

To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

Send any inquiries to <http://www.renesas.com/inquiry>.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.
 - “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.
 - “High Quality”: 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; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

Single Chip Transceiver Silicon MMIC for PHS

DESCRIPTION

The μPC8139GR-7JH is a silicon microwave monolithic IC (SiMMIC) developed as a transceiver for Personal Handyphone System (PHS).

This IC is a highly integrated single chip, suitable for PHS, including a quadrature modulator, up converter, and AGC circuit for adjusting the output level in the transmitter block, a 2nd down converter and RSSI circuit in the receiver block, and a transistor for 2nd VCO.

This low power IC employs NEC's proprietary bipolar process NESAT™ IV ($f_T = 20$ GHz) and also has a built-in power save function, which contributes to lowering power consumption of the RF block.

This IC is packaged in a small, thin 30 pin plastic TSSOP (225 mil).

FEATURES

- Low voltage operation, low current consumption
 $V_{CC} = 2.7$ to 4.0 V, $I_{CC} = 32.5$ mA at transmitter, $I_{CC} = 4.8$ mA at receiver, 3.2 mA/ $V_{CC} = 3$ V at 2nd VCO block
- LPF is installed to suppress leakage of transmitter's local (L01) harmonics.
 Spurious within transmission band ($LO1 \times 7, 8$): -55 dBc (MAX.)
- On-chip AGC circuit for adjusting the output level: $GCR = 20$ dB (MIN.) / @ $f_{RFout} = 1906.55$ MHz
- High-performance
 Output level: $PR_{Fout} = -13$ dBm (TYP.) / @ $f_{RFout} = 1906.55$ MHz, $V_{I/Q} = 500$ mV_{P-P} (Differential phase)
 Error vector magnitude: $EVM = 1.0\%$ rms (TYP.)
 Adjacent channel leak power: $P_{adj} = -68$ dBc (TYP.) / @ $\Delta f = \pm 600$ kHz
 RSSI output dynamic range: 83 dB
- CR phase shifter is adopted.

APPLICATION

- Digital cordless telephone: PHS
- PHS application equipment: PDA, PC card, etc.

ORDERING INFORMATION

Part Number	Package	Supplying Form
μPC8139GR-7JH-E1	30-pin plastic TSSOP (225 mil)	Embossed tape 16 mm-wide. Pin 1 is in pull-out direction. 2.5 kp/reel

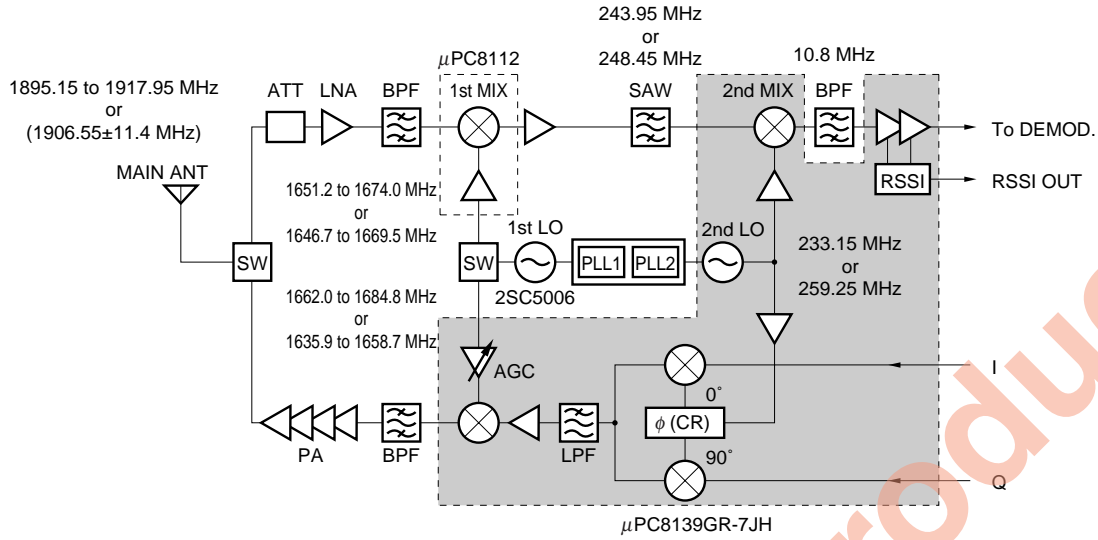
Remark To order evaluation samples, contact your local NEC sales office. (Part Number for sample order: μPC8139GR-7JH)

Caution This product is an electrostatic sensitive device.

The information in this document is subject to change without notice.

SYSTEM APPLICATION EXAMPLE

[PHS]

