DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUITS

μPC2757T, μPC2758T

SILICON MMIC 1st FREQUENCY DOWN-CONVERTER FOR MOBILE COMMUNICATIONS

DESCRIPTION

The μPC2757T and μPC2758T are silicon monolithic integrated circuits designed as 1st down-converters for L band mobile communications. The ICs consist of mixer and local amplifier. The μPC2757T features low current consumption and the μPC2758T features improved intermodulation. From these two version, you can chose either IC corresponding to your system design.

The μPC2757T and μPC2758T are manufactured using NEC's 20 GHz f_T NESAT™ III 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 and migration. Thus, these products have excellent performance, uniformity and reliability.

FEATURES

- Wide band operation : f_{RFin} = 0.1 GHz to 2.0 GHz
- High-density surface mounting : 6-pin minimold
- Low voltage operation : Supply voltage 3.0 V TYP.
- Low power consumption 15 mW : μPC2757T
- Power-save function : μPC2757T, μPC2758T

ORDERING INFORMATION

Part Number	Markings	Product Type	Package	Supplying Form
μPC2757T-E3	C1X	Low power consumption	6-pin minimold	Embossed tape 8-mm wide. Pin 1, 2, 3 face to perforation side of the tape. QTY 3 kp/Reel.
μPC2758T-E3	C1Y	High output IP_3		

Note To order evaluation samples, please contact local NEC sales office. (Part number for sample order: μPC2757T, μPC2758T)

Caution Electro-static sensitive devices

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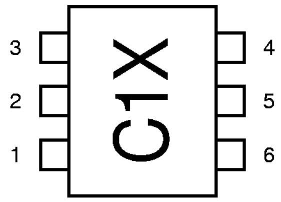
Printed in Japan

The mark ★ shows major revision points.

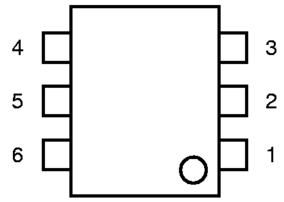
PIN CONNECTIONS

(Top View)



Example marking is for μPC2757T

(Bottom View)



Pin No.	Pin Name
1	RF input
2	GND
3	LO input
4	PS
5	V_{CC}
6	IF output

★ PRODUCT LINE-UP (T_A = +25 °C, V_{CC} = 3.0 V, Z_L = Z_S = 50 Ω)

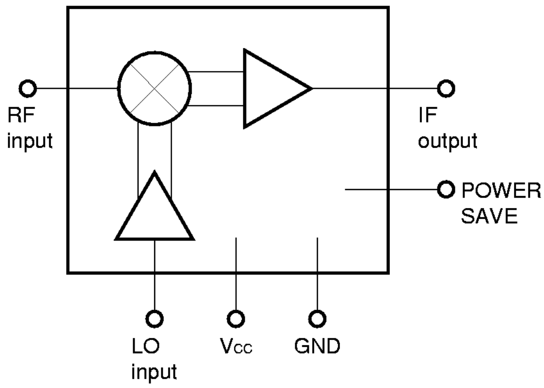
Part No. \ Items	No RF I_{CC} (mA)	900 MHz SSB NF (dB)	1.5 GHz SSB NF (dB)	1.9 GHz SSB NF (dB)	900 MHz CG (dB)	1.5 GHz CG (dB)	1.9 GHz CG (dB)	900 MHz IIP_3 (dBm)	1.5 GHz IIP_3 (dBm)	1.9 GHz IIP_3 (dBm)
μPC2757T μPC2757TB	5.6	10	10	13	15	15	13	–14	–14	–12
μPC2758T μPC2758TB	11	9	10	13	19	18	17	–13	–12	–11
μPC8112T μPC8112TB	8.5	9	11	11	15	13	13	–10	–9	–7

Part No. \ Items	900 MHz $P_{O(sat)}$ (dBm)	1.5 GHz $P_{O(sat)}$ (dBm)	1.9 GHz $P_{O(sat)}$ (dBm)	900 MHz RF_{lo} (dB)	1.5 GHz RF_{lo} (dB)	1.9 GHz RF_{lo} (dB)	IF Output Configuration	Packages
μPC2757T	–3	–	–8	–	–	–	Emitter follower	6-pin minimold
μPC2757TB								6-pin super minimold
μPC2758T	+1	–	–4	–	–	–		6-pin minimold
μPC2758TB								6-pin super minimold
μPC8112T	–2.5	–3	–3	–80	–57	–55	Open collector	6-pin minimold
μPC8112TB								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.

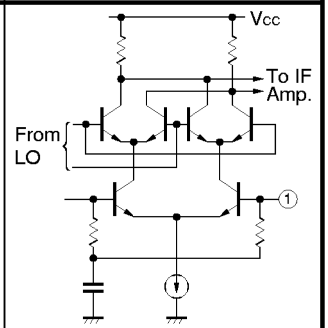
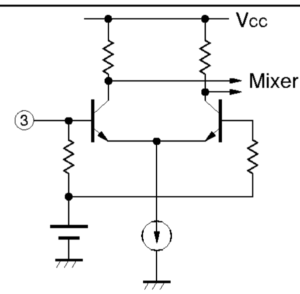
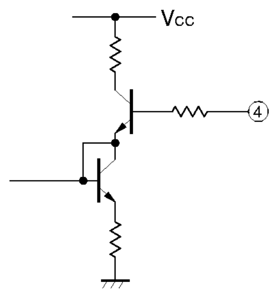
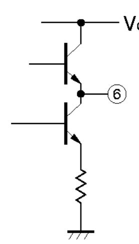
Notice μPC2757 and μPC2758's IIP_3 are calculated with ΔIM_3 = 3 which is the same IM_3 inclination as μPC8112. On the other hand, OIP_3 of Standard characteristics in page 4 is cross point IP.

