



## Description

WF308TBM is one ASK transmitter for remote control application. The circuit working frequency range is about 240MHz-450MHz. It is mainly intended for the ISM (Industrial, Scientific and Medical) band 315/433MHz.

WF308TBM integrates one phase-locked loop (PLL) and MCU to set different working frequency and select the transmitting power.

WF308TBM is designed for remote wireless control systems. It is available in SOP-16 package and working over the extended temperature range (-40 to +85°C).

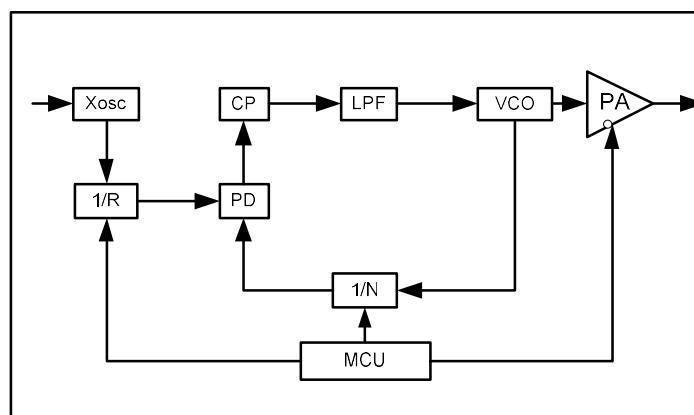
## Features

- Working frequency range: 240MHz-450MHz.
- Tunable output power : 13dBm @ 3V with 50 ohm load, typ.
- Low supply voltage: 2.3V-3.6V for 315/433MHz.
- Low supply voltage detection
- Automatic shutdown protection
- 3-wire SPI interface.

## Applications

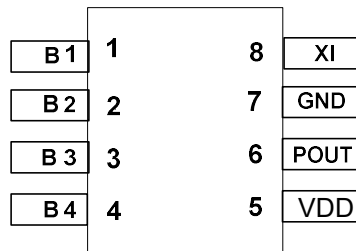
- Remote Keyless Entry (RKE)
- Remote Control, Garage door and gate openers
- AMR-Automatic Meter Reading
- Wireless alarm and security system.

## Block Diagram





## Pin Configuration



**Table 1. Pin Description**

Pin	Symbol	I/O	Description
1	B1	I/O	Bi-direction I/O pin with system wake-up function Software controlled pull-high/open-drain
2	B2	I/O	Bi-direction I/O pin with system wake-up function Software controlled pull-high/open-drain/pull-down External interrupt input
3	B3	I/O	Input pin or open-drain output pin with system wake-up function System clear (RESET) input. Active low RESET to the device. Weak pull-high always on if configured as RSTB. Voltage on this pin must not exceed VDD, See IOB3 diagram for detail description.
4	B4	I/O	Bi-direction I/O pin with system wake-up function Software controlled pull-high/open-drain
5	VDD		Analog circuit Power supply
6	POUT		Transmitted RF output
7	GND		Ground
8	XI		Input terminal of local oscillation signal. It is connected to the crystal or driven by an external clock.



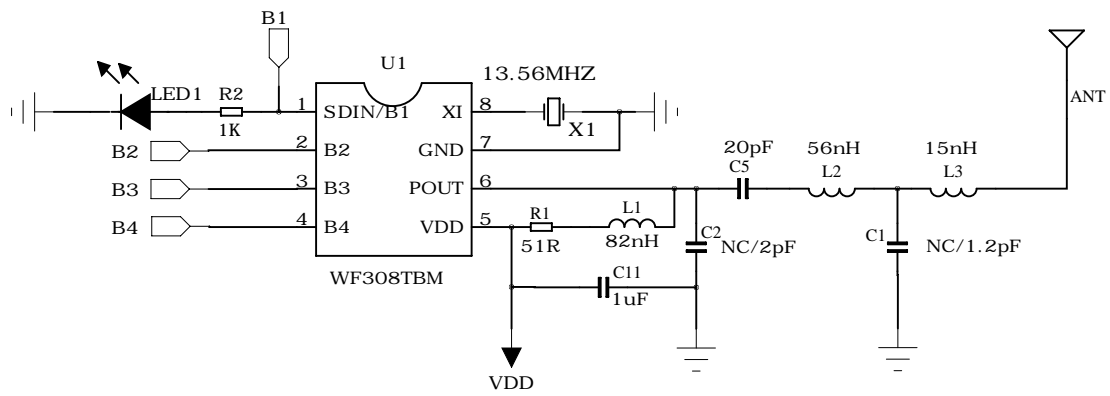
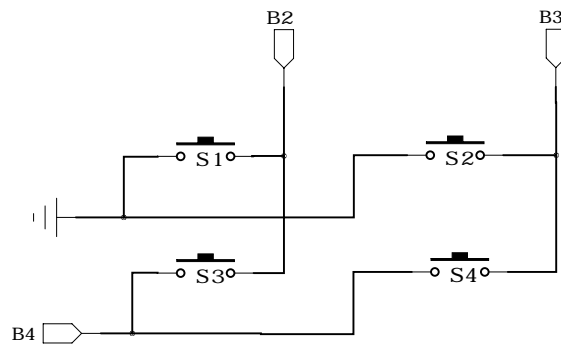
Note: B1 connect to WF308TBM SDIN

