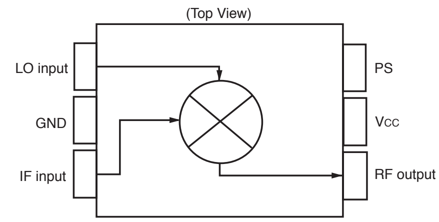
BIPOLAR ANALOG INTEGRATED CIRCUIT
UPC8172TB

SILICON RFIC 2.5 GHz FREQUENCY UP-CONVERTER FOR WIRELESS TRANSCEIVER

FEATURES

- **RECOMMENDED OPERATING FREQUENCY:**
  f_{RFout} = 0.8 to 2.5 GHz
- **SUPPLY VOLTAGE:**
  V_{CC} = 2.7 to 3.3 V
- **HIGHER IP_3 AND CONVERSION GAIN:**
  CG = 9.5 dB TYP
  OIP_3 = +7.5 dBm TYP @ f_{RFout} = 0.9 GHz
- **HIGH-DENSITY SURFACE MOUNTING:**
  6-pin super minimold package

BLOCK DIAGRAM



DESCRIPTION

The UPC8172TB is a silicon monolithic integrated circuit designed as a frequency up-converter for a wireless transceiver transmitter stage. This IC is manufactured using the 30 GHz f_{max} UHS0 (Ultra High Speed Process) silicon bipolar process. This IC has the same circuit current as the conventional UPC8106TB, but operates at higher frequency, higher gain and lower distortion. Such performance and operation from a 3 volts supply makes this device ideal for mobile communications and wireless LAN applications.

Stringent quality assurance and test procedures ensure the highest reliability and performance.

APPLICATIONS

- PCS1900 MHz
- 2.4 GHz band transmitter/receiver system (wireless LAN, etc.)

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))

PART NUMBER PACKAGE OUTLINE			UPC8172TB S06		
SYMBOLS	**PARAMETERS AND CONDITIONS[1]**	**UNITS**	**MIN**	**TYP**	**MAX**
I_{CC}	Circuit Current (no signal)	mA	5.5	9.0	13.0
$I_{CC(PS)}$	Circuit Current in Power Save Mode, V_{PS} = 0 V	μA	–	–	2
CG1	Conversion Gain, f_{RFout} = 0.9 GHz, P_{IFin} = -30 dBm	dB	6.5	9.5	12.5
CG2	Conversion Gain, f_{RFout} = 1.9 GHz, P_{IFin} = -30 dBm	dB	5.5	8.5	11.5
CG3	Conversion Gain, f_{RFout} = 2.4 GHz, P_{IFin} = -30 dBm	dB	5.0	8.0	11.0
$P_{O(SAT)1}$	Saturated RF Output Power, f_{RFout} = 0.9 GHz, P_{IFin} = 0 dBm	dBm	-2.5	0.5	–
$P_{O(SAT)2}$	Saturated RF Output Power, f_{RFout} = 1.9 GHz, P_{IFin} = 0 dBm	dBm	-3.5	0	–
$P_{O(SAT)3}$	Saturated RF Output Power, f_{RFout} = 2.4 GHz, P_{IFin} = 0 dBm	dBm	-4.0	-0.5	–
OIP_31	Output Third-Order Distortion Intercept Point, f_{RFout} = 0.9 GHz, $f_{IFin}1$ = 240 MHz, $f_{IFin}2$ = 241 MHz	dBm	–	7.5	–
OIP_32	Output Third-Order Distortion Intercept Point, f_{RFout} = 1.9 GHz, $f_{IFin}1$ = 240 MHz, $f_{IFin}2$ = 241 MHz	dBm	–	6.0	–
OIP_33	Output Third-Order Distortion Intercept Point, f_{RFout} = 2.4 GHz, $f_{IFin}1$ = 240 MHz, $f_{IFin}2$ = 241 MHz	dBm	–	4.0	–
IIP_31	Input Third-Order Distortion Intercept Point, f_{RFout} = 0.9 GHz, $f_{IFin}1$ = 240 MHz, $f_{IFin}2$ = 241 MHz	dBm	–	-2.0	–
IIP_32	Input Third-Order Distortion Intercept Point, f_{RFout} = 1.9 GHz, $f_{IFin}1$ = 240 MHz, $f_{IFin}2$ = 241 MHz	dBm	–	-2.5	–
IIP_33	Input Third-Order Distortion Intercept Point, f_{RFout} = 2.4 GHz, $f_{IFin}1$ = 240 MHz, $f_{IFin}2$ = 241 MHz	dBm	–	-4.0	–
SSB•NF1	SSB Noise Figure, f_{RFout} = 0.9 GHz, $f_{IFin}1$ = 240 MHz	dB	–	9.5	–
SSB•NF2	SSB Noise Figure, f_{RFout} = 1.9 GHz, $f_{IFin}1$ = 240 MHz	dB	–	10.4	–
SSB•NF3	SSB Noise Figure, f_{RFout} = 2.4 GHz, $f_{IFin}1$ = 240 MHz	dB	–	10.6	–
$T_{PS(rise)}$	Power Save Response Time, Rise Time, V_{PS}: GND → V_{CC}	μs	–	1	–
$T_{PS(fall)}$	Power Save Response Time, Fall Time, V_{PS}: V_{CC} → GND	μs	–	1.5	–

Note:
1. $f_{RFout} < f_{LOin}$ @ f_{RFout} = 0.9 GHz
   $f_{LOin} < f_{RFout}$ @ f_{RFout} = 1.9 GHz/2.4 GHz

ABSOLUTE MAXIMUM RATINGS[1]

(T_A = +25°C unless otherwise specified)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CC}	Supply Voltage	V	3.6
V_{PS}	PS Pin Input Voltage	V	3.6
P_D	Power Dissipation[2]	mW	270
T_A	Operating Ambient Temperature	°C	-40 to +85
T_{STG}	Storage Temperature	°C	-55 to +150
P_{IN}	Input Power	dBm	+10

Notes:
1. Operation in excess of any one of these conditions may result in permanent damage.
2. Mounted on a double-sided copper clad 50x50x1.6 mm epoxy glass PWB, T_A = +85°C.