INTERNAL BLOCK DIAGRAM (μPC2757T, μPC2758T IN COMMON)



To know the detail in associated product, please refer to its latest data sheet.

PIN EXPLANATION (BOTH μPC2757T, 2758T)

<table>
<tr><th>Pin No.</th><th>Pin Name</th><th>Applied Voltage (V)</th><th>Pin Voltage (V)Note</th><th>Function and Application</th><th>Equivalent Circuit</th></tr>
<tr><td>1</td><td>RF input</td><td>–</td><td>1.2</td><td>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.</td><td>
</td></tr>
<tr><td>2</td><td>GND</td><td>GND</td><td>–</td><td>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.)</td><td>–</td></tr>
<tr><td>3</td><td>LO input</td><td>–</td><td>1.3</td><td>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.</td><td>
</td></tr>
<tr><td>4</td><td>PS</td><td>V_{CC}/GND</td><td>–</td><td>This pin is for power-save function. This pin can control ON/OFF operation with bias as follows;<table><tr><th></th><th>Bias: V</th><th>Operation</th></tr><tr><td>V_{PS}</td><td>≥ 2.5</td><td>ON</td></tr><tr><td></td><td>0 to 0.5</td><td>OFF</td></tr></table>Rise time/fall time using this pin are approximately 10 μs.</td><td>
</td></tr>
<tr><td>5</td><td>V_{CC}</td><td>2.7 to 3.3</td><td>–</td><td>Supply voltage 3.0 ±0.3 V for operation. Must be connected bypass capacitor. (example: 1 000 pF) to minimize ground impedance.</td><td>–</td></tr>
<tr><td>6</td><td>IF output</td><td>–</td><td>1.7</td><td>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.</td><td>
</td></tr>
</table>

Note Each pin voltage is measured with V_{CC} = 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	280	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	μPC2757T			μPC2758T			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_{RFin}	CG ≥ (CG1 –3 dB) f_{IFout} = 130 MHz constant	0.1		2.0	0.1		2.0	GHz
IF Frequency Response	f_{IFout}	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°C, V_{CC} = V_{PS} = 3.0 V, P_{LOin} = –10 dBm, Z_L = Z_S = 50 Ω)

Parameters	Symbol	Conditions	Reference Value		Unit
			μPC2757T	μPC2758T	
Output 3rd intercept point	OIP_3	f_{RFin} = 0.8 to 2.0 GHz, f_{IFout} = 0.1 GHz, Cross point IP	+5	+11	dBm
LO leakage at RF pin	LO_{rf}	f_{LOin} = 0.8 to 2.0 GHz	–35	–30	dBm
LO leakage at IF pin	LO_{if}	f_{LOin} = 0.8 to 2.0 GHz	–23	–15	dBm
Power-saving current	I_{PS}	V_{PS} = 0.5 V	0.1	0.1	μA

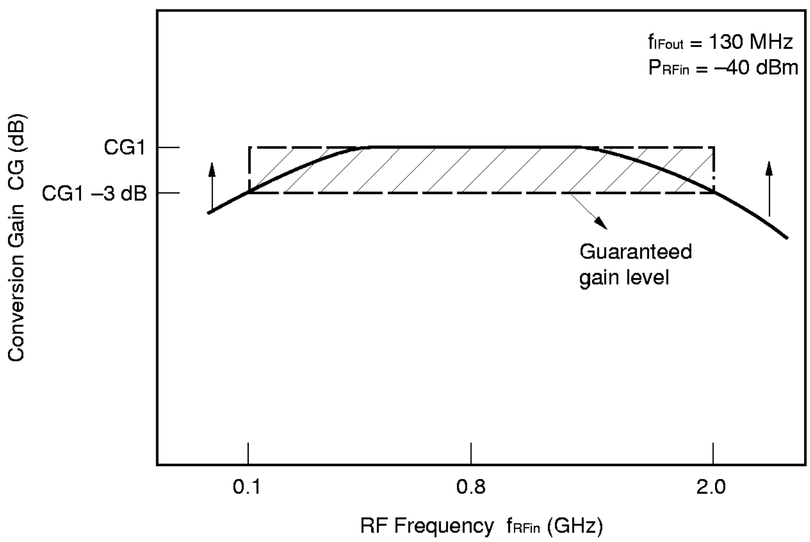
Remark IIP_3 is determined by comparing two method; theoretical calculation and cross point of IM_3 curve.
$IIP_3 = (\Delta IM_3 \times P_{in} + CG - IM_3) \div (\Delta IM_3 - 1)$ (dBm) [ΔIM_3: IM_3 curve inclination in linear range]

