



Actions Semiconductor Co., Ltd.

**TX6 ATS306T/RX6 ATS306R
Data Sheet**

Version 1.00



Notice:

The 7-function TX6 ATS306T/RX6 ATS306R heritages the sophisticated architecture and design methodology from TX6/RX6 of Realtek Semiconductor who is one of the leaders of remote controller technology design of toy product.

This pair of TX6 ATS306T/RX6 ATS306R is the best Transmitter/ Receiver choice of remote control car and fully covers TX6RX6 features with superior performance. The TX6 ATS306T/RX6 ATS306R is with more functions and excellent quality, its stability and affectivity promoted to a higher level applications. Actions keeps on leading the designing technique of remote controller of toy product.

Remark: Realtek Semiconductor is the trademark of Taiwan Realtek Semiconductor

REMOTE CONTROLLER WITH SEVEN FUNCTIONS



General Description

The TX6 ATS306T/RX6 ATS306R are a pair of CMOS LSIs designed for remote controlled car applications. TX6 ATS306T is the encoder and RX6 ATS306R is the decoder. They provide seven function keys to control forward, Backward, Rightward, Leftward, Turbo, F1 and F2 motions. Besides, a combination of these five common motions (Forward, Backward, Left, Right and Turbo) can be played. And RX6 ATS306R provides the ability of two shift gears for Forward and Backward functions.

TX6 ATS306T is built with auto Power-OFF function. When input key is pulled low, TX6 ATS306T will wake up, SO and SC will continuously send out the outputs used in wireless (Non-Carrier) and infrared (Carrier) applications respectively. When a complete code is sent out and all the keys are open, TX6 ATS306T will automatically go into power-off mode.

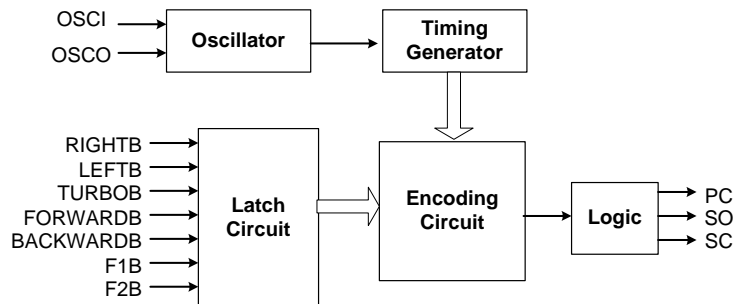
RX6 ATS306R provides two high effective amplifiers and enhance Signal Input (SI) recognition circuit for increasing remote control distance.

RX6 ATS306R has an internal, selectable DC-DC converter that makes the application stable, reliable under lower supply voltage.

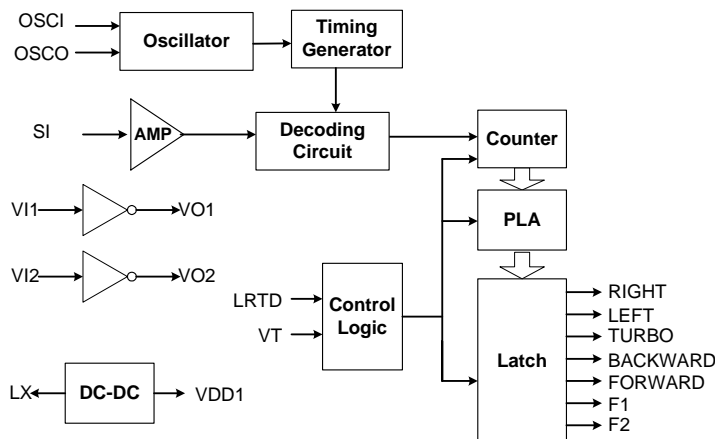
RX6 ATS306R has Motor Limit-Current Protection Circuit for safe and friendly application of RC toy.

Block Diagrams

TX6 ATS306T(Encoder)



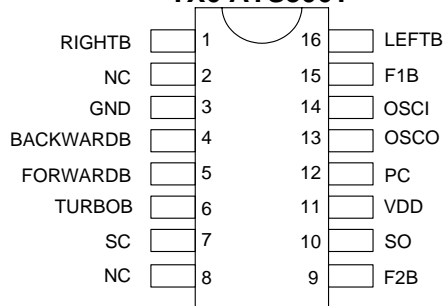
RX6 ATS306R(Decoder)



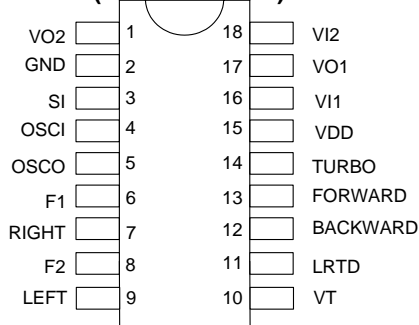
Pin outs



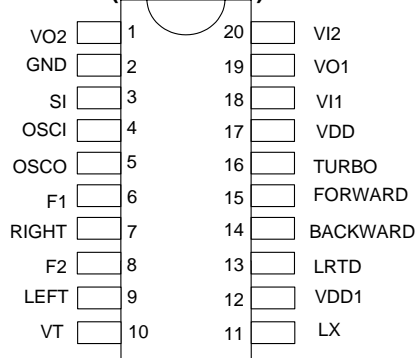
TX6 ATS306T



**RX6 ATS306R
(Without DC/DC)**



**RX6 ATS306R
(With DC/DC)**



Features

- Wide and Low operating voltage range:
2.0V to 5.0V(TX6 ATS306T and RX6 ATS306R without DC/DC)
A 3.8V zener is built in RX6 ATS306R, so a current limitation resistor is required

1.0V ~ 3.0V (RX6 ATS306R with DC/DC)
- Seven-function remote controller controlling Forward/ Backward/ Turbo/ Right/ Left/F1/F2
- Provide two transmissive interface (RF and IR) for different application
- Two speed-shift is realized for Forward and Backward
- Few external components needed
- RX6 ATS306R's Oscillator only with an external resistor and an external capacitance.
- Low standby current and low operating current.
- Typical oscillator frequency:
RF: 128KHz
IR: 114KHz(Carrier Frequency: 57KHz)
IR: 76KHz(Carrier Frequency: 38KHz)
- Auto Power-OFF function for TX6 ATS306T
- Internal, Selectable Limit-Current protection function. If selected, few external components needed
- Provide the function of gearing down if swerving
- Provide two high effective amplifiers and enhance signal input (SI) recognition circuit for very weak signal for increasing remote control distance.