**Table 2. Absolute Maximum Rating**

Item	Rating
Supply Voltage, VDD	+ 5.6V
Inputs and Clock Outputs	- 0.5V to + 5.6V
Storage Temperature	- 65 to + 150 oC
Soldering Temperature	+ 260 oC

**Table 3. Electrical Specifications**

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Supply Voltage	V <sub>DD</sub>	240MHz-450MHz	2.2	3.0	3.6	V
Supply Current	I <sub>DD</sub>	Fout=315MHz, 13dBm, 3V		8.5		mA
		Fout=434MHz, 13dBm, 3V		8.5		mA
RF Power On/Off Ratio	Pratio	240MHz-450MHz		60		dB
Pout supply voltage	Pvol	240MHz-450MHz			3.6	V
Transmitted Power	Pout	Fin=315MHz, Vdd=5V		10		dBm
		Fin=434MHz, Vdd=5V		10		dBm
Data Rate		OOK/ASK mode	0.5		10	Kb/s
OSCI operating Frequency	F <sub>OSC</sub>		9	10	20	MHz
RC-OSC	Rosc	RC Oscillator		4		MHz
Operating Temperature	T <sub>a</sub>		-40	27	85	°C
Leakage Current	I <sub>SB</sub>	Power down mode			1	uA

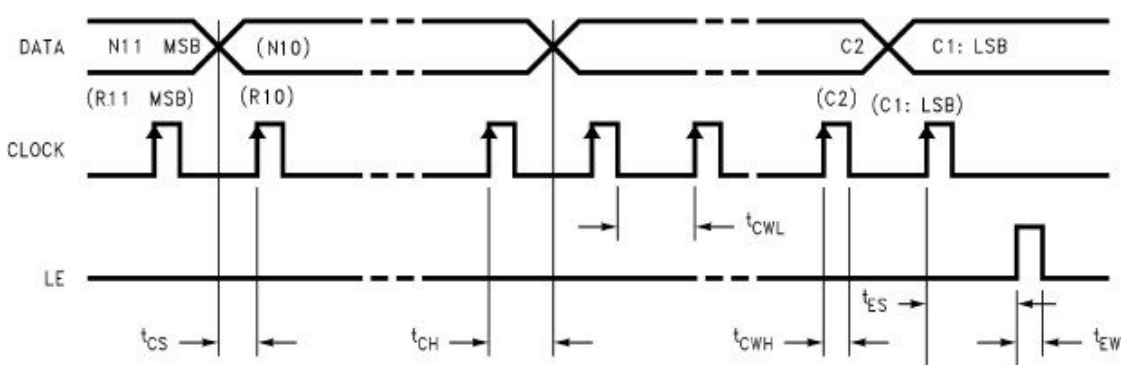




## Functional Description

### Serial Data input and Timing

WF308TBM has 3-wire interface (CLK, DATA, LE) to set R counter, PLL N counter, and other parameters. At the rising edge of CLK, DATA are written into shift-register (MSB: first input data; LSB: last input data). At the rising edge of LE, stored data is loaded into mid-latches.



- Note:
- (1) MSB loaded first.
  - (2) When WF 308TBM power is disconnected CLK, DATA, LE are pulled at low
  - (3)

Symbol	Parameter	Min	Max	Unit
$t_{CS}$	Data to Clock Setup time	10.5		$\mu s$
$t_{CH}$	Data to Clock Hold time	22		$\mu s$
$t_{CWH}$	Clock Pulse width High	10.5		$\mu s$
$t_{CWL}$	Clock Pulse width Low	20.5		$\mu s$
$t_{ES}$	Clock to LE Setup time	10		$\mu s$
$t_{EW}$	LE pulse width	10		$\mu s$

11-Bit data are transfer from shift-register into the latches, MSB first, LSB last. The last two LSB bits control the register address. The bit format is as below.