SCHEMATIC SUPPLEMENT FOR RF, IF SPECIFICATIONS

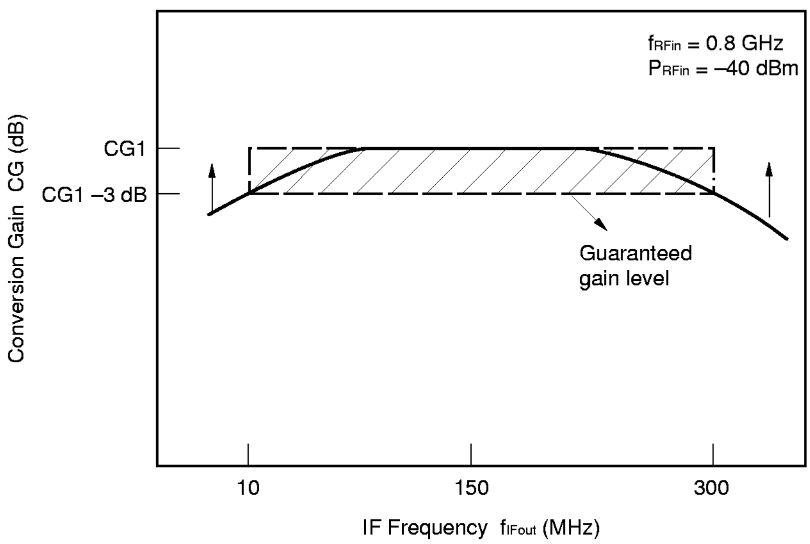
Note

	μPC2757T			μPC2758T			Unit
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
CG1	12	15	18	16	19	22	dB
CG1 – 3 dB	9	12	15	13	16	19	dB

RF FREQUENCY RESPONSE

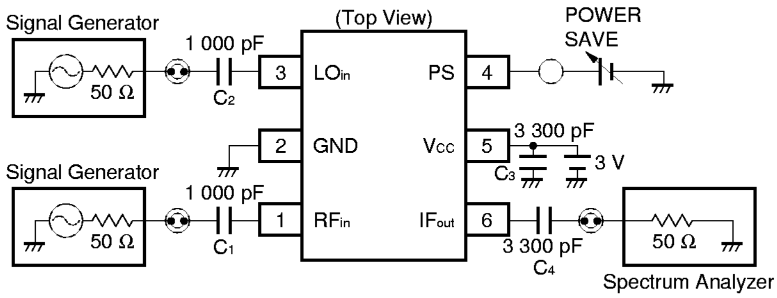


IF FREQUENCY RESPONSE

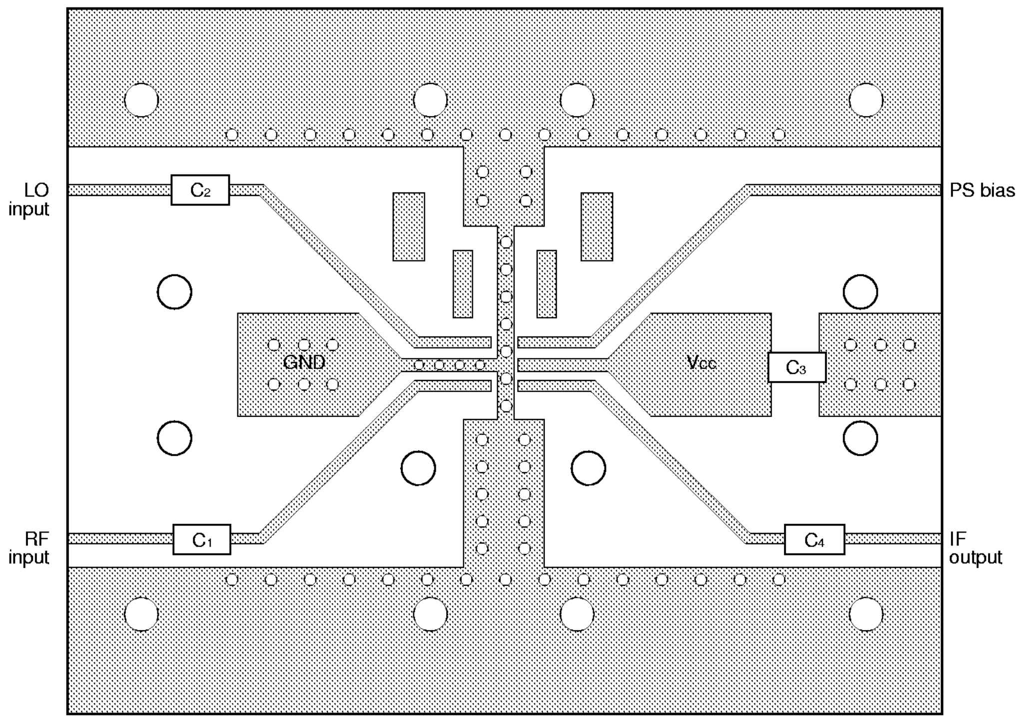


TEST CIRCUIT

μPC2757T, μPC2758T



★ ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



COMPONENT LIST

No.	Value
C_1, C_2	1 000 pF
C_3 to C_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.

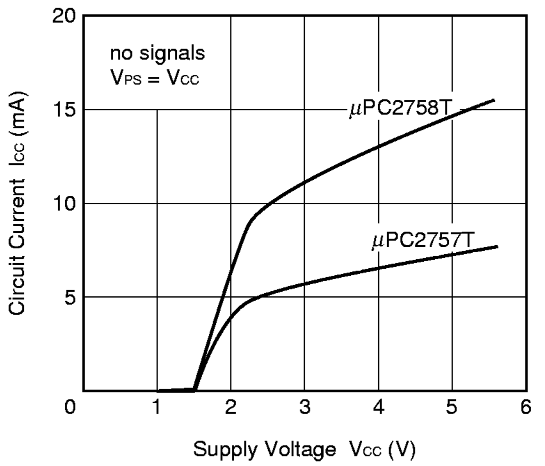
This IC, however, does not have 50 Ω input/output impedance, but electrical characteristics such as conversion gain and intermodulation distortion are described herein on these conditions without impedance matching. So, you should understand that conversion gain and intermodulation distortion at input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

External circuits of the IC can be referred to following application notes.

