

## Features

- The PT8A971AP works as the encoder and the PT8A972AP works as the decoder
- Five pins for five control functions
- Operating power supply voltage: 2.5 to 5.0V
- Auto-power-off if no press on any button in 8s or continuously press on any button over 4 minutes (971AP)
- Press on any button to wake up
- Manual-power-off with OFF button (971AP)
- One output pin used for external power control
- On-chip oscillator with an external resistor
- Low operating current
- Few external components needed
- Package: 14-pin DIP (971AP) and 16-pin DIP (972AP)

## General Description

The PT8A971AP and PT8A972AP is a pair of CMOS

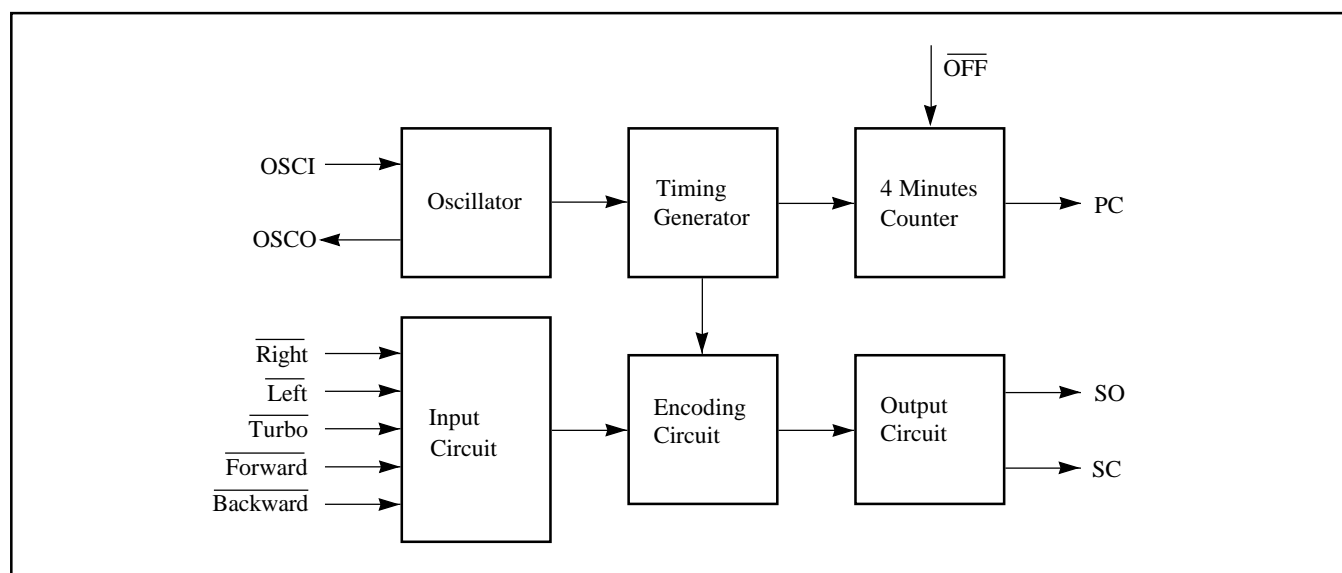
LSIs designed to provide a complete control functions to remote-controlled toy. The PT8A971AP has five input pins corresponding with the five function buttons - forward, backward, right, left and turbo. The encoding circuit in the PT8A971AP sends digital codes to the two output pins SO and SC. The digital codes correspond to the definite function buttons and their combinations. The SO and SC outputs are used in wireless and infrared applications respectively.

There is an internal oscillator in the PT8A971AP and PT8A972AP respectively. The oscillator frequency can be adjusted by the external resistor. The relative error between the frequencies of the two on-chip oscillators in the PT8A971AP and PT8A972AP must be less than  $\pm 25\%$ .

