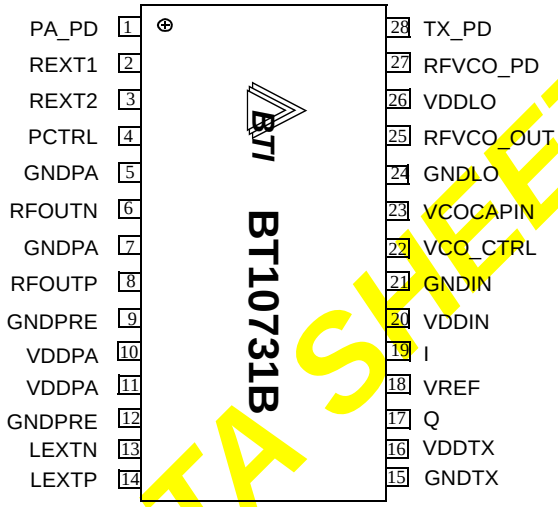
900MHz RF TRANSMITTER

Features

- Complete RF transmitter front end
- I/Q input interface
- On-chip RF local oscillator
- Single power supply 2.7 - 3.3 V
- Low power BiCMOS technology
- On-chip RF power amplifier
- Power selectivity (-2dBm or +14dBm)
- 28L SSOP package
- Ambient temperature range (-40^{O}C to +85^{O}C)



Applications

- 900 MHz Digital Telephones
- Wireless Communication Products
- Cordless Telephones
- Spread Spectrum Voice and Data
- Wireless Communication Products
- Wireless Networking Products
- 902-928 MHz ISM Band Applications

Description

The BT10731B is a BiCMOS monolithic integrated RF transmitter. With an RF signal range of 850MHz to 950MHz, it is ideally suited for use in digital cordless phones. Designed for use with the BT10732B receiver, the IC contains all of the required components to implement a complete RF-IF transceiver. This IC includes an RF local oscillator, an upconversion mixer, and an on-chip power amplifier capable of delivering -2dBm to +14dBm into a 50Ω load. The unit operates from 2.7 - 3.3 volts.

Specifications

Parameters	Min.	-3σ	Typ.	+3σ	Max.	Units
Overall:						
Power supply	2.7		3.0		3.3	V
Standby current	3		5		7	uA
Frequency of operation	850				950	MHz
Transmitter:						
Gain			16			dB
Output IP3			19			dBm
Current consumption (w/ RFVCO) @14dBm Output			100			mA
Transmitter Section						
I&Q Modulator & Filter:						
Input impedance			>20			kΩ
I/Q input frequency			<1			MHz
I/Q input swing			0.5			Vp-p
I/Q input DC level			VDD/2			V
VREF DC level			VDD/2			V

Parameters	Min.	-3σ	Typ.	+3σ	Max.	Units
RF Upconversion Mixer:						
Conversion gain (internal)			0			dB
Input IP3			-10			dBm
Input 1dB compression point			-20			dBm
Power Amplifier:						
Output power into 50Ω load, high power mode (PCTRL=0V)	+10		+14		+16	dBm
Output power into 50Ω load, low power mode (PCTRL=VDD)			-2			dBm
Voltage gain (internal)			25			dB
Output impedance (w/external combiner)			50			Ω
Output 1dB compression point			+13			dBm
Output IP3			+19			dBm
Output spurious suppression			-40			dBc
RF VCO Section						
Frequency range (at output to PLL)	840				940	MHz
VCO phase noise at 100KHz offset (closed-loop)			-100			dBc/Hz
VCO phase noise at 1MHz offset			-120			dBc/Hz

Absolute Maximum Ratings

Parameters	Value	Unit
Supply Voltage	7	V
Power Control Voltage	V_{DD}+0.5	V
Storage Temperature	+150	^{o}C