RECOMMENDED OPERATING CONDITIONS

SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
V_{CC}	Supply Voltage[1]	V	2.7	3.0	3.3
T_A	Operating Ambient Temperature	˚C	-40	+25	+85
P_{LOin}	Local Input Level[2]	dBm	-10	-5	0
f_{RFout}	RF Output Frequency[3]	GHz	0.8	–	2.5
f_{IFin}	IF Input Frequency	MHz	50	–	400

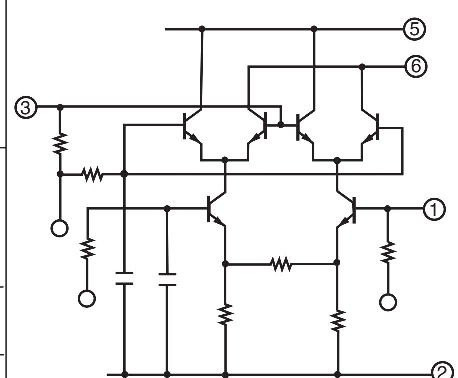
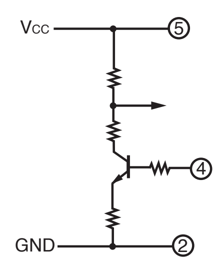
Note:
1. Same voltage applied to pins 5 and 6.
2. Z_S = 50 Ω (without matching).
3. With external matching circuit.

SERIES PRODUCTS[1] (T_A = +25°C, V_{CC} = V_{RFout} = 3.0 V, Z_S = Z_L = 50 Ω)

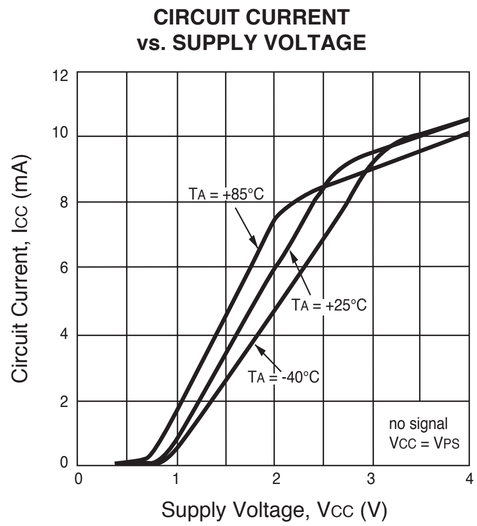
Part Number	Icc	f_{RFout}	CG (dB			OIP_3 (dBm)		
	(mA)	(GHz)	@RF 0.9 GHz[2]	@RF 1.9 GHz	@RF 2.4 GHz	@RF 0.9 GHz[2]	@RF 1.9 GHz	@RF 2.4 GHz
UPC8172TB	9	0.8 to 2.5	9.5	8.5	8.0	+7.5	+6.0	+4.0
UPC8106TB	9	0.4 to 2.0	9	7	–	+5.5	-1.0	–
UPC8109TB	5	0.4 to 2.0	6	4	–	+1.5	+2.0	–
UPC8163TB	16.5	0.8 to 2.0	9	5.5	–	+9.5	+6.0	–

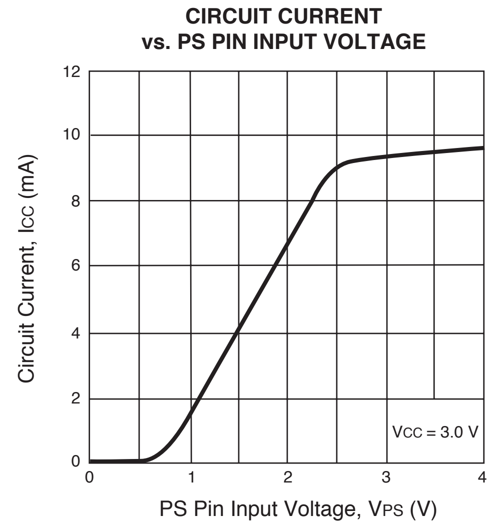
Notes:
1. Typical performance.
2. f_{RFout} = 0.83 GHz @ UPC8163TB

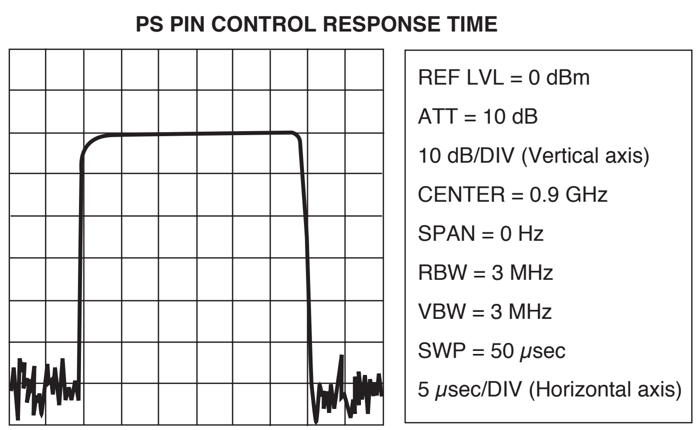
PIN FUNCTIONS (Voltage is measured at V_{CC} = V_{PS} = V_{RFOUT} = 3.0 V)

