

NEC

PRELIMINARY DATA SHEET

BIPOLAR ANALOG INTEGRATED CIRCUITS μ PC2757TB, μ PC2758TB

SILICON MMIC 1st FREQUENCY DOWNCONVERTER FOR CELLULAR/CORDLESS TELEPHONE

DESCRIPTION

The μ PC2757TB and μ PC2758TB are silicon monolithic integrated circuit designed as 1st frequency downconverter for cellular/cordless telephone receiver stage. The ICs consist of mixer and local amplifier. The μ PC2757TB features low current consumption and the μ PC2758TB features improved intermodulation. From these two version, you can chose either IC corresponding to your system design. These TB suffix ICs which are smaller package than conventional T suffix ICs contribute to reduce your system size.

The μ PC2757TB and μ PC2758TB are manufactured using NEC's 20 GHz fr NESAT™||| silicon bipolar process. This process uses silicon nitride passivation film and gold electrodes. These materials can protect chip surface from external pollution and prevent corrosion/migration. Thus, this IC has excellent performance, uniformity and reliability

FEATURES

- Wideband operation : $f_{RFIn} = 0.1 \text{ GHz to } 2.0 \text{ GHz}$, $f_{IFIn} = 20 \text{ MHz to } 300 \text{ MHz}$
- High-density surface mounting : 6-pin super mini mold package
- Low current consumption : $I_{CC} = 5.6 \text{ mA}_{TYP.} @ \mu\text{PC2757TB}$
 $I_{CC} = 11 \text{ mA}_{TYP.} @ \mu\text{PC2758TB}$
- Supply voltage : $V_{CC} = 2.7 \text{ to } 3.3 \text{ V}$
- Minimized carrier leakage : Due to double balanced mixer
- Built-in power save function

APPLICATION

- Cellular/cordless telephone up to 2.0 GHz MAX (eg GSM, PDC800M, PDC1.5G and so on): μ PC2758TB
- Cellular/cordless telephone up to 2.0 GHz MAX (eg CT1, CT2 and so on): μ PC2757TB

ORDERING INFORMATION

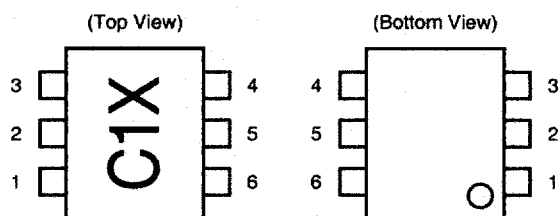
Part Number	Markings	Product Type	PACKAGE	Supplying Form
μ PC2757TB-E3	C1X	Low current consumption	6-pin super minimold	Embossed tape 8 mm wide. Pin 1, 2, 3 face to tape perforation side. QTY 3kp/Reel.
μ PC2758TB-E3	C1Y	High OIP3		

Remark To order evaluation samples, please contact your local NEC sales office.
(Part number for sample order: μ PC2757TB, μ PC2758TB)

Caution Electro-static sensitive devices

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

PIN CONNECTIONS



Example marking is for μ PC2757TB

Pin NO.	Pin name
1	RF in
2	GND
3	LOin
4	PS
5	Vcc
6	IFout

PRODUCT LINE-UP ($T_A = +25^\circ\text{C}$, $V_{CC} = 3.0\text{ V}$, $Z_L = Z_S = 50\ \Omega$)

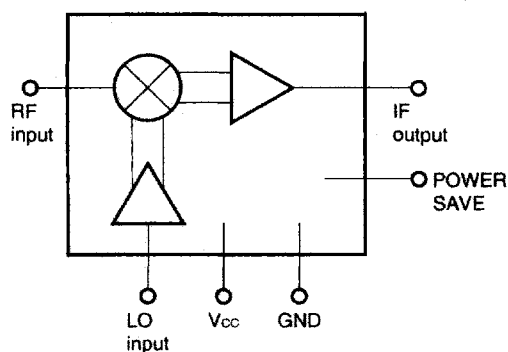
Items Part No.	No RF I_{CC} (mA)	900 MHz SSB · NF (dB)	1.5 GHz SSB · NF (dB)	1.9 GHz SSB · NF (dB)	900 MHz CG (dB)	1.5 GHz CG (dB)	1.9 GHz CG (dB)	900 MHz IIP ₃ (dBm)	1.5 GHz IIP ₃ (dBm)	1.9 GHz IIP ₃ (dBm)
μ PC2757T	5.6	10	10	13	15	15	13	-14	-14	-12
μ PC2757TB										
μ PC2758T	11	9	10	13	19	18	17	-13	-12	-11
μ PC2758TB										
μ PC8112T	8.5	9	11	11	15	13	13	-10	-9	-7
μ PC8112TB										

