Features

- The PT8A9701P works as the encoder and the PT8A974P/974LP works as the decoder
- Nine output pins, 5 for forward, backward, left, right and turbo functions, and 3 functional keys
- Operation power supply for PT8A9701: 3V to 12V (with series resistor)
- Auto power-off if no key pressed (PT8A9701P)
- Motor current limit to meet toy safety standard HD271 (PT8A974P/974LP)
- Low operating current
- On-chip oscillator with an external resistor
- On-chip reversing amplifiers
- Built-in 3.7V Zener (Vz) (PT8A974P) and 3.1V Zener (Vz) (PT8A974LP)
- Few external components needed

General Description

The PT8A9701P and PT8A974P/974LP is a pair of CMOS LSIs designed for remote controlled toy car application. They have eight control keys for controlling the corresponding motion, i.e., forward, backward, left, right, turbo and 3 functional keys, of the remote controlled car. They also have 'Forward (Backward)' and 'Turbo' combination application.

Ordering Information

Device Name	Encoder	Decoder	
Part No.	PT8A9701P	PT8A974P	PT8A974LP
Package	16-pin PDIP	20-pin PDIP	

Block Diagram

Figure 1. Block Diagram of PT8A9701P

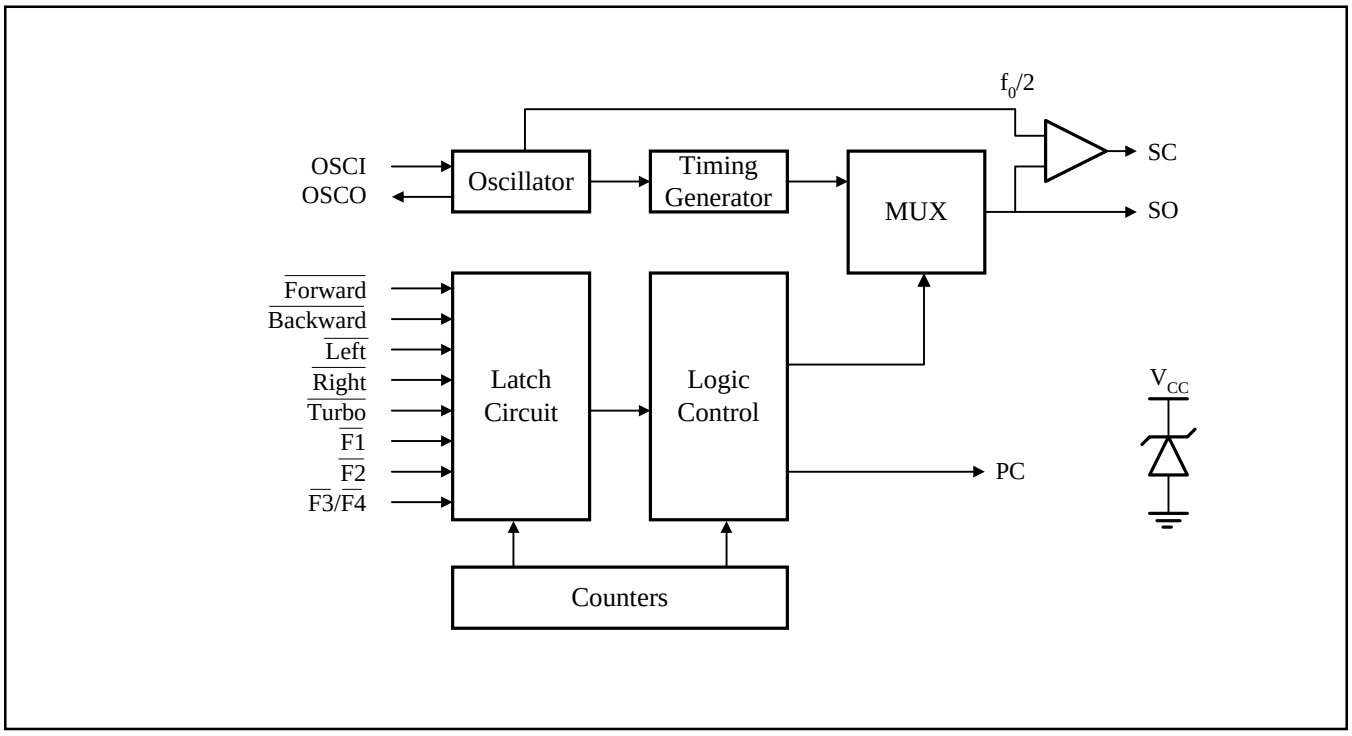
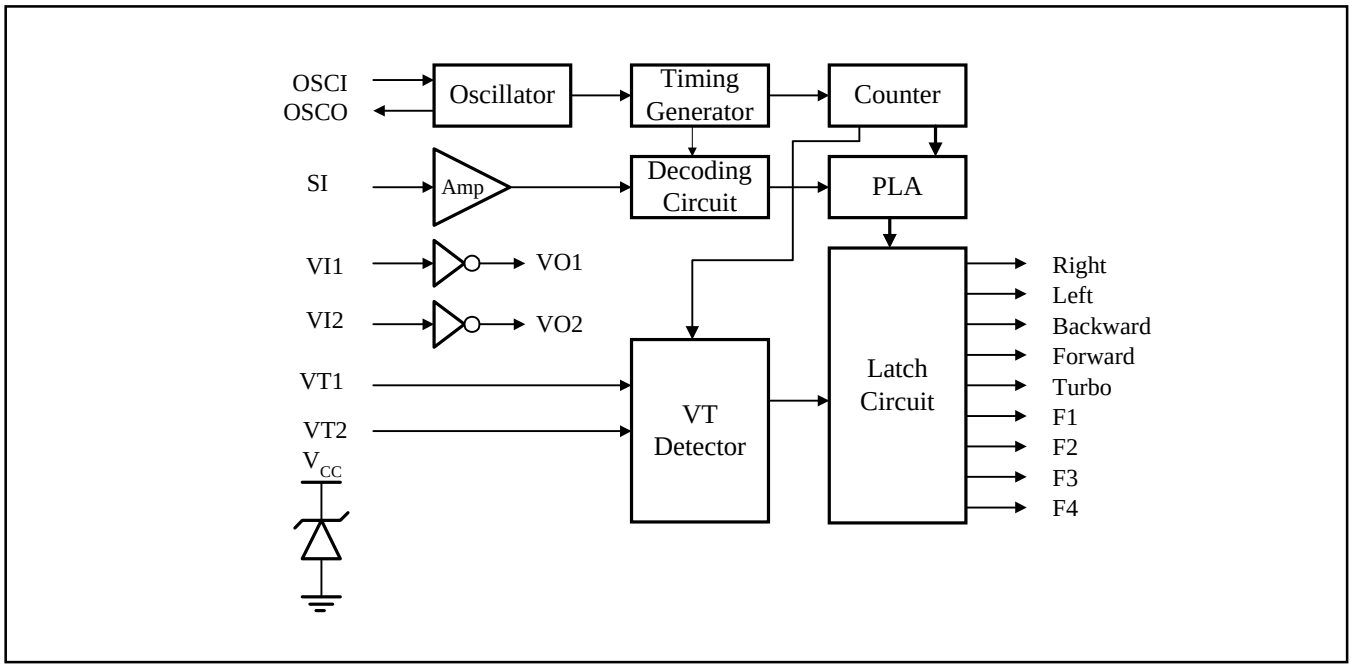
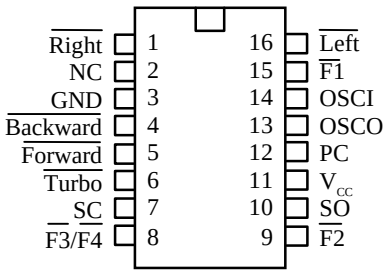


