

PRELIMINARY DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μ PC8172TK

SMALL PACKAGE FREQUENCY UP-CONVERTER IC

DESCRIPTION

The μ PC8172TK is a silicon monolithic integrated circuit designed as frequency up-converter for cellular telephone transmitter stage.

This TK suffix IC which is smaller package than conventional TB suffix IC contribute to reduce your system size.

This IC is manufactured using our 30 GHz f_{max} UHS0 (Ultra High Speed Process) silicon bipolar process.

FEATURES

- High output frequency : $f_{Rout} = 0.8$ to 2.5 GHz
- Circuit current : $I_{CC} = 9.0$ mA TYP.
- High-density surface mounting : 6-pin lead-less minimold package
- Supply voltage : $V_{CC} = 2.7$ to 3.3 V

APPLICAIONS

- PCS1900M
- 2.4 GHz band transmitter/receiver system (wireless LAN etc.)
- RF module etc.

ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
μ PC8172TK-E2	6-pin lead-less minimold (1511)	6A	<ul style="list-style-type: none">• Embossed tape 8 mm wide• Pin 1, 6 face the perforation side of the tape• Qty 5 kpcs/reel

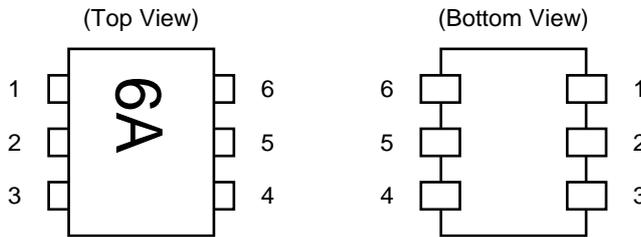
Remark To order evaluation samples, contact your nearby sales office.

Part number for sample order: μ PC8172TK

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

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Not all devices/types available in every country. Please check with local NEC Compound Semiconductor Devices representative for availability and additional information.

PIN CONNECTIONS



Pin No.	Pin Name
1	IFinput
2	GND
3	LOinput
4	PS
5	Vcc
6	RFoutput

Caution Pin arrangement differs from the conventional 6-pin super mini-mold type (μPC8172TB).

PRODUCT LINE-UP

Part No.	Package	I _{CC} (mA)	f _{RFout} (GHz)	CG (dB)		
				@RF0.9 (GHz) ^{Note}	@RF1.9 (GHz)	@RF2.4 (GHz)
μPC8172TK	6-pin lead-less minimold	9.0	0.8 to 2.5	9.5	8.5	8.0
μPC8106TB	6-pin super minimold (1511)	9.0	0.4 to 2.0	9.0	7.0	–
μPC8109TB		5.0	0.4 to 2.0	6.0	4.0	–
μPC8163TB		16.5	0.8 to 2.0	9.0	5.5	–
μPC8172TB		9.0	0.8 to 2.5	9.5	8.5	8.0
μPC8187TB		15.0	0.8 to 2.5	11.0	11.0	10.0

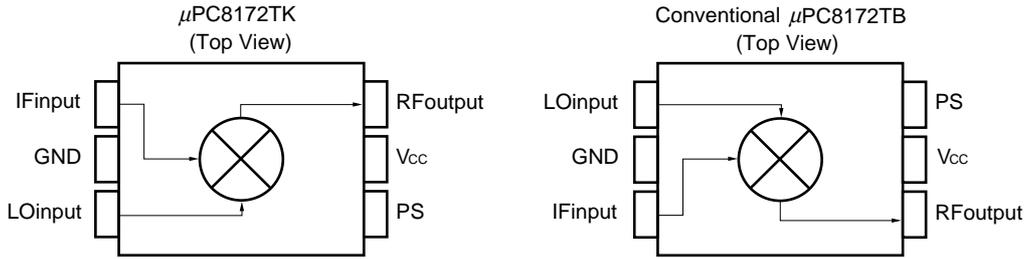
Part No.	P _{O(sat)} (dBm)			OIP ₃ (dBm)		
	@RF0.9 (GHz) ^{Note}	@RF1.9 (GHz)	@RF2.4 (GHz)	@RF0.9 (GHz) ^{Note}	@RF1.9 (GHz)	@RF2.4 (GHz)
μPC8172TK	+0.5	0	–0.5	+7.5	+6.0	+4.0
μPC8106TB	–2.0	–4.0	–	+5.5	+2.0	–
μPC8109TB	–5.5	–7.5	–	+1.5	–1.0	–
μPC8163TB	+0.5	–2.0	–	+9.5	+6.0	–
μPC8172TB	+0.5	0	–0.5	+7.5	+6.0	+4.0
μPC8187TB	+4.0	+2.5	+1.0	+10.0	+10.0	+8.5