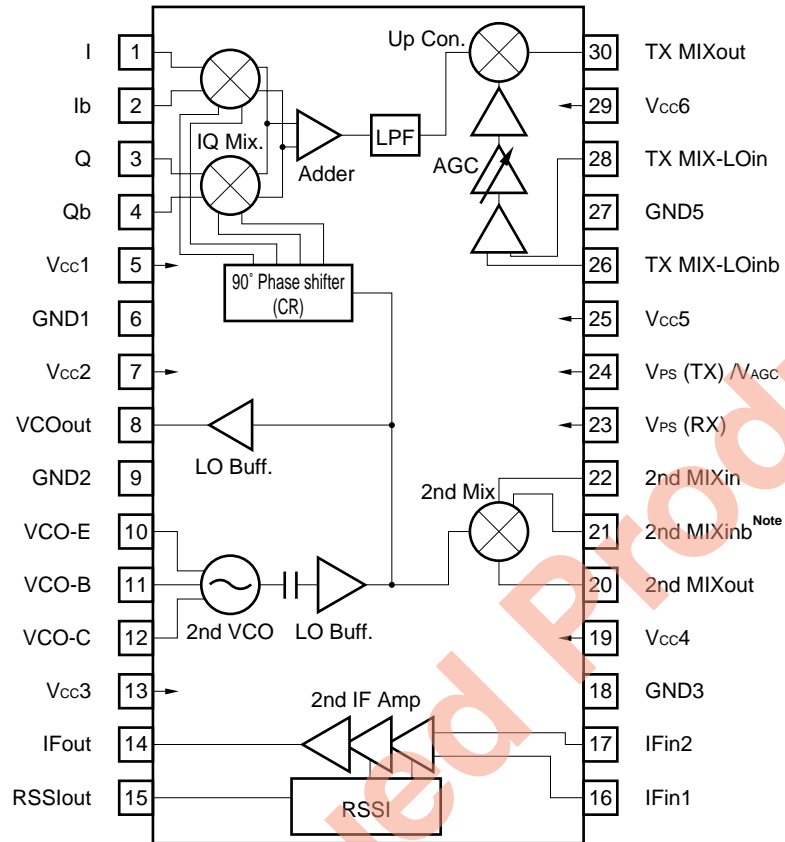


QUADRATURE MODULATOR IC SERIES PRODUCT LIST

Part Number	Function	I _{cc} (mA)	f _{LOin} (MHz)	f _{MODout} (MHz)	Up Converter fr _{Fout} (MHz)	Phase Shifter Type	Application Field	Package
μPC8101GR	150-MHz quadrature modulator	15 /@2.7 V	100 to 300	50 to 150	External	F/F	CT-2, etc.	20 pin SSOP (225 mil)
μPC8104GR	RF up converter + IF quadrature modulator	28 /@3.0 V	100 to 400		900 to 1900	Multiplier + F/F	Various digital communications	
μPC8105GR	400-MHz quadrature modulator	16 /@3.0 V	100 to 400		External	Multiplier + F/F	Various digital communications	16 pin SSOP (225 mil)
μPC8110GR	1-GHz direct quadrature modulator	24 /@3.0 V	800 to 1000		Direct modulation	Multiplier + F/F	PDC800 MHz, etc.	20 pin SSOP (225 mil)
μPC8125GR	On-chip AGC function RF up converter + IF quadrature modulator	36 /@3.0 V	220 to 270		1800 to 2000	Multiplier + F/F	PHS	
μPC8126GR μPC8126K	On-chip local PreMIX 1-GHz direct quadrature modulator	35 /@3.0 V	915 to 960		Direct modulation	Multiplier + F/F	PDC800 MHz, etc.	
μPC8129GR	LO × 2 frequency input type IF quadrature modulator + RF up converter	28 /@3.0V	200 to 800	100 to 400	800 to 1900	F/F	GSM, DCS1800, etc.	20 pin SSOP (225 mil)
μPC8158K	On-chip AGC function RF up converter + IF quadrature modulator	28 /@3.0 V	100 to 300		800 to 1500	CR	PDC800 M/1.5 G	28 pin QFN

For an outline of the quadrature modulator IC series, see the application note "Usage of μPC8101, 8104, 8105, 8125, and 8129" (document number P13251E).

INTERNAL BLOCK DIAGRAM AND PIN CONNECTIONS (Top View)



Note Pin 21 was specified to function as the GND4 in the initial design sample, however in subsequent design samples and commercial products it functions as the 2nd MIXinb.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Rating	Unit
Power supply voltage	V _{CC}	Pins 5, 7, 12, 13, 19, 25, 29, 30 T _A = +25°C	4.5	V
Power save pin voltage	V _{PS}	Pin 23, Pin 24, T _A = +25°C	4.5	V
Power dissipation	P _D	T _A = +80°C ^{Note}	TBD	mW
Operating ambient temperature	T _A		-30 to +80	°C
Storage temperature	T _{stg}		-55 to +150	°C
Pin current of Pin 8	I _{8 pin}		4	mA
Pin current of Pin 10	I _{10 pin}		4	mA
Collector to base voltage in VCO	V _{CB0}	Pin 12 → Pin 11	4.5	V
Collector to emitter voltage in VCO	V _{CE0}	Pin 12 → Pin 10	4.5	V
Emitter to base voltage in VCO	V _{EB0}	Pin 10 → Pin 11	3.0	V

Note When mounted on 50 × 50 × 1.6 mm double sided copper clad epoxy glass board

RECOMMENDED OPERATING RANGE

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Power supply voltage	V _{CC}	Pins 5, 7, 12, 13, 19, 25, 29, 30	2.7	3.0	4.0	V
Power save pin voltage	V _{PS}	Pin 23, Pin 24	0	-	V _{CC}	V
Operating ambient temperature	T _A		-30	+25	+80	°C
TX up converter output frequency	f _{TX • MIXout}		1800	-	2000	MHz
TX up converter LO input frequency	f _{TX • MIX-LOin}	P _{TX • MIX-LOin} = -10 dBm	1500	-	1800	MHz
TX up converter input frequency	f _{TX • MIXin}		220	-	270	MHz
IQ-MOD output frequency	f _{MODout}					
2nd VCO oscillating frequency (IQ-MOD LO, 2nd MIX LO input frequency)	f _{2ndVCO} (f _{MOD • LOin} , f _{2ndMIX-LOin})					
2nd MIX input frequency	f _{2ndMIXin}					
2nd MIX output frequency	f _{2ndMIXout}		8	10.8	12	MHz
2nd IF amplifier input frequency	f _{2ndIFin}		8	10.8	12	MHz
2nd IF amplifier output frequency	f _{2ndIFout}					
I/Q input frequency	f _{I/Qin}	V _{I/Qin} = 600 mV _{P-P} (MAX.), Double phase	DC	-	10	MHz
TX up converter LO input level	P _{TX • MIX-LOin}		-15	-10	-5	dBm
2nd MIX input level	P _{2ndMIXin}		-90	-	-10	dBm
2nd IF amplifier input level	P _{2ndIFin}		23	-	108	dBμ VEMF
I/Q input amplitude	V _{I/Qin}	Double phase input I/Q (DC) = I _b /Q _b (DC) = V _{CC} /2	-	500	600	mV _{P-P}

ELECTRICAL SPECIFICATIONS (1)

$T_A = +25^{\circ}\text{C}$, $V_{CC} = 3.0\text{ V}$, unless otherwise specified, $V_{PS-TX}/V_{AGC} = 3.0\text{ V}$, $V_{PS-RX} = 3.0\text{ V}$ (high), I/Q (DC) = I_b/Q_b (DC) = $V_{CC}/2 = 1.5\text{ V}$, $V_{I/Qin} = 500\text{ mV}_{P-P}$ (double phase input), $f_{I/Qin} = 24\text{ kHz}$, $\pi/4$ DQPSK modulated wave input
 Transmission rate: 384 kbps, Filter roll-off rate: $\alpha = 0.5$, MOD pattern: all zero, $f_{MOD \cdot LOin} = 233.15\text{ MHz}$, $P_{MODLOin} = -7\text{ dBm}$, $f_{TX \cdot MIX-LOin} = 1673.4\text{ MHz}$, $P_{TX \cdot MIX-LOin} = -10\text{ dBm}$, $f_{TX \cdot MIXout} = 1906.55\text{ MHz} + f_{I/Qin}$