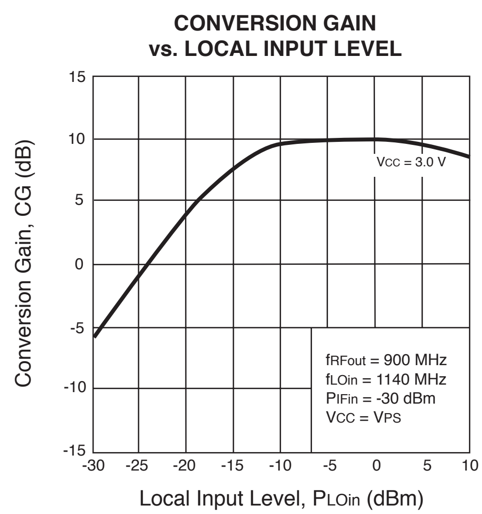
Pin No.	Pin Name	Applied Voltage (V)	Pin Voltage (V)	Function and Explanation	Equivalent Circuit
1	IFinput	—	1.4	This pin is the IF input pin to the double balanced mixer (DBM). The input is designed as a high impedance. The circuit helps suppress spurious signals. Also this symmetrical circuit can keep specified performance insensitive to process-condition distribution. For that reason, a 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 inductance.	
3	LOinput	–	2.3	Local input pin. Recommendable input level is -10 to 0 dBm.	
5	V_{CC}	2.7 to 3.3	—	Supply voltage pin.	
6	RFoutput	Same bias as V_{CC} through external inductor	—	This pin is the RF output from the double balanced mixer. This pin is designed as an open collector. Due to the high impedance output, this pin should be externally equipped with an LC matching circuit to the next stage.	
4	PS	V_{CC}/GND		Power save control pin. Bias controls operate as follows: Pin Bias / Control V_{CC} / Operation GND / Power Save	

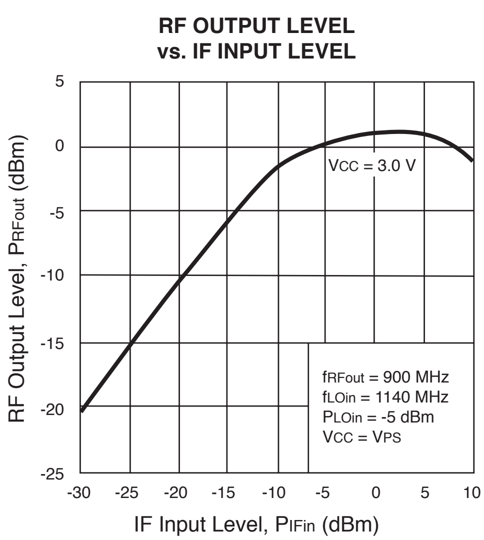
TYPICAL PERFORMANCE CURVES (TA = 25°C)

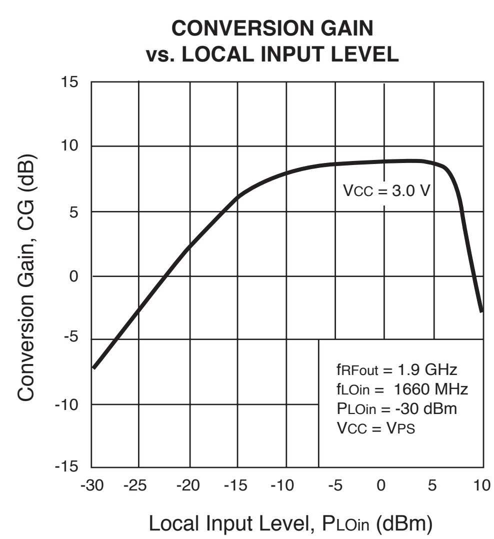






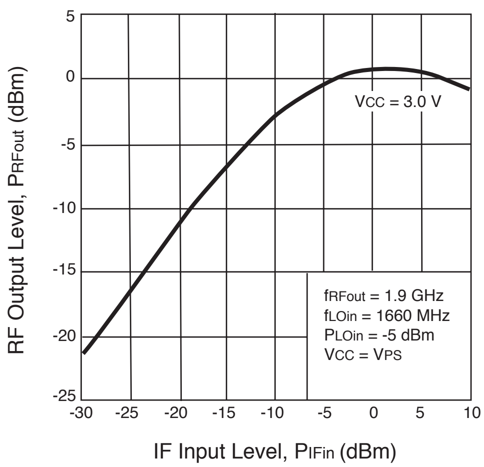




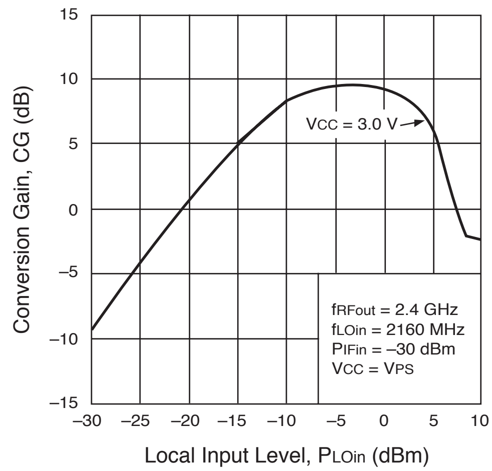


TYPICAL PERFORMANCE CURVES (TA = 25°C)