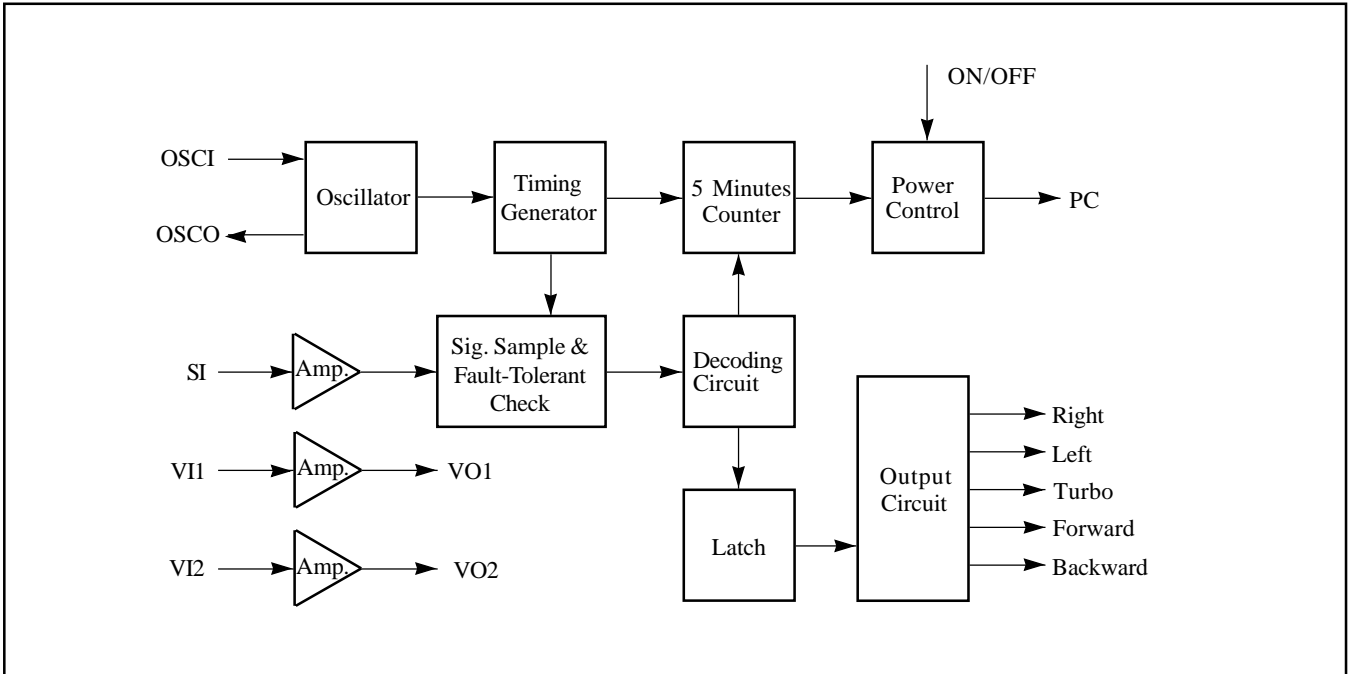
The auto-power-off function is achieved by internal counters. Pressing OFF button can also shut down the power supply. Press on any function button will wake up the chip promptly.