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit		
Total characteristics								
Total circuit current (TX + RX + VCO)	$I_{CC(TOTAL)}$	No signal input	33	40.5	49	mA		
Transmitter block total characteristics (quadrature modulator + up converter + AGC circuit)								
Total circuit current (TX)	$I_{CC(TX-TOTAL)}$	No signal input	27	32.5	39.5	mA		
Dark current at power save (TX)	$I_{CC(PS)TX-TOTAL}$	$V_{PS} \leq 0.5\text{ V}$ (Low), No signal input	–	0.1	5	μA		
Transmitter block (quadrature modulator + up converter + AGC circuit)								
Total output level	$P_{TX \cdot MIXout}$	$V_{AGC} = 3.0\text{ V}$	–17	–13	–	dBm		
Local carrier leak	LOL	$f_{MODin \cdot LOin} + f_{TX \cdot MIX-LOin}$	–	–40	–30	dBc		
Image rejection (side-band leak)	ImR		–	–40	–30	dBc		
I/Q 3rd order inter-modulation distortion	$IM_3(I/Q)$		–	–50	–30	dBc		
AGC circuit gain control range	GCR	$V_{AGC} = 3\text{ V} \rightarrow 1\text{ V}$	20	35	–	dB		
Error vector magnitude (vector error)	EVM	MOD pattern: PN 9	–	1.0	5	%rms		
Adjacent channel leak power	P_{adj}	$\Delta f = \pm 600\text{ kHz}$, MOD pattern: PN 9	–	–68	–60	dBc		
Spurious within transmission band 1	P_{out} (7 MOD·LO)	$f_{MOD \cdot LOin} = 259.25\text{ MHz}$ $f_{MOD \cdot LOin} \times 7$, $f_{MOD \cdot LOin} \times 7$ (Image)	–	–65	–55	dBc		
Spurious within transmission band 2	P_{out} (8 MOD·LO)	$f_{MOD \cdot LOin} = 233.15\text{ MHz}$ $f_{MOD \cdot LOin} \times 8$, $f_{MOD \cdot LOin} \times 8$ (Image)	–	–65	–55	dBc		
Power saving response time	Rise time	$T_{PS-TX(Rise)}$	$V_{PS-TX} = 0\text{ V} \rightarrow 3\text{ V}$		–	2	5	μs
	Fall time	$T_{PS-TX(Fall)}$	$V_{PS-TX} = 3\text{ V} \rightarrow 0\text{ V}$		–	2	5	μs
I/Q input impedance	$Z_{I/Q}$	Value between Pins I/Ib and Q/Qb	–	180	–	kΩ		
I/Q input bias current	$I_{I/Q}$	Value of each pin when $V_I = V_{Ib} = V_Q = V_{Qb}$	3.5	7	16	μA		
Power save low	Note 1	$V_{PS-TX(Low)}$	0	–	0.5	V		
Power save high	Note 2	$V_{PS-TX(High)}$	0.9	–	V_{CC}	V		

- Notes** 1. Power save pin applied voltage in sleep mode
 2. Power save pin applied voltage in active mode

ELECTRICAL SPECIFICATIONS (2)

T_A = +25°C, V_{CC} = 3.0 V, unless otherwise specified, V_{PS} = 3.0 V (high), f_{2ndMIXin} = 243.95 MHz, P_{2ndMIXin} = -40 dBm, f_{2ndMIX-LOin} = 233.15 MHz, P_{2ndMIX-LOin} = -7 dBm, f_{2ndMIXout} = 10.8 MHz, f_{2ndIFin} = 10.8 MHz, P_{2ndIFin} = -15 dBm, f_{2ndFout} = 10.8 MHz

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Receiver block total characteristics						
Total circuit current (RX)	I _{CC (RX-TOTAL)}	No signal input	3.5	4.8	6	mA
Dark current at power save	I _{CC (PS-RX TOTAL)}	V _{PS-RX} ≤ 0.3 V (Low), No signal input	–	0.1	5	μA
Power save response time	Rise time	T _{PS-RX (Rise)}	V _{PS-RX} = 0 V → 3 V		5	μs
	Fall time	T _{PS-RX (Fall)}	V _{PS-RX} = 3 V → 0 V		5	μs
Power save low	Note 1	V _{PS-RX (Low)}	0	–	0.3	V
Power save high	Note 2	V _{PS-RX (High)}	2.5	–	V _{CC}	V
Receiver block 1 (2nd down converter)						
2nd MIX conversion gain	CG _{2ndMIX}	Combining capacitance with SG	6	10	14	dB
1-dB compression output level	P _{1dB2ndMIX}		–	93	–	dBμV
Input 3rd order intercept point	IIP3 (2ndMIX)	f _{2ndMIXin1} = 243.95 MHz, f _{2ndMIXin2} = 244.25 MHz	–	94	–	dBμV
2nd MIX noise figure	NF _{2ndMIX}	At I/O LC matching	–	8	–	dB
2nd MIX local leak 1	ISL (2ndLO)1	Pin 10 input -7-dBm input ^{Note 3}	–	52	–	dBμV
2nd MIX local leak 2	ISL (2ndLO)2	Pin 10 input -7-dBm input ^{Note 4}	–	24	–	dBμV
2nd MIX output resistance	Z _{2ndMIXout}	Pin 20	–	330	–	Ω
Receiver block 2 (IF amplifier)						
Limiting sensitivity	S _L	-3 dB point	–	27	32	dBμVEMF
2nd IF amplifier gain	G _V	P _{2ndIFin} = 13 dBμVEMF	–	80	–	dB
2nd IF amplifier phase shift	S _P	P _{2ndIFin} = 63 to 98 dBμVEMF ^{Note 5}	–	6	–	deg
2nd IF amplifier output amplitude	V _O	10 kΩ/10 pF ^{Note 6}	0.5	0.62	0.75	V _{P-P}
2nd IF amplifier output rise time	t _r		–	13	25	ns
2nd IF amplifier output fall time	t _f		–	10	20	ns
2nd IF amplifier input resistance	R _{in}	Pin 16, Pin 17	–	330	–	Ω
2nd IF amplifier input capacitance	C _{in}	Pin 16, Pin 17	–	TBD	–	pF
2nd IF amplifier output duty ratio	V _O (duty)		–	52	–	%
2nd IF amplifier output bias level	V _O (DC)		–	1.5	–	V

Notes 1. Power save pin applied voltage in sleep mode

2. Power save pin applied voltage in active mode

3. Leak to 2nd MIX output pin (Pin 20) of 2nd MIX-LO

4. Leak to 2nd MIX input pin (Pin 22) of 2nd MIX-LO

5. RBW of network analyzer = 3 Hz

6. 10 pF is a value including all capacitance connected to the pins (wiring pattern)

ELECTRICAL SPECIFICATIONS (3)

T_A = +25°C, V_{CC} = 3.0 V, unless otherwise specified, V_{PS} = 3.0 V (high), f_{2ndMIXin} = 243.95 MHz, P_{2ndMIXin} = -40 dBm, f_{2ndMIX-LOin} = 233.15 MHz, P_{2ndMIX-LOin} = -7 dBm, f_{2ndMIXout} = 10.8 MHz, f_{2ndFin} = 10.8 MHz, P_{2ndFin} = -15 dBm, P_{2ndFout} = 10.8 MHz

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Receiver block 3 (RSSI)						
RSSI linearity	L _R	V _{IF} = 33 to 98 dBμVEMF	-	±1.5	±2.0	dB
RSSI slope	S _R		-	28	-	mV/dB
RSSI intercept	I _R		-	4	-	dBμVEMF
RSSI output voltage 1	V _{R1}	V _{2ndFin} = 33 dBμVEMF	0.6	0.8	1	V
RSSI output voltage 2	V _{R2}	V _{2ndFin} = 63 dBμV	1.44	1.68	1.92	V
RSSI output voltage 3	V _{R3}	V _{2ndFin} = 98 dBμV	2.4	2.7	2.9	V
RSSI output voltage 4	V _{R4}	No signal input	-	0.5	-	V
RSSI output temperature stability	S _T	T _A = -30°C to +80°C	-	±2.0	-	dB
RSSI output dynamic range	D _R		75	83	-	dB
RSSI rise time	t _{rf1}		-	1	5	μs
RSSI fall time	t _{rf2}		-	1	5	μs
RSSI output ripple	R _R	10 pF ^{Note}	-	30	-	mV _{P-P}
RSSI output resistance	R _{OR}		28	35	42	kΩ