Note f_{RFout} = 0.83 GHz @ μPC8163TB, μPC8187TB

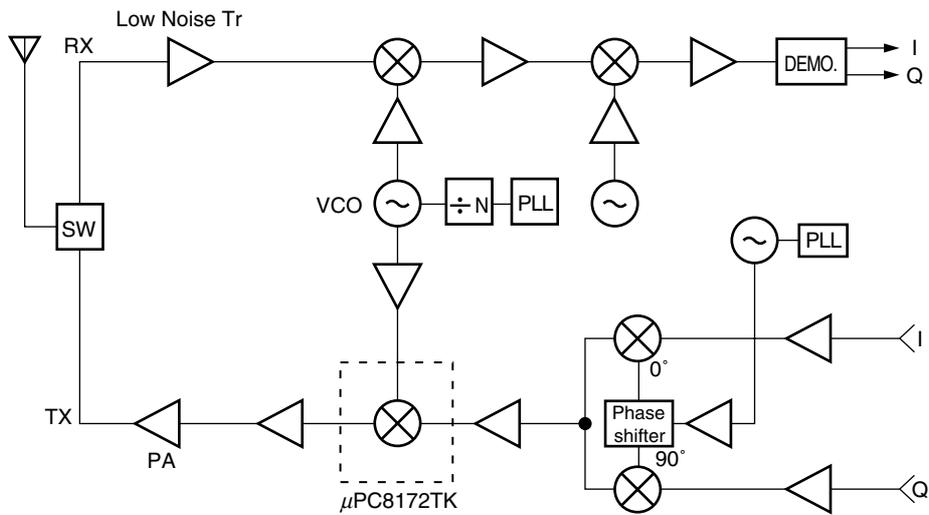
Remarks 1. Typical performance. Please refer to **ELECTRICAL CHARACTERISTICS** in detail.

2. To know the associated product, please refer to each latest data sheet.

BLOCK DIAGRAM



SYSTEM APPLICATION EXAMPLE



Caution To know the associated products, please refer to each latest data sheet.

PIN EXPLANATION

Pin No.	Pin Name	Applied Voltage (V)	Pin Voltage (V) <small>Note</small>	Function and Applications	Internal Equivalent Circuit					
1	IFinput	–	1.3	This pin is IF input to double balanced mixer (DBM). The input is designed as high impedance. The circuit contributes to suppress spurious signal. Also this symmetrical circuit can keep specified performance insensitive to process-condition distribution. For above reason, double balanced mixer is adopted.						
2	GND	GND	–	GND pin. Ground pattern on the board should be formed as wide as possible. Track Length should be kept as short as possible to minimize ground impedance.						
3	LOinput	–	2.4	Local input pin. Recommendable input level is –10 to 0 dBm.						
5	Vcc	2.7 to 3.3	–	Supply voltage pin.						
6	RFoutput	Same bias as Vcc through external inductor	–	This pin is RF output from DBM. This pin is designed as open collector. Due to the high impedance output, this pin should be externally equipped with LC matching circuit to next stage.						
4	PS	Vcc/GND	–	Power save control pin. Bias controls operation as follows.						
				<table border="1"> <thead> <tr> <th>Pin bias</th> <th>Control</th> </tr> </thead> <tbody> <tr> <td>Vcc</td> <td>Operation</td> </tr> <tr> <td>GND</td> <td>Power Save</td> </tr> </tbody> </table>	Pin bias		Control	Vcc	Operation	GND
Pin bias	Control									
Vcc	Operation									
GND	Power Save									

Note Each pin voltage is measured with V_{CC} = V_{PS} = V_{RFout} = 3.0 V

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Test Conditions	Ratings	Unit
Supply Voltage	V _{CC}	T _A = +25°C	3.6	V
PS pin input Voltage	V _{PS}	T _A = +25°C	3.6	V
Power Dissipation of Package	P _D	T _A = +85°C Note	203	mW
Operating Ambient Temperature	T _A		-40 to +85	°C
Storage Temperature	T _{stg}		-55 to +150	°C
Input Power	P _{in}		+10	dBm