## Block Diagram

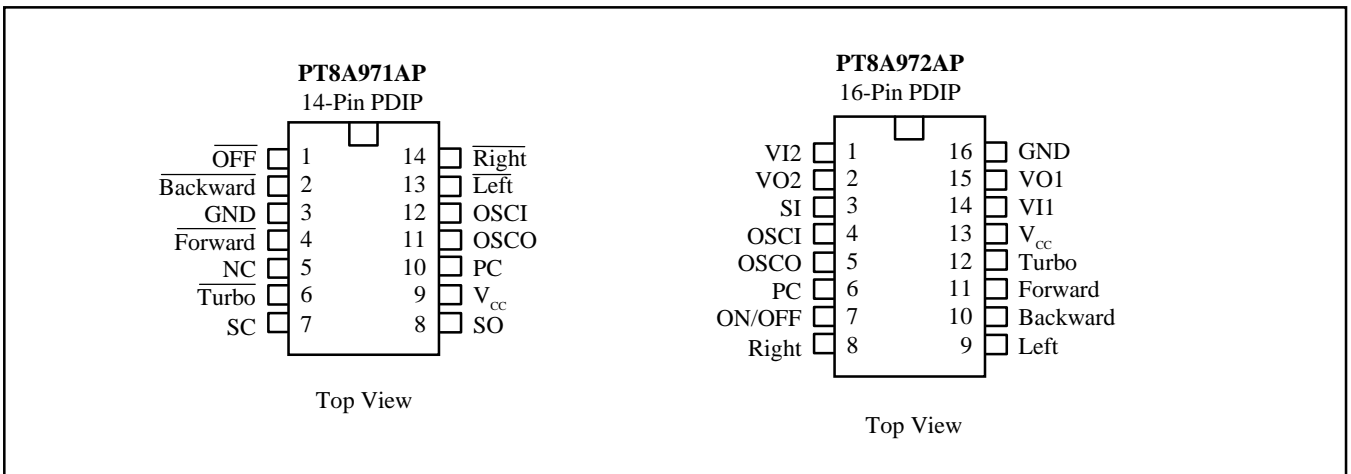
Block Diagram of PT8A971AP



**Block Diagram of PT8A972AP**



**Pin Configuration**



## Pin Description

### Pin Description of PT8A971AP

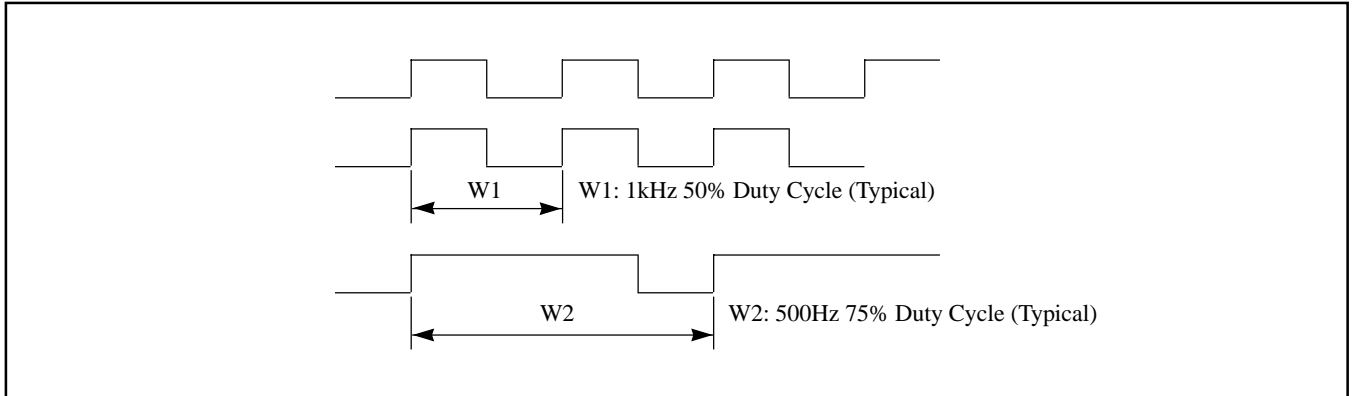
Pin	Name	Type	Description
1	$\overline{\text{OFF}}$	I	Cuts off external power supply to the PT8A971A when Low.
2	$\overline{\text{Backward}}$	I	Backward function selected if this pin connected to GND, with pull-up resistor.
3	GND	GND	Ground
4	$\overline{\text{Forward}}$	I	Forward function selected if this pin connected to GND, with pull-up resistor.
5	NC		No Connection
6	$\overline{\text{Turbo}}$	I	Turbo function selected if this pin connected to GND, with pull-up resistor.
7	SC	O	Output pin of the encoding signal with carrier frequency
8	SO	O	Output pin of the encoding signal without carrier frequency
9	V <sub>CC</sub>	P	Power supply
10	PC	O	Power control output pin
11	OSCO	O	Oscillator output pin
12	OSCI	I	Oscillator input pin
13	$\overline{\text{Left}}$	I	Leftward function selected if this pin connected to GND, with pull-up resistor.
14	$\overline{\text{Right}}$	I	Rightward function selected if this pin connected to GND, with pull-up resistor.

### Pin Description of PT8A972AP

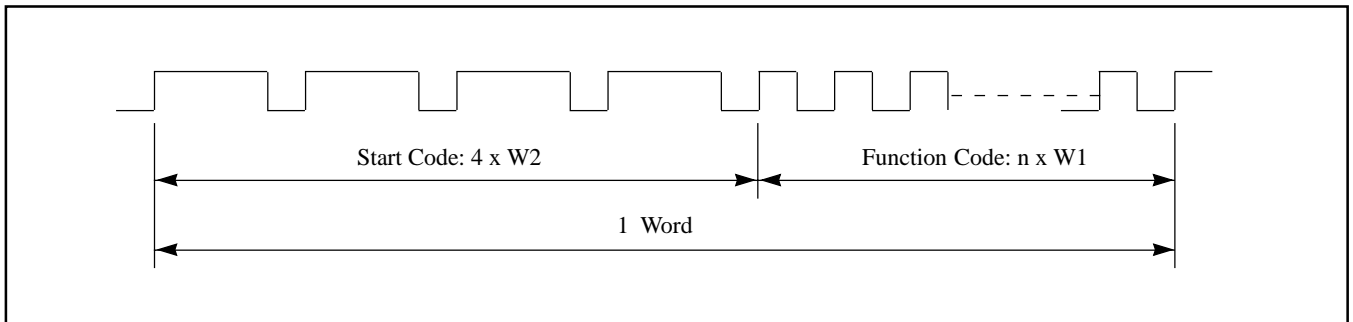
Pin No	Pin Name	Type	Description
1, 14	VI2, VI1	I	Input pins of amplifiers 1 and 2
2, 15	VO2, VO1	O	Output pins of amplifiers 1 and 2
3	SI	I	Input pin for encoded signal
4	OSCI	I	Oscillator input pin
5	OSCO	O	Oscillator output pin
6	PC	O	Power Control output pin
7	ON/OFF	I	On/Off pin
8	Right	O	Right output pin
9	Left	O	Left output pin
10	Backward	O	Backward output pin
11	Forward	O	Forward output pin
12	Turbo	O	Turbo output pin
13	V <sub>CC</sub>	P	Power supply
16	GND	GND	Ground