Pin Table

Pin	Parameter	I/O	Description
Power and Ground Pins			
9/12 / 5/7	GNDPRE / GNDPA	-	Ground to preamp and power amplifier
21 / 24	GNDIN / GNDLO	-	Ground to RF VCO
15	GNDTX	-	Ground to upconversion mixer
10/11	VDDPA	-	Power supply to power amplifier
20 / 26	VDDIN / VDDLO	-	Power supply to RF VCO
16	VDDTX	-	Power supply to preamp and upconversion mixer
RF VCO Pins			
25	RFVCO_OUT	O	RF VCO output
22	VCO_CTRL	I	RF VCO control input
23	VCOCAPIN	I	External Tuning capacitor for RFVCO
Transmitter Pins			
8 / 6	RFOUTP / RFOUTN	O	Power amplifier output

Pin	Parameter	I/O	Description
4	PCTRL	I	Transmission output power control: Hi - high power mode Low - low power mode
2 / 3	REXT1 / REXT2	I	Bias pins for power amplifier
17	Q	I	Baseband quadrature input to the transmitter
18	VREF	I	I/Q input DC reference
19	I	I	Baseband in-phase input to the transmitter
13 / 14	LEXTN / LEXTP	O	Preamplifier Output control pins
Power Down Pins			
28	TX_PD	I	Receiver power down control
1	PA_PD	I	PA enable
27	RFVCO_PD	I	RF VCO power down control

Detailed Pin Descriptions

TRANSMITTER

RFOUTN and RFOUTP (pins 6 and 8)
Power Amplifier Output pins
These are the differential output pins of the power amplifier that require a combining network as shown in the Application circuit. The combiner converts the differential signal to single-ended and also provides the required matching impedance of 50Ω. A DC bias to VDD is required since these terminals are open-collector outputs, furthermore, AC coupling is needed after the combiner.

LEXTN and LEXTP (pins 13 and 14)
Preamplifier Output control pins
These pins are the open-collector differential output signals of the preamplifier. Two inductors to VDD are required for tuning the preamplifier to the desired frequency band. Recommended values for 900MHz are shown in the Application circuit. Since these pins are also inputs to the power amplifier, the inductors should be close to the pins and isolated from the power amplifier output to avoid output feedback to these pins which may cause instability for the power amplifier.

REXT1 and REXT2 (pins 2 and 3)
Preamplifier/Power Amplifier Bias/Gain Adjust
REXT1 is the biasing resistor for the preamplifier, and REXT2 is the biasing resistor for the power amplifier. For an output power of +14dBm, recommended values are 330 Ω for REXT1 and 4.7 KΩ for REXT2. Increasing REXT1 and lowering REXT2 will lower output power and vice versa.

Q, VREF and I (pins 17, 18 and 19)
Baseband Data Inputs
These are inputs which interface with the data signals from the digital signal processor (DSP) or microprocessor (µP). I and Q are inphase (I) and quadrature (Q) signals. VREF is the DC signal coming from the DSP/µP. All of these pins require a DC level of VDD/2, and an I and Q voltage swing of 500mVp-p. The Application circuit shows a technique to interface 1Vp-p I and Q signals with a 6dB voltage attenuator with DC reference to the VREF pin. A low pass filter may also be required to reject sampling noise from the DSP/µP.

VDDPA (pins 10 and 11)
Power Supply for Pre and Power Amplifier
These are the power supply pins dedicated for both the pre and power amplifiers. Decoupling should be done right at these pins to a ground plane, if possible.

VDDTX (pin 16)
Power Supply for Input Buffer and IF Upconversion Mixer
The input buffer and the RF upconversion mixer share this power supply on-chip. Since this is the power supply for the baseband and IF block, decoupling should be done for low frequency. Bypass capacitors of 0.1µF and 100pF in parallel are sufficient for this purpose.

GNDPA (Pins 5 and 7) - *Ground Pins for the Power Amplifier*
GNDPRE (Pins 9 and 12) - *Ground Pins for the Preamplifier*
GNDTX (Pin 15) - *Ground Pins for the RF Upconversion Mixer and Input Buffer*
These pins are the dedicated ground pins for various on-chip circuits. They could share the same ground as long as a good ground plane is available.