- Internal, Selectable DC-DC converter, which need few external components. The input voltage ranges from 1.0V to 3.0V, where V_{OUT} can be set to about 3.1V. Start-up is guaranteed from 1.0V inputs. Hold voltage is 0.8V.
- RX6 ATS306R has very strong driving ability about seven function-output

Absolute Maximum Ratings

Comments*

DC Supply Voltage..... -0.3V to 6.0V
 Input/Output Voltage..... GND -0.2V to VDD + 0.2V
 Operating temperature..... -10°C to 60°C
 Storage Temperature..... -25°C to 125°C

Never allow a stress to exceed the values listed under "Absolute Maximum Ratings", otherwise the device would suffer from a permanent damage. Nor is a stress at the listed value be allowed to persist over a period, since an extended exposure to the absolute maximum rating condition may also affect the reliability of the device, if not causing a damage thereof.

Electrical Characteristics

TX6 ATS306T

Typical operating Conditions : VDD = 3.8V, Fosc = 128KHz, $T_A=25^\circ\text{C}$, (unless otherwise noted.)

Parameter	Symbol	Conditions	TX6 ATS306T			Units
			Min	Typ	Max	
Input Low Voltage	V_{iL}	Function Input Pin	-0.7		1.5	V
Stand by Current	$I_{StandBy}$	No function input		0.2	1.0	uA
Operating Current	I_{DD}	Unload		0.1	0.6	mA
SO Driving Current	I_{DrSO}	Load=0.7V(1N4148)	10			mA
SC Driving Current	I_{DrSC}	Load=0.7V(1N4148)	10			mA
PC Driving Current	I_{DrPC}	Load=0.7V(1N4148)	10			mA
Oscillator Frequency Tolerance	$F_{tolerance}$	RX6 ATS306R Fosc=128KHz	-20%		+20%	%
Code Speed	S_{Code}	Fosc=128KHz	500		1000	Hz

Note 1: "Function input pin" means Forwardb, Backwardb, Rightwardb, Leftwardb, Turbob, F1B and F2B inputs

RX6 ATS306R(Without DC/DC)

Typical operating Conditions: VCC (Power supply) = 4.5V, a Current Limitation resistor (68Ω) is between power supply and VDD pin. Fosc = 128KHz, $T_A=25^\circ\text{C}$, (unless otherwise noted.)

Parameter	Symbol	Conditions	RX6 ATS306R			Units
			Min	Typ	Max	
Function Output voltage	V_o	Unload	3.7	3.8	3.9	V
Operating Current	I_{DD}	Unload		8.0		mA
Output Driving Current	$I_{Driving}$	Load=0.7V(1N4148)	8.0			mA
Oscillator Frequency Tolerance	$F_{tolerance}$	TX6 ATS306T Fosc=128KHz	-20%		+20%	%

Note 1: "Function Output pin" means forward, Backward, Rightward, Leftward, Turbo, F1 and F2 outputs



Note 2. Operating Current value is high because of supply voltage higher than zener voltage. The operating current will only be less than 0.8mA if power supply is less than 3.6V.

RX6 ATS306R (With DC/DC)

Typical operating Conditions : $V_{INPUT}=1.5V$, $F_{osc} =128KHz$, $T_A=25^{\circ}C$. Using DC-DC converter, (unless otherwise noted.)

Parameter	Symbol	Conditions	RX6 ATS306R			units
			Min	Typ	Max	
DC-DC Output voltage	V_{DD}		3.0	3.1	3.3	V
Function Output voltage	V_{OH}	Unload	3.0	3.1	3.3	V
DC-DC Hold voltage	V_{HOLD}	Unload	0.8			V
Operating Current	I_{DD}	Unload (Use recommended DC-DC circuit)		1.0		mA
Output Driving Current	$I_{Driving}$	Load=0.7V(1N4148)	5.0			mA
Oscillator Frequency Tolerance	$F_{tolerance}$	TX6 ATS306T 128KHz	-20%		+20%	%

Note 1: "Function Output pin" means forward, Backward, Rightward, Leftward, Turbo, F1 and F2 outputs

Note 2: " V_{INPUT} " means the input voltage to the DC-DC converter.

Note 3: The start-up voltage depends on the application circuit. 1.0V(Start-up) means that the Schottky Type Diode(1N5817) must be used.

Pin Description

**TX6 ATS306T**

NAME	PIN	FUNCTION
RIGHTB	1	The rightward function will be selected when this pin is connected to GND. (High when open)
GND	3	Negative power supply
BACKWARDB	4	The backward function will be selected when this pin is connected to GND. (High when open)
FORWARDB	5	The forward function will be selected when this pin is connected to GND. (High when open)
TURBOB	6	The turbo function will be selected when this pin is connected to GND. (High when open)
SC	7	Output pin of the encoding signal with carrier frequency (IR)
F2B	9	The F2 function will be selected when this pin is connected to GND. (High when open)
SO	10	Output pin of the encoding signal without carrier frequency (Wireless)
VDD	11	Positive power supply
PC	12	Power control output pin. When any function key is pulled low, PC will be high logic. If not, it will be Low logic.
OSCO	13	Oscillator output pin
OSCI	14	Oscillator input pin
F1B	15	The F1 function will be selected when this pin is connected to GND. (High when open)
LEFTB	16	The leftward function will be selected when this pin is connected to GND. (High when open)