### Code Format

(W1 is for function codes and W2 for start codes)

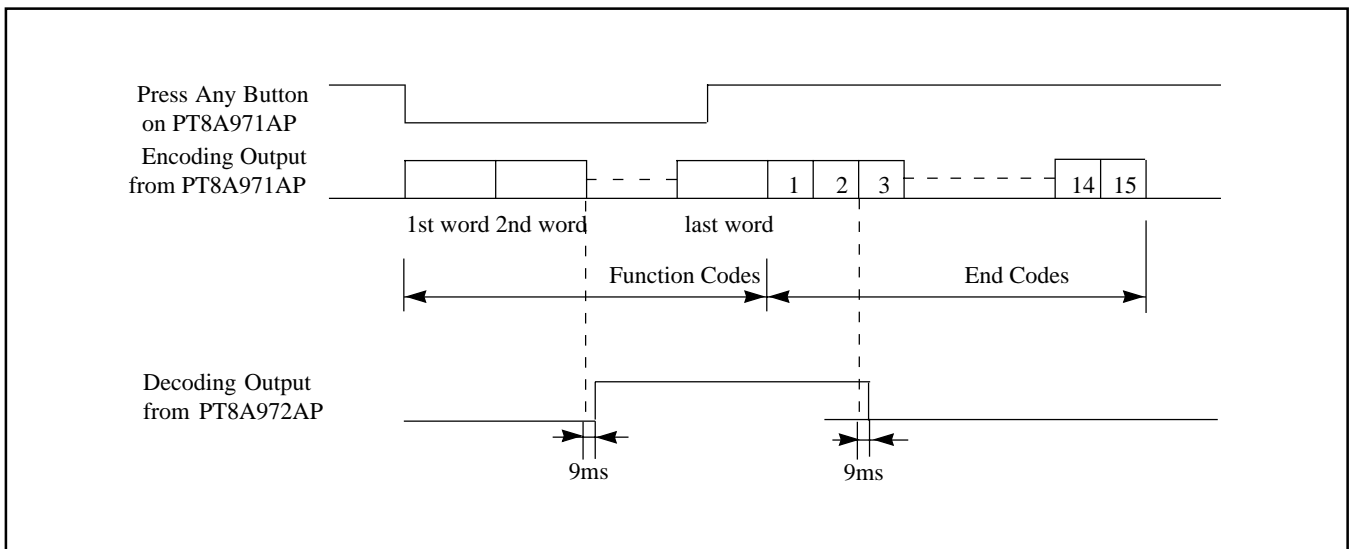


### Word Format



### Encoding and Decoding Timing

Encoding String: W2, W2, W2, W2, (n)xW1, W2, W2, W2, W2, (n)xW1, W2, W2, W2, W2, (n)xW1, ... ..