Note 10 pF is a value including all capacitance (wiring capacitance) connected to the pins

ELECTRICAL SPECIFICATIONS (4)

T_A = +25°C, V_{CC} = 3.0 V

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Common block (2nd VCO)						
Total circuit current (2nd VCO)	I _{CC (2ndVCO)}	3 kΩ is attached to pin 10 externally (without pull-down resistance for pin 8)	2.5	3.2	3.5	mA
2nd VCO output level	P _{2ndVCO}	Pin 8 pull-down resistance is 1 kΩ	-10	-	-	dBm
2nd VCO oscillating frequency	f _{2ndVCO}		220	-	270	MHz

PIN FUNCTIONS

Pin No.	Symbol	Applied Voltage (V)	Pin Voltage (V) <small>Note</small>	Function and Description	Internal Equivalent Circuit
1	I	V _{cc} /2	–	Input pin for I signal. The input impedance is about 180 kΩ.	
2	Ib	V _{cc} /2	–	Input pin for Ib signal. The input impedance is about 180 kΩ. Single ended input is also possible. In the case of single ended input, input only the DC voltage of V _{cc} /2.	
3	Q	V _{cc} /2	–	Input pin for Q signal. The input impedance is about 180 kΩ.	
4	Qb	V _{cc} /2	–	Input pin for Qb signal. The input impedance is about 180 kΩ. Single ended input is also possible. In the case of single ended input, input only the DC voltage of V _{cc} /2.	
5	V _{cc} 1	2.7 to 4.0	–	Power supply voltage pin for the quadrature modulator block.	_____
6	GND1	0	–	Ground pin for the quadrature modulator block. Form as wide a ground pattern as possible to minimize its impedance.	_____
7	V _{cc} 2	2.7 to 4.0	–	Power supply voltage pin for the VCO block.	_____
8	VCOout	–	1.6	Oscillator output pin. The output level can be adjusted with an external pull-down resistor.	
9	GND2	0	–	Ground pin for the VCO block. Form as wide a ground pattern as possible to minimize its impedance.	_____
10	VCO_E	–	2.1	Emitter pin for oscillator. Ground with an external pull-down resistor. It can be oscillated by performing feedback with a resonance circuit mounted externally between this pin and Pin 11.	
11	VCO_B	–	2.9	Base pin for oscillator. It can be oscillated by performing feedback with a resonance circuit mounted externally between this pin and Pin 10.	
12	VCO_C	2.7 to 4.0	–	Collector pin for oscillator. Open collector.	

: External attachment

Note The pin voltage is measured on V_{cc}=3.0 V.

PIN FUNCTIONS

Pin No.	Symbol	Applied Voltage (V)	Pin Voltage (V) <small>Note</small>	Function and Description	Internal Equivalent Circuit
13	Vcc3	2.7 to 4.0	–	Supply voltage pin for the IF amplifier and RSSI block.	
14	IFout	–	1.5	Output pin for the IF amplifier.	
15	RSSIout	–	0.5 (No input signal)	Output pin for the RSSI. The output resistance is about 35 kΩ.	
16	IFin1	–	1.9	Input pin for the IF amplifier. The input resistance is about 330 Ω.	
17	IFin2	–	1.9	Input pin for the IF amplifier. The input resistance is about 330 Ω.	
18	GND3	0	–	Ground pin for the IF amplifier, RSSI block, and 2nd down converter block. Form as wide a ground pattern as possible to minimize its impedance.	
19	Vcc4	2.7 to 4.0	–	Power supply voltage pin for the 2nd down converter block.	
20	2nd MIXout	–	1.5	Output pin for the 2nd down converter. The output resistance is about 330 Ω.	
21	2nd MIXinb	–	1.9	Bypass pin for the 2nd down converter block. Ground this pin through an external capacitor.	
22	2nd MIXin	–	1.9	Input pin for the 2nd down converter. High impedance input.	

: External attachment

Note The pin voltage is measured on Vcc=3.0 V.

PIN FUNCTIONS

Pin No.	Symbol	Applied Voltage (V)	Pin Voltage (V) <small>Note</small>	Function and Description	Internal Equivalent Circuit						
23	V _{PS (RX)}	0 to V _{CC}	—	Power save pin for the receiver block (IF amplifier, RSSI, 2nd down converter). This pin is interlocked to the internal regulator and can control the following. <table border="1"> <tr> <td>V_{PS} (V)</td> <td>IC stat</td> </tr> <tr> <td>2.5 to V_{CC}</td> <td>ON (Active Mode)</td> </tr> <tr> <td>0 to 0.3</td> <td>OFF (Sleep Mode)</td> </tr> </table>	V _{PS} (V)	IC stat	2.5 to V _{CC}	ON (Active Mode)	0 to 0.3	OFF (Sleep Mode)	
V _{PS} (V)	IC stat										
2.5 to V _{CC}	ON (Active Mode)										
0 to 0.3	OFF (Sleep Mode)										
24	V _{PS (TX)/V_{AGC}}	0 to V _{CC}	—	Power save pin for the transmitter block (quadrature modulator, up converter, AGC circuit). This pin is interlocked to the internal regulator and can control the following. <table border="1"> <tr> <td>V_{PS} (V)</td> <td>IC stat</td> </tr> <tr> <td>0.9 to V_{CC}</td> <td>ON (Active Mode)</td> </tr> <tr> <td>0 to 0.5</td> <td>OFF (Sleep Mode)</td> </tr> </table>	V _{PS} (V)	IC stat	0.9 to V _{CC}	ON (Active Mode)	0 to 0.5	OFF (Sleep Mode)	
V _{PS} (V)	IC stat										
0.9 to V _{CC}	ON (Active Mode)										
0 to 0.5	OFF (Sleep Mode)										
25	V _{CC5}	2.7 to 4.0	—	Supply voltage for the AGC block.	—————						
26	TX MIX-LOinb	—	2.0	Bypass pin for the local input of the up converter. Ground this pin through an external capacitor.							
28	TX MIX-LOin	—	2.0	Local input pin for the up converter. High impedance input.							
27	GND5	0	—	Ground pin for the AGC and up converter. Form as wide a ground pattern as possible to minimize its impedance.	—————						
29	V _{CC6}	2.7 to 4.0	—	Supply voltage pin for the up converter block.							
30	TX MIXout	2.7 to 4.0	—	RF output pin for the up converter block. This is an open collector output, so an impedance matching circuit should be attached externally.							

: External attachment

Note The pin voltage is measured on V_{CC}=3.0 V.

