DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC8220T5A

Tx AND Rx MCP IC FOR 1.9 GHz PHS

DESCRIPTION

The μPC8220T5A is MCP (Multi Chip Packaging) IC consisted of silicon germanium (SiGe) bipolar process and LDMOS designed for use as transmitting and receiving for 1.9 GHz PHS.

This device is packaged in surface mount 16-pin plastic TSON (Thin Small Outline Non-leaded) package.

This IC manufactured using our 50 GHz f_{max} UHS2 (Ultra High Speed Process) SiGe bipolar process and LDMOS (Lateral Diffusion MOS FET Process).

FEATURES

– Tx Block –

- Circuit Current (DRV + PA) : I = 160 mA TYP. @ $V_{CC} = V_{ds}$ = 3.0 V, f = 1.9 GHz, P_{in} = –19 dBm, P_{out} = +20.5 dBm
- Output Power : P_{out} = +20.5 dBm MIN. @ $V_{CC} = V_{ds}$ = 3.0 V, f = 1.9 GHz, P_{in} = –19 dBm
- Power Gain : G_P = 39.5 dB MIN. @ $V_{CC} = V_{ds}$ = 3.0 V, f = 1.9 GHz, P_{in} = –19 dBm
- Adjacent Channel Power : P_{adj1} = –65 dBc TYP. @ $V_{CC} = V_{ds}$ = 3.0 V, f = 1.9 GHz, P_{out} = +20.5 dBm, Δ ±600 kHz
  : P_{adj2} = –70 dBc TYP. @ $V_{CC} = V_{ds}$ = 3.0 V, f = 1.9 GHz, P_{out} = +20.5 dBm, Δ ±900 kHz
- Harmonics Frequency Level : $2f_0$ = –45 dBc TYP. @ $V_{CC} = V_{ds}$ = 3.0 V, P_{out} = +20.5 dBm
  : $3f_0$ = –60 dBc TYP. @ $V_{CC} = V_{ds}$ = 3.0 V, P_{out} = +20.5 dBm
- Gain 1 dB Compression Output Power : $P_{O\ (1\ dB)}$ = +21 dBm TYP. @ $V_{CC} = V_{ds}$ = 3.0 V

– Rx Block –

- Circuit Current : I_{CC} = 11.5 mA TYP. @ V_{CC} = 3.0 V
- Convertion Gain : CG = 21.5 dB TYP. @ f_{RF} = 1.9 GHz, f_{IF} = 240 MHz, f_{Lo} = 1.66 GHz
- Noise Figure : NF = 3.1 dB TYP. @ SSB
- Input 3rd Order Distortion Intercept Point : IIP_3 = –14.5 dBm TYP. @ f_{RF1} = 1.9 GHz, f_{RF2} = 1.9006 GHz, P_{RF} = –35 dBm/tome
- Image Rejection Ratio : IMR = 40 dBc TYP. @ f_{RF1} = 1.9 GHz, f_{RF2} = 1.42 GHz, P_{RF} = –35 dBm/tome
- High-density Surface Mounting : 16-pin plastic TSON package (3.3 × 2.3 × 0.6 mm)

APPLICATION

- PHS

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPC8220T5A-E1	μPC8220T5A-E1-A	16-pin plastic TSON (Pb-Free)[Note]	8220	• Embossed tape 12 mm wide • Pin 8, 9 face the perforation side of the tape • Qty 3 kpcs/reel

Note With regards to terminal solder (the solder contains lead) plated products (conventionally plated), contact your nearby sales office.

Remark To order evaluation samples, contact your nearby sales office.
Part number for sample order: μPC8220T5A

Caution Observe precautions when handling because these devices are sensitive to electrostatic discharge.