<div>Items</div> <div>Part No.</div>	900 MHz P_{Osat} (dBm)	1.5 GHz P_{Osat} (dBm)	1.9 GHz P_{Osat} (dBm)	900 MHz RF_{lo} (dB)	1.5 GHz RF_{lo} (dB)	1.9 GHz RF_{lo} (dB)	IF Output Configuration	Packages
$\mu\text{PC2757T}$	-3	-	-8				Emitter follower	6-pin minimold
$\mu\text{PC2757TB}$								6-pin super minimold
$\mu\text{PC2758T}$	+1	-	-4					6-pin minimold
$\mu\text{PC2758TB}$								6-pin super minimold
$\mu\text{PC8112T}$	-2.5	-3	-3	-80	-57	-55	Open collector	6-pin minimold
$\mu\text{PC8112TB}$								6-pin super minimold

Remark Typical performance. Please refer to ELECTRICAL CHARACTERISTICS in detail.
To know the associated product, please refer to each latest data sheet.

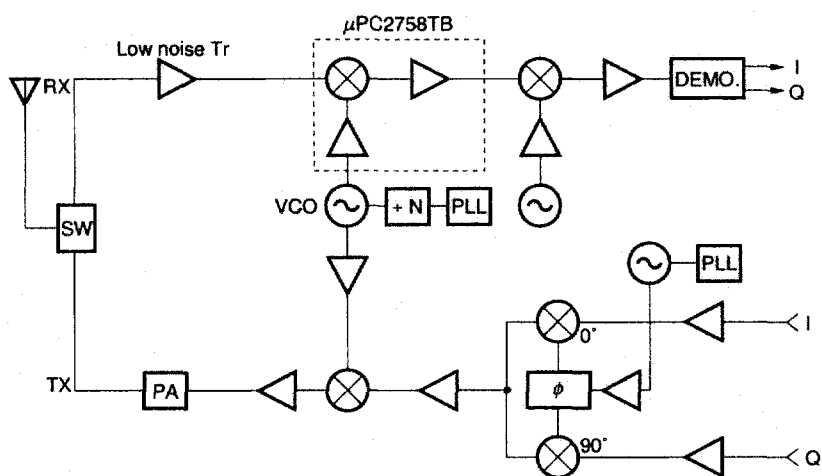
Notice μ PC2757 and μ PC2758's IIP₃ are calculated with $\Delta\text{IM}_3 = 3$ which is the same IM₃ inclination as μ PC8112.
On the other hand, OIP₃ of Standard characteristics in page 4 is cross point IP.

INTERNAL BLOCK DIAGRAM (μ PC2757TB, μ PC2758TB in common)



SYSTEM APPLICATION EXAMPLE

DIGITAL CELLULAR TELEPHONE



These examples show only IC's location on the system use schematically, do not present or recommend the actual application circuit in detail.

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

PIN EXPLANATION (Both μ PC2757TB, 2758TB)

Pin No.	Pin Name	Applied Voltage V	Pin Voltage V_{Note}	Function and Application	Internal Equivalent Circuit								
1	RF in	—	1.2	This pin is RF input for mixer designed as double balance type. This circuit contributes to suppress spurious signal with minimum LO and bias power consumption. Also this symmetrical circuit can keep specified performance insensitive to process-condition distribution.									
2	GND	GND	—	This pin is ground of IC. Must be connected to the system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. (Track length should be kept as short as possible.)	—								
3	LO in	—	1.3	This pin is LO input for local buffer designed as differential amplifier. Recommendable input level is -15 to -0 dBm. Also this symmetrical circuit can keep specified performance insensitive to process-condition distribution.									
4	PS	Vcc/GND	—	<p>This pin is for power-save function. This pin can control ON/OFF operation with bias as follows;</p> <table border="1"><thead><tr><th></th><th>Bias: V</th><th>Operation</th></tr></thead><tbody><tr><td rowspan="2">V_{PS}</td><td>≥ 2.5</td><td>ON</td></tr><tr><td>0 - 0.5</td><td>OFF</td></tr></tbody></table> <p>Rise time/fall time using this pin are approximately 10 μs.</p>		Bias: V	Operation	V_{PS}	≥ 2.5	ON	0 - 0.5	OFF	
	Bias: V	Operation											
V_{PS}	≥ 2.5	ON											
	0 - 0.5	OFF											
5	Vcc	2.7 - 3.3	—	Supply voltage 3.0 \pm 0.3 V for operation. Must be connected bypass capacitor. (e.g. 1 000 pF) to minimize ground impedance.	—								
6	IF out	—	1.7	This pin is output from IF buffer amplifier designed as single-ended push-pull type. This pin is assigned for emitter follower output with low-impedance. In the case of connecting to high-impedance stage, please attach external matching circuit.									