RELATION BETWEEN I/Q PIN INPUT SIGNAL POTENTIAL AND UPPER LIMIT AMPLITUDE

Power Supply Voltage (V) V _{cc}	I/Q bias voltage (V) V _{cc} /2 = I = Ib = Q = Qb	Input Amplitude (mV _{P-P})	
		Single ended Input I = Q	Differential Phase Input I = Ib = Q = Qb
2.7	1.35	≤400	≤600
to	to		
3.0	1.5	≤800	≤600
to	to		
4.0	2.0	≤1000	≤600

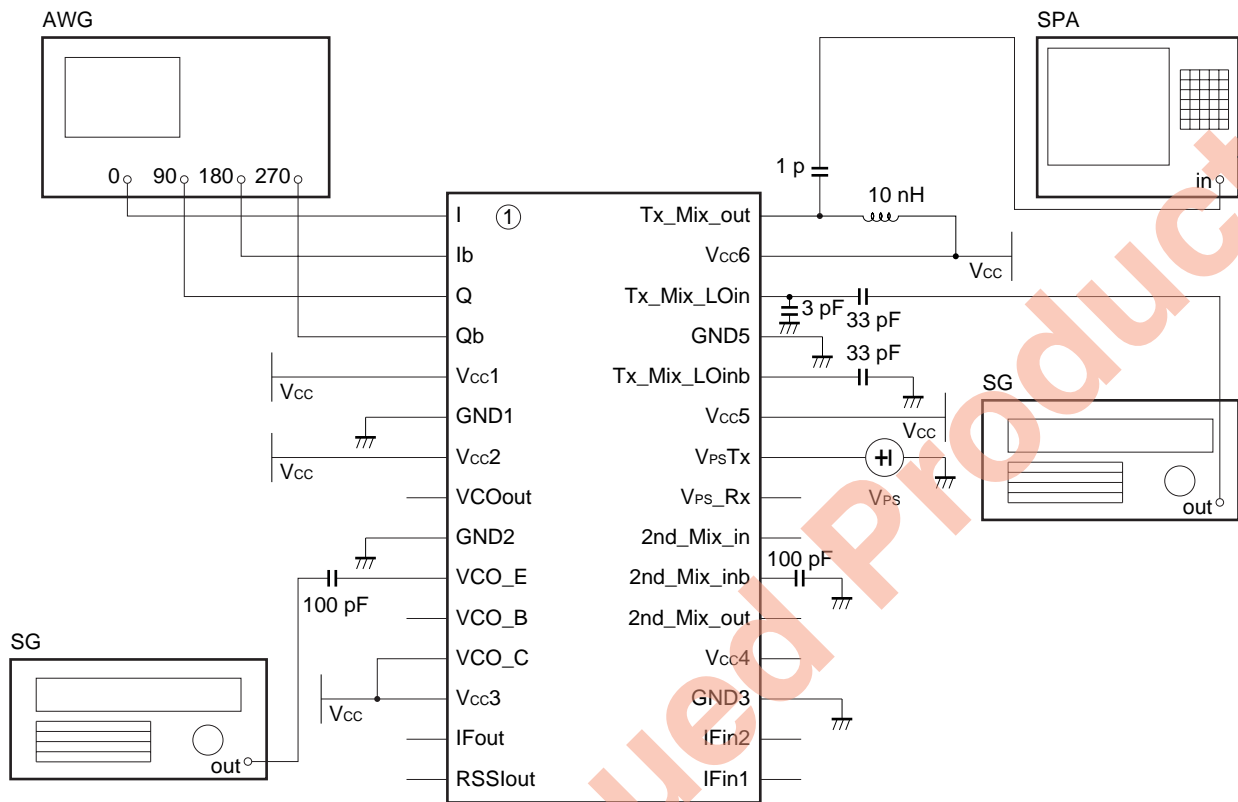
COMPARISON OF I/Q INPUT AMPLITUDES IN THE SAME TX OUTPUT LEVEL

Power Supply Voltage (V) V _{cc}	I/Q bias voltage (V) V _{cc} /2 = I = Ib = Q = Qb	Input Amplitude (mV _{P-P})		Reference Characteristics TX Total Output Level (dBm) P _{TX-MIXout}
		Single ended Input I = Q	Differential Phase Input I = Ib = Q = Qb	
2.7	1.35	400	200	-20
3.0	1.5	800	400	-14
4.0	2.0	1200	600	-10.5

Discontinued Product

TEST CIRCUIT 1

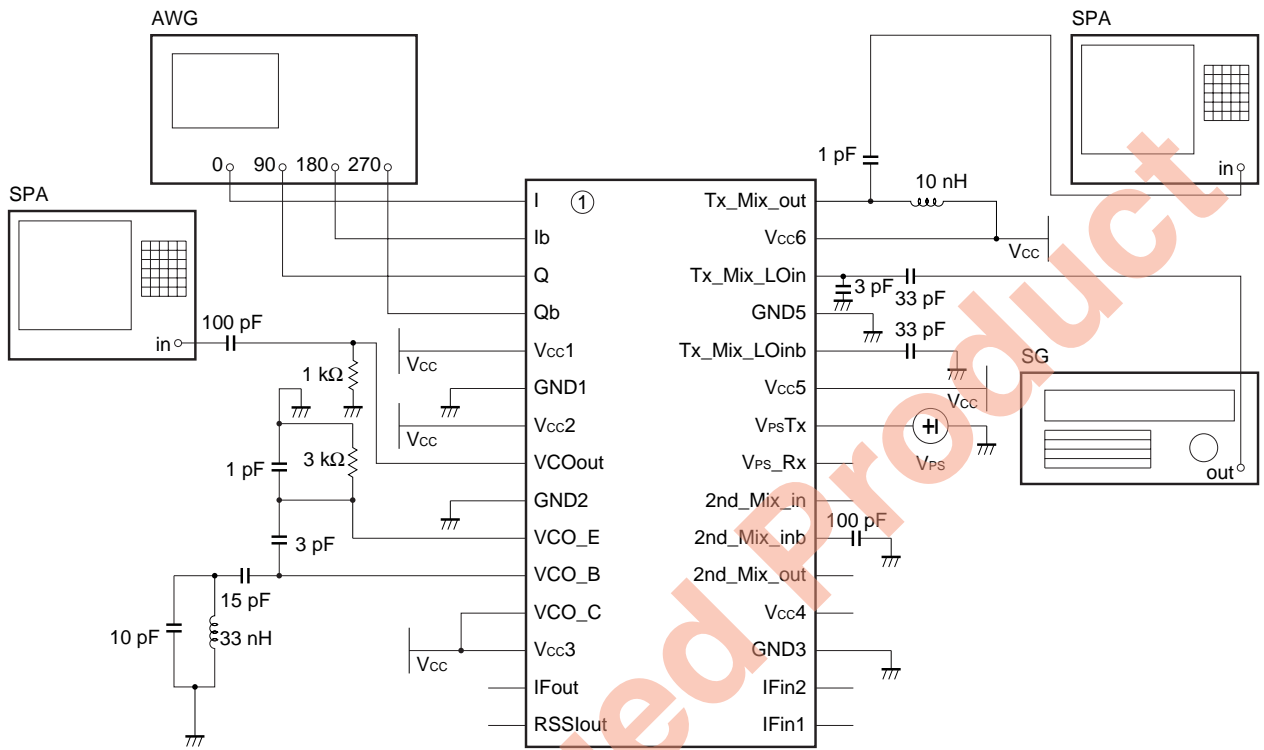
Transmitter Block (Quadrature Modulator + Up Converter + AGC Circuit)