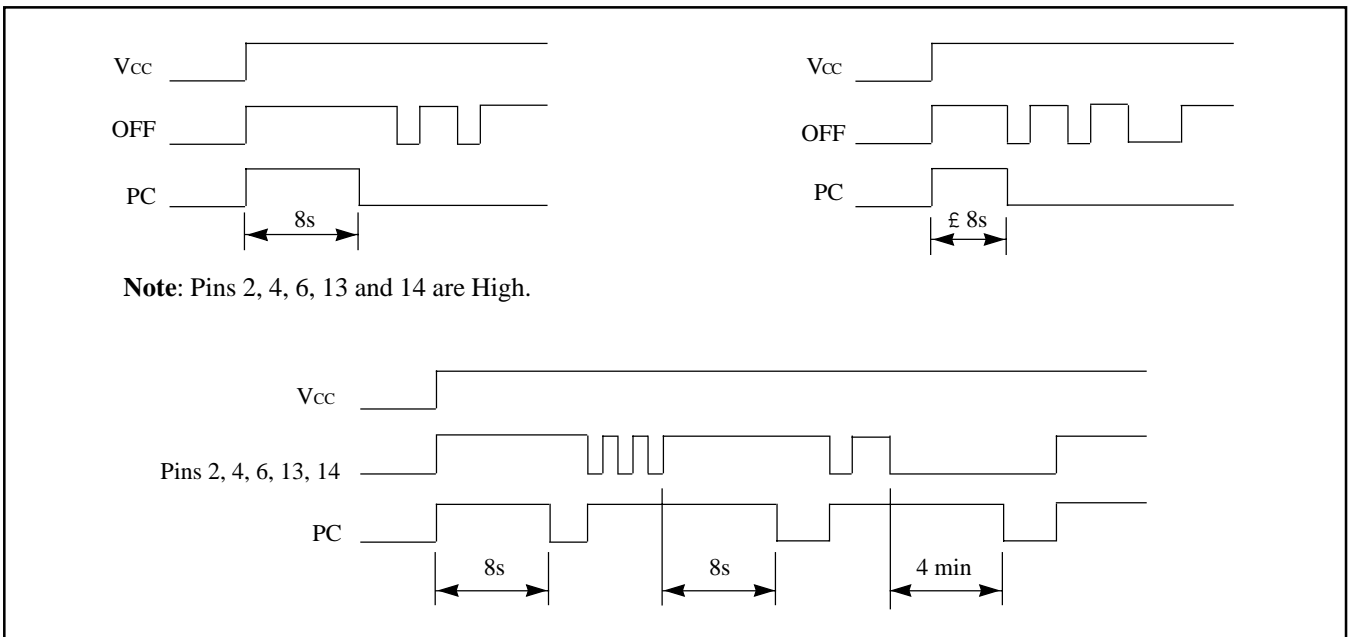


**Encoding Input and Decoding Result**

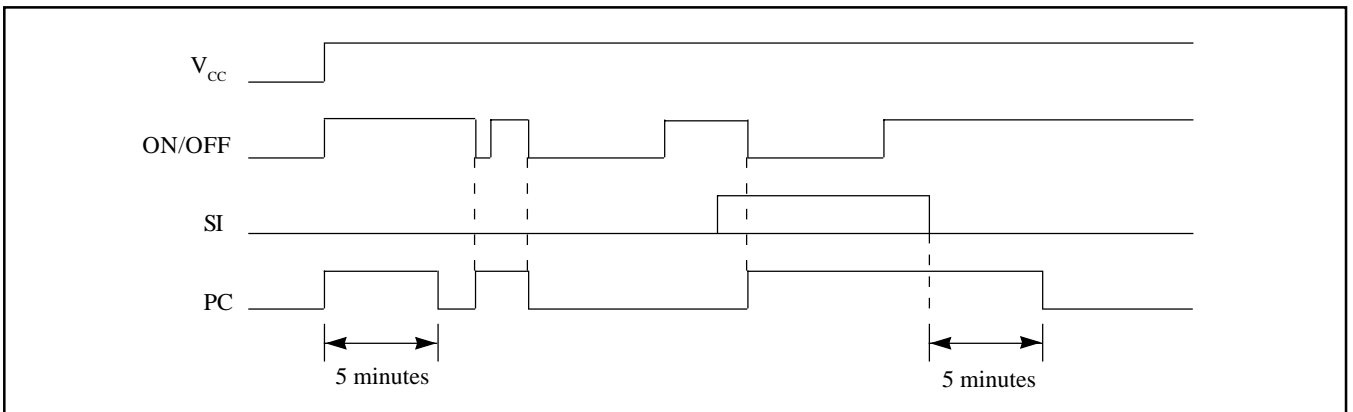
Number of Function Codes (n) W1	Decoding Results
4 ± 1	End Code
10 ± 1	Forward (Pulse)
16 ± 1	Forward (High level)
22 ± 1	Turbo
28 ± 1	Forward (High level) & Left
34 ± 1	Forward (High level) & Right
40 ± 1	Backward
46 ± 1	Backward & Right
52 ± 1	Backward & Left
58 ± 1	Left
64 ± 1	Right

**PC Output Timing**

PC Timing of PT8A971AP



PC Timing of PT8A972AP



## Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested)

Storage Temperature .....	-25°C to +85°C
Ambient Temperature with Power Applied .....	-10°C to +40°C
Supply Voltage to Ground Potential (Inputs & V <sub>CC</sub> Only) ....	-0.5 to +6.0V
Supply Voltage to Ground Potential (Outputs & D/O Only)	-0.5 to +6.0V
DC Input Voltage .....	-0.5 to +6.0V
DC Output Current .....	20mA
Power Dissipation .....	500mW

### Note:

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## DC Electrical Characteristics