RFVCO

VCO_CTRL (Pin 22)
RFVCO Input Control
An external tank circuit is connected to this pin (*see Application Circuit*). The tank circuit generates the overall oscillation frequency for the RFVCO and therefore must be optimized to avoid any interference from other components. The VCO_CTRL pin and the external PLL completes the RF-PLL loop that generates a fixed oscillation frequency for the RFVCO. An external VCO can also be used to drive this input if such a source is available and preferred over the on-chip VCO.

RFVCO_OUT (Pin 25)
RFVCO Output
This is the RFVCO output pin designed to drive the 50Ω input impedance of the external RFPLL/Frequency synthesizer.

VCOCAPIN (Pin 23)
RFVCO Tank circuit Input
This pin is used in conjunction with VCO_CTRL (pin# 22) to form the external tank circuitry for the on-chip RFVCO.

VDDIN and GNDIN (Pins 20 and 21)
RFVCO Input Stage Power Supply and Ground
VDDIN is the power supply for the input stage of the RFVCO. For optimum performance, VDDIN should be bypassed to GNDIN using a high frequency decoupling capacitor. The input stage of the RFVCO is very critical in generating the overall frequency of the RFVCO, therefore, isolating these power supply pins will enhance the overall performance of the RFVCO.

VDDLO and GNDLO (Pin 26 and 24)
RFVCO Power Supply and Ground
VDDLO and GNDLO provide the power supply for the remaining stages of the RFVCO.

POWER SAVING/POWER DOWN/CONTROL PINS
The following pins are all CMOS digital interfaces:

PCTRL (Pin 4)
Transmission Output Power Control
This pin controls the power amplifier output with two levels. A HIGH signal puts the power amplifier in low mode with -2dBm output power. A LOW signal puts the power amplifier in high mode with +14dBm output power. These two levels are based upon using the resistor values shown in the Application circuit on pins REXT1 and REXT2.

PA_PD (Pin 1)
Transmitter Power Amplifier Power Down Control
This is the power down control pin for the power amplifier and preamplifier, separate from the transmitter power down. A HIGH signal turns these amplifiers *on* while a LOW signal turns them *off*.

TX_PD (Pin 28)

Transmitter Power Down Control

This pin controls the power down function of the entire transmitter, excluding the power amplifier and preamplifier. A HIGH signal turns the circuit *on* while a LOW signal turns the circuit *off*.

RFVCO_PD (Pin 27)

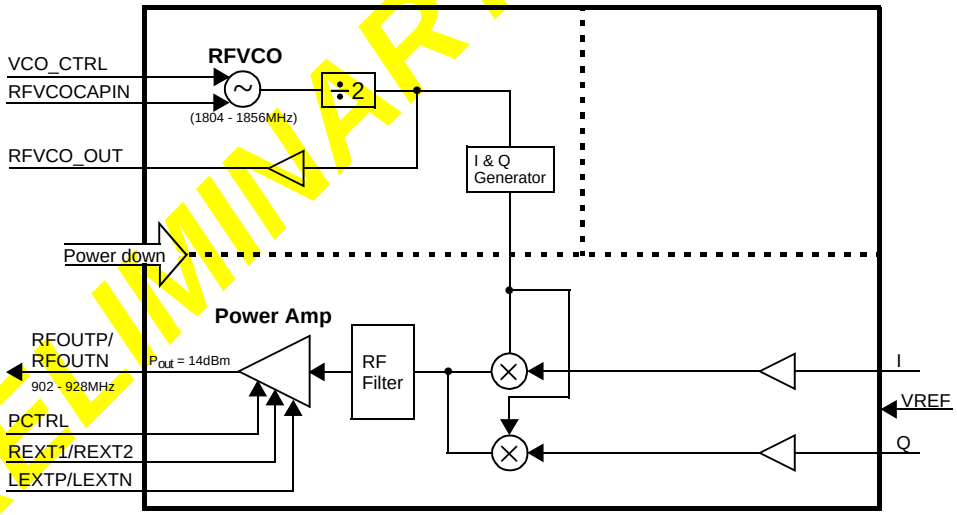
RF VCO Power Down Control

This pin controls the power down function of the RFVCO. A HIGH signal turns the circuit *off* while a LOW signal turns the circuit *on*.