Discontinued Product

TEST CIRCUIT 2

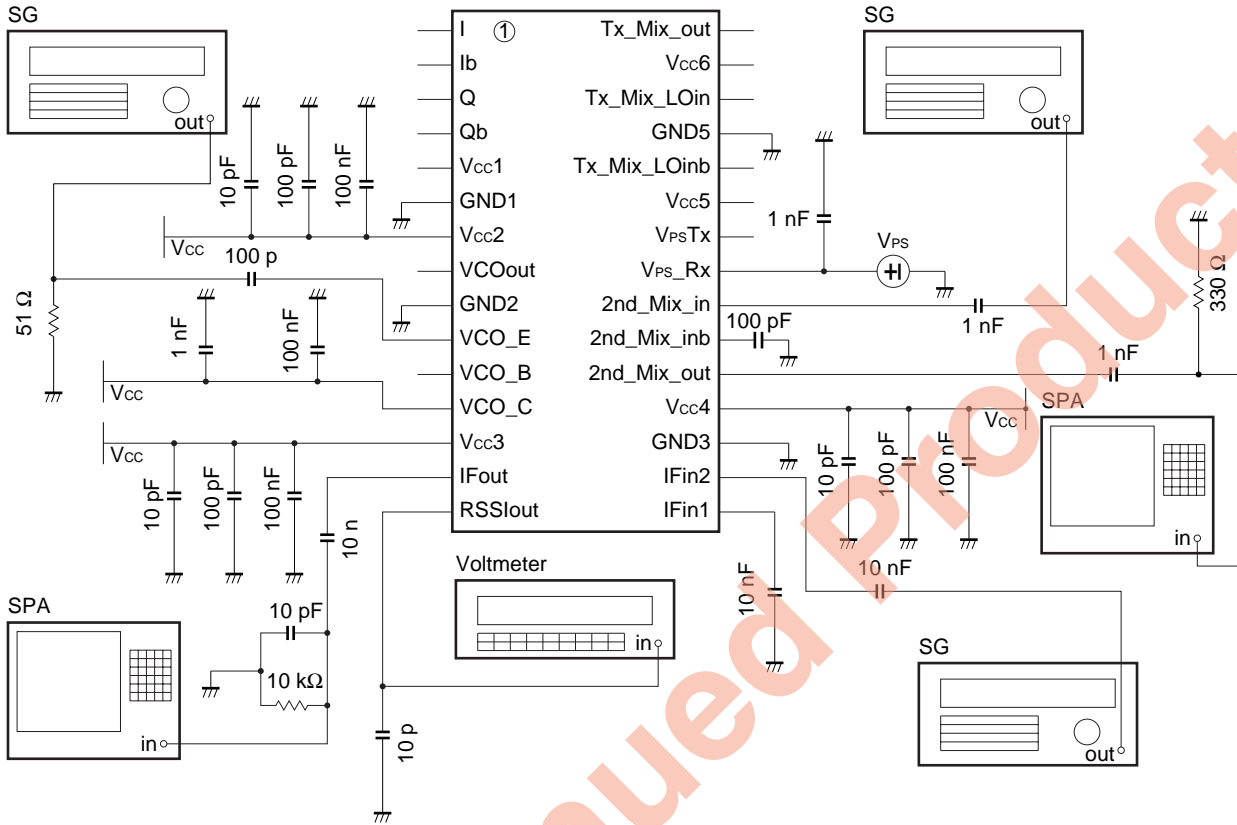
Transmitter Block + Common Block (Quadrature Modulator + Up Converter + AGC Circuit + 2nd VCO)



Discontinued Product

TEST CIRCUIT 3

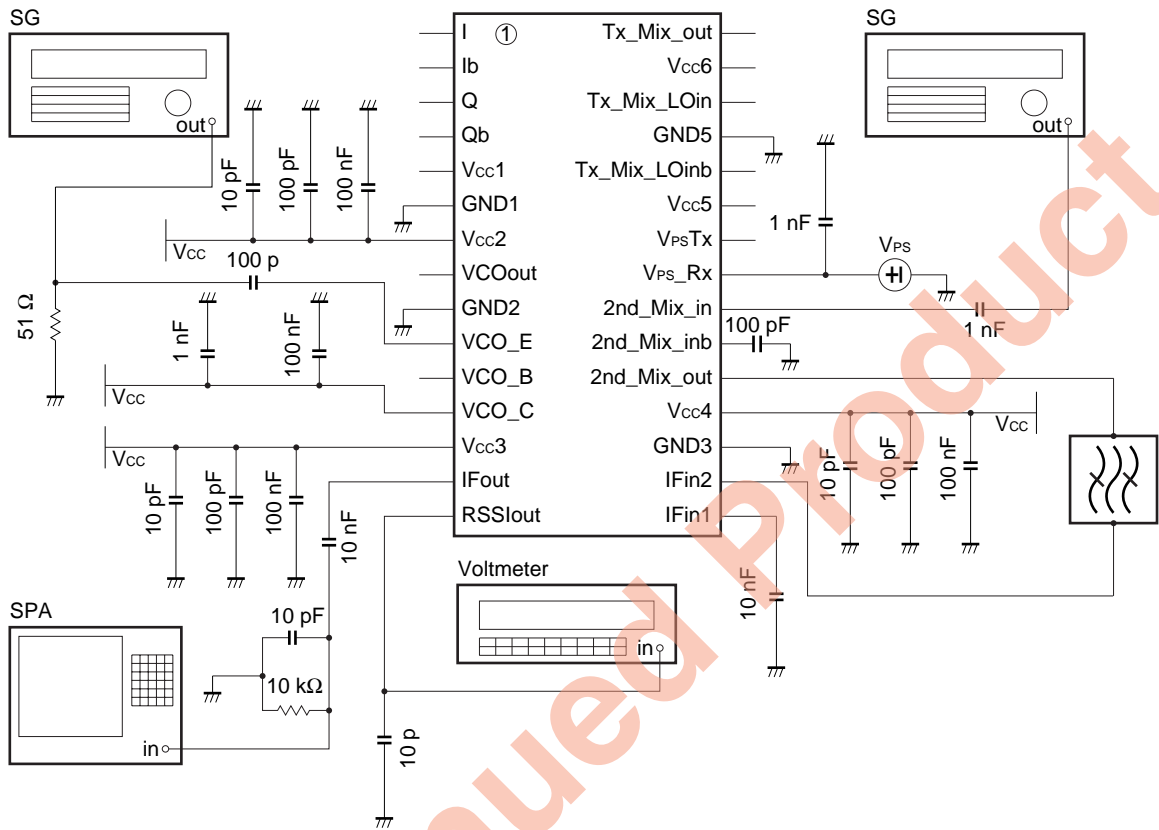
Receiver Block (2nd Down Converter + 2nd IF Amplifier + RSSI)



