



Actions Semiconductor Co., Ltd.

TX5 ATS305T/RX5 ATS305R Data Sheet

Version 1.00



Notice:

The 9-function TX5 ATS305T/RX5 ATS305R heritages the sophisticated architecture and design methodology from TX5/RX5 of Realtek Semiconductor who is one of the leaders of remote controller technology design of toy product.

This pair of TX5 ATS305T/RX5 ATS305R is the best Transmitter/ Receiver choice of remote control car and fully covers TX5RX5 features with superior performance. The TX5 ATS305T/RX5 ATS305R 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 NINE FUNCTIONS

General Description



The TX5 ATS305T/RX5 ATS305R are a pair of CMOS LSIs designed for remote controlled car applications. TX5 ATS305T is the encoder and RX5 ATS305R is the decoder. They provide eight function keys to control forward, Backward, Rightward, Leftward, Turbo, F1, F2 F3, and F4 motions. Besides, a combination of these five common motions (Forward, Backward, Left, Right and Turbo) can be played. And RX5 ATS305R provides the ability of two shift gears for Forward and Backward functions.

TX5 ATS305T is built with auto Power-OFF function. When input key is pulled low, TX5 ATS305T 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, TX5 ATS305T will automatically go into power-off mode.

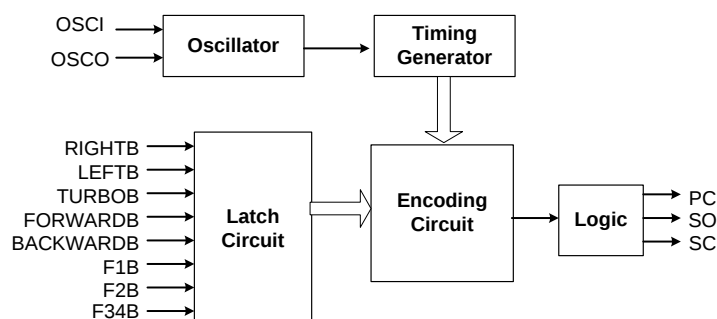
RX5 ATS305R provides two high effective amplifiers and enhance Signal Input (SI) recognition circuit for increasing remote control distance.

RX5 ATS305R has an internal, selectable DC-DC converter that makes the application stable, reliable under lower supply voltage.

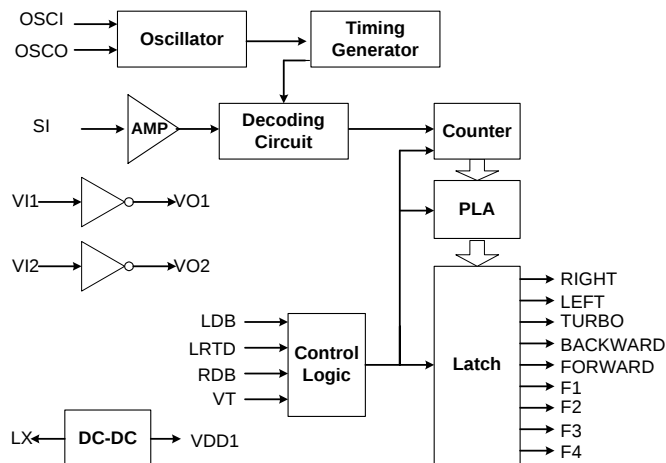
RX5 ATS305R has Motor Limit-Current Protection Circuit and Automatic Swerving Circuit for safe and friendly application of RC toy.

Block Diagrams

TX5 ATS305T (Encoder)

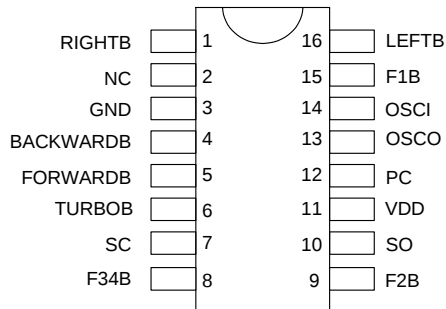


RX5 ATS305R (Decoder)