The recommended TDD mode as well as power saving mode usage for all of the control pins are as follows:

Pins	Communication Mode	Power Save
	TX	
TX_PD	HI	LO
PA_PD	HI	LO
RFVCO_PD	LO	HI
PCTRL	LO	HI

Block Diagram



Typical Performance Characteristics

TRANSMITTER:

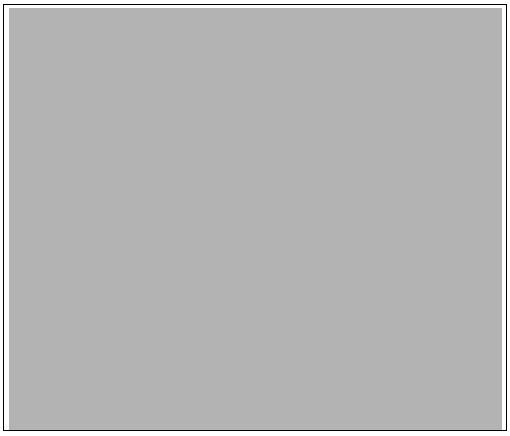


Figure 1. Pout vs Freq, varying temp.

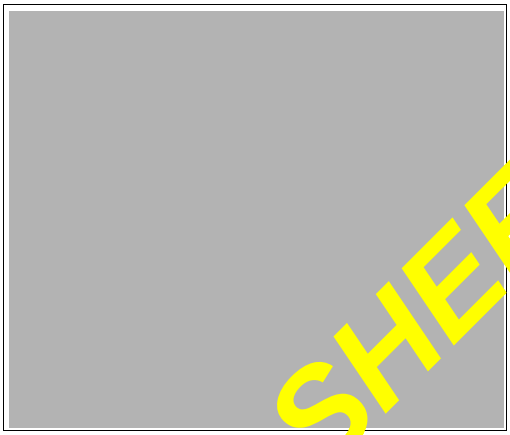


Figure 2. Pout vs Freq, varying vdd

RFVCO:

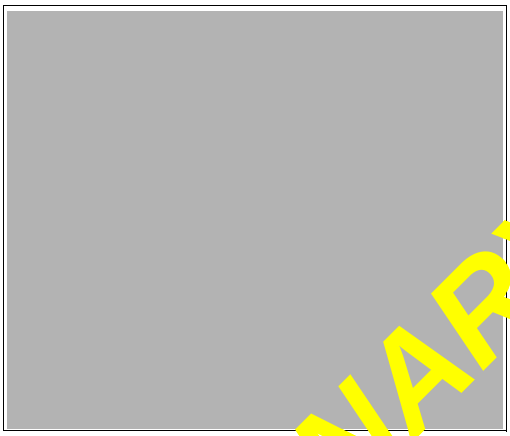


Figure 3. Freq vs Cap., varying temp.

Figure 4. Freq vs Cap., varying vdd

Application Information

The BT10731B is a BiCMOS monolithic integrated RF transmitter (Tx) designed for use with the BT10732B receiver. The BT10731B/BT10732B chip set contains all of the required components for a complete RF-IF transceiver. The BT10731B includes an RF local oscillator, a highly linear upconversion mixer, and an on-chip power amplifier capable of delivering -2dBm to +14dBm. The unit operates from 2.7 - 3.3 volts.

The transmitter accepts I&Q input signals and a DC reference level to the VREF pin from the external system interface. An on-chip filter eliminates spurious signals before entering the on-chip power amplifier. The PA RF output signals are differential, thus a power combining network is required to convert the signals to a single-ended interface with the output load. A power control pin (PCTRL) selects between high or low transmission power mode (+14dBm to -2dBm). The power level could also be set with external resistors connected to the REXT1 and REXT2 pins (*see Application Circuit, Figure 2*).