Discontinued Product

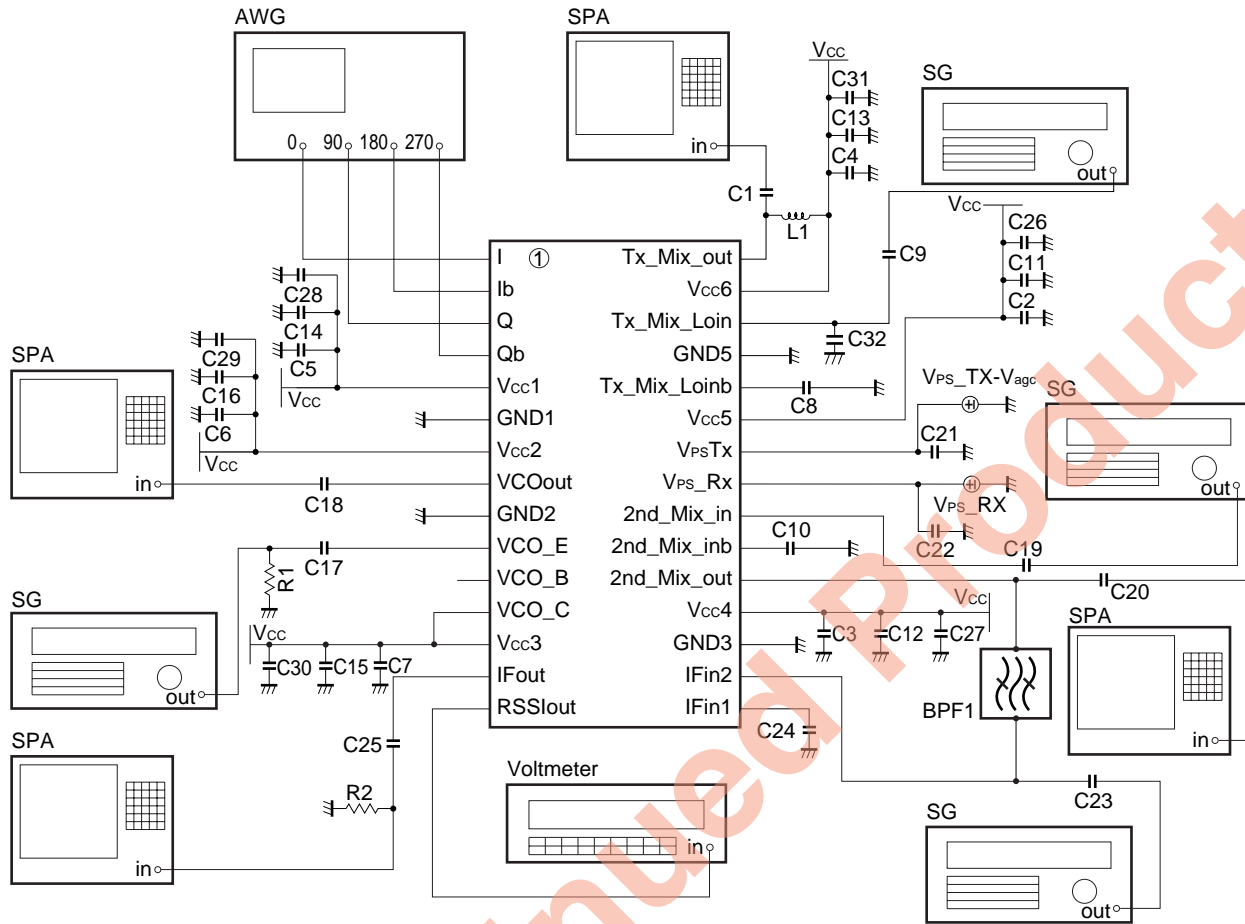
TEST CIRCUIT 4

Receiver Block (2nd Down Converter + 2nd IF Amplifier + RSSI)