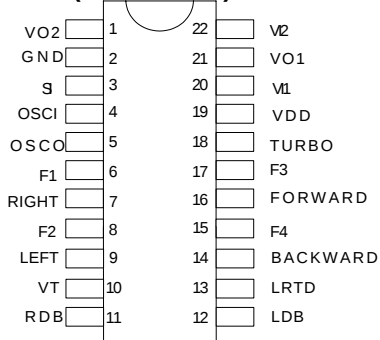


Pin outs

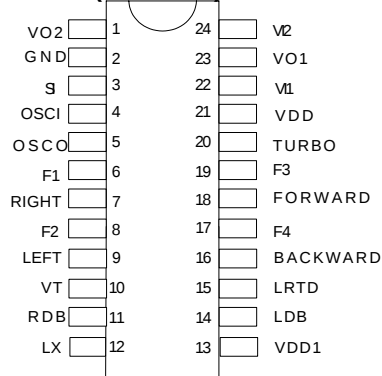
TX5 ATS305T



RX5 ATS305R (Without DC/DC)



RX5 ATS305R (With DC/DC)





Features

- Wide and Low operating voltage range:
2.0V to 5.0V(TX5 ATS305T and RX5 ATS305R without DC/DC)
A 3.8V zener is built in RX5 ATS305R, so a current limitation resistor is required
1.0V ~ 3.0V (RX5 ATS305R with DC/DC)
- Nine-function remote controller controlling Forward/ Backward/ Turbo/ Right/ Left/F1/F2/F3/F4. And the corresponding outputs of RX5 ATS305R alternate between F3 and F4 by turn according to F34B
- Provide two transmissive interface (RF and IR) for different application
- Two speed-shift is realized for Forward and Backward
- Few external components needed and Oscillator only with an external resistor
- Low standby current and low operating current.
- Typical oscillator frequency:
RF: 128 KHz
IR: 114 KHz (Carrier Frequency: 57 KHz)
IR: 76 KHz (Carrier Frequency: 38 KHz)
- Auto Power-OFF function for TX5 ATS305T
- Internal, Selectable Limit-Current protection function. If selected, few external components needed
- Friendly automatic swerving for avoiding the obstacles. And gearing down function 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.
- RX5 ATS305R has very strong driving ability about nine 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

TX5 ATS305T

Typical operating Conditions : VDD = 3.8V, Fosc = 128KHz, T_A = 25°C, (unless otherwise noted.)

Parameter	Symbol	Conditions	TX5 ATS305T			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}	RX5 ATS305R 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, F2B and F34B inputs.

RX5 ATS305R(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°C, (unless otherwise noted.)

Parameter	Symbol	Conditions	RX5 ATS305R			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}	TX5 ATS305T Fosc=128KHz	-20%		+20%	%

Note 1: "Function Output pin" means forward, Backward, Rightward, Leftward, Turbo, F1, F2, F3 and F4 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.

RX5 ATS305R (With DC/DC)

Typical operating Conditions : V_{INPUT} = 1.5V, Fosc = 128KHz, T_A = 25°C. Using DC-DC converter, (unless otherwise noted.)

Parameter	Symbol	Conditions	RX5 ATS305R			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	$F_{\text{tolerance}}$	TX5 ATS305T 128KHz	-20%		+20%	%

Note 1: "Function Output pin" means forward, Backward, Rightward, Leftward, Turbo, F1, F2, F3 and F4 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

TX5 ATS305T

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)
F34B	8	When this pin is connected to Gnd by turn, the output of RX5 ATS305R will alternate between F3 and F4 (High when open)
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)