Where C1, C2 are control bits, determines the register address.

Register Address control bits		Register	Note
C2	C1		
0	0	R0	



0	1	R1	
1	0	R2	
1	1	R3	

For R0 register, R0<8:7> control charge pump current, R0<9> not used.

		R counter						CP current		Not used
LSB										MSB
C1	C2	N	N	N	N	N	N	N	N	N
		1	2	3	4	5	6	7	8	9
0	0	R0								

function	R0<8:7>		
	N8	N7	Icp (uA)
	0	0	0.5
	0	1	1.0
	1	0	1.5
	1	1	2.0

R counter is controlled by initial 6-Bits N<6:1>, see below table. Default state, R=10

R<6:1>	N6	N5	N4	N3	N2	N1
1	0	0	0	0	0	0
1	0	0	0	0	0	1
2	0	0	0	0	1	0
3	0	0	0	0	1	1
63	1	1	1	1	1	1

Note:

- (1) MSB load first.
- (2)  $R \geq 1$
- (3)  $R = R1 \times 2^0 + R2 \times 2^1 + \dots + R6 \times 2^5$ , R = 1 to 64.

For R1 register, R1<9>=1, power down chip. Other bits control B counter.

		B counter								Global Powerdown
LSB										MSB
C1	C2	N	N	N	N	N	N	N	N	N
		1	2	3	4	5	6	7	8	9
1	0	R1								

B counter are controlled through 8-Bits, according to below table, N8 default state is 1, else bits are zeros.



B	N8	N7	N6	N5	N4	N3	N2	N1
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
255	1	1	1	1	1	1	1	1

$B = N1 \times 2^0 + N2 \times 2^1 + \dots + N8 \times 2^7, B \geq 1$ , Divider ration: 1 to 255 ( $B \geq A$ ),

For R2 register, R2<9> not used. R2<8> select N-divider modulus P.

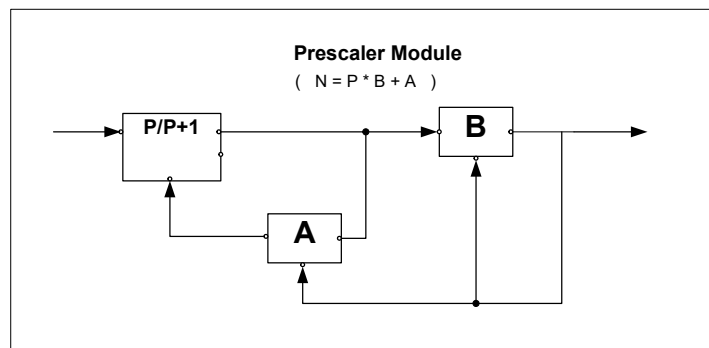
Mode sel	Clk sel	A Counter							N divider select	Spur control
LSB										MSB
C1	C2	N1	N2	N3	N4	N5	N6	N7	N8	N9
1	1	R2								

	R2<8> control N-divider mode	
	0	1
function	P=16	P=32

Counter (N) consists of one 7-Bits SWALLOW COUNTER (A Counter), one 8-Bits PULSE COUNTER (B counter), and one P/ (P+1) prescaler. When counter A counts, dual module prescaler divider ratio is P+1. When A counter is overflow but B counter still counts, dual module prescaler divider ratio is P, P =16, or 32. While B counter overflow, A counter and B counter both are reset. Finally the divider ration N is,

$N = P \times B + A, B \geq A$

The default state N=320, P=32, B=10, A=0.





A counter is controlled by initial 7-Bits, see below table.

A	N7	N6	N5	N4	N3	N2	N1
0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	1
127	1	1	1	1	1	1	1

Pulse swallow formula:  $fvco = [(P * B) + A] * fosc / R$ ,

- $fvco$ , VCO oscillation frequency
- B, 11-Bits B counter's divider ration, 1-255
- A, swallow A counter's divider ration,  $0 \leq A \leq 127$ ,  $A \leq B$ .
- $fosc$ , crystal oscillation frequency
- R, 6-Bits R counter divider ration, 1-63
- P, dual module prescaler,  $P = 16/32$ .

For R3 register,  $R3<2:1>=1$ , not used.  $R3<6:3>$  control power amplifier transmitting power.  $R3<9:7>=1$ , not used.