RX6 ATS306R



NAME	PIN (Without DC/DC)	PIN (With DC/DC)	FUNCTION
VO2	1	(1)	Output pin for the Second amplify
GND	2	(2)	Negative power supply
SI	3	(3)	Input pin of the encoding signal. A inverter must be between SO and SI if connected directly
OSCI	4	(4)	Oscillator input pin
OSCO	5	(5)	Oscillator output pin
F1	6	(6)	F1 function output pin (High when active)
RIGHT	7	(7)	Rightward output pin (High when active)
F2	8	(8)	F2 function output pin (High when active)
LEFT	9	(9)	Leftward output pin (High when active)
VT	10	(10)	Input pin of Limit-Current protection function. If no used, it should be connected to GND
LX1	-----	(11)	DC-DC converter Switch signal output pin. The LX pin should be connected with a switch-transistor through a resistor for Limiting the current
VDD1	-----	(12)	DC-DC converter voltage output pin. Supply positive power for VDD
LRTD	11	(13)	The Turbo (High speed) function will be cancelled in the swerve motion if it is connected to Gnd
BACKWARD	12	(14)	Backward output pin (High when active)
FORWARD	13	(15)	Forward output pin (High when active)
TURBO	14	(16)	Turbo output pin (High when active)
VDD	15	(17)	Positive power supply
VI1	16	(18)	Input pin for the First amplify
VO1	17	(19)	Output pin for the first amplify
VI2	18	(20)	Input pin for the Second amplify



Detailed Description

(1) Common Functions

RC toy's Common Functions include Forward, Backward, Left, Right and Turbo motions.

Input/Output Tables

Function input (TX6 ATS306T) ①	Decode Result (RX6 ATS306R) ②
No any function Input	No output
Forward (L)	Forward pulse (Z)
Forward (L)&Turbo (L)	Forward (H)&Turbo(H)
Turbo(L)	Turbo(H)
Forward(L)&Left(L) <Or Right(L)>	Forward pulse(Z) &Left(H) <Or Right(H)>
Turbo(L) &Left(L) <Or Right(L)>	Turbo(H)&Left(H) <Or Right(H)>
Turbo(L)&Forward(L)&Left(L) <Or Right (L)>	Turbo(H)&Forward(H)&Left(H) <Or Right(H)>
Backward (L)	Backward pulse(Z)
Backward(L)&Turbo(L)	Backward(H)&Turbo(H)
Backward(L)&Left(L) <Or Right(L)>	Backward pulse(Z) &Left(H) <Or Right(H)>
Turbo(L)&Backward(L)&Left(L) <Or Right (L)>	Turbo(H)&Backward(H)&Left(H) <Or Right (H)>
Left(L)	Left(H)
Right (L)	Right(H)

Note 1: Tab ① longitudinal data indicates that corresponding Function input keys are pulled down to Gnd (L=LOW)

Note 2: Tab ② longitudinal data indicates that corresponding outputs are active. H=HIGH, Z= 84Hz 66.7% DUTY Pulse

Note 3:The frequency of pulse depends on the local oscillator frequency. If the local oscillator frequency is 128KHz, the frequency of pulse will be 84Hz.

Note 4:The duty of pulse will not vary in any case.

Note 5:The Forward and Backward outputs cannot be active at the same time in any case though AST305T has the corresponding inputs. So are left and right outputs.

(2) F1 and F2 functions

RX6 ATS306R has two absolute independent Digital Channel: F1 and F2. They also haven't any relation with common functions and other F3, F4 functions.

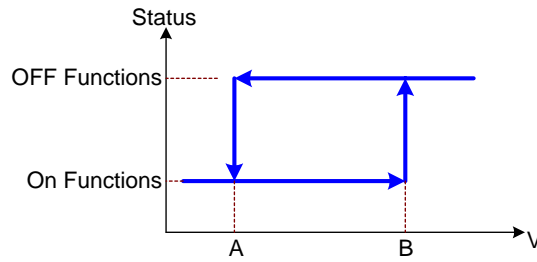
F1 and F2 functions can be used in audio control, Lamp indication and other motor driving.

(3) VT: Limit-Current protection

At some time the toy's servomotor will be blocked for some reasons, so the function of protecting the motor is very important for us. And then, RX6 ATS306R provides the protection function for avoiding it take place.

The function is selectable. If not, VT pin should be pulled down to Gnd.

If select, the circuit that needs few external components should transform the servomotor current to the voltage for VT input



Note 1: The abscissa data is the voltage that is from VT input. And ordinate data is the On-Off status of All the IC outputs.

Note 2: There are different voltage overturn point of A and B depended on the power supply .For example, If power supply is 3.8V, A point 1.2V, B point 1.7V. And if power supply is 2.7V, A point is 1V, B point 1.35V.

(4) LRTD: Auto Gearing Down function

The toys should not be played in high speed when it is turning. Just do so, turnover will happen. RX6 ATS306R provides the function that prohibits the motion of high speed (Turbo output) while turning if LRTD is connected to Gnd. LRTD function is selectable. If not, Let it be open.

The steering output controlled by The toy player (TX6 ATS306T)	Input of LRTD	The final output (RX6 ATS306R)
Turbo&Left <Or Right>	Inactive(Open)	Turbo(H)&Left(H) <Or Right(H)>
Turbo&Forward&Left <Or Right>	Inactive (Open)	Turbo (H)&Forward (H)&Left(H) <Or Right (H)>
Turbo&Backward&Left <Or Right>	Inactive (Open)	Turbo (H)&backward (H)&Left(H) <Or Right (H)>
Turbo&Left <Or Right>	Active (Low)	Left(H) <Or Right(H)>
Turbo&Forward&Left <Or Right>	Active (Low)	Forward(Z)&Left(H) <Or Right(H)>
Turbo&Backward&Left <Or Right>	Active (Low)	Backward(Z)&Left(H) <Or Right(H)>

Note 1: Z=pulse(84Hz 66.7%Duty) H= High logic.