RX5 ATS305R

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
RDB	11	(11)	Rightward function will be cancelled if it is connected to Gnd. The pin is used in Automatic, Intellective Swerving.
LX1	-----	(12)	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	-----	(13)	DC-DC converter voltage output pin. Supply positive power for VDD
LDB	12	(14)	Leftward function will be cancelled if it is connected to Gnd. The pin is used in Automatic, Intellective Swerving.
LRTD	13	(15)	The Turbo (High speed) function will be cancelled in the swerve motion if it is connected to Gnd
BACKWARD	14	(16)	Backward output pin (High when active)
F4	15	(17)	F4 function output pin (High when active)
FORWARD	16	(18)	Forward output pin (High when active)
F3	17	(19)	F3 function output pin (High when active)
TURBO	18	(20)	Turbo output pin (High when active)
VDD	19	(21)	Positive power supply
VI1	20	(22)	Input pin for the First amplify
VO1	21	(23)	Output pin for the first amplify
VI2	22	(24)	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 (TX5 ATS305T) ①	Decode Result (RX5 ATS305R) 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

RX5 ATS305R has two absolute independent Digital Channel: F1 and F2. They also haven't any relation with common functions and other F3, F4 functions.

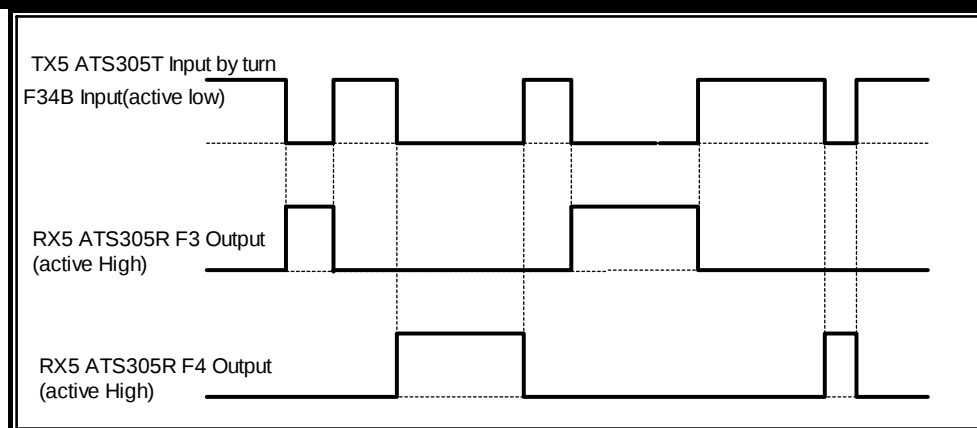
F1 and F2 functions can be used in audio control, Lamp indication and other motor driving.

(3) F3 and F4 functions

There is a digital independent, channel F34B that is different from other functions.

When F34B of TX5 ATS305T is connected to Gnd by turn, the output of RX5 ATS305R will alternate between F3 and F4

Figure of Input/output is below:

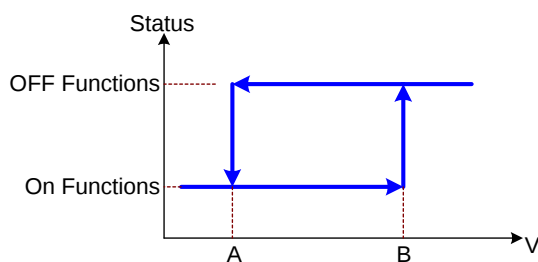


(4) VT: Limit-Current protection

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, RX5 ATS305R 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.

(5) LDB and RDB: Automatic Swerving Functions

RX5 ATS305R provides the intellectual auto swerving function for evading the obstacle.

The function is selective. If not, LDB and RDB should be open (High)

If selected, two mechanical trigger switches are assembled on the Left and Right sides of toy's steer. Auto swerving functions will be active when toys come into contact with opstacle (switch is connected to Gnd).

Figure of input/output is below:



The steering output controlled by The toy player ^①	Input of LDB and RDB ^②	Toy's Output when Auto Swerving activated ^③
No any turn	LDB and RDB inactive (H)	No any turn
No any turn	LDB active (L)	Right(H)
No any turn	RDB active (L)	Left (H)
Left <Or Right>	LDB and RDB inactive (H)	Left (H) <Or Right(H)>
Left	LDB active (L)	No any turn
Right	RDB active (L)	No any turn

Note 1: Tab ① longitudinal data indicates that the actual control result that player operates. When LDB and RDB have inactive inputs, the toy's steer motion is just the result player operates

Note 2: Tab ② longitudinal data indicates that the inputs of LDB and RDB the toys generated in the player's controlling situation.(L is active)

Note 3: Tab ③ longitudinal data indicates that the toy's final steering motion in the affection of player's controller and auto swerving function.