		Not used		TX power control				Not used		MSB
LSB										
C1	C2	N 1	N 2	N 3	N 4	N 5	N 6	N 7	N 8	N 9
<b>1</b>	<b>1</b>	R3								

R3<6:3>	Function, tune TX power
0000	Def power
0001	Max power
1110	Min Power

### Crystal Oscillator

The crystal oscillator circuit consists of a colpitts oscillator. It can drive 10MHz-30MHz crystal without external capacitors required. The crystal driver stage can also take input clock as input clock buffer.

The R counter is used to divide the crystal clock down to the low frequency clock, which is sent to PFD in PLL block as reference clock.





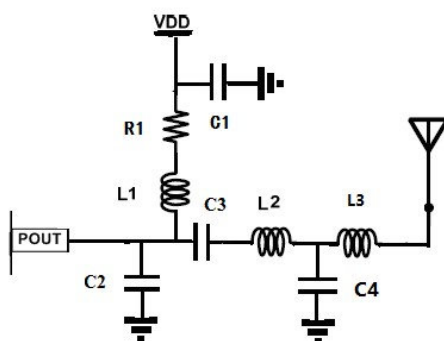
## PLL Block

The PLL consists of phase-frequency detector (PFD), charge pump, loop filter, voltage-controlled oscillator (VCO), and divider (N). The PFD compares two signals and produces an error signal which is proportional to the two signal phase difference. The error signal is used to control the VCO to run fast or slow.

The divider N counter is selectable through SPI interface. The VCO oscillation frequency range is tunable between 300MHz-500MHz.

## RF OUTPUT

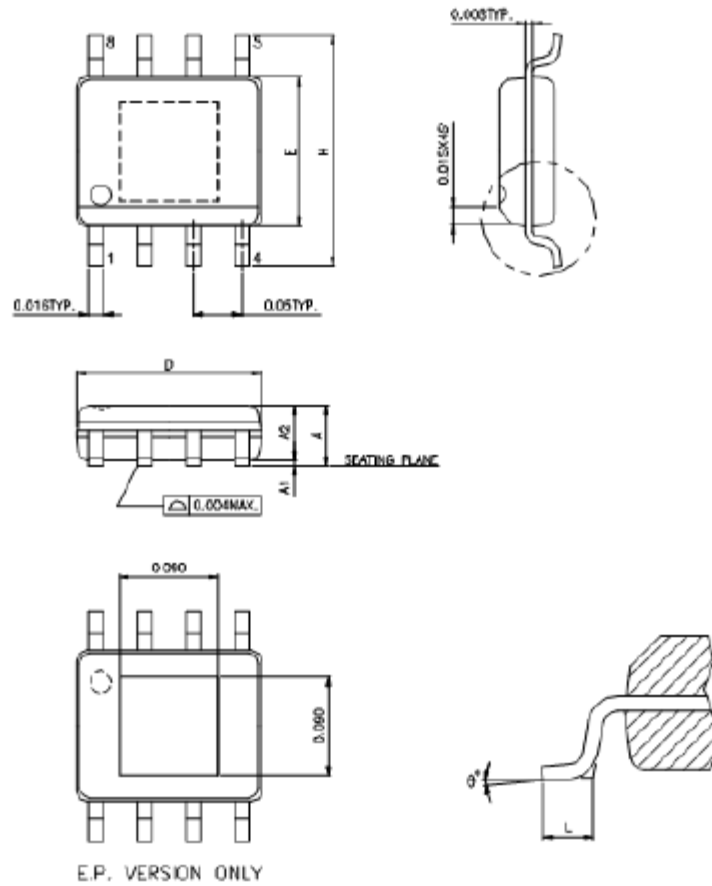
The POUT pin can be matched to 50 Ohm with a T-type circuit. The supply voltage can be as high as 3.6V. Below table is suggested inductor and capacitor value for different frequency.



Frequency (MHz)	L1 (nH)	L2 (nH)	L3 (nH)	C1 (uF)	C2 (pF)	C3 (pF)	C4 (pF)	R1 ( $\Omega$ )	Note
315	100	82	82	1.0	1.0	5	1.8	100	
433	82	68	68	1.0	1.0	5	1.2	100	



Package Information SOP- 8



SYMBOLS	MIN	NOR	MAX	MIN	NOR	MAX
	(inch)			(mm)		
A	0.053	-	0.069	1.346	-	1.753
A1	0.004	-	0.010	0.102	-	0.254
A2	-	-	0.059	-	-	1.498
D	0.189	-	0.196	4.800	-	4.978
E	0.150	-	0.157	3.810	-	3.988
H	0.228	-	0.244	5.791	-	6.198
L	0.016	-	0.050	0.406	-	1.270
θ°	0°	-	8°	0°	-	8°