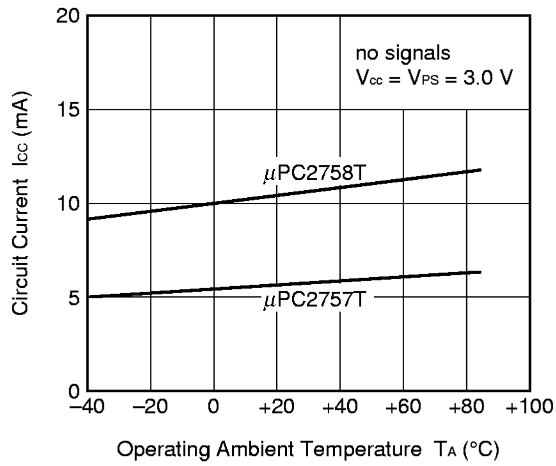
- To RF and IF port: μPC2757, μPC2758, μPC8112 application note (Document No. P11997E)

TYPICAL CHARACTERISTICS (T_A = +25 °C)

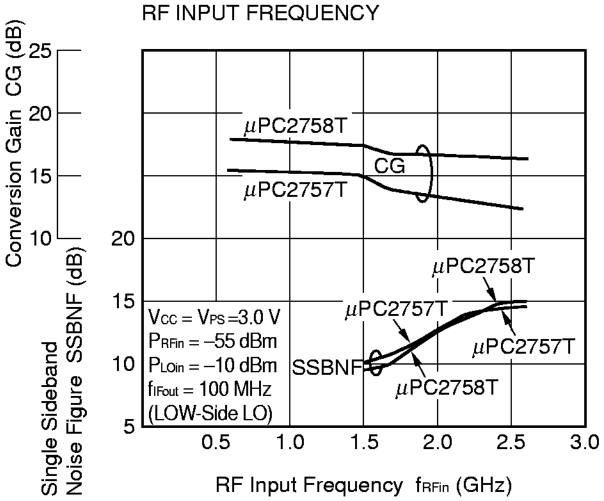
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



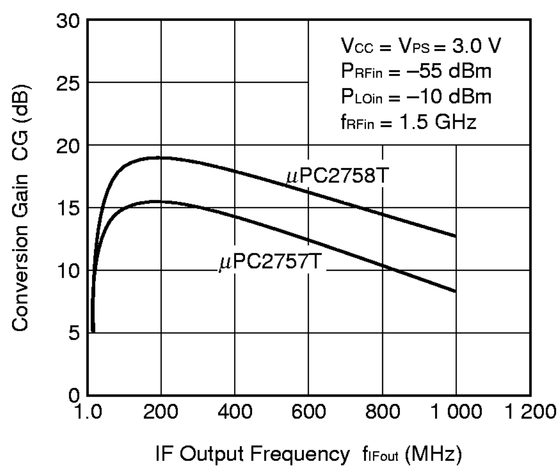
CIRCUIT CURRENT vs. TEMPERATURE



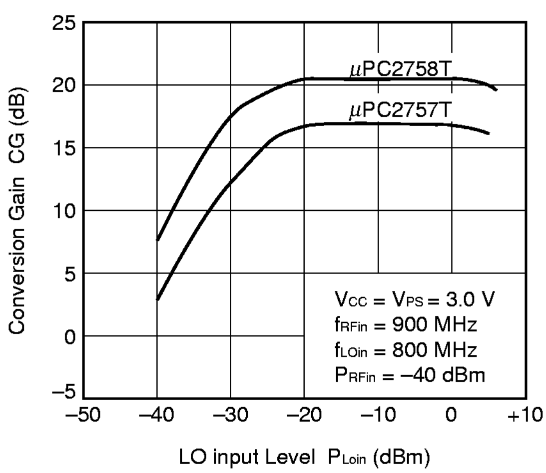
CONVERSION GAIN AND NOISE FIGURE vs. RF INPUT FREQUENCY