(5) Two-speed Shift Function

How to realize the two-speed shift of servomotor?

Please use Forward and Backward output for driving the servomotor. If Turbo is inactive, the motor works in low speed because of pulse driving .And if Turbo is active, the motor works in high speed for High logic driving



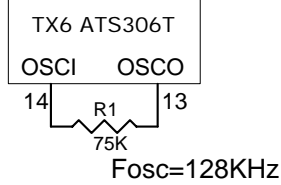
Typical Application Circuit

Transmitter (TX6 ATS306T Fosc=128 KHz)

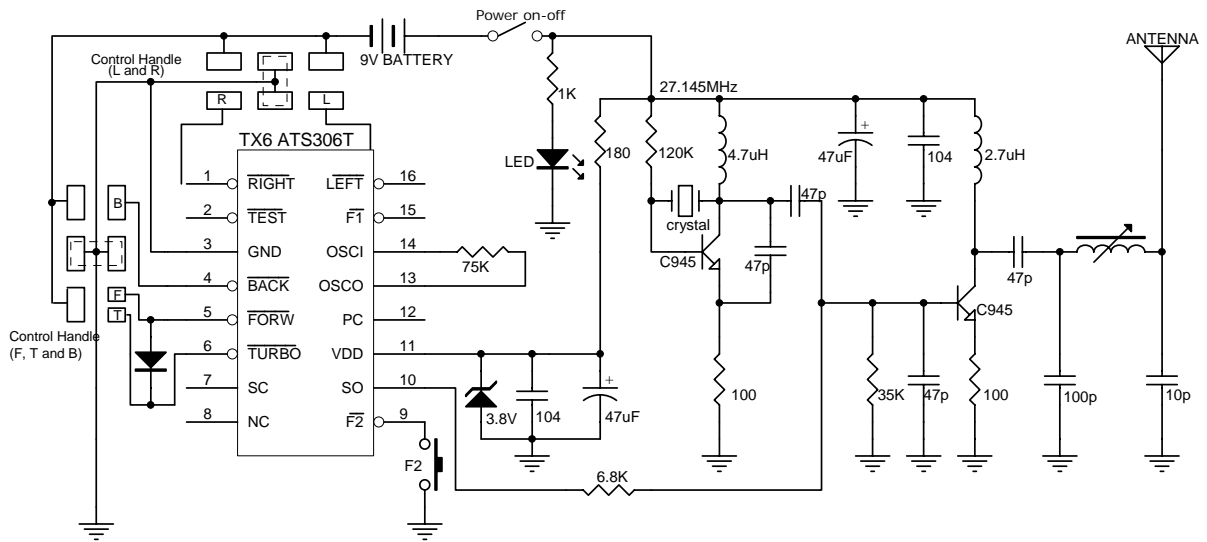
Note 1: Two-Speed shift is realized about forward output.

Note 2: The frequency in the table below is 128KHz. The value of resistor (R1) should be changed, if the other oscillator frequency needed.

Oscillator Circuit



R1	Fosc
80K	About 120KHz
75K	About 128KHz
68K	About 143KHz





Receiver I (RX6 ATS306R Fosc =128 KHz)

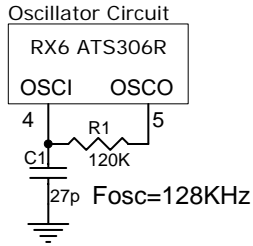
Note 1: The VT pin is pulled down to Gnd because of no using Limit-Current protection.

Note 2: Please use the appropriate Current-Limit resistor when using internal zener.

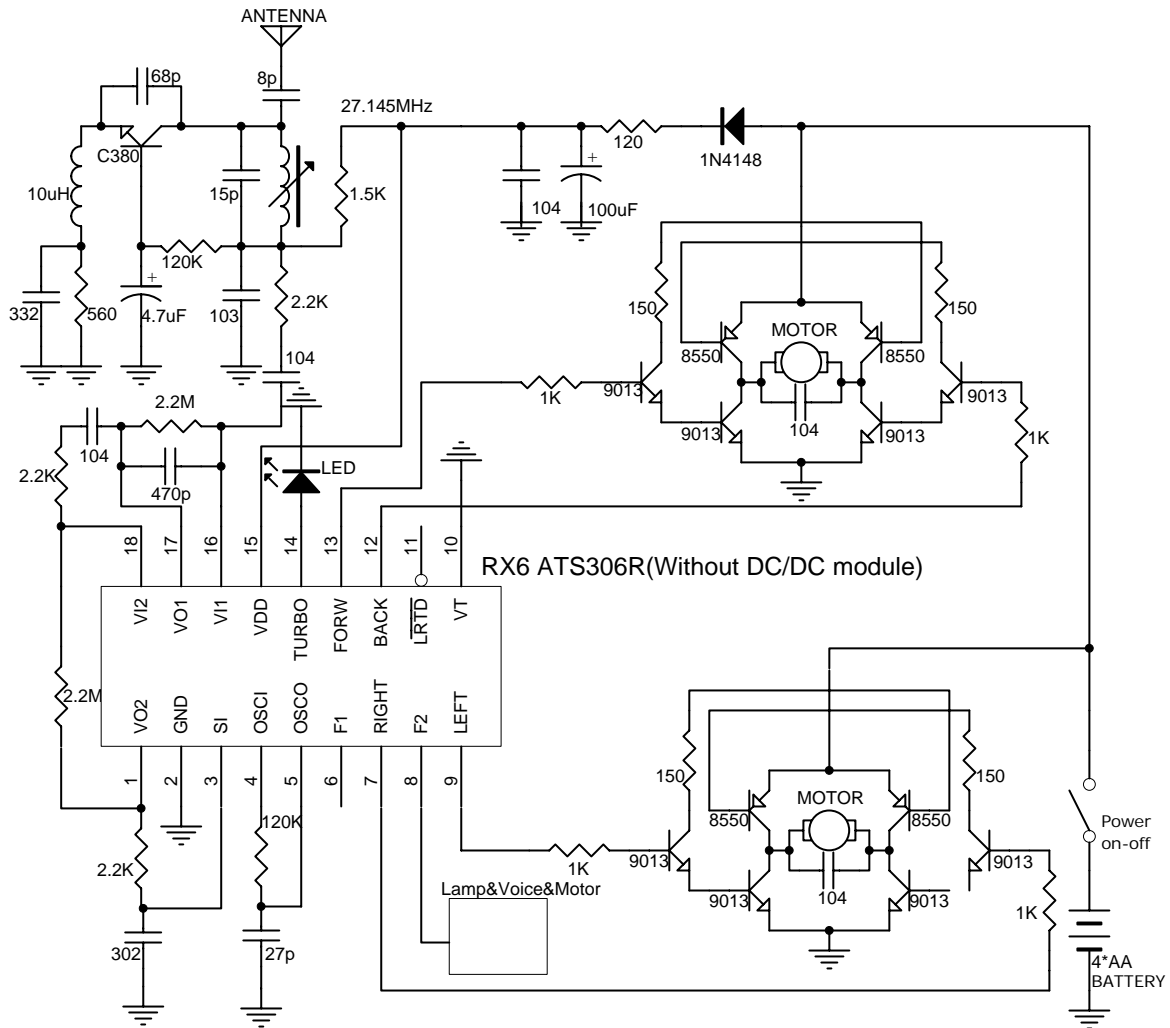
Note 3: F2 output is connected with the circuit that needs control.