The RF local oscillator is conveniently provided on-chip and can be used with an external RF PLL frequency synthesizer. The RF local oscillator requires external tuning elements, as shown in the Application Circuit (*Figure 2*) to achieve the required oscillation frequency.

The BT10731B provides power-down pins for the different sections of the chip. The power down/power save mode can be implemented on the BT10731B by a microcontroller (*see Application Circuit, Figure 2 for more power down information*). In addition, the PA_PD pin can be used to slowly ramp up or down the output level of the Power Amplifier by applying a varying linear control signal.

The BT10731B uses an advanced silicon BiCMOS process which provides superior performance compared to existing discrete components. The BT10731B chip demonstrates low sensitivity to process and temperature variations and the power consumption of the unit is less than 450mW under typical conditions from a 3V power supply.

The recommended usage for the BT10731B is shown below in *Figure 1.*

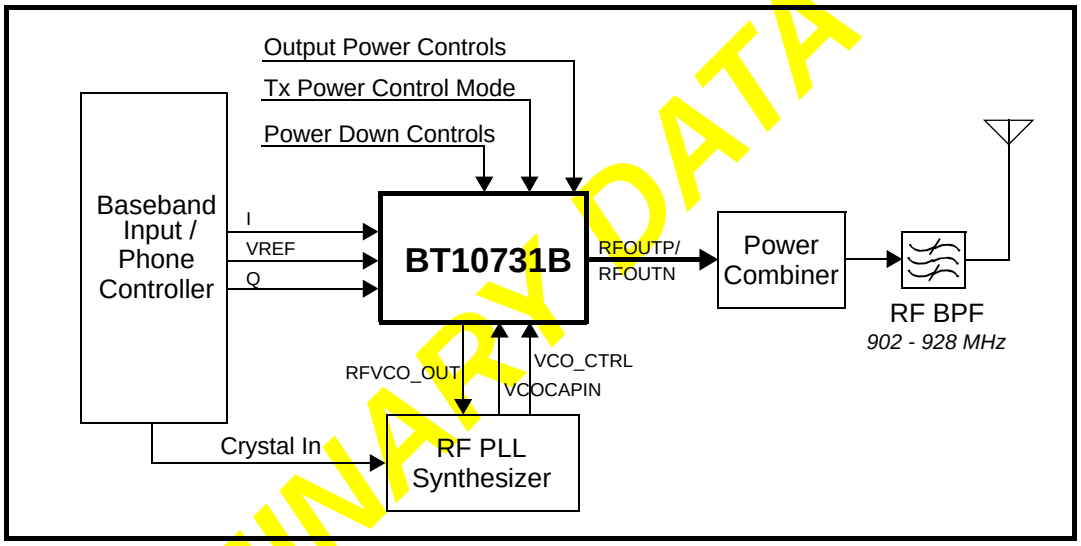


Figure 1

Typical Application Circuit:

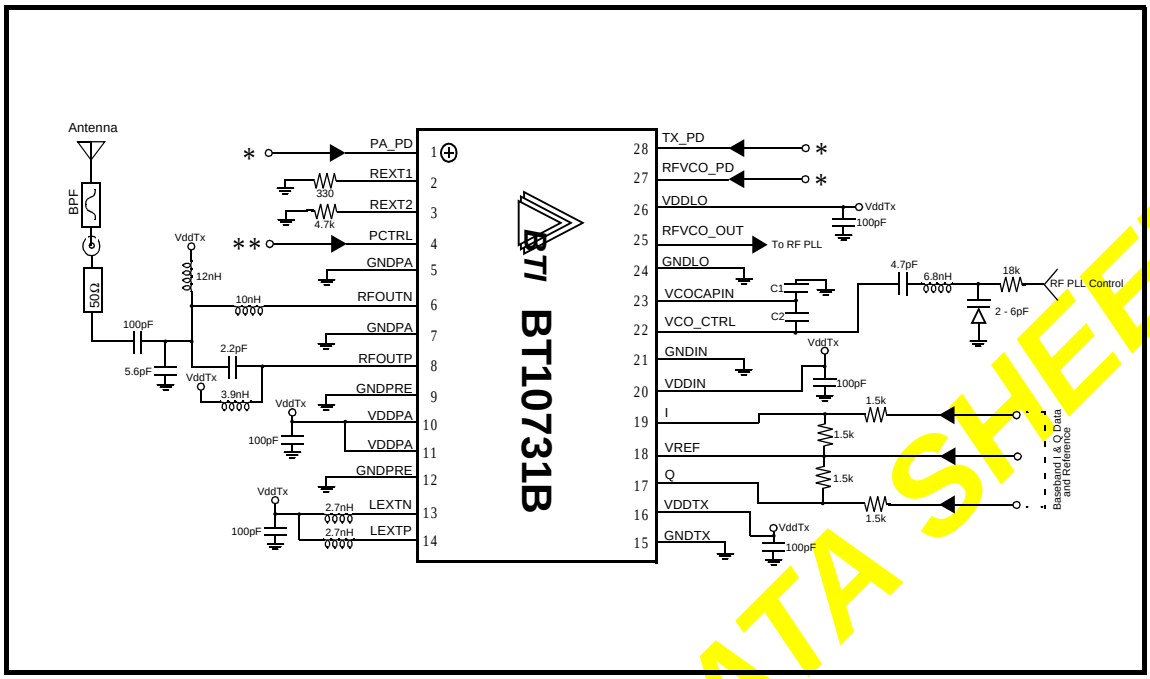


Figure 2

Notes :

* Power Down Mode:

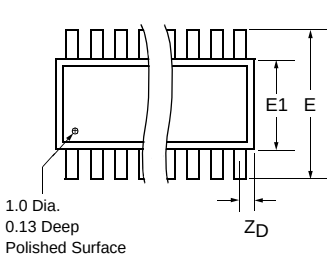
RFVCO_PD = ***high*** for power down mode, ***low*** for operational mode.
TX_PD = ***low*** for power down mode, ***high*** for operational mode.
PA_PD = ***low*** for power down mode, ***high*** for operational mode.

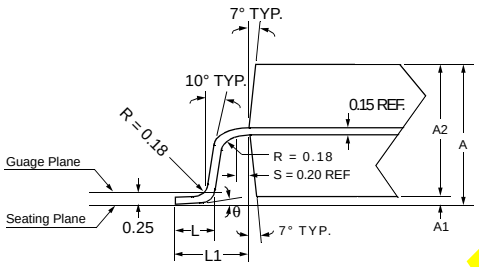
** Tx Power Control Mode:

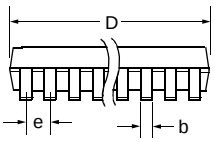
PCTRL = ***low*** for HIGH power mode, ***high*** for LOW power mode.

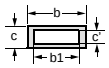
Package Dimensions

28L (150mils) 3.9mm Wide SSOP Package









Lead Count		28L
Body Thickness		2.00
Footprint (Body+)		2.50
Dimensions	Tolerance	
A	Max.	2.00
A1		0.05 Min/0.21 Max
A2	± 0.05	1.70
D	± 0.05	7.20
E	± 0.10	5.99
E1	± 0.10	1.47
L	+0.15/-0.10	0.80
L1	Ref.	1.25
e	Basic	0.65
b	± 0.05	0.30
c		0.13 Min/0.20 Max
Z_D	Ref.	0.20
θ	±4°	0.675

Package dimensions in mm.

Ordering Information

Part No./ Description	For:	Contact:
BT10731B **RF TRANSMITTER**	• Pricing Information • Application Assistance • Application Notes • Samples & Eval Boards • Other TRFIC™ products	USA:* BethelTronix, Inc. Tel: (562) 407-0500 Fax: (562) 407-0510 *see our WEB SITE for a list of our world wide sales reps

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