Note 4: For more information, please contact with the IC provider.

(6) LRTD: Auto Gearing Down function

The toys should not be played in high speed when it is turning. Just do so, turnover will happen. RX5 ATS305R 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 (TX5 ATS305T)	Input of LRTD	The final output (RX5 ATS305R)
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.

(6) 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



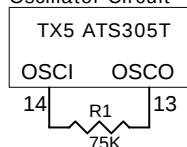
Typical Application Circuit

Transmitter (TX5 ATS305T Fosc=128 KHz)

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

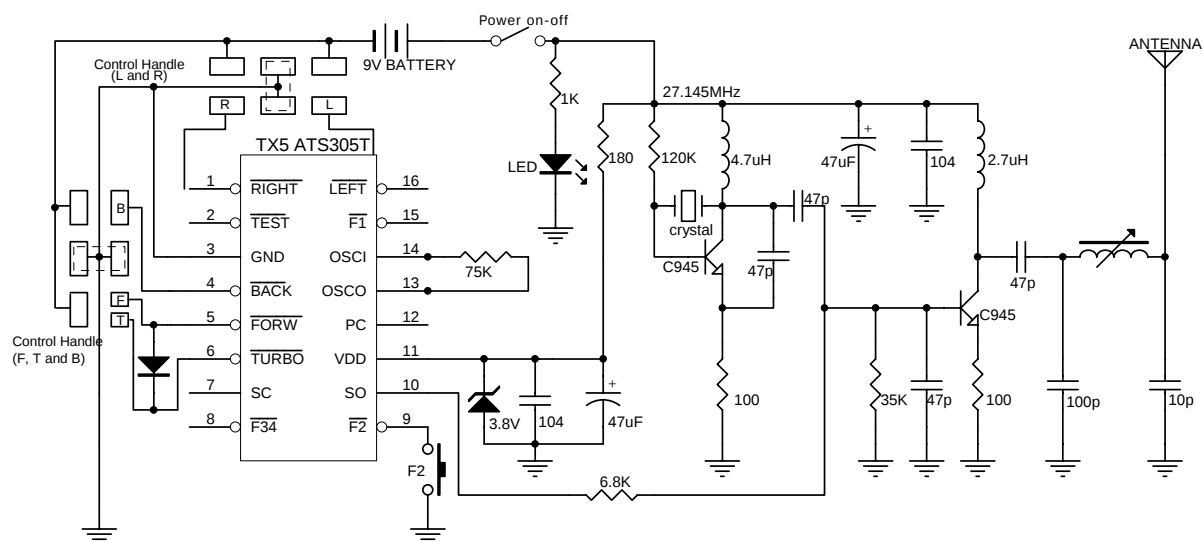
Note 2: The frequency in the table below is 128KHz. The value of resistor (R1) should be changed, if the other oscillator frequency needed.