Note 4: The frequency in the table below is 128KHz. The value of resistor (R1) should be changed, if the other oscillator frequency needed. And changing the value of oscillator capacitance (C1) is not necessary

Note 5: Without the DC/DC module



R1	C1	Fosc
150K	27p	About 103KHz
120K	27p	About 128KHz
100K	27p	About 154KHz





Receiver II (RX6 ATS306R Fosc =128 KHz)

Note 1: Using the Limit-Current Protection function

Note 2: Please use the appropriate Current-Limit resistor when using internal zener.

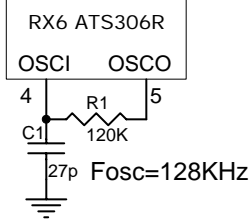
Note 3: F2 output is connected with the circuit that needs control.

Note 4: Using the LRTD function

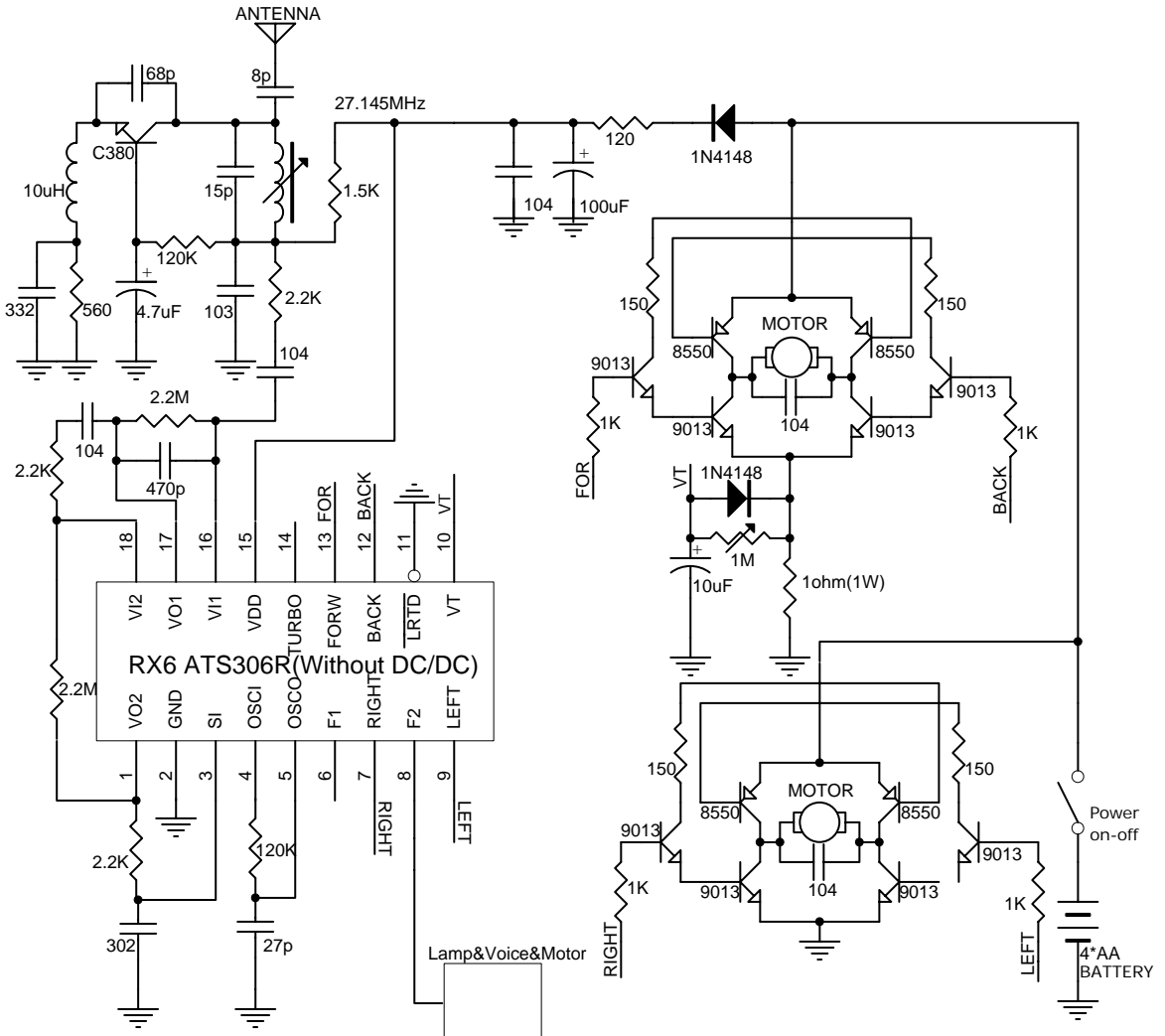
Note 5: The frequency in the table below is 128KHz. The value of resistor (R1) should be changed , if the other oscillator frequency needed. And changing the value of oscillator capacitance (C1) is not necessary