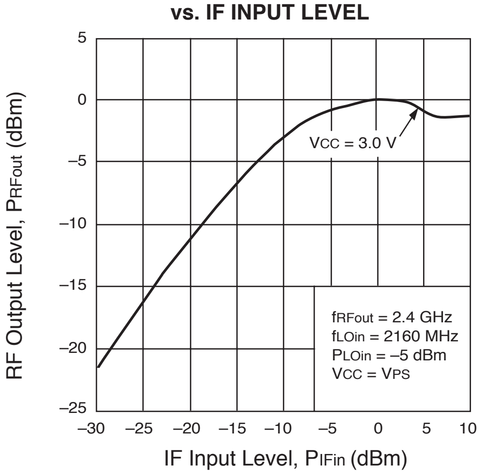
RF OUTPUT LEVEL vs. IF INPUT LEVEL



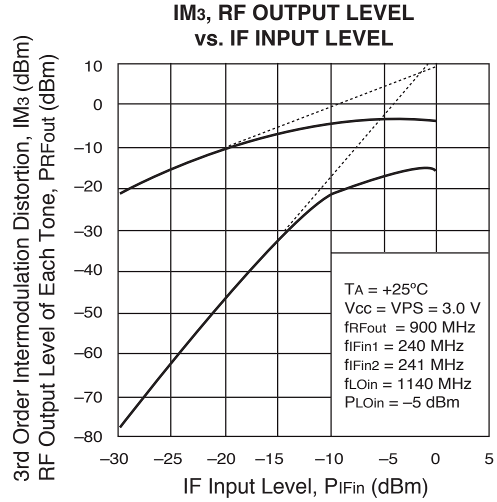
CONVERSION GAIN vs. LOCAL INPUT LEVEL



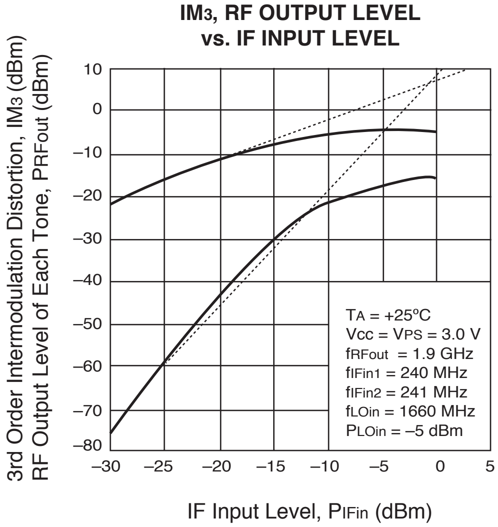
RF OUTPUT LEVEL vs. IF INPUT LEVEL



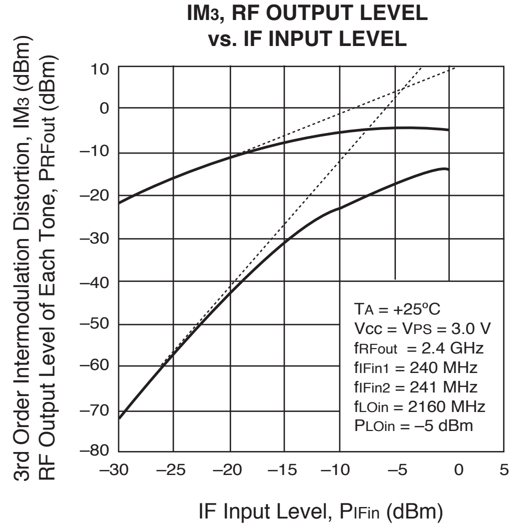
IM3, RF OUTPUT LEVEL vs. IF INPUT LEVEL



IM3, RF OUTPUT LEVEL vs. IF INPUT LEVEL

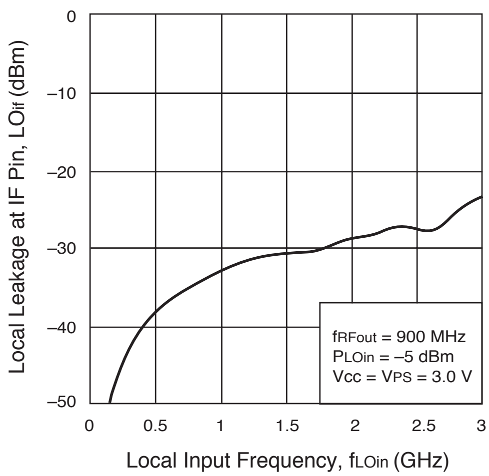


IM3, RF OUTPUT LEVEL vs. IF INPUT LEVEL

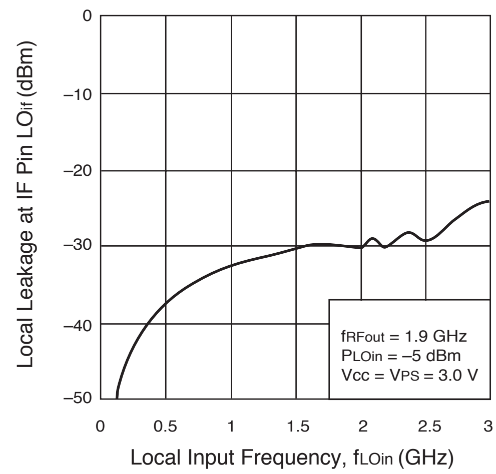


TYPICAL PERFORMANCE CURVES (TA = 25°C)

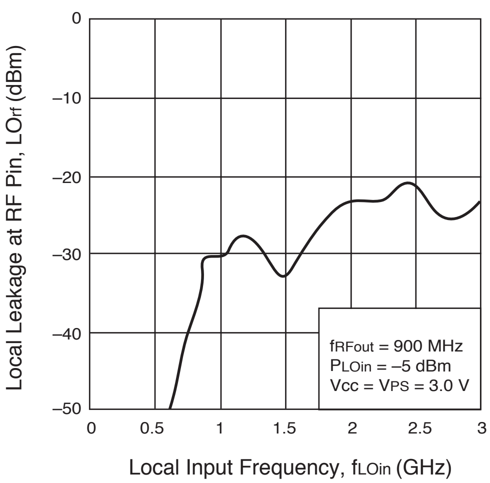
LOCAL LEAKAGE AT IF PIN vs. LOCAL INPUT FREQUENCY



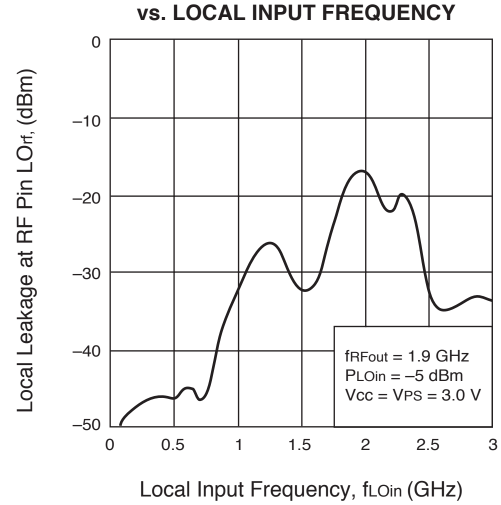
LOCAL LEAKAGE AT IF PIN vs. LOCAL INPUT FREQUENCY