Note Each pin voltage is measured with Vcc = 3.0 V

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V _{CC}	T _A = +25 °C	5.5	V
PS Pin Voltage	V _{PS}	T _A = +25 °C	5.5	V
Power Dissipation of Package Allowance	P _D	Mounted on 50 × 50 × 1.6 mm double sided copper clad epoxy glass board at T _A = +85 °C	200	mW
Operating Ambient Temperature	T _A		−40 to +85	°C
Storage Temperature	T _{stg}		−55 to +150	°C

RECOMMENDED OPERATING RANGE

Parameters	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V _{CC}	2.7	3.0	3.3	V
Operating Ambient Temperature	T _A	−40	+25	+85	°C
LO Input Level	P _{LOin}	−15	−10	0	dBm

ELECTRICAL CHARACTERISTICS (T_A = +25 °C, V_{CC} = V_{PS} = 3.0 V, P_{LOin} = −10 dBm, Z_L = Z_s = 50 Ω)

Parameters	Symbol	Conditions	μ PC2757TB			μ PC2758TB			Unit
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Circuit Current	I _{CC}	No input signal	3.7	5.6	7.7	6.6	11	14.8	dB
RF Frequency Response	f _{RF}	CG ≥ (CG1 −3 dB) f _{IFout} = 130 MHz constant	0.1		2.0	0.1		2.0	GHz
IF Frequency Response	f _{IF}	CG ≥ (CG1 −3 dB) f _{RFIn} = 0.8 GHz constant	20		300	20		300	MHz
Conversion Gain 1	CG1	f _{RFIn} = 0.8 GHz, f _{IFout} = 130 MHz P _{RFIn} = −40 dBm, Upper local	12	15	18	16	19	22	dB
Conversion Gain 2	CG2	f _{RFIn} = 2.0 GHz, f _{IFout} = 250 MHz P _{RFIn} = −40 dBm, Lower local	10	13	16	14	17	20	dB
Single Sideband Noise Figure 1	SSB NF1	f _{RFIn} = 0.8 GHz, f _{IFout} = 130 MHz, Upper local		10	13		9	12	dB
Single Sideband Noise Figure 2	SSB NF2	f _{RFIn} = 2.0 GHz, f _{IFout} = 250 MHz, Lower local		13	16		13	15	dB
Maximum IF Output Level 1	P _{O(SAT)} 1	f _{RFIn} = 0.8 GHz, f _{IFout} = 130 MHz P _{RFIn} = −10 dBm, Upper local	−11	−3		−7	+1		dBm
Maximum IF Output Level 2	P _{O(SAT)} 2	f _{RFIn} = 2.0 GHz, f _{IFout} = 250 MHz P _{RFIn} = −10 dBm, Lower local	−11	−8		−7	−4		dBm

STANDARD CHARACTERISTICS FOR REFERENCE

(Unless otherwise specified: $T_A = +25\text{ }^{\circ}\text{C}$, $V_{CC} = V_{PS} = 3.0\text{ V}$, $P_{LOin} = -10\text{ dBm}$, $Z_L = Z_S = 50\text{ }\Omega$)

Parameters	Symbol	Conditions	Reference value		Unit
			μ PC2757TB	μ PC2758TB	
Output 3rd intercept point	OIP_3	$f_{RFin} = 0.8\text{ to }2.0\text{ GHz}$, $f_{Fout} = 0.1\text{ GHz}$, Cross point IP	+5	+11	dBm
LO leakage at RF pin	LO_{rf}	$f_{LOin} = 0.8\text{ to }2.0\text{ GHz}$	-35	-30	dBm
LO leakage at IF pin	LO_{if}	$f_{LOin} = 0.8\text{ to }2.0\text{ GHz}$	-23	-15	dBm
Power-saving current	I_{PS}	$V_{PS} = 0.5\text{ V}$	0.1	0.1	μA