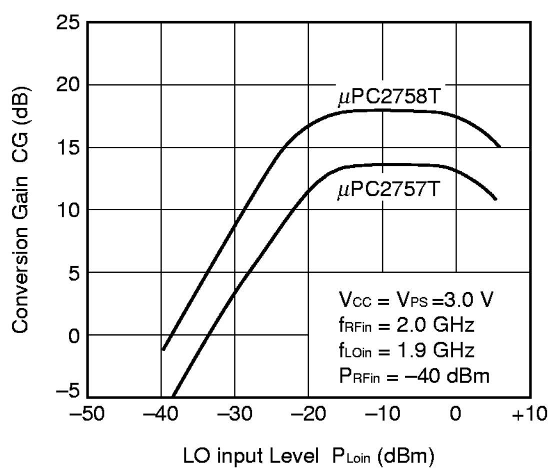
CONVERSION GAIN vs. IF OUTPUT FREQUENCY



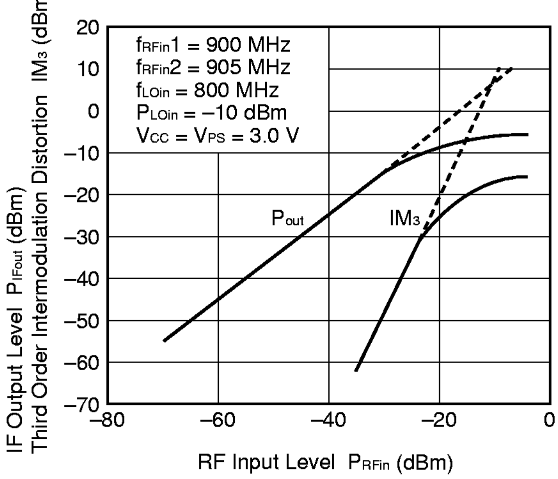
CONVERSION GAIN vs. LOCAL INPUT LEVEL



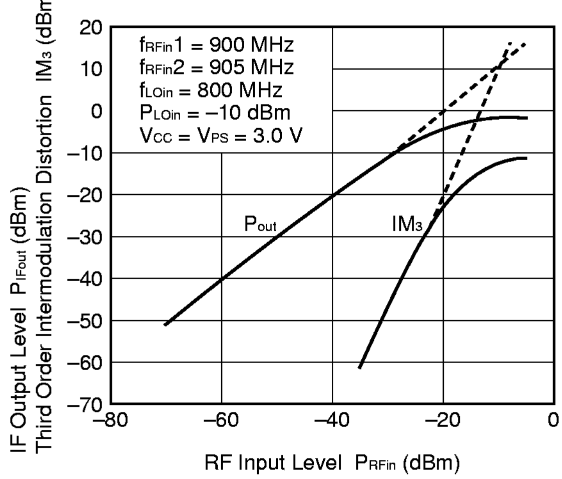
CONVERSION GAIN vs. LOCAL INPUT LEVEL



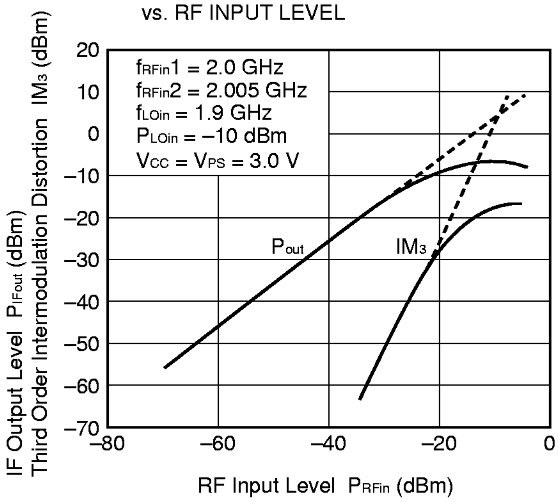
μPC2757T IM_3 AND IF OUTPUT LEVEL vs. RF INPUT LEVEL



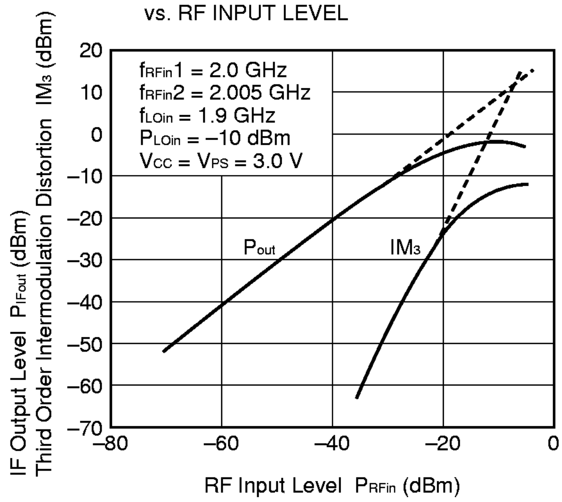
μPC2758T IM_3 AND IF OUTPUT LEVEL vs. RF INPUT LEVEL



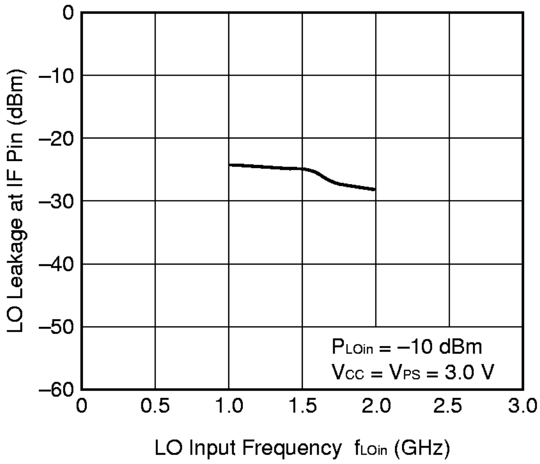
μPC2757T IM_3 AND IF OUTPUT LEVEL vs. RF INPUT LEVEL



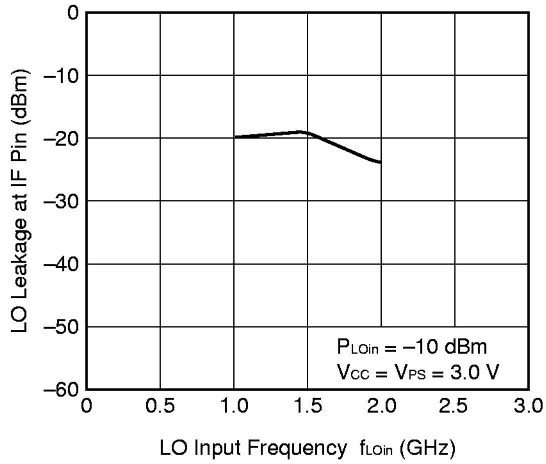
μPC2758T IM_3 AND IF OUTPUT LEVEL vs. RF INPUT LEVEL