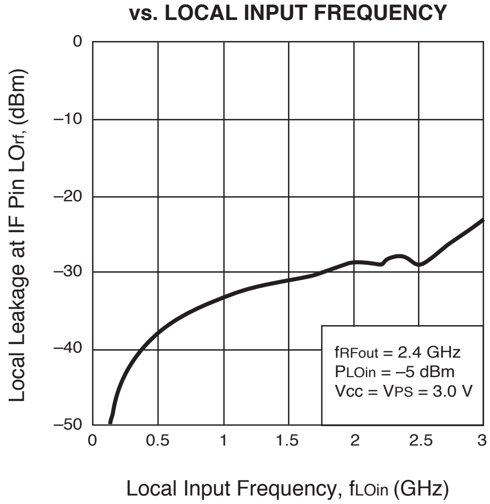
LOCAL LEAKAGE AT RF PIN vs. LOCAL INPUT FREQUENCY



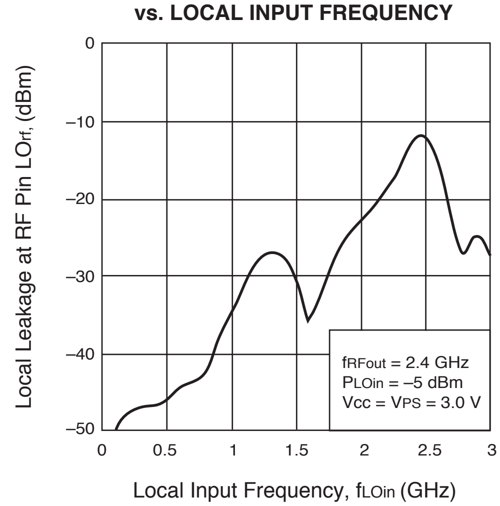
LOCAL LEAKAGE AT RF PIN vs. LOCAL INPUT FREQUENCY



LOCAL LEAKAGE AT IF PIN vs. LOCAL INPUT FREQUENCY

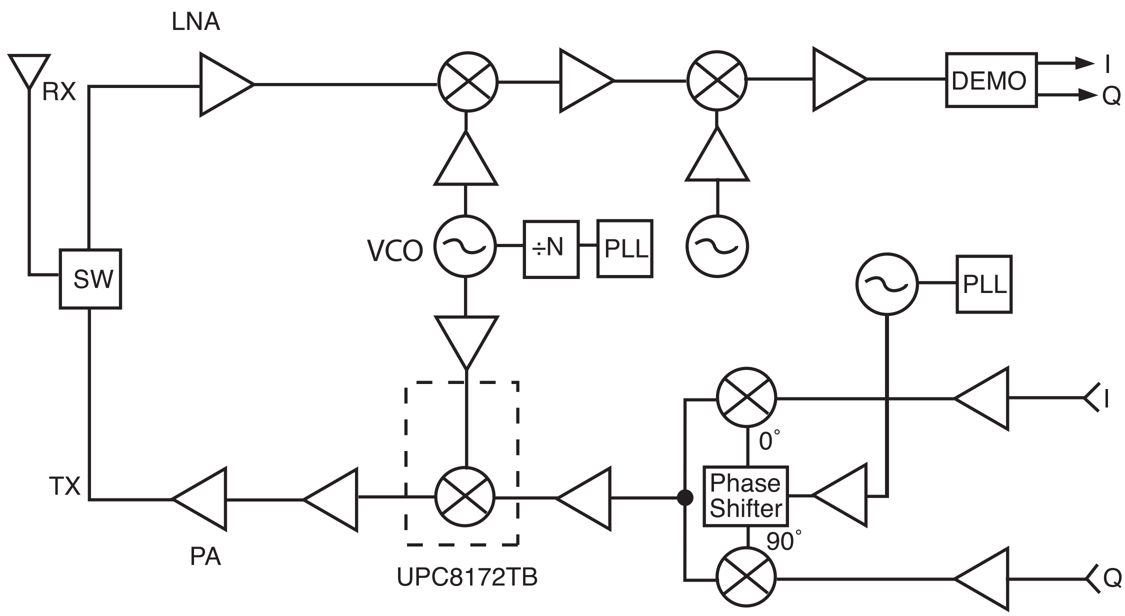


LOCAL LEAKAGE AT RF PIN vs. LOCAL INPUT FREQUENCY



SYSTEM APPLICATION EXAMPLE

Wireless Transceiver

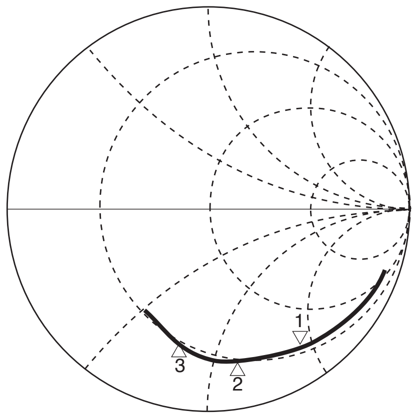


S-PARAMETERS FOR EACH PORT (V_{CC} = V_{PS} = V_{RFout} = 3.0 V)

(The paramters are monitored at DUT pins)

LO port

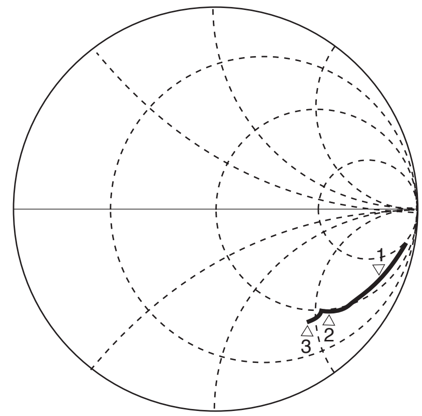
S_{11} Z
REF 1.0 Units
1 200.0 mUnits/
21.625 Ω -91.148 Ω
∇ *hp*
MARKER 1
1.15 GHz
MARKER 2
1.65 GHz
MARKER 3
2.15 GHz



START 0.400000000 GHz
STOP 2.500000000 GHz

RF port (without matching)

