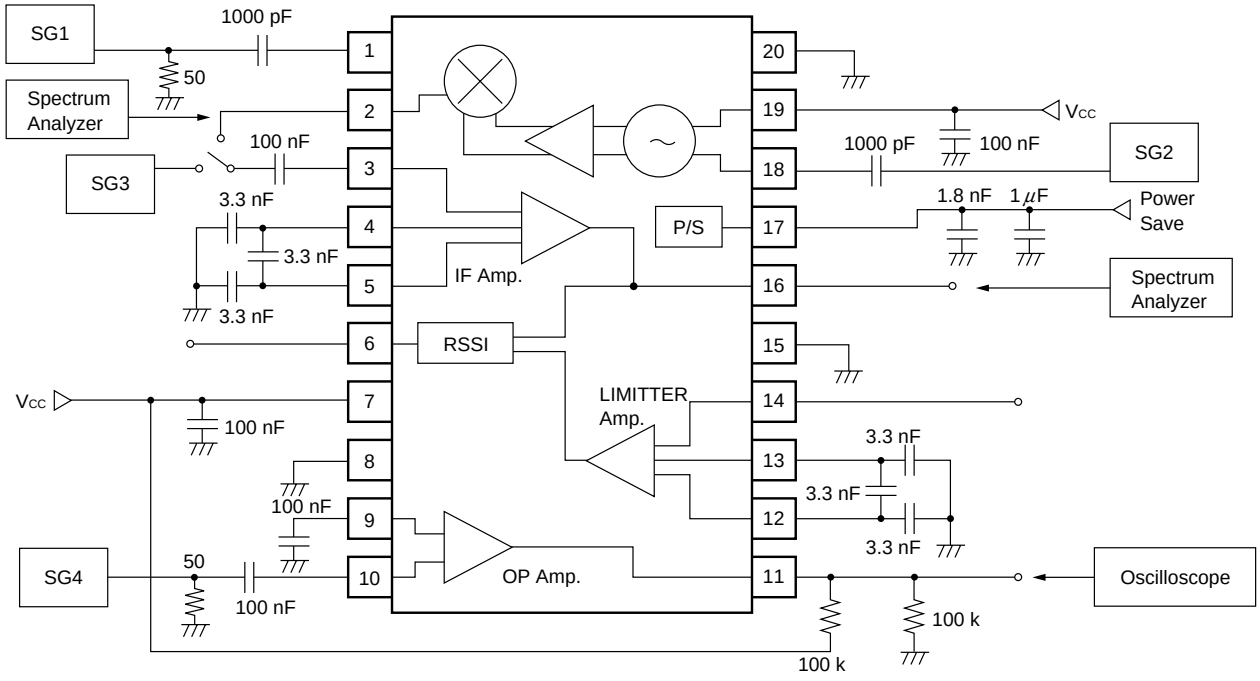
TEST CIRCUIT1



Remarks 1. Measured by High-impedance Probe (1 MHz, 1.5pF)

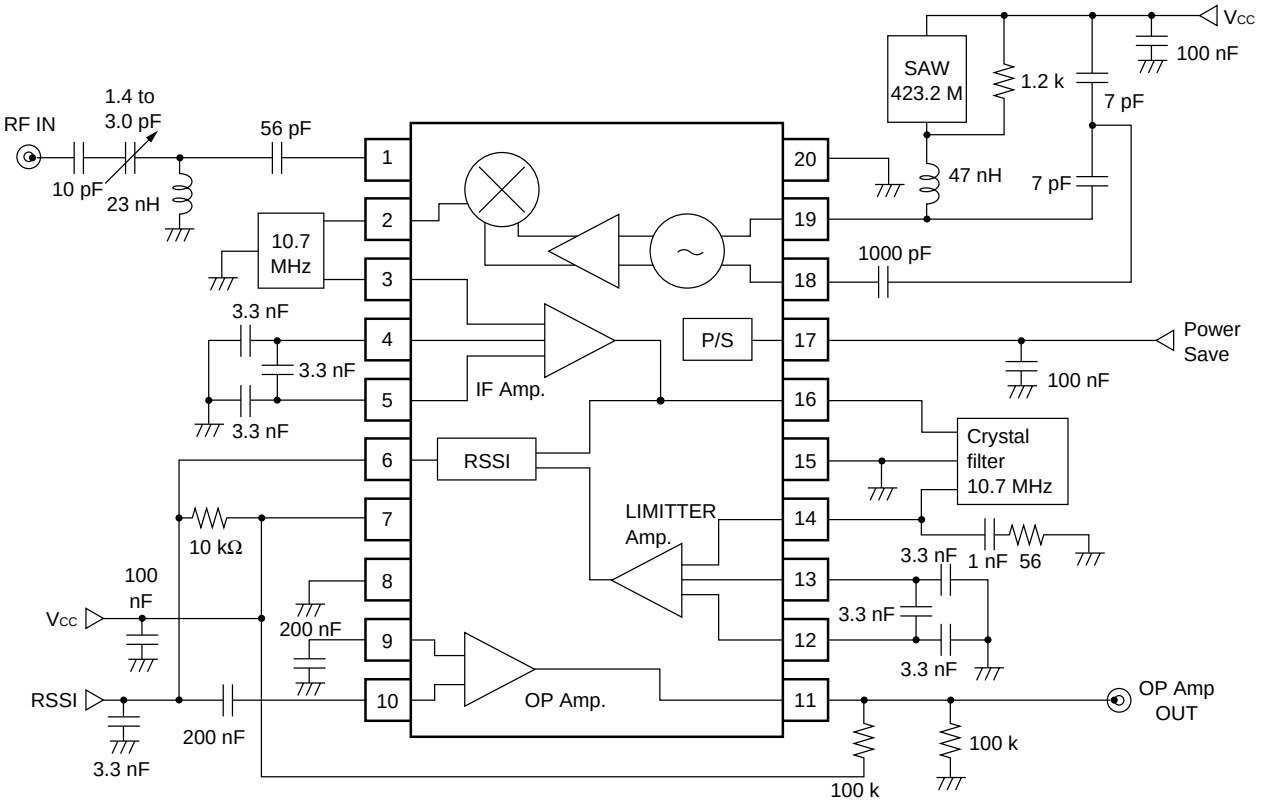
2. 17 pin: GND, 11 pin: OPEN in case of measurement of powersave current