Note 6: Without the DC/DC module

Oscillator Circuit



R1	C1	Fosc
150K	27p	About 103KHz
120K	27p	About 128KHz
100K	27p	About 154KHz





Receiver III (RX6 ATS306T Fosc =128 KHz)

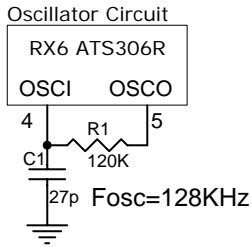
Note 1: With the DC/DC module, because of lower supply voltage, and the Schottky Type Diode must be used

Note 2: Using the Limit-Current Protection function .The VT pin must be pulled down to Gnd If no using Limit-Current protection.

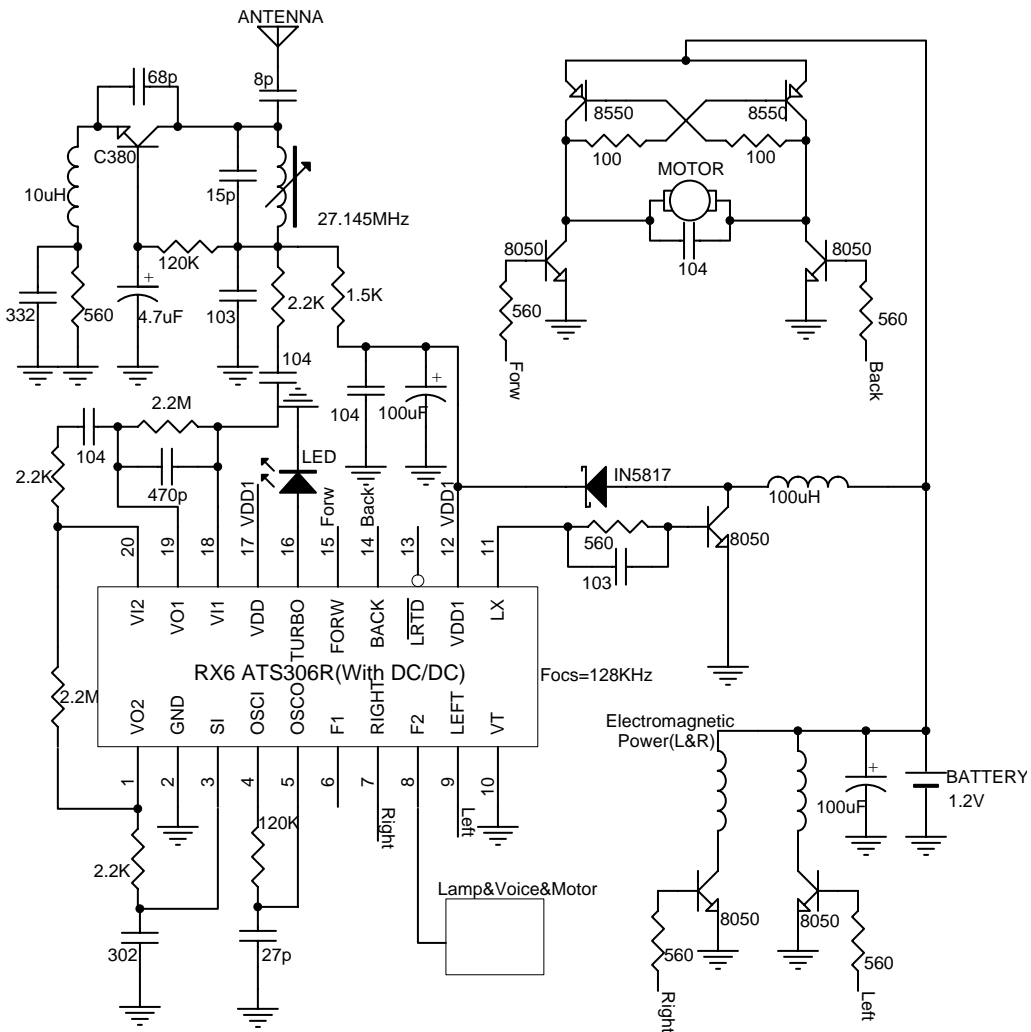
Note 3: The TURBO pin connect with a LED that shows high speed motive status.

Note 4: F2 output is connected with the circuit that needs control.

Note 5: The frequency in the table below is 128KHz. The value of resistor (R1) should be changed, if the other oscillator frequency needed. And changing the value of oscillator capacitance (C1) is not necessary



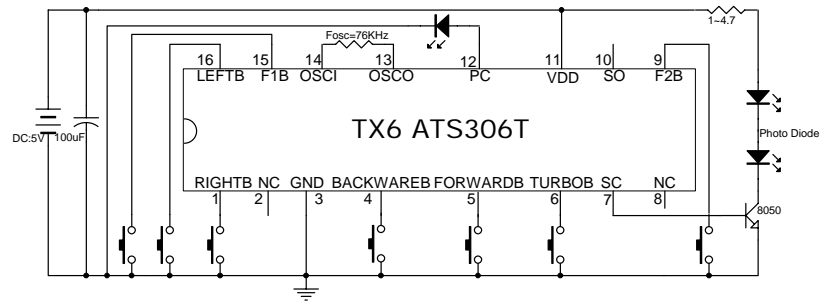
R1	C1	Fosc
150K	27P	About 103KHz
120K	27P	About 128KHz
100K	27P	About 154KHz