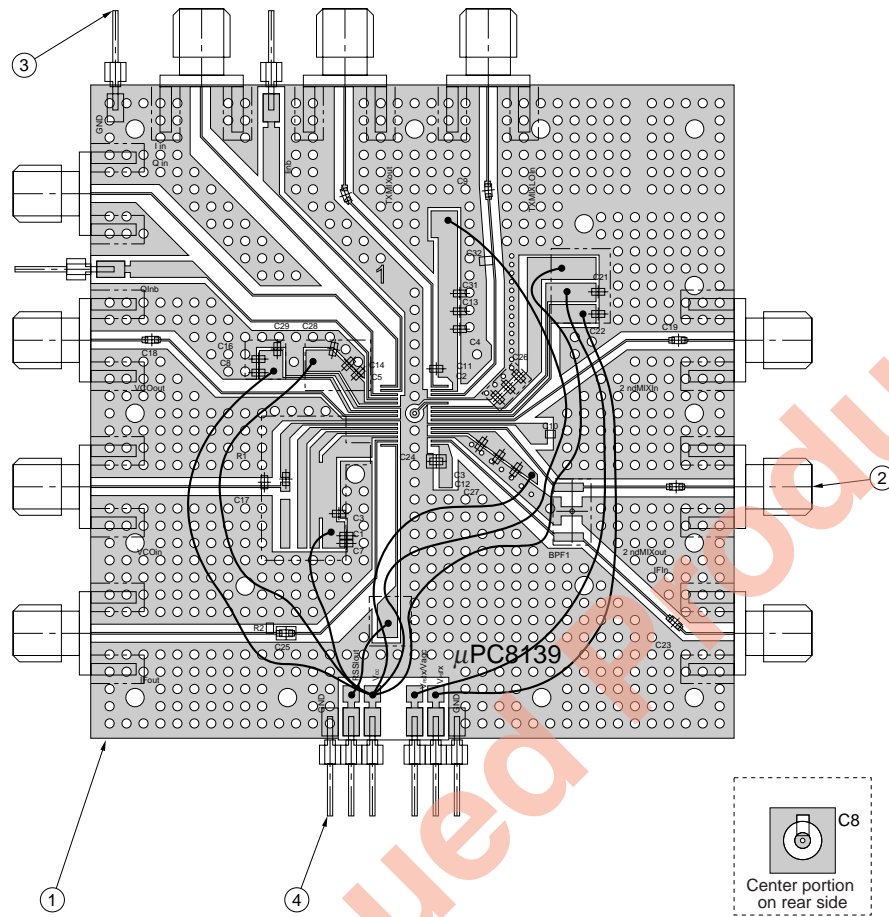


Discontinued Product

TEST CIRCUIT TOTAL CONFIGURATION



EXAMPLE OF THE TEST CIRCUIT MOUNTED ON PRINTED CIRCUIT BOARD



Parts List

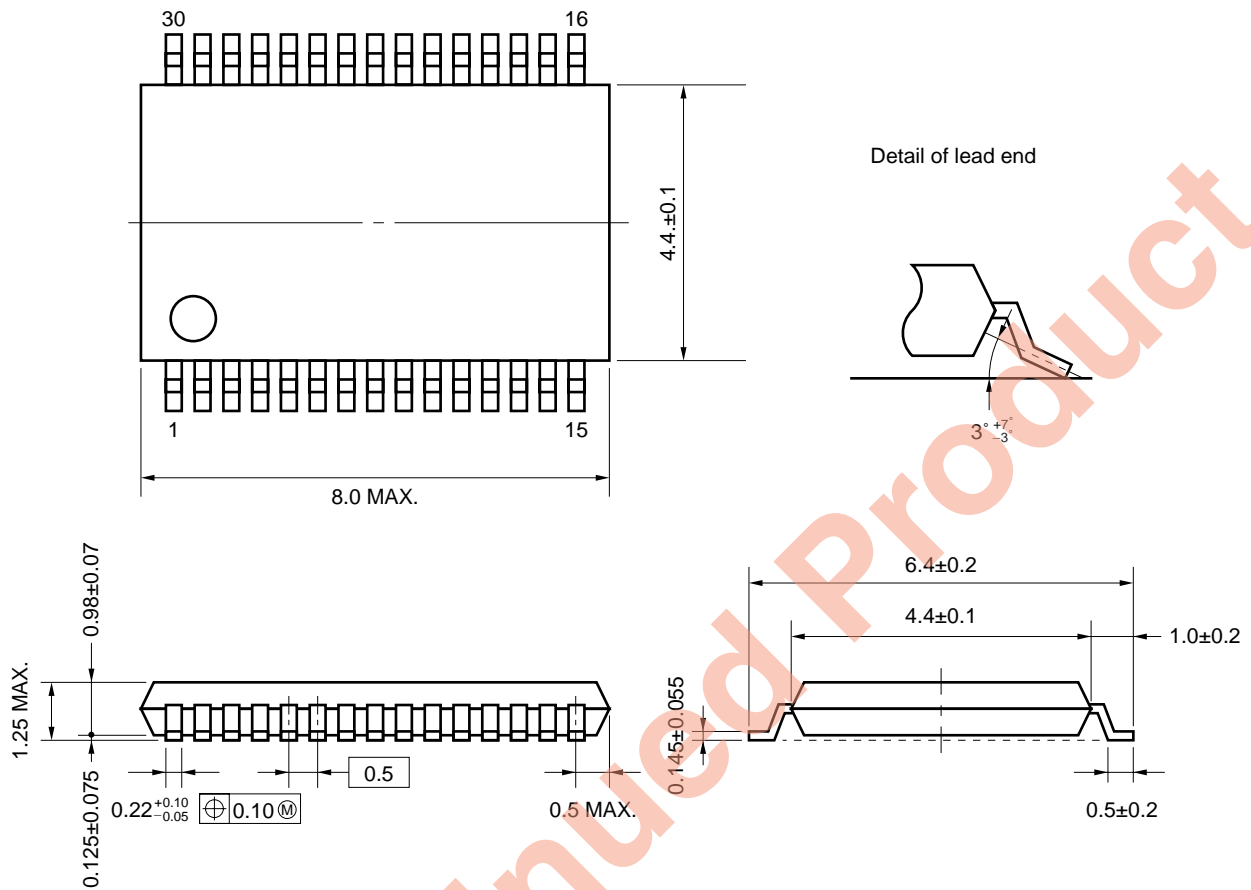
Symbol	Name	Value	Model name • Specifications	Manufacturer	Quantity
BPF1	BPF		CFEC10.8 MK1	Murata Mfg.	1
L1	Chip inductor	10 nH	TFL0816-10N	SSM	1
R2	Chip resistor	10 kΩ	RR0816R-103-D	SSM	1
R1	Chip resistor	51 Ω	RR0816R-510-D	SSM	1
C32	Chip capacitor	3 pF	GRM39B030J50PB	Murata Mfg.	1
C26 to 31	Chip capacitor	100 nF	GRM39B104J50PB	Murata Mfg.	6
C23 to 25	Chip capacitor	10 nF	GRM39B103J50PB	Murata Mfg.	3
C19 to 22	Chip capacitor	1 nF	GRM39B102J50PB	Murata Mfg.	4
C10 to 18	Chip capacitor	100 pF	GRM39B101J50PB	Murata Mfg.	8
C8 to 9	Chip capacitor	33 pF	GRM39B330J50PB	Murata Mfg.	2
C2 to 7	Chip capacitor	10 pF	GRM39B100J50PB	Murata Mfg.	7
C1	Chip capacitor	1 pF	GRM39B010J50PB	Murata Mfg.	1
④	PCC pin		A2-3PA-2.54DSA	Hirose Electric	2
③	PCC pin		A2-1PA-2.54DSA	Hirose Electric	3
②	SMA connector		142-0701-881	JHONSON	10
①	Polyimide substrate		R4775 (t0.2)	Matsushita Electric Works	1

Notes on the board

- (1) Copper patterning on a polyimide board of 76 × 76 × 0.2 mm in size.
- (2) Full grounding on rear side.
- (3) Solder coating over patterns.
- (4) ○ and ⊙ indicate through holes.

PACKAGE DIMENSIONS

30-pin plastic TSSOP (225 mil) (Unit: mm)



CAUTIONS ON USE

1. Observe precautions for handling because this IC is an electrostatic sensitive device.
2. Form as wide a ground pattern as possible to minimize its impedance.
3. Keep the track length of the ground pins as short as possible (to prevent malfunction).
4. Connect a bypass capacitor to the Vcc pin.

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered in the following recommended conditions.

For soldering methods and conditions other than the recommended conditions, consult an NEC sales representative.

μPC8139GR-7JH

Soldering Method	Soldering Conditions	Symbol
Infrared reflow	Package peak temperature: 235°C. Duration: 30 sec. max. (210°C or above) Number of times: 2, Exposure limit: None ^{Note}	IR35-00-2
VPS	Package peak temperature: 215°C. Duration: 40 sec. max. (200°C or above) Number of times: 2, Exposure limit: None ^{Note}	VP15-00-2
Wave soldering	Soldering bath temperature : 260°C max. Duration: 10 sec. max. Number of times: 1, Exposure limit: None ^{Note}	WS60-00-1
Partial heating method	Pin temperature: 300°C max. Duration: 3 sec. max. (per side of device) Exposure limit: None ^{Note}	

Note Storage period (days) after opening the dry pack. Storage conditions: 25°C and 65% RH or less
(This product is not dry packed.)

Caution Do not use different soldering methods together (except for pin partial heating.)

For details of recommended soldering conditions, refer to the information document **Semiconductor Device Mounting Technology Manual (C10535E)**

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

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: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.