Note Mounted on double-side copper-clad 50 × 50 × 1.6 mm epoxy glass PWB

RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Remarks
Supply Voltage	V _{CC}	2.7	3.0	3.3	V	Same voltage should be applied to pin 5 and pin 6.
Operating Ambient Temperature	T _A	-40	+25	+85	°C	
Local Input Level	P _{LOin}	-10	-5	0	dBm	Z _s = 50 Ω (without matching)
RF Output Frequency	f _{RFout}	0.8	-	2.5	GHz	With external matching circuit
IF Input Frequency	f _{IFin}	50	-	600	MHz	

ELECTRICAL CHARACTERISTICS (T_A = +25°C, V_{CC} = V_{RFout} = 3.0 V, f_{IFin} = 240 MHz, P_{LOin} = -5 dBm, and V_{PS} ≥ 2.7 V, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit	
Circuit Current	I _{CC}	No signal	5.5	9.0	13	mA	
Circuit Current In Power Save Mode	I _{CC(PS)}	V _{PS} = 0 V	-	-	2.0	μA	
Conversion Gain	CG1	f _{RFout} = 0.9 GHz ^{Note1}	P _{IFin} = -30 dBm f _{IFin} = 240 MHz	6.5	9.5	12.5	dB
	CG2	f _{RFout} = 1.9 GHz ^{Note2}		5.5	8.5	11.5	dB
	CG3	f _{RFout} = 2.4 GHz ^{Note2}		5.0	8.0	11.0	dB
Saturated RF output Power	P _{O(sat) 1}	f _{RFout} = 0.9 GHz ^{Note1}	P _{IFin} = 0 dBm f _{IFin} = 240 MHz	-2.5	+0.5	-	dBm
	P _{O(sat) 2}	f _{RFout} = 1.9 GHz ^{Note2}		-3.5	0	-	dBm
	P _{O(sat) 3}	f _{RFout} = 2.4 GHz ^{Note2}		-4.0	-0.5	-	dBm

Notes 1. f_{RFout} < f_{LOin} @ f_{RFout} = 0.9 GHz

2. f_{LOin} < f_{RFout} @ f_{RFout} = 1.9 GHz/2.4 GHz

OTHER CHARACTERISTICS, FOR REFERENCE PURPOSES ONLY

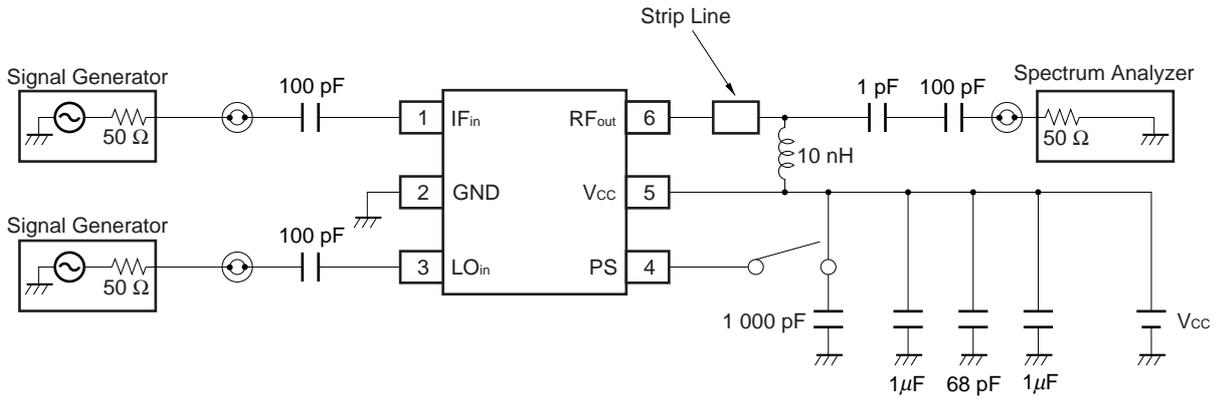
($T_A = +25^\circ\text{C}$, $V_{CC} = V_{RFout} = 3.0\text{ V}$, $P_{LOin} = -5\text{ dBm}$, and $V_{PS} \geq 2.7\text{ V}$, unless otherwise specified)