Oscillator Circuit



Fosc=128KHz

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





Note 5: Without the DC/DC module





Receiver II (RX5 ATS305R 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

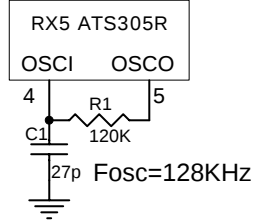
Note 4: Using the LRTD function

Note 5: Using LDB and RDB Auto Swerving functions

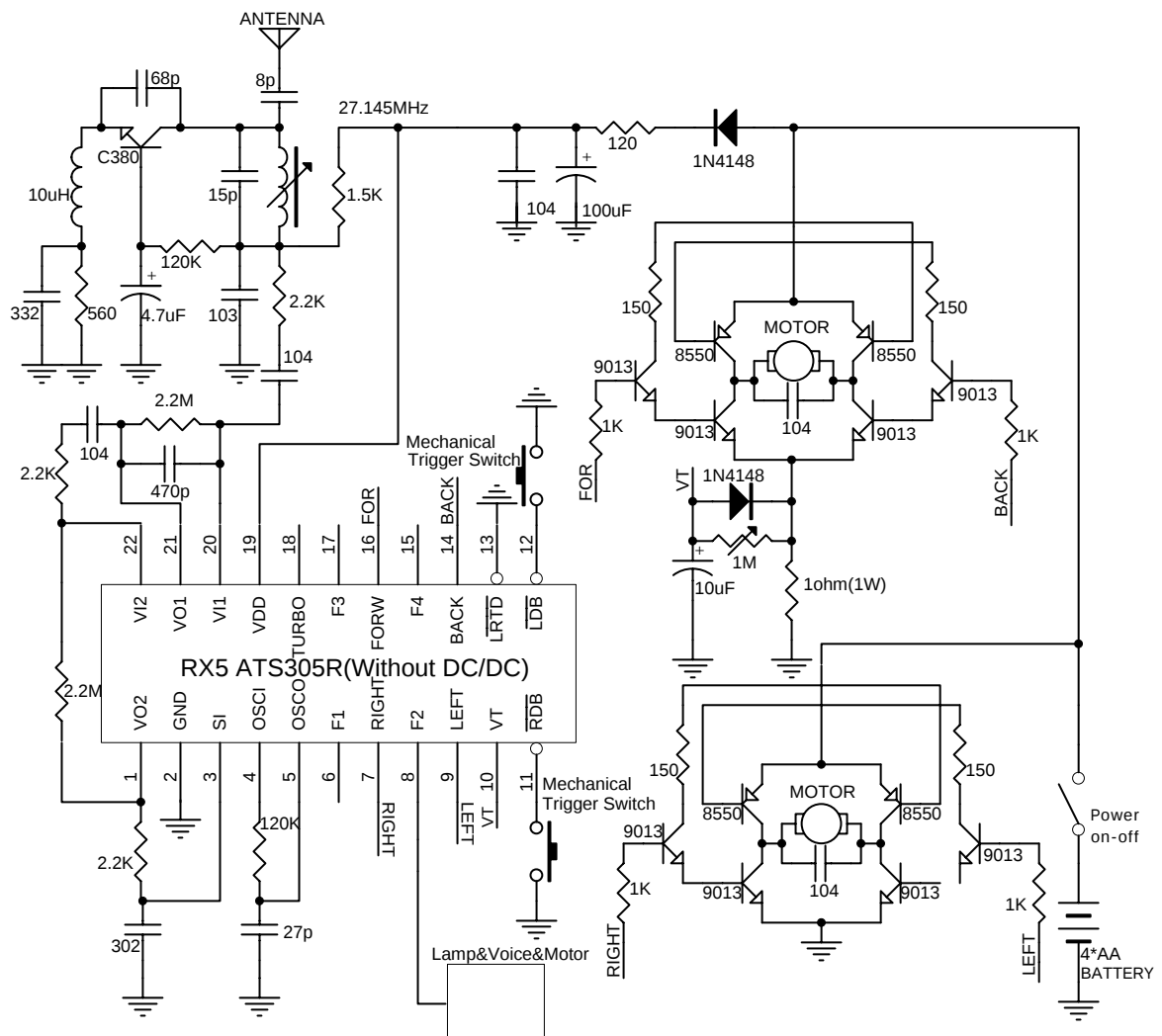
Note 6: The frequency in the table below is 128KHz. The value of resistor (R1) should be changed, if the other oscillator frequency needed. And changing the value of oscillator capacitance (C1) is not necessary

Note 7: Without the DC/DC module

Oscillator Circuit



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





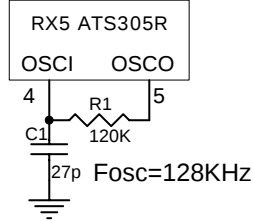
Receiver III (RX6 ATS305T Fosc =128 KHz)