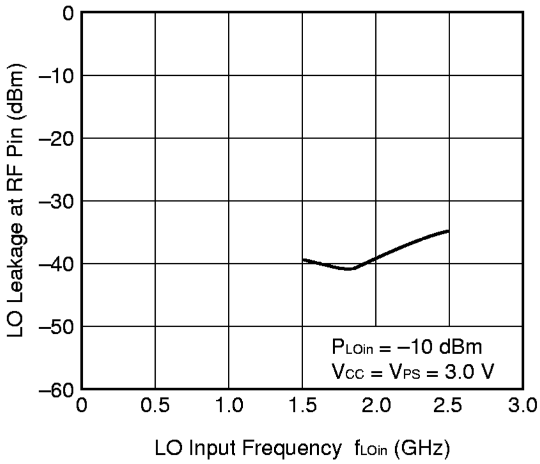
μPC2757T LO LEAKAGE AT IF PIN
vs. LOCAL INPUT FREQUENCY



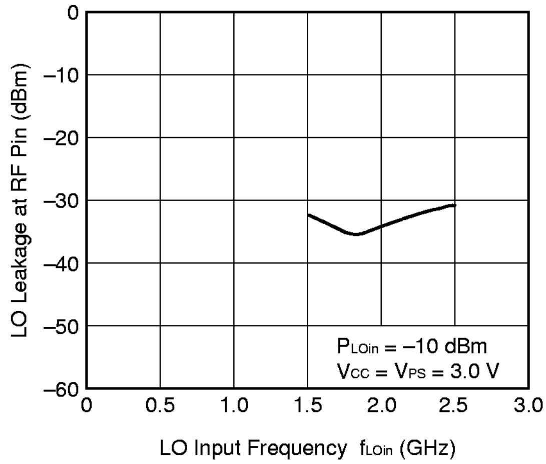
μPC2758T LO LEAKAGE AT IF PIN
vs. LOCAL INPUT FREQUENCY



μPC2757T LO LEAKAGE AT RF PIN
vs. LOCAL INPUT FREQUENCY

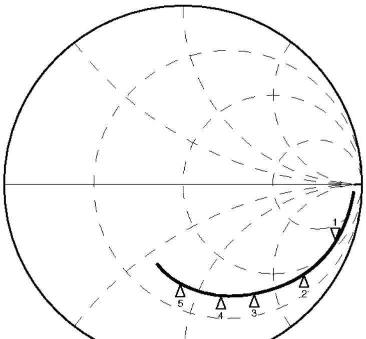


μPC2758T LO LEAKAGE AT RF PIN
vs. LOCAL INPUT FREQUENCY



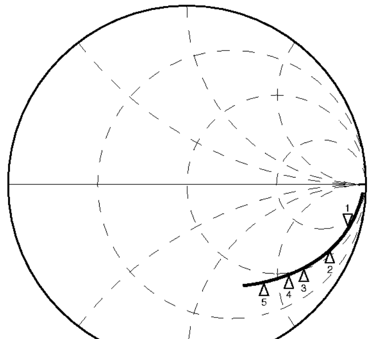
★ S-PARAMETERS

– μPC2757T –



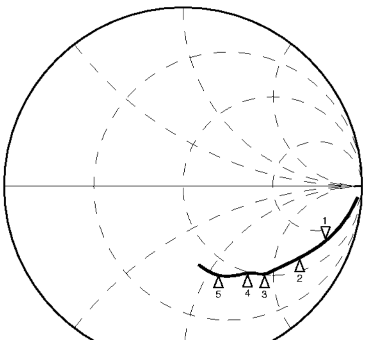
RF port
$V_{CC}=V_{PS}$=3.0V
1:500MHz 64.273 Ω–j250.85 Ω
2:900MHz 40.93 Ω–j141.55 Ω
3:1500MHz 31.09 Ω–j82.902 Ω
4:1900MHz 27.545 Ω–j62.115 Ω
5:2500MHz 26.459 Ω–j41.922 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



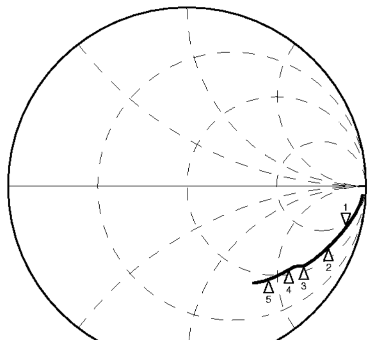
RF port
V_{CC}=3.0V V_{PS}=GND
1:500MHz 109.98 Ω–j363.47 Ω
2:900MHz 79.687 Ω–j214.84 Ω
3:1500MHz 60.195 Ω–j141.38 Ω
4:1900MHz 50.621 Ω–j114.52 Ω
5:2500MHz 42.488 Ω–j87.531 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



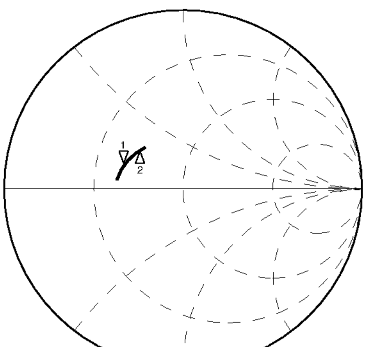
LO port
$V_{CC}=V_{PS}$=3.0V
1:500MHz 99.852 Ω–j220.24 Ω
2:900MHz 73.133 Ω–j139.53 Ω
3:1500MHz 52.672 Ω–j91.57 Ω
4:1900MHz 48.867 Ω–j74.281 Ω
5:2500MHz 40.842 Ω–j55.199 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