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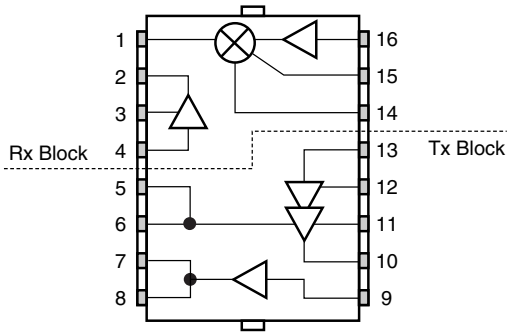
PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM

(Top View)



Pin No.	Pin Name	Pin No.	Pin Name
1	RF_{in}	9	INPUT2
2	LNA_{out}	10	OUTPUT1
3	GND (LNA)	11	V_{CC} (TX)
4	LNA_{in}	12	GND (DRV)
5	GND (DRV)	13	INPUT1
6	GND (DRV)	14	IF OUT
7	OUT2 (PA)	15	V_{CC} (RX)
8	OUT2 (PA)	16	Lo IN

NOTE ON CORRECT USE

Exposed heatsink at bottom on package that is combined with GND (ground) must be soldered to PCB RF/DC ground.

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

Parameter	Symbol	Ratings	Unit
LNA Output Voltage	V_{LNAout}	4.0	V
Mixier Output Voltage	V_{CC}, IF_{out}	4.0	V
Driver Output Voltage	V_{CC}, V_{out1}	4.0	V
PA Drain-Source Voltage	V_{ds}	8.0	V
PA Gate-Source Voltage	V_{gs}	8.0	V
Input Power 1	P_{in1}	+10	dBm
Input Power 2	P_{in2}	+16	dBm
LNA Input Power	P_{LNAin}	+10	dBm
Local Input Power	P_{Loin}	+10	dBm
Channel Temperature	T_{ch}	150	°C
Operating Ambient Temperature	T_A	−30 to +70	°C
Storage Temperature	T_{stg}	−55 to +150	°C
Power Dissipation of Package	P_D	5.33 Note	W
Circuit Current 1 (LNA + Mixer)	I_{CC1}	21	mA
Circuit Current 2 (PA Driver)	I_{CC2}	70	mA
Circuit Current 3 (PA)	I_{ds}	259	mA

Note Mounted on 33 × 21 × 0.4 mm polyimide PCB

RECOMMENDED OPERATING RANGE (T_A = +25°C, unless otherwise specified)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
LNA Output Voltage	V_{LNAout}	2.7	3.0	3.3	V
Mixer Output Voltage	V_{CC}, IF_{out}	2.7	3.0	3.3	V
Driver Output Voltage	V_{CC}, V_{out1}	2.7	3.0	3.3	V
PA Drain-Source Voltage	V_{ds}	2.7	3.0	3.5	V
PA Gate-Source Voltage	V_{gs}	0	2.0	2.5	V
Operating Ambient Temperature	T_A	−30	+25	+70	°C
RF Input Frequency	f_{RF}	1.8	1.9	2.0	GHz
Local Input Power	P_{Loin}	−20	−15	−10	dBm

ELECTRICAL CHARACTERISTICS

– Tx Block – (T_A = +25°C, V_{CC} = V_{ds} = 3.0 V, Z_S = Z_L = 50 Ω, unless otherwise specified)