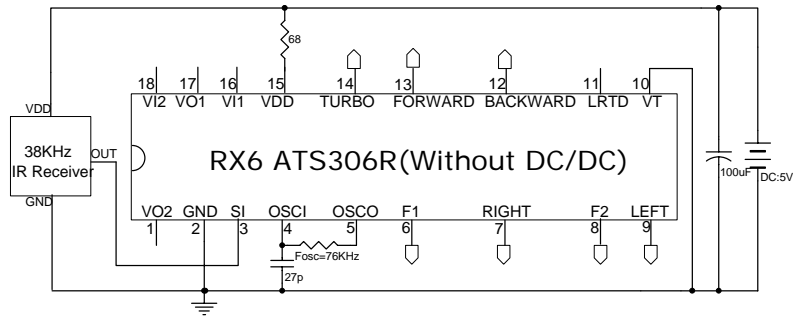


Infrared Application Circuit

Transmitter (TX6 ATS306T $F_{osc} = 76\text{ KHz}$)



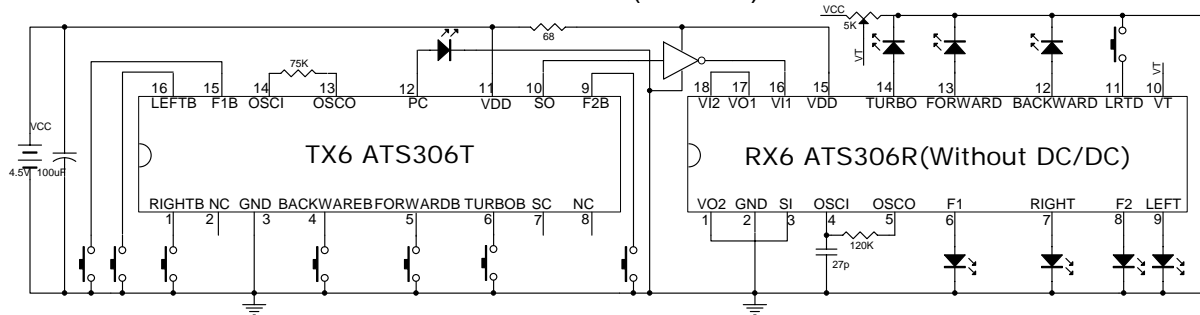
Receiver (RX6 ATS306R $F_{osc} = 76\text{ KHz}$)



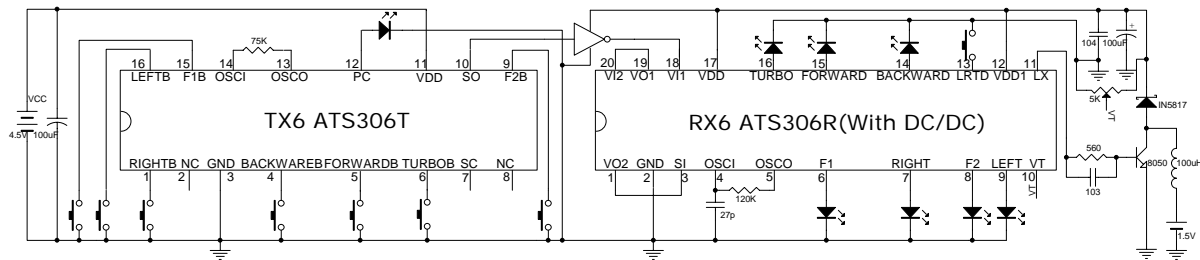


Testing Circuit

TX6 ATS306T/RX6 ATS306R without DC/DC (128KHz)



TX6 ATS306T/RX6 ATS306R with DC/DC (128KHz)



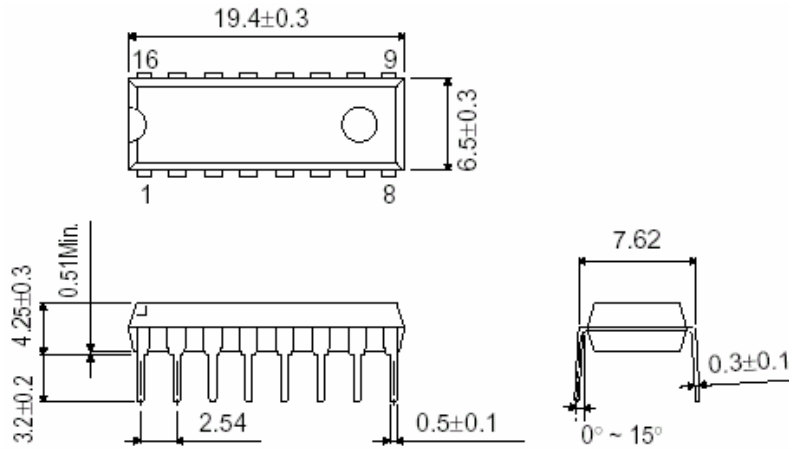
Note 1: There must be an inverter between SO (TX6 ATS306T) output and SI (RX6 ATS306R) input when connected directly.