### DC Electrical Characteristics of PT8A971AP

Sym	Description	Test Condition	Min	Type	Max	Units
V <sub>CC</sub>	Operating Voltage	-	2.5	4.0	5.0	V
I <sub>CC</sub>	Supply Current	Output Unloaded			300	uA
I <sub>STB</sub>	Stand-by Current	-			10	uA
V <sub>IH</sub>	Input High Voltage	Guaranteed Logic High Level	3.5			V
V <sub>IL</sub>	Input Low Voltage	Guaranteed Logic Low Level			0.5	V
I <sub>IH</sub>	Input High Current	V <sub>IN</sub> = V <sub>CC</sub>			10	uA
I <sub>IL</sub>	Input Low Current	V <sub>IN</sub> = GND			-60	uA
I <sub>OH</sub>	Output High Current	Pins 7, 8, 10	V <sub>OUT</sub> = 3.5V	-1		mA
		Pin 11	V <sub>OUT</sub> = 3.5V	-0.2	-1	mA
I <sub>OL</sub>	Output Low Current	Pins 7, 8, 10	V <sub>OUT</sub> = 0.5V	0.5		mA
		Pin 11	V <sub>OUT</sub> = 0.5V	0.2	1	mA

Note: Over the Operating Rating, 0°C ≤ T<sub>A</sub> ≤ 70°C, V<sub>CC</sub> = 4V

### DC Electrical Characteristics of PT8A972AP

Sym	Description	Test Condition	Min	Type	Max	Units
V <sub>CC</sub>	Operating Voltage	-	2.5	4.0	5.0	V
I <sub>CC</sub>	Supply Current	*			1.5	mA
I <sub>STB</sub>	Stand-by Current	In OFF state			30	uA
V <sub>IH</sub>	Input High Voltage	Guaranteed Logic High Level	3.5			V
V <sub>IL</sub>	Input Low Voltage	Guaranteed Logic Low Level			0.5	V
I <sub>IH</sub>	Input High Current	Pin 3	V <sub>IN</sub> = V <sub>CC</sub>		20	uA
		Pins 1, 4, 7, 14	V <sub>IN</sub> = V <sub>CC</sub>		10	uA
I <sub>IL</sub>	Input Low Current	Pin 7	V <sub>IN</sub> = GND	-10	-60	uA
		Pin 3	V <sub>IN</sub> = GND		-20	uA
		Pins 1, 4, 14	V <sub>IN</sub> = GND		-10	uA
I <sub>OH</sub>	Output High Current	Pins 6, 8, 9, 10, 11, 12	V <sub>OUT</sub> = 3.5V	-4		mA
		Pins 2, 5, 15	V <sub>OUT</sub> = 3.5V	-0.2	-1	mA
I <sub>OL</sub>	Output Low Current	Pins 6, 8, 9, 10, 11, 12	V <sub>OUT</sub> = 0.5V	0.5		mA
		Pins 2, 5, 15	V <sub>OUT</sub> = 0.5V	0.2	0.5	mA

Note: Over the Operating Rating, 0°C ≤ T<sub>A</sub> ≤ 70°C, V<sub>CC</sub> = 4V

\* Output unloaded; 2.2MΩ feedback resistors for two reversing amplifiers; 200kΩ external resistor for on-chip oscillator.

## AC Electrical Characteristics

### AC Electrical Characteristics of PT8A971AP

Sym	Description	Test Condition	Min	Type	Max	Units
$f_{OSC}$	Oscillator Frequency *	$T_A = 25^\circ\text{C}$ , $R = 200\text{ kW}$	102	128	154	kHz
$t_{FUN}$	Cycle Time of Function Code	$f_{OSC} = 102$ to $154\text{ kHz}$	0.8	1	1.2	ms
$t_{STA}$	Cycle Time of Start Code	$f_{OSC} = 102$ to $154\text{ kHz}$	1.6	2	2.4	ms
$f_{CSC}$	Carrier Frequency of SC Pin	$f_{OSC} = 102$ to $154\text{ kHz}$	51	64	77	kHz
$t_{OFF}$	Time of Auto-Power-Off **	Pins 2, 4, 6, 13 and 14 are High.	6.4	8	9.6	s
		Any of pins 2, 4, 6, 13 and 14 is Low.	3.2	4	4.8	min

**Note:** Over the Operating Rating,  $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ ,  $V_{CC} = 4\text{V}$

\* The relative frequency error between two on-chip oscillators of the PT8A971AP and PT8A972AP must be less than  $\pm 25\%$ .

\*\* Adjusting the external oscillator resistor will cause the auto-power-off time change.