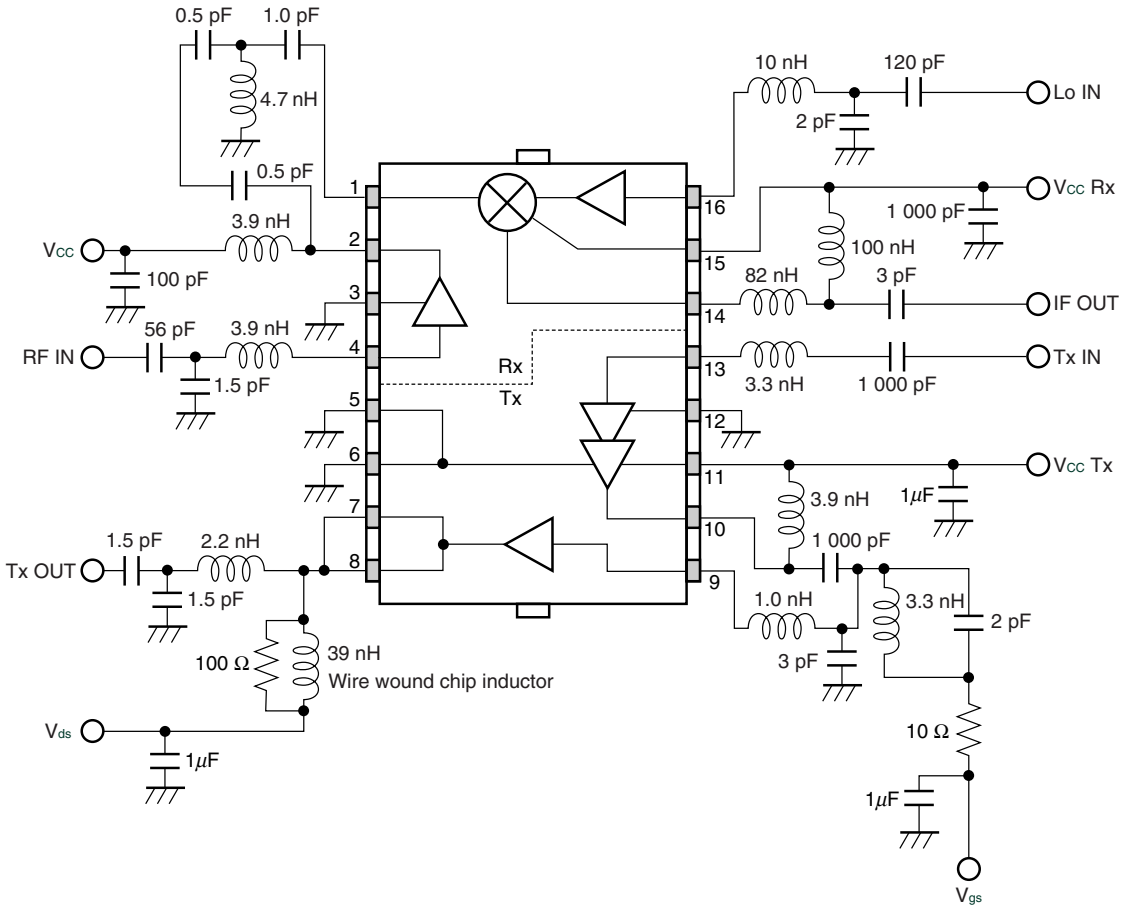
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Threshold Voltage	V_{th}	I_{ds} = 8 mA, V_{ds} = 3.5 V	1.15	1.4	1.65	V
Gate-Source Voltage	V_{gs}	f = 1.9 GHz, P_{in} = –19 dBm, P_{out} = +20.5 dBm	1.5	1.8	2.1	V
Circuit Current (DRV + PA)	I		–	160	190	mA
Input Return Loss	RL_{in}	f = 1.9 GHz, P_{in} = –19 dBm	–	10	–	dB
Output Return Loss	RL_{out}		–	5	–	dB
Output Power	P_{out}	f = 1.9 GHz, P_{in} = –19 dBm, V_{gs} adjusting	+20.5	–	–	dBm
Power Gain (DRV + PA)	G_P		39.5	40.5	–	dB
Power Gain (DRV)	$G_{P\ (DRV)}$		–	31	–	dB
Power Gain (PA)	$G_{P\ (PA)}$		–	9.5	–	dB
Liner Gain	G_L	P_{in} = –20 dBm	–	40.5	–	dB
Adjacent Channel Power 1	P_{adj1}	f = 1.9 GHz, P_{out} = +20.5 dBm ⊿ 600 kHz [Note]	–	–65	–58	dBc
Adjacent Channel Power 2	P_{adj2}	f = 1.9 GHz, P_{out} = +20.5 dBm ⊿ 900 kHz [Note]	–	–70	–60	dBc
Occupied Band Width	OBW	P_{out} = +20.5 dBm [Note]	–	250	270	kHz
2nd Harmonics Frequency Level	$2f_0$	P_{out} = +20.5 dBm	–40	–45	–	dBc
3rd Harmonics Frequency Level	$3f_0$	P_{out} = +20.5 dBm	–55	–60	–	dBc
Gain 1 dB Compression Output Power	$P_{O\ (1\ dB)}$		–	+21.0	–	dBm