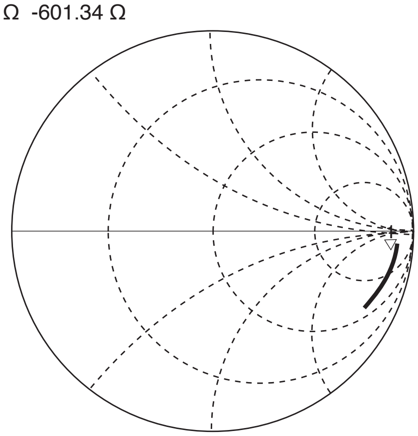
S_{22} Z
REF 1.0 Units
1 200.0 mUnits/
∇ 71.5 Ω -240.34 Ω
hp
MARKER 1
900 MHz
MARKER 2
1.9 GHz
MARKER 3
2.5 GHz



START 0.400000000 GHz
STOP 2.500000000 GHz

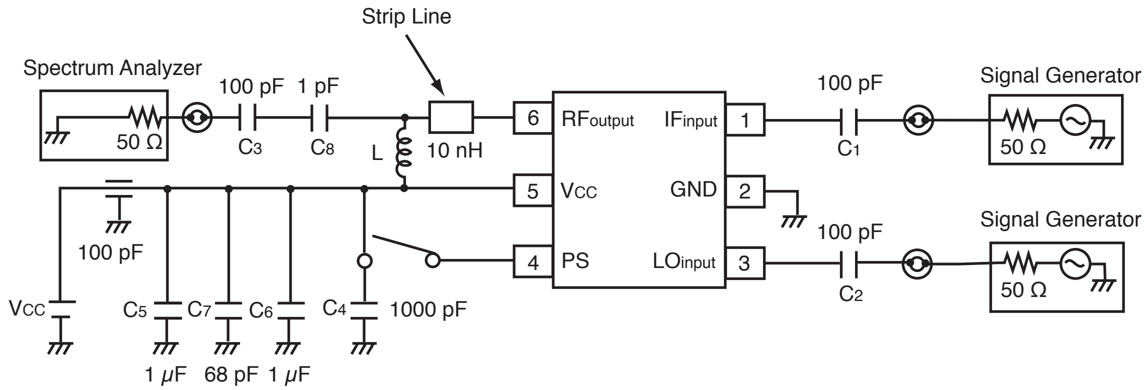
IF port

S_{11} Z
REF 1.0 Units
1 200.0 mUnits/
∇ 332.63 Ω -601.34 Ω
hp
MARKER 1
240.0 MHz

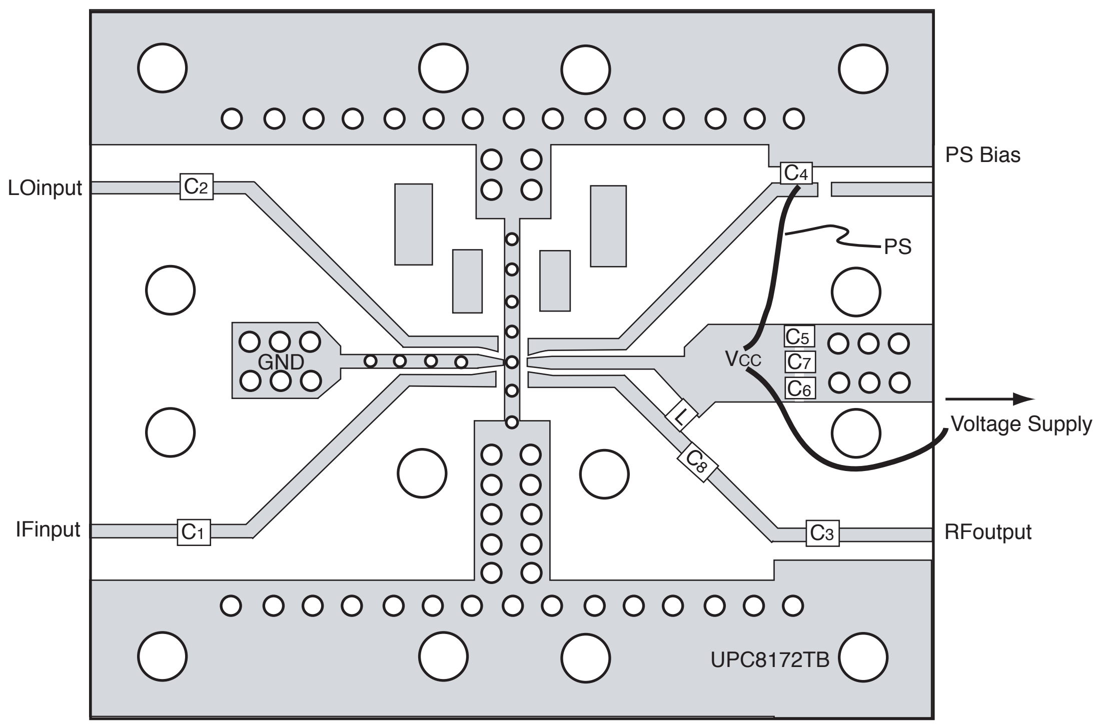


START 0.100000000 GHz
STOP 1.000000000 GHz

TEST CIRCUIT 1 (f_{RFout} = 900 MHz)