### AC Electrical Characteristics of PT8A972AP

Sym	Description	Test Condition	Min	Type	Max	Units
$f_{OSC}$	Oscillator Frequency *	$T_A = 25^\circ\text{C}$ , $R = 200\text{ kW}$	102	128	154	kHz
$V_{SI}$	SI Pin VPP Receive Sensitivity	Guaranteed effective decoding	300			mV
$t_{FUN}$	Cycle Time of Function Code	$f_{OSC} = 128\text{ kHz}$ to $154\text{ kHz}$	0.75	1	1.25	ms
$t_{STA}$	Cycle Time of Start Code	$f_{OSC} = 128\text{ kHz}$ to $154\text{ kHz}$	1.5	2	2.5	ms
$t_{OFF}$	Time of Auto-Power-Off **	$f_{OSC} = 102$ to $154\text{ kHz}$	4	5	6	min.
$t_{DEC}$	Decode time for function code	$f_{OSC} = 128\text{ kHz}$	45		153	ms
	Decode time for end code	$f_{OSC} = 128\text{ kHz}$ to $154\text{ kHz}$	7	9	11	ms

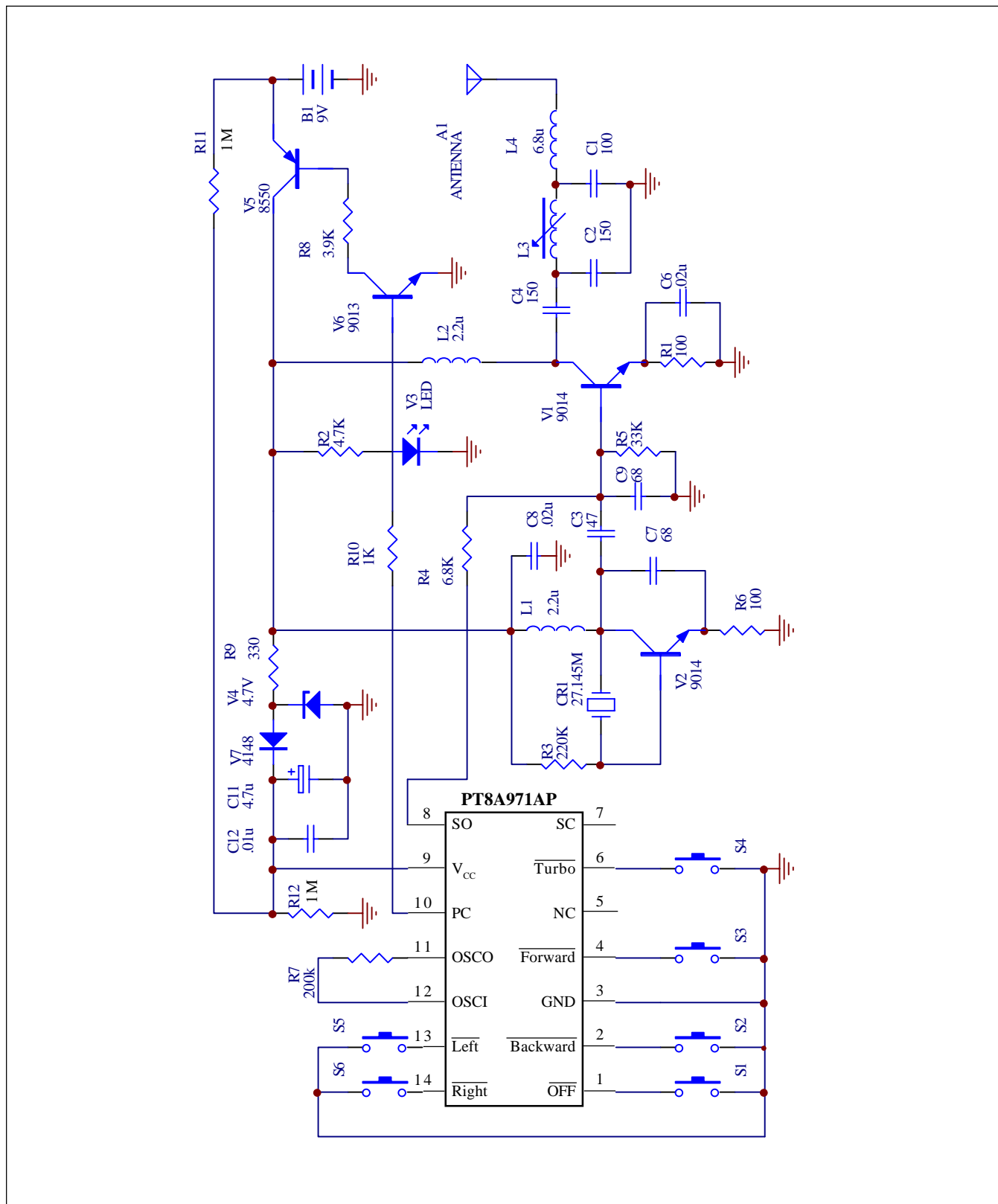
**Note:** Over the Operating Rating,  $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ ,  $V_{CC} = 4\text{V}$