TEST CIRCUIT2



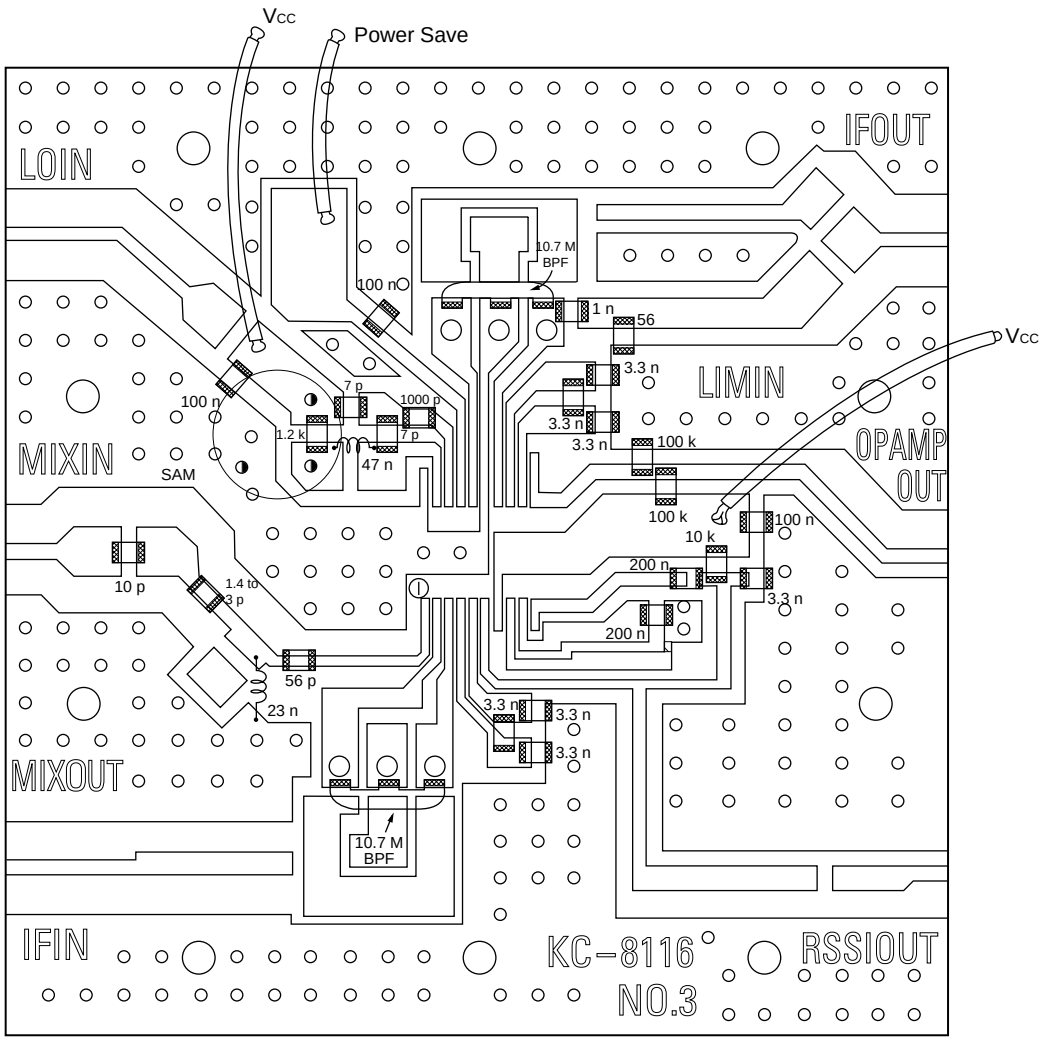
Remark Measured by High-impedance Probe (1 MHz, 1.5pF)

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-ins.