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

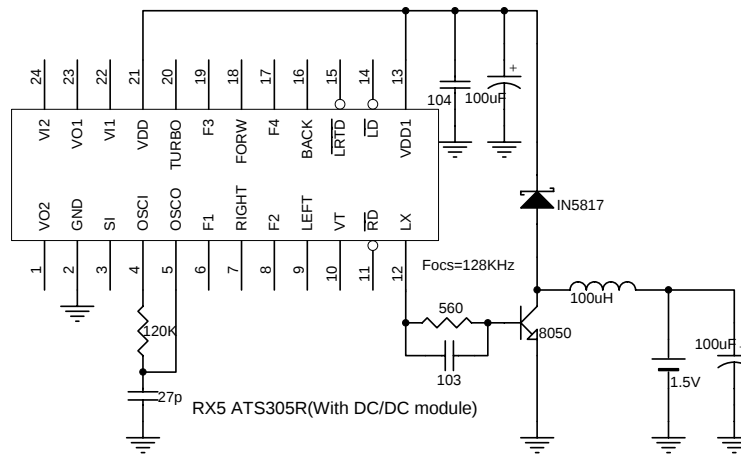
Note 2: Only the circuit of DC/DC module

Note 3: 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

Oscillator Circuit



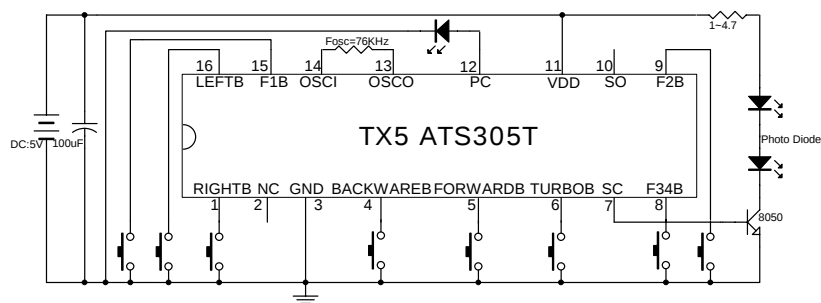
R1	C1	Fosc
150K	27p	About 103KHz
120K	27p	About 128KHz
100K	27p	About 154KHz



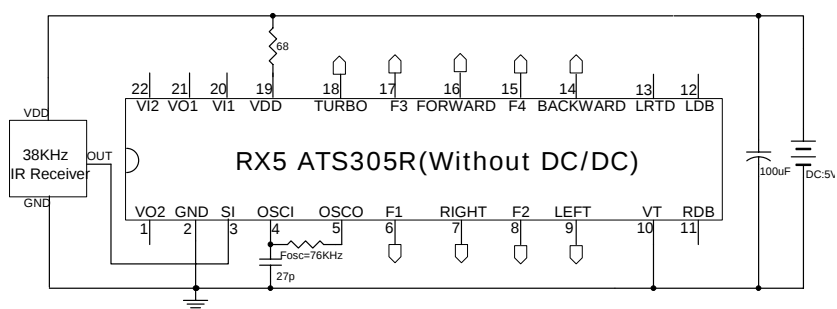


Infrared Application Circuit

Transmitter (TX5 ATS305T Fosc =76 KHz)



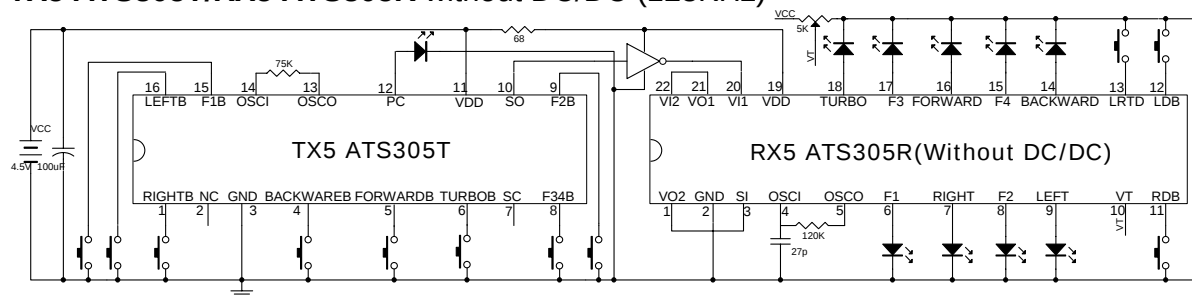
Receiver (RX5 ATS305R Fosc=76KHz)