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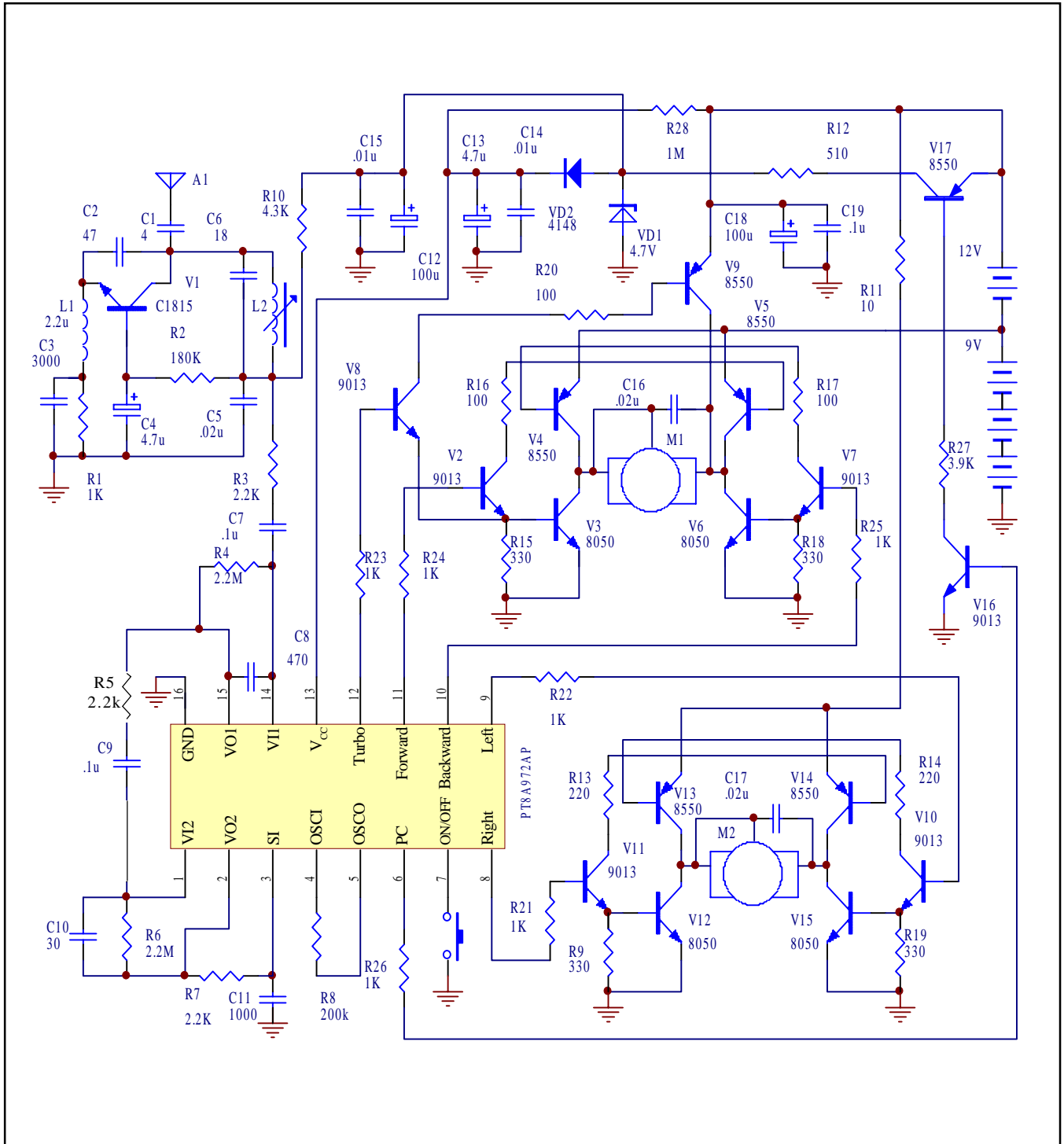
## Application Circuit

Typical Application of PT8A971AP for Transmit Circuit With 9V Battery





**Typical Application of PT8A972AP**



**Notes**

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