ILLUSTRATION OF THE APPLICATION CIRCUIT ASSEMBLED ON EVALUATION BOARD

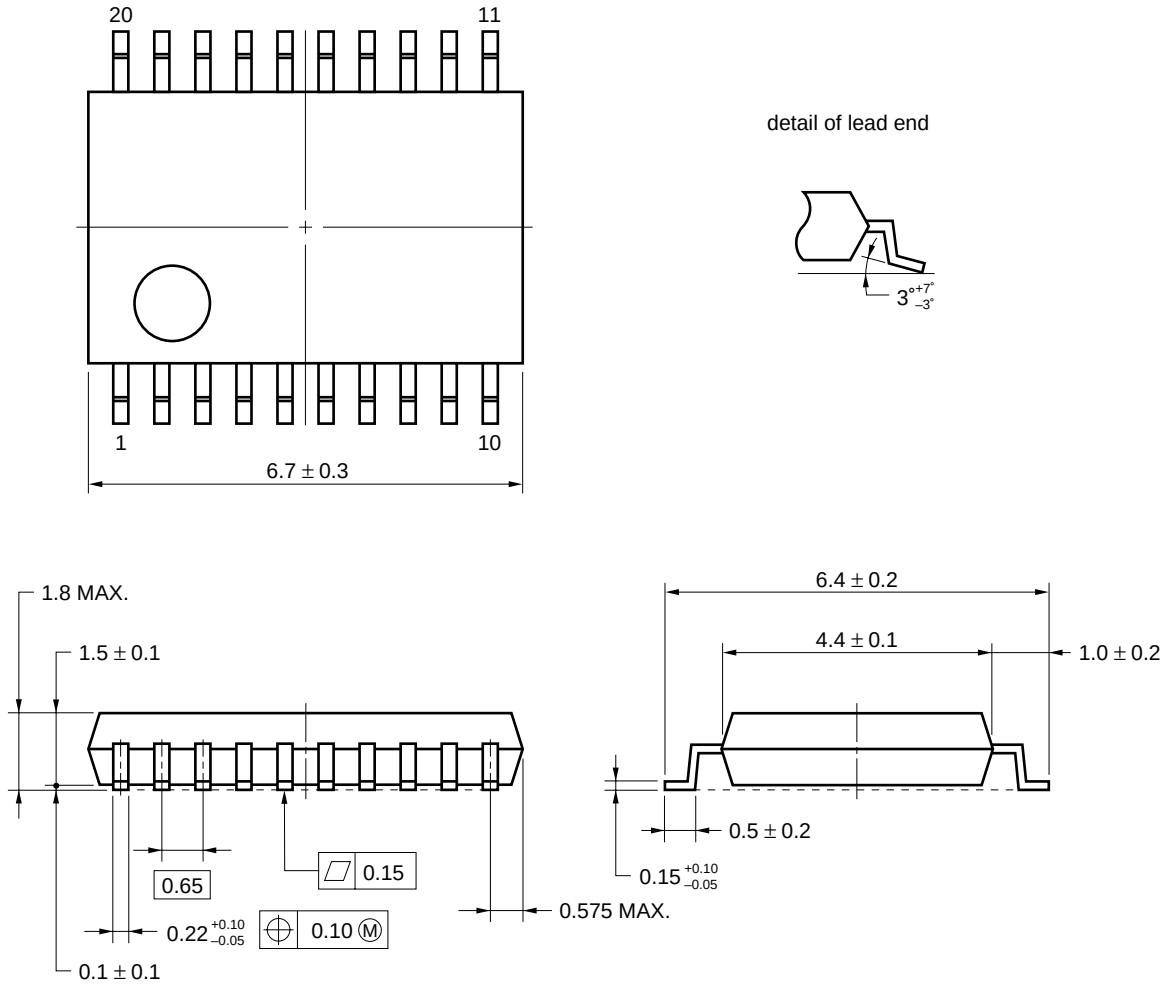


Notes

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

PACKAGE DIMENSIONS

20 PIN PLASTIC SSOP (5.72 mm (225)) (UNIT: mm)



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 abnormal oscillation).
(3) Keep the track length of the ground pins as short as possible.
(4) Connect a bypass capacitor (example: 1 000 pF) to the V_{CC} pin.
(5) Frequency signal input/output pins must be each coupled with capacitor for DC cut.

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: None[Note]	IR35-00-3
VPS	Package peak temperature: 215°C or below Time: 40 seconds or less (at 200°C) Count: 3, Exposure limit: None[Note]	VP15-00-3
Wave Soldering	Soldering bath temperature: 260°C or below Time: 10 seconds or less Count: 1, Exposure limit: None[Note]	WS60-00-1
Partial Heating	Pin temperature: 300°C Time: 3 seconds or less (per side of device) Exposure limit: None[Note]	–

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

[MEMO]

[MEMO]

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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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