Note P_{in} = –19 dBm, CW: Measure by changing to modulation wave, after setting from adjusting by V_{gs} to P_{out} = +20.5 dBm.

– Rx Block – (T_A = +25°C, V_{CC} = 3.0 V, f_{RF} = 1.9 GHz, f_{IF} = 240 MHz, f_{Lo} = 1.66 GHz, P_{Loin} = –15 dBm, Z_S = Z_L = 50 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No Signal	8.9	11.5	15.0	mA
Circuit Current (LNA)	I_{CCLNA}	No Signal	1.25	1.8	–	mA
Convertion Gain (LNA + Mixer)	CG	P_{RF} = –35 dBm	19.0	21.5	25.5	dB
Convertion Gain (LNA)	CG (LNA)	P_{RF} = –35 dBm	–	15.5	–	dB
Convertion Gain (Mixer)	CG (Mixer)	P_{RF} = –20 dBm	–	6.0	–	dB
Noise Figure	NF	SSB	–	3.1	4.5	dB
Input 3rd Order Distortion Intercept Point	IIP_3	f_{RF1} = 1.9 GHz, f_{RF2} = 1.9006 GHz, P_{RF} = –35 dBm/tone	–16.5	–14.5	–	dBm
Image Rejection Ratio	IMR	f_{RF1} = 1.9 GHz, f_{RF2} = 1.42 GHz, P_{RF} = –35 dBm/tone	30	40	–	dBc
1/2 IF Ratio	1/2 IFR	f_{RF1} = 1.9 GHz, f_{RF2} = 1.78 GHz, P_{RF} = –35 dBm/tone, f_{IF} = 240 MHz	40	50	–	dBc
Local Leak	Lo_{Leak}	Lo_{in} → LNA_{in} Leak	–	–62	–50	dBm

EVALUATION CIRCUIT (V_{CC} = V_{ds} = 3.0 V)

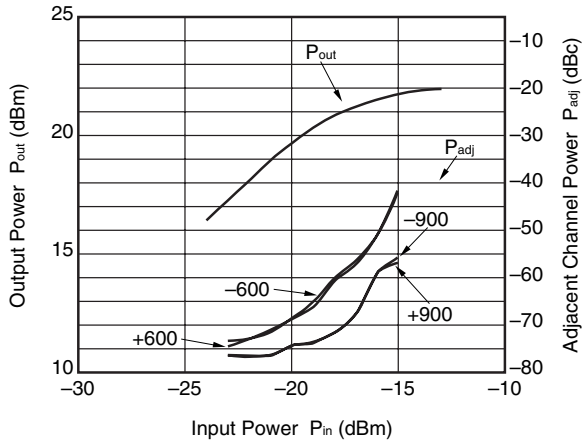


The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

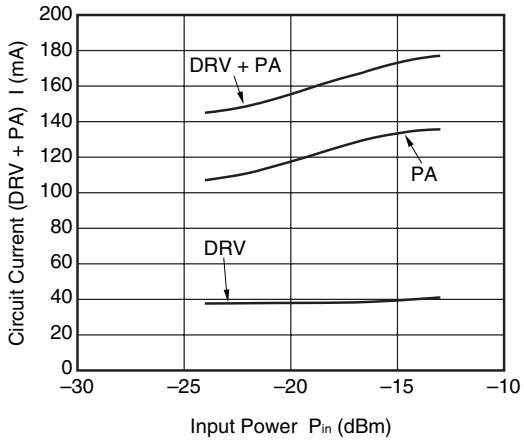
TYPICAL CHARACTERISTICS (T_A = +25°C, unless otherwise specified)