Parameter		Symbol	Test Conditions	Data	Unit
Out 3rd Order Distortion Intercept Point	OIP ₃₁	$f_{RFout} = 0.9\text{ GHz}$ ^{Note1}	$f_{Fin1} = 240\text{ MHz}$ $f_{Fin2} = 241\text{ MHz}$	+7.5	dBm
	OIP ₃₂	$f_{RFout} = 1.9\text{ GHz}$ ^{Note2}		+6.0	dBm
	OIP ₃₃	$f_{RFout} = 2.4\text{ GHz}$ ^{Note2}		+4.0	dBm
Input 3rd Order Distortion Intercept Point	IIP ₃₁	$f_{RFout} = 0.9\text{ GHz}$ ^{Note1}	$f_{Fin1} = 240\text{ MHz}$ $f_{Fin2} = 241\text{ MHz}$	-2.0	dBm
	IIP ₃₂	$f_{RFout} = 1.9\text{ GHz}$ ^{Note2}		-2.5	dBm
	IIP ₃₃	$f_{RFout} = 2.4\text{ GHz}$ ^{Note2}		-4.0	dBm
SSB Noise Figure	SSB-NF1	$f_{RFout} = 0.9\text{ GHz}$, $f_{Fin} = 240\text{ MHz}$		9.5	dB
	SSB-NF2	$f_{RFout} = 1.9\text{ GHz}$, $f_{Fin} = 240\text{ MHz}$		10.4	dB
	SSB-NF3	$f_{RFout} = 2.4\text{ GHz}$, $f_{Fin} = 240\text{ MHz}$		10.6	dB
Power Save Response Time	Rise time	$T_{PS (rise)}$	$V_{PS} : \text{GND} \rightarrow V_{CC}$	1.0	μs
	Fall time	$T_{PS (fall)}$	$V_{PS} : V_{CC} \rightarrow \text{GND}$	1.5	μs

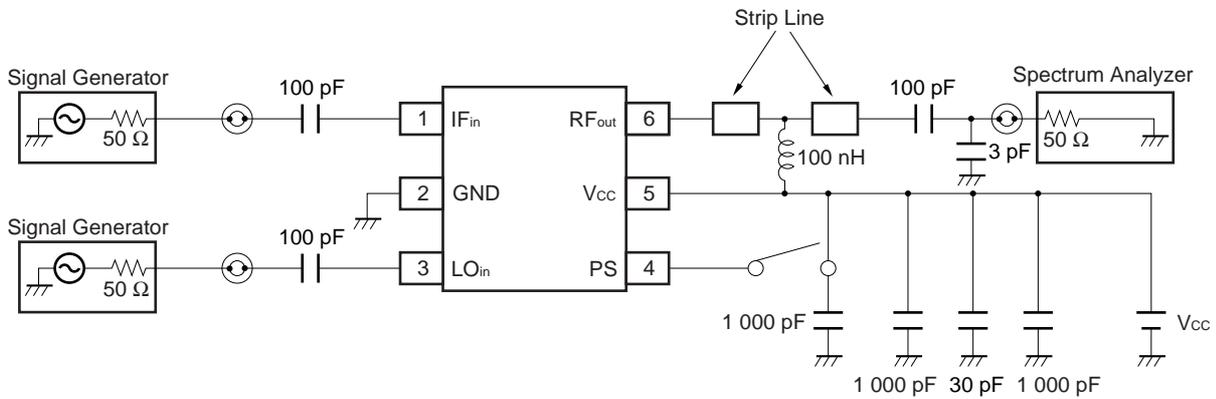
Notes1. $f_{RFout} < f_{LOin}$ @ $f_{RFout} = 0.9\text{ GHz}$