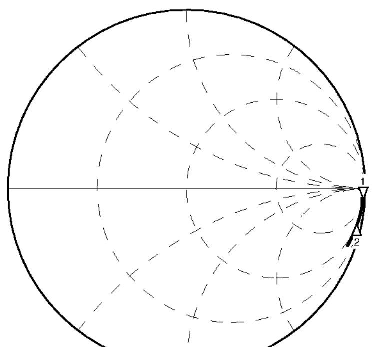
LO port
V_{CC}=3.0V V_{PS}=GND
1:500MHz 128.02 Ω–j354.03 Ω
2:900MHz 88.133 Ω–j222.33 Ω
3:1500MHz 62.516 Ω–j140.97 Ω
4:1900MHz 58.312 Ω–j117.96 Ω
5:2500MHz 45.59 Ω–j93.238 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



IF port
$V_{CC}=V_{PS}$=3.0V
1:130MHz 24.197 Ω–j7.668 Ω
2:250MHz 28.207 Ω–j13.525 Ω

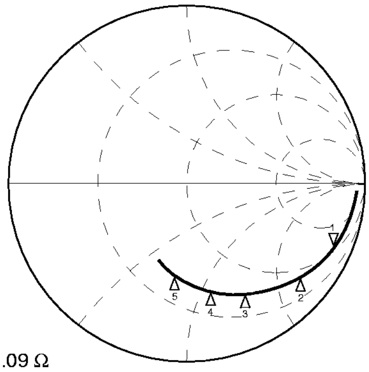
START 0.050000000 GHz
STOP 0.300000000 GHz



IF port
V_{CC}=3.0V V_{PS}=GND
1:130MHz 168.88 Ω–j1.2039k Ω
2:250MHz 120.56 Ω–j652.25 Ω

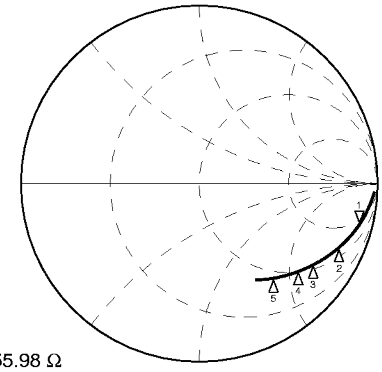
START 0.050000000 GHz
STOP 0.300000000 GHz

– μPC2758T –



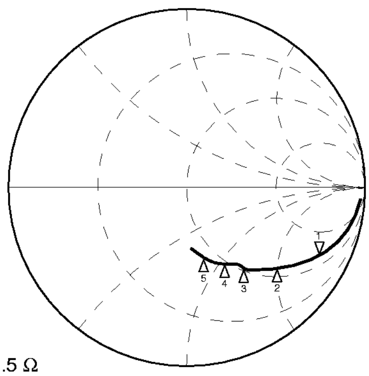
RF port
$V_{CC}=V_{PS}=3.0V$
1:500MHz 59.633 Ω–j235.09 Ω
2:900MHz 37.609 Ω–j131.38 Ω
3:1500MHz 29.121 Ω–j76.48 Ω
4:1900MHz 26.992 Ω–j56.742 Ω
5:2500MHz 26.697 Ω–j37.975 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



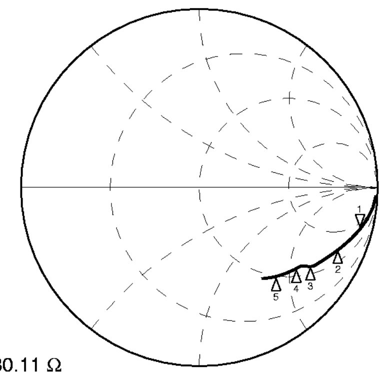
RF port
$V_{CC}=3.0V$ V_{PS}=GND
1:500MHz 105.94 Ω–j355.98 Ω
2:900MHz 79.336 Ω–j214.39 Ω
3:1500MHz 61.398 Ω–j139.99 Ω
4:1900MHz 51.539 Ω–j113.45 Ω
5:2500MHz 42.875 Ω–j87.09 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



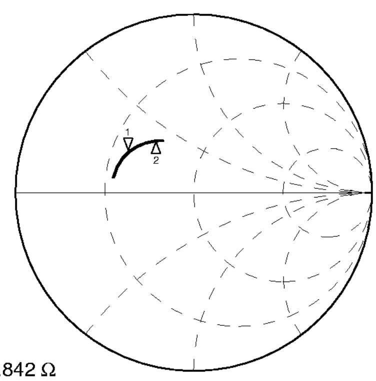
LO port
$V_{CC}=V_{PS}=3.0V$
1:500MHz 69.883 Ω–j177.5 Ω
2:900MHz 59.047 Ω–j102.83 Ω
3:1500MHz 49.656 Ω–j67.445 Ω
4:1900MHz 46.871 Ω–j53.65 Ω
5:2500MHz 42.143 Ω–j40.105 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