– Tx Block – (V_{CC} = V_{ds} = 3.0 V, f = 1.9 GHz, P_{in} = –19 dBm, P_{out} = +20.5 dBm)

OUTPUT POWER, ADJACENT CHANNEL POWER vs. INPUT POWER



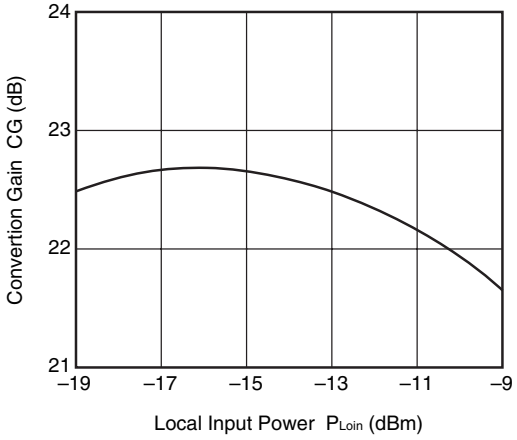
CIRCUIT CURRENT (DRV + PA) vs. INPUT POWER



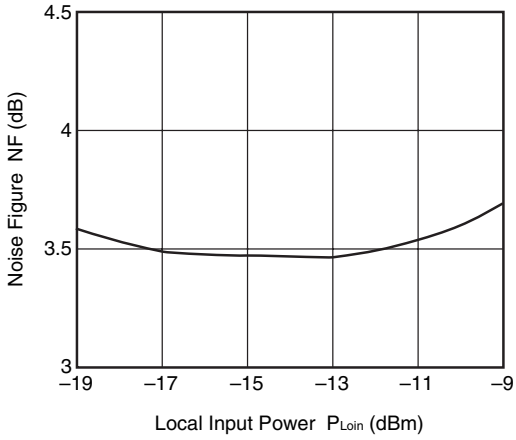
Remark The graphs indicate nominal characteristics.

– Rx Block – (V_{CC} = 3.0 V, f_{RF1} = 1.90 GHz, P_{RF1} = –35 dBm, f_{RF2} = 1.9006 GHz , P_{RF2} = –35 dBm, f_{LO} = 1.66 GHz)