2. $f_{LOin} < f_{RFout}$ @ $f_{RFout} = 1.9\text{ GHz}/2.4\text{ GHz}$

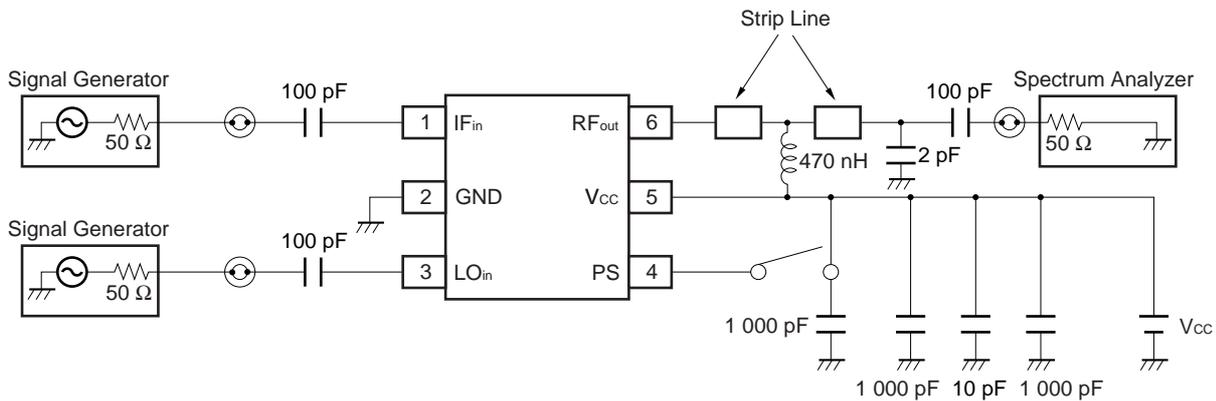
TEST CIRCUIT 1 ($f_{RFout} = 0.9\text{ GHz}$)



TEST CIRCUIT 2 ($f_{RFout} = 1.9\text{ GHz}$)

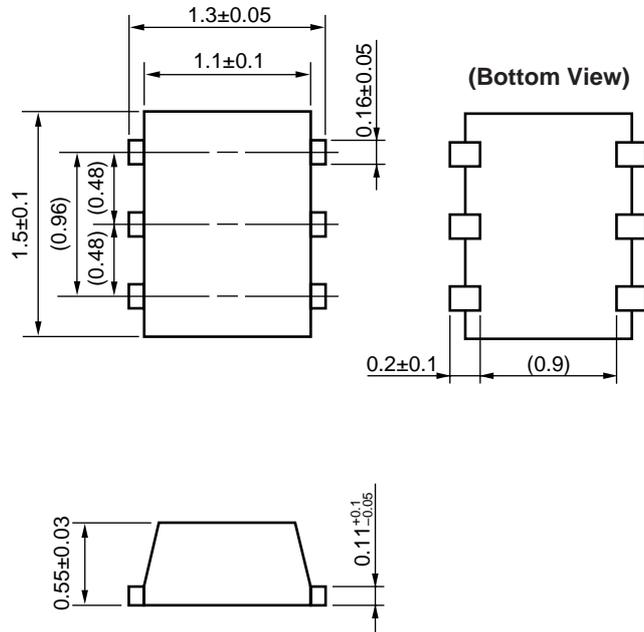


TEST CIRCUIT 3 ($f_{RFout} = 2.4\text{ GHz}$)



PACKAGE DIMENSIONS

6-PIN LEAD-LESS MINIMOLD (1511) (UNIT: mm)



Remark (): Reference value

NOTES ON CORRECT USE

- (1) Observe precautions for handling because of electro-static sensitive devices.
- (2) Form a ground pattern as widely as possible to minimize ground impedance (to prevent undesired oscillation).
- (3) Connect a bypass capacitor (example : 1 000 pF) to the Vcc pin.
- (4) Connect a matching circuit to the RF output pin.
- (5) The DC cut capacitor must be attached to input and output pin.

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) : 260°C or below Time at peak temperature : 10 seconds or less Time at temperature of 220°C or higher : 60 seconds or less Preheating time at 120 to 180°C : 120±30 seconds Maximum number of reflow processes : 3 times Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	IR260
VPS	Peak temperature (package surface temperature) : 215°C or below Time at temperature of 200°C or higher : 25 to 40 seconds Preheating time at 120 to 150°C : 30 to 60 seconds Maximum number of reflow processes : 3 times Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	VP215
Wave Soldering	Peak temperature (molten solder temperature) : 260°C or below Time at peak temperature : 10 seconds or less Preheating temperature (package surface temperature) : 120°C or below Maximum number of flow processes : 1 time Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	WS260
Partial Heating	Peak temperature (pin temperature) : 350°C or below Soldering time (per side of device) : 3 seconds or less Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	HS350

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

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