EXAMPLE OF TEST CIRCUIT 1 ASSEMBLED ON EVALUATION BOARD



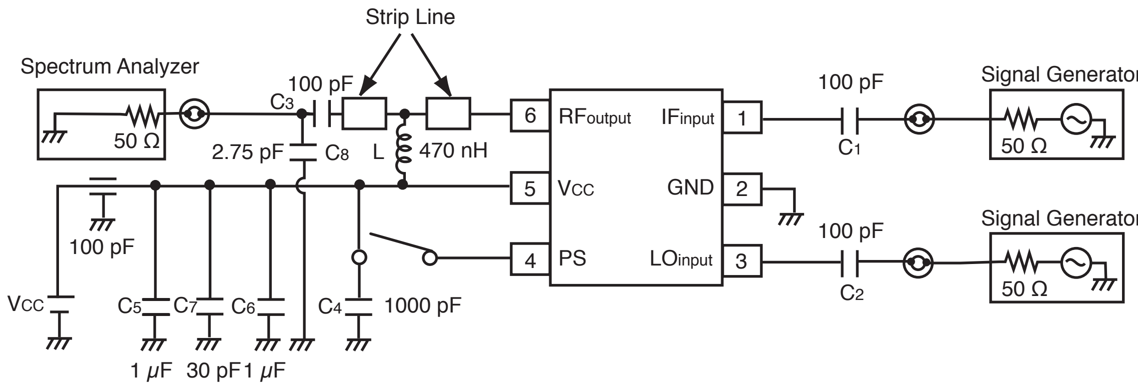
COMPONENT LIST

FORM	SYMBOL	VALUE
Chip Capacitor	C_1, C_2, C_3	100 pF
	C_4	1000 pF
	C_5, C_6	1 μF
	C_7	68 pF
	C_8	1 pF
Chip Inductor	L	10 nH[1]

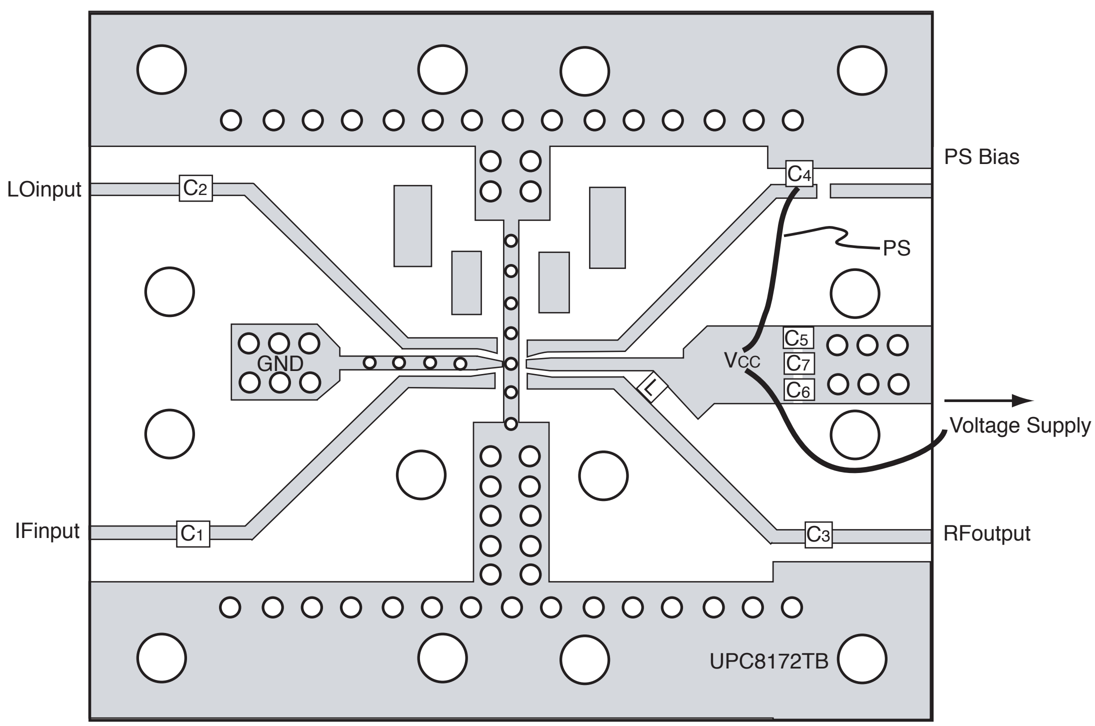
Note:
1. 10 nH: LL1608-FH10N (TOKO Co., Ltd.)

(*1) 35x42x0.4 mm polymide board, double-sided copper clad
(*2) Ground pattern on rear of the board
(*3) Solder plated patterns
(*4) ⚬⚬◯: Through holes

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



EXAMPLE OF TEST CIRCUIT 2 ASSEMBLED ON EVALUATION BOARD



COMPONENT LIST

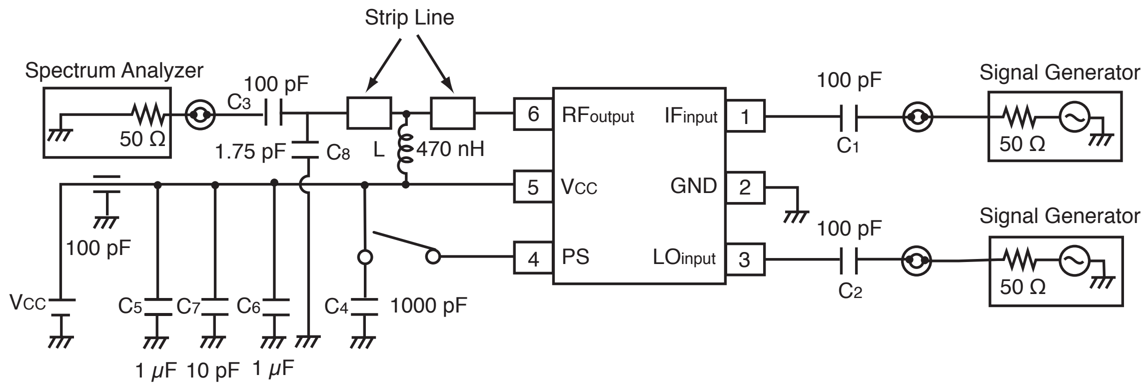
FORM	SYMBOL	VALUE
Chip Capacitor	C_1, C_2, C_3	100 pF
	C_4	1000 pF
	C_5, C_6	1 μF
	C_7	30 pF
	C_8	2.75 pF
Chip Inductor	L	470 nH[1]

Note:

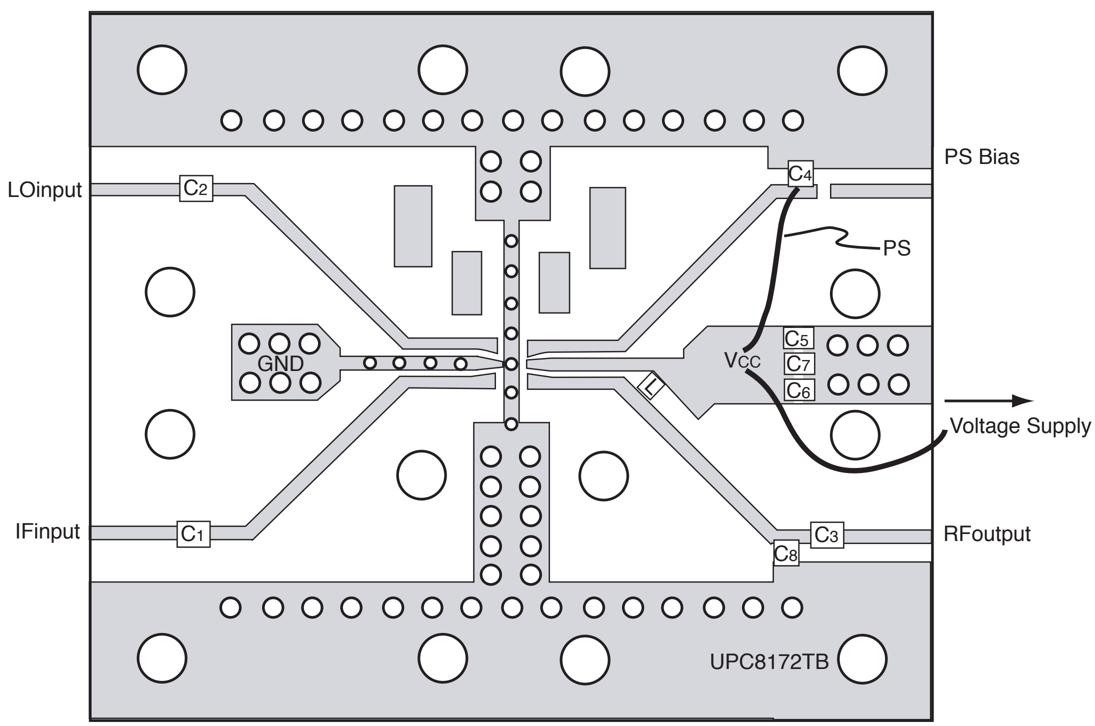
1. 470 nH: LL2012-FR47 (TOKO Co., Ltd.)

(*1) 35 x 42 x 0.4 mm polymide board, double-sided copper clad
(*2) Ground pattern on rear of the board
(*3) Solder plated patterns
(*4) ○○: Through holes

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



EXAMPLE OF TEST CIRCUIT 3 ASSEMBLED ON EVALUATION BOARD



COMPONENT LIST

FORM	SYMBOL	VALUE
Chip Capacitor	C_1, C_2, C_3	100 pF
	C_4	1000 pF
	C_5, C_6	1 μF
	C_7	10 pF
	C_8	1.75 pF
Chip Inductor	L	470 nH[1]

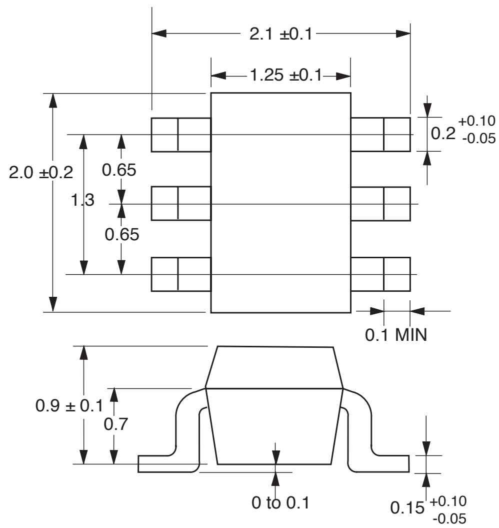
Note:

1. 470 nH: LL2012-FR47 (TOKO Co., Ltd.)

(*1) 35 x 42 x 0.4 mm polymide board, double-sided copper clad
(*2) Ground pattern on rear of the board
(*3) Solder plated patterns
(*4) ㎜m: Through holes

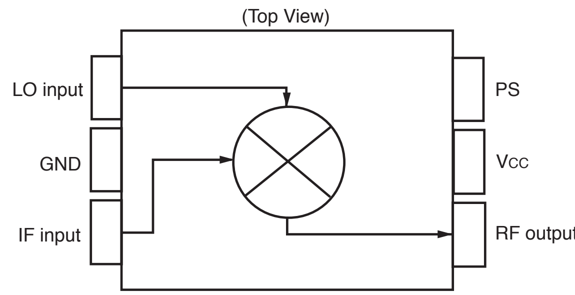
OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE S06

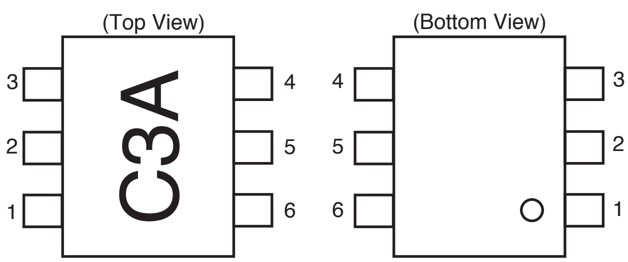


Note:
All dimensions are typical unless otherwise specified.

BLOCK DIAGRAM



PIN CONNECTIONS



PIN NO.	PIN NAME
1	IF_{input}
2	GND
3	LO_{input}
4	PS
5	V_{CC}
6	RF_{output}

ORDERING INFORMATION

Part Number	Quantity
UPC8172TB-E3-A	3 K pcs/reel

Note: Embossed tape, 8 mm wide. Pins 1, 2 and 3 face the tape perforation side.

OCEAN CHIPS

Океан Электроники

Поставка электронных компонентов

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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