TEST CIRCUIT

μ PC2757TB, μ PC2758TB

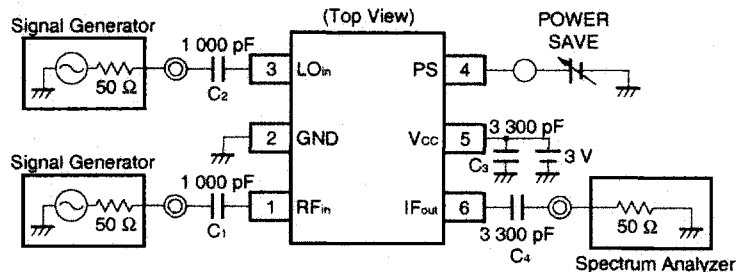
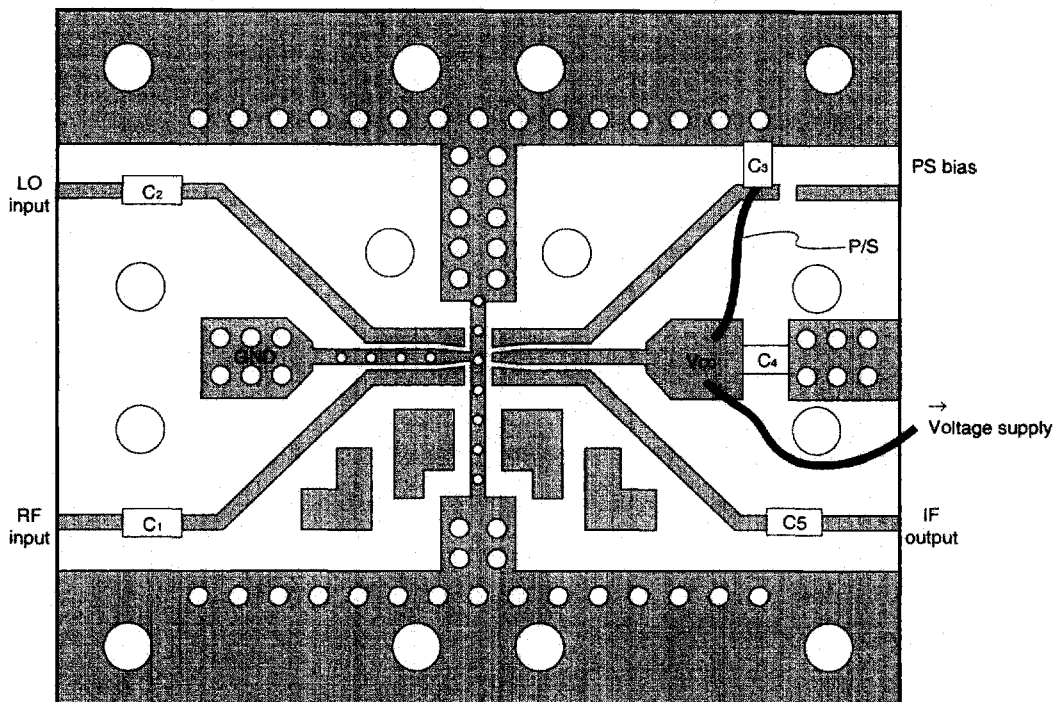


ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



Component List

No.	Value
C1 to 2	1 000 pF
C3 to 5	3 300 pF

Notes 1. 35 × 42 × 0.4 mm double sided copper clad polyimide board.

2. Back side: GND pattern
3. Solder plated on pattern
4. °O: Through holes

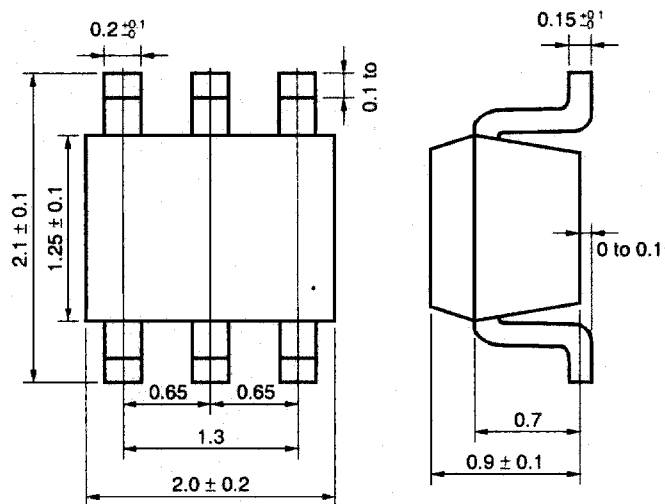
APPLICATION

This IC is guaranteed on the test circuit constructed with 50 Ω equipment and transmission line.

This IC, however, does not have 50 Ω input/output impedance, but electrical characteristics such as conversion gain and intermodulation distortion are described herein on these conditions without impedance matching. So, you should understand that conversion gain and intermodulation distortion at input level will vary when you improve VS of RF input with external circuit (50 Ω termination or impedance matching.)

PACKAGE DIMENSIONS

6 pin super minimold (Unit: mm)



NOTE ON CORRECT USE

- (1) Observe precautions for handling because of electrostatic sensitive devices.
- (2) Form a ground pattern as wide as possible to keep the minimum ground impedance (to prevent undesired oscillation).
- (3) Keep the track length of the ground pins as short as possible.
- (4) Connect a bypass capacitor (e.g. 1 000 pF) to the Vcc pin.

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.

μPC2756TB

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

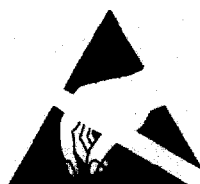
Note After opening the dry pack, keep it in a place below 25 °C and 65 % RH for the allowable storage period.

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]

**ATTENTION**

OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES

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.