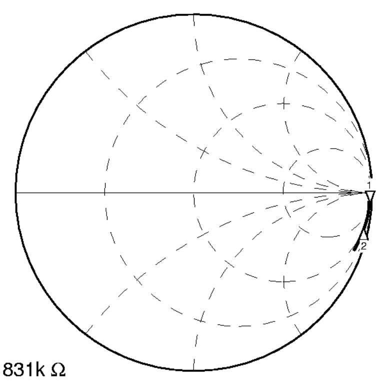
LO port
$V_{CC}=3.0V$ V_{PS}=GND
1:500MHz 102.48 Ω–j330.11 Ω
2:900MHz 79.703 Ω–j199.25 Ω
3:1500MHz 60.961 Ω–j128.63 Ω
4:1900MHz 59.211 Ω–j107.32 Ω
5:2500MHz 48.105 Ω–j86.215 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



IF port
$V_{CC}=V_{PS}=3.0V$
1:130MHz 20.784 Ω–j10.842 Ω
2:250MHz 27.586 Ω–j18.538 Ω

START 0.050000000 GHz
STOP 0.300000000 GHz

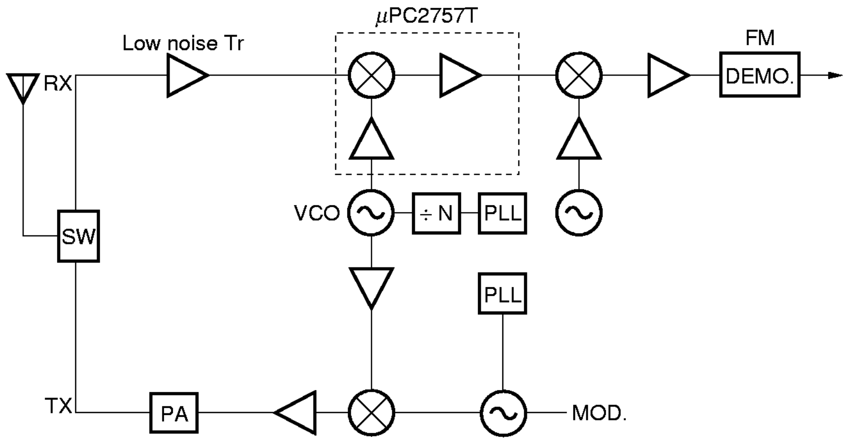


IF port
$V_{CC}=3.0V$ V_{PS}=GND
1:130MHz 182.06 Ω–j1.1831k Ω
2:250MHz 117.16 Ω–j631.63 Ω

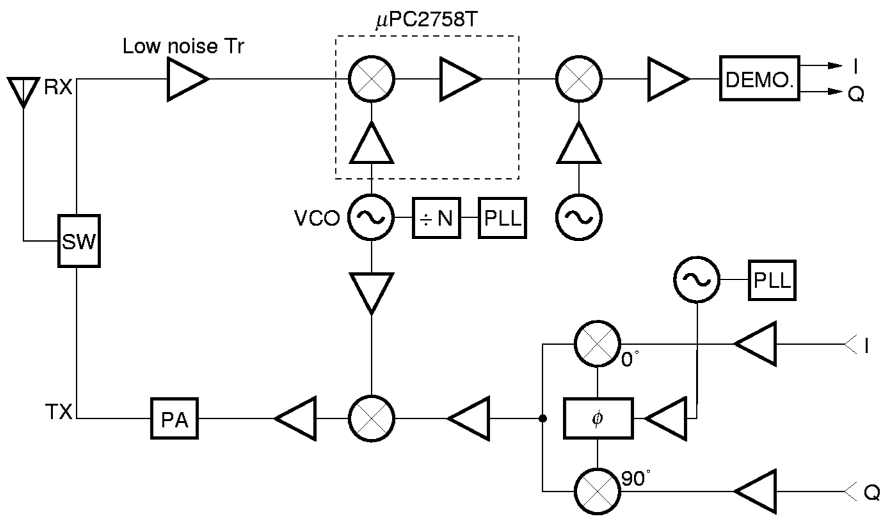
START 0.050000000 GHz
STOP 0.300000000 GHz

SYSTEM APPLICATION EXAMPLE

ANALOG CELLULAR TELEPHONE



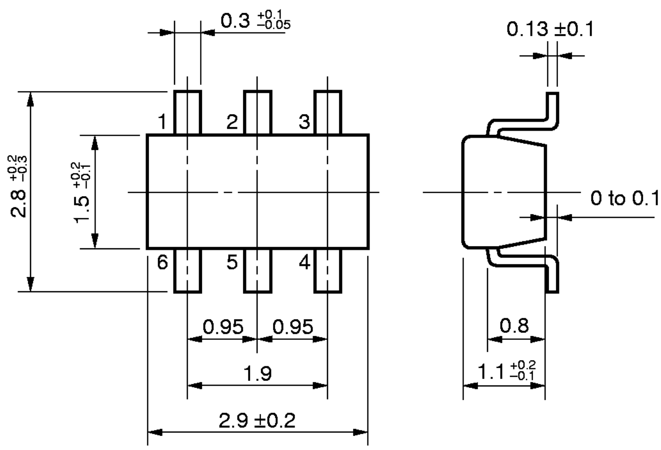
DIGITAL CELLULAR TELEPHONE



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

PACKAGE DIMENSIONS

6 PIN 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 minimize ground impedance (to prevent undesired 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.

RECOMMENDED SOLDERING CONDITIONS

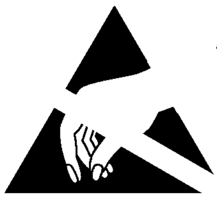
This product should be soldered under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your NEC sales representative.

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).



ATTENTION

OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES

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