Package Information

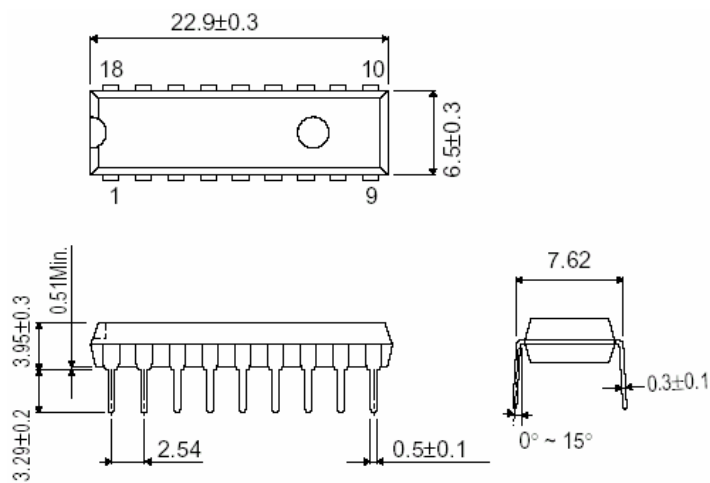
TX6 ATS306T DIP16 Pin Outline Drawing

Unit in mm



RX6 ATS306R DIP18 Pin Outline Drawing

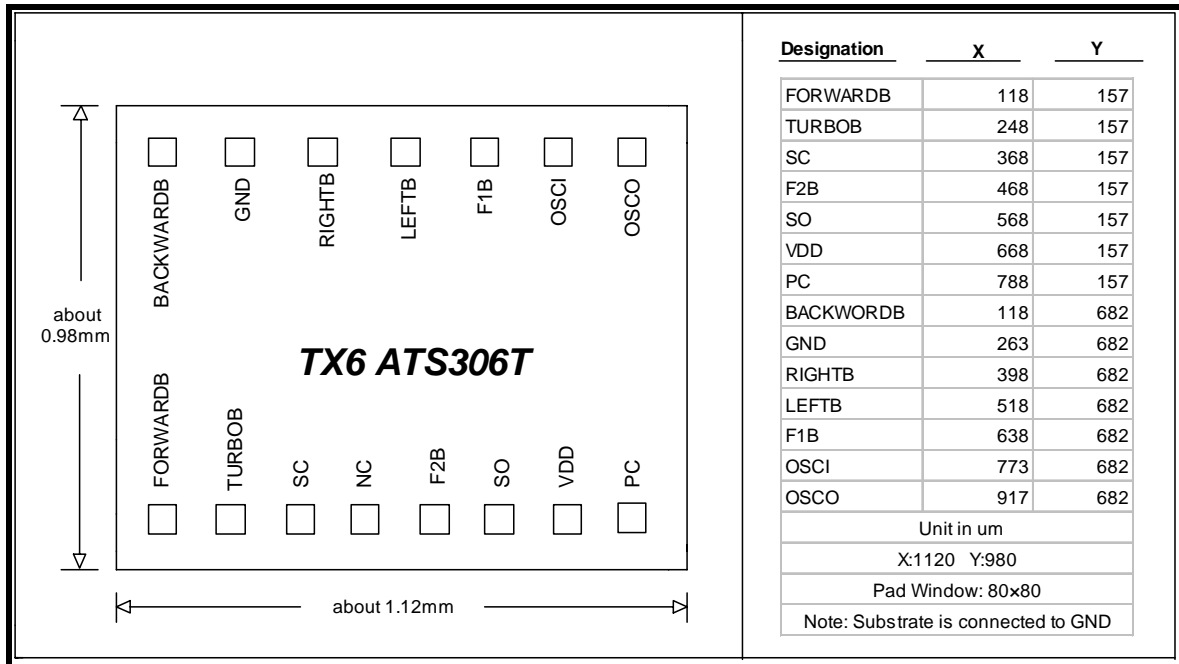
Unit in mm



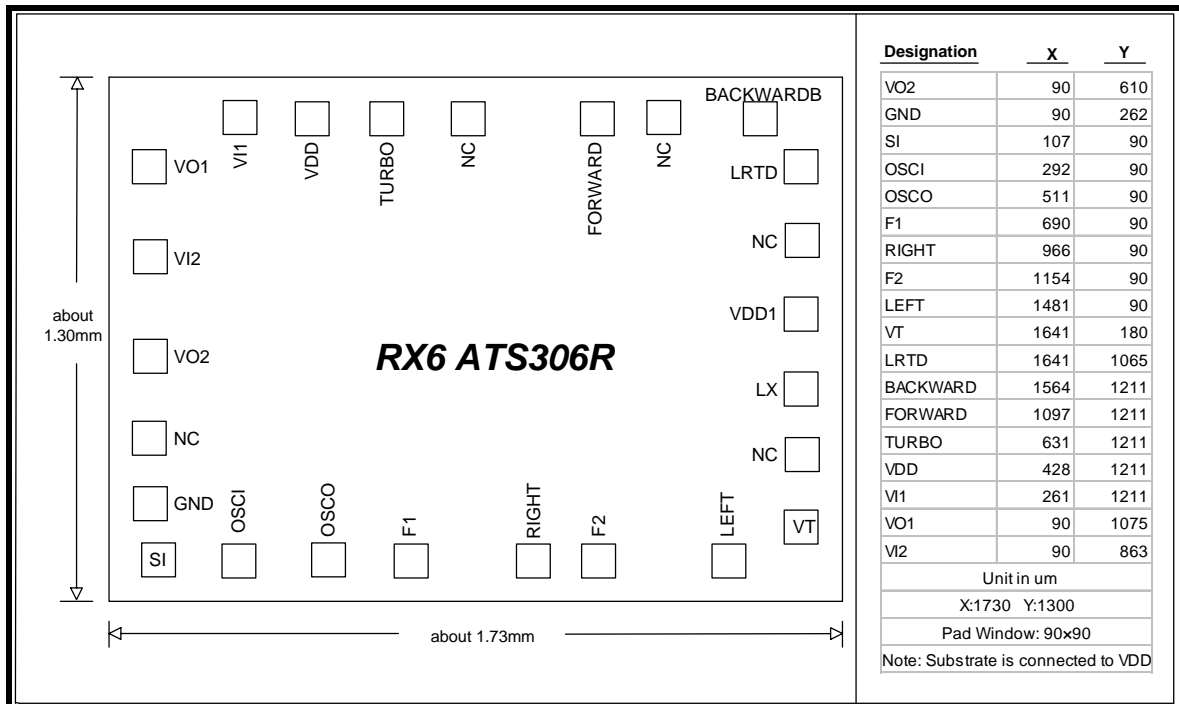


COB Bonding Figure

TX6 ATS306T



RX6 ATS306R





Version List

Version	Release date	Comment
1.00	2004/5/15	First Version

Notice: ACTIONS's products are sold by description only, ACTIONS reserves the rights to make changes in circuit design and/or specification at any time without notice. Accordingly, the reader is cautioned to make sure the latest versions of data sheets are available before placing orders.