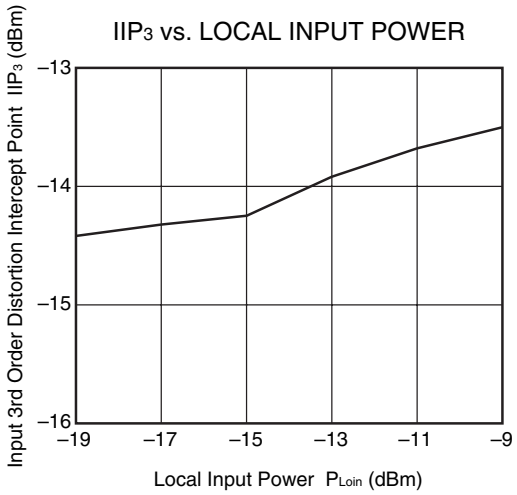
CONVERTION GAIN
vs. LOCAL INPUT POWER



NOISE FIGURE
vs. LOCAL INPUT POWER



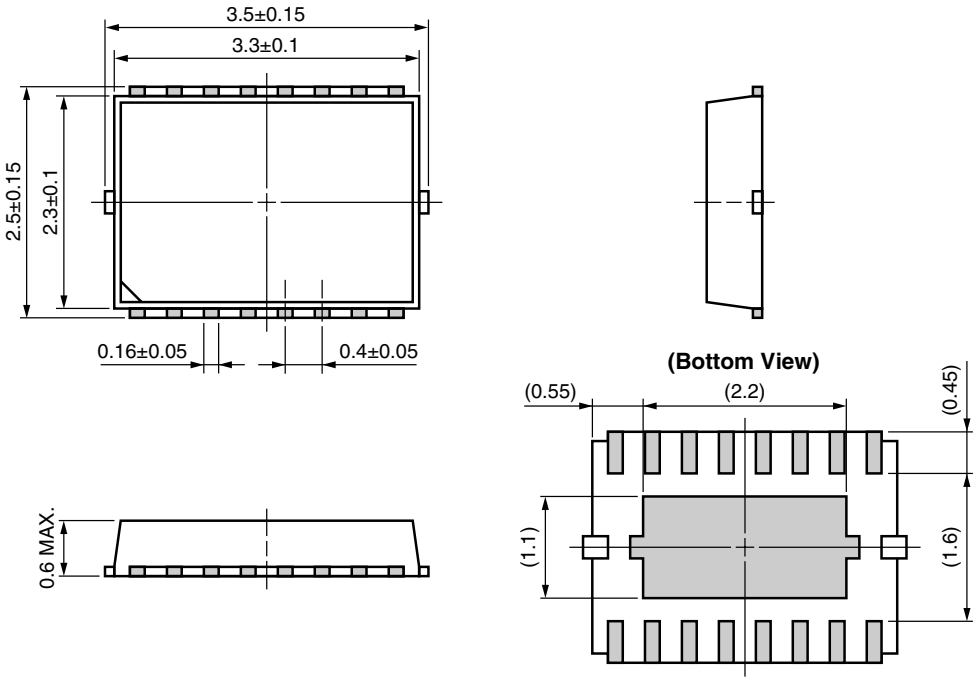
IIP_3 vs. LOCAL INPUT POWER



Remark The graphs indicate nominal characteristics.

PACKAGE DIMENSIONS

16-PIN PLASTIC TSON (UNIT: mm)



Remark ( ) : Reference value

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered and mounted under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your nearby sales office.

Soldering Method	Soldering Conditions		Condition Symbol
Infrared Reflow	Peak temperature (package surface temperature) Time at peak temperature Time at temperature of 220°C or higher Preheating time at 120 to 180°C Maximum number of reflow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 60 seconds or less : 120±30 seconds : 3 times : 0.2%(Wt.) or below	IR260
Wave Soldering	Peak temperature (molten solder temperature) Time at peak temperature Preheating temperature (package surface temperature) Maximum number of flow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 120°C or below : 1 time : 0.2%(Wt.) or below	WS260
Partial Heating	Peak temperature (terminal temperature) Soldering time (per side of device) Maximum chlorine content of rosin flux (% mass)	: 350°C or below : 3 seconds or less : 0.2%(Wt.) or below	HS350

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

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▶For further information, please contact

NEC Compound Semiconductor Devices, Ltd. **http://www.ncsd.necel.com/**
E-mail: salesinfo@ml.ncsd.necel.com (sales and general)
techinfo@ml.ncsd.necel.com (technical)
Sales Division TEL: +81-44-435-1588 FAX: +81-44-435-1579

NEC Compound Semiconductor Devices Hong Kong Limited
E-mail: ncsd-hk@elhk.nec.com.hk (sales, technical and general)

Hong Kong Head Office	TEL: +852-3107-7303	FAX: +852-3107-7309
Taipei Branch Office	TEL: +886-2-8712-0478	FAX: +886-2-2545-3859
Korea Branch Office	TEL: +82-2-558-2120	FAX: +82-2-558-5209

NEC Electronics (Europe) GmbH **http://www.ee.nec.de/**
TEL: +49-211-6503-0 FAX: +49-211-6503-1327

California Eastern Laboratories, Inc. **http://www.cel.com/**
TEL: +1-408-988-3500 FAX: +1-408-988-0279

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