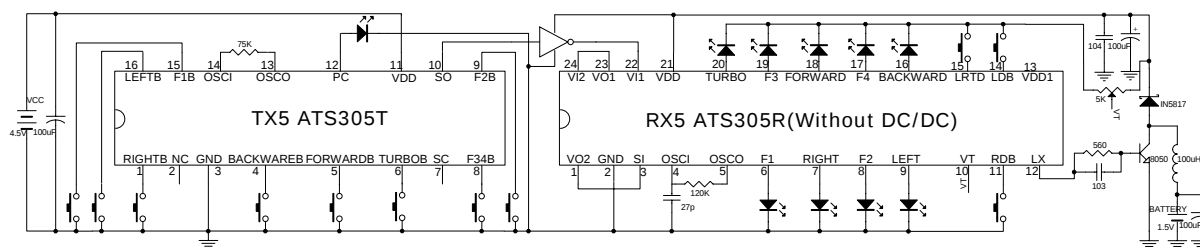


Testing Circuit

TX5 ATS305T/RX5 ATS305R without DC/DC (128KHz)



TX5 ATS305T/RX5 ATS305R with DC/DC (128KHz)



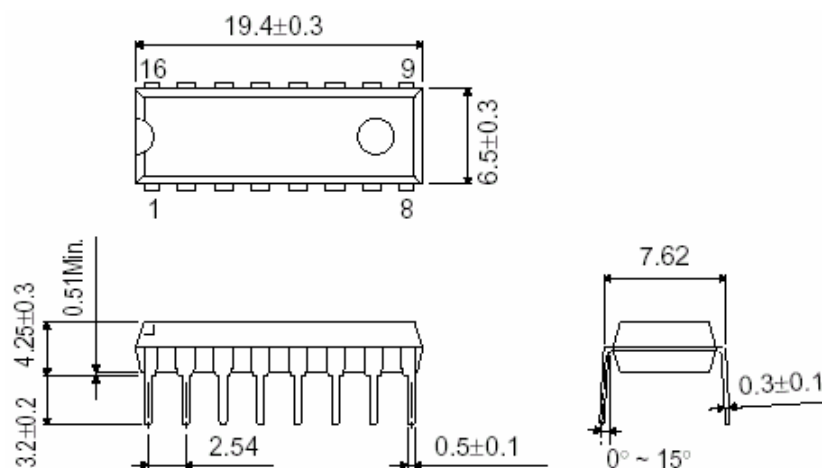
Note 1: There must be an inverter between SO(TX5 ATS305T) output and SI(RX5 ATS305R) input when connected directly



Package Information

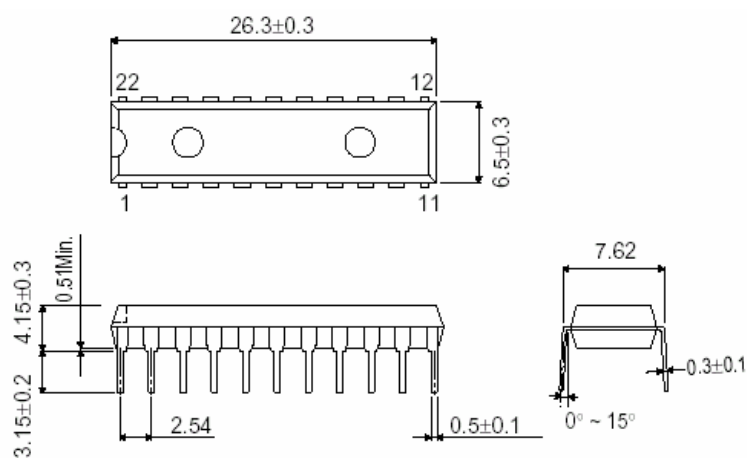
TX5 ATS305T DIP16 Pin Outline Drawing

Unit in mm



RX5 ATS305R DIP22 Pin Outline Drawing

Unit in mm





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.