Figure 2. Block Diagram of PT8A974P/974LP

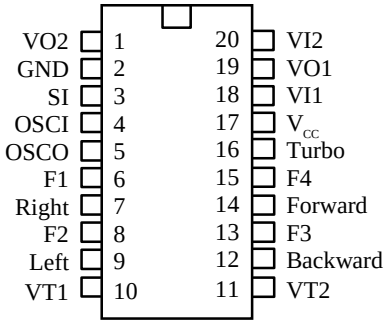


Package and Pin Assignment

PT8A9701P
16-Pin PDIP



PT8A974P/974LP
20-Pin PDIP



Top View

Pin Description

Table 1. Pin Description of PT8A9701P

Pin No	Pin Name	Type	Description
1	$\overline{\text{Right}}$	I	Rightward function selected if this pin connected to GND
2	NC	-	No connection
3	GND	GND	Ground
4	$\overline{\text{Backward}}$	I	Backward function selected if this pin connected to GND
5	$\overline{\text{Forward}}$	I	Forward function selected if this pin connected to GND
6	$\overline{\text{Turbo}}$	I	Turbo function selected if this pin connected to GND
7	SC	O	Output pin of the encoding signal with carrier freqency
8	$\overline{\text{F3}}/\overline{\text{F4}}$	I	Able to toggle between Function 3 and Function 4 if connected to GND
9	$\overline{\text{F2}}$	I	Function 2 selected if connected to GND
10	SO	O	Output pin of the encoding signal without carrier freqency
11	V_{CC}	P	Power supply
12	PC	O	Power control output pin
13	OSCO	O	Oscillator output pin
14	OSCI	I	Oscillator input pin
15	$\overline{\text{F1}}$	I	Function 1 selected if connected to GND
16	$\overline{\text{Left}}$	I	Leftward function selected if this pin connected to GND

Table 2. Pin Description of PT8A974P/974LP

Pin No	Pin Name	Type	Description
1, 19	VO2, VO1	O	Output pins of amplifiers 1 and 2
2	GND	GND	Ground
3	SI	I	Input pin for encoded signal
4	OSCI	I	Oscillator input pin
5	OSCO	O	Oscillator output pin
6	F1	O	F1 function output pin
7	Right	O	Rightward output pin
8	F2	O	F2 function output pin
9	Left	O	Leftward output pin
10	VT1	I	Auto shut-off input pin: If voltage on VT1 pin is over $0.095V_{CC}$ for 3 sec, all outputs will be shut off automatically.
11	VT2	I	Auto shut-off input pin: If voltage on VT2 pin is over $0.095V_{CC}$ for 3 sec, all outputs will be shut off automatically.
12	Backward	O	Backward output pin
13	F3	O	F3 function output pin
14	Forward	O	Forward output pin
15	F4	O	F4 function output pin
16	Turbo	O	Turbo output pin
17	V_{CC}	P	Power supply
18, 20	VI1,VI2	I	Input pins of amplifiers 1 and 2

Functional Description

In normal operation without 'Turbo', forward (backward) output pin of the decoder PT8A974P/974LP sends out a 60Hz signal. In operation with 'Forward (Backward)' and 'Turbo' combined, the output signal will be completely high. This function is depicted in Table 3.

Timing Diagram

Data Format

See Figure 4.

Coding Method

Each trigger pin is triggered by corresponding bit of data in format of "1". The data string is 16-bit and divided to four segments, i.e., Start Code, Data Code, Parity Code and End code, where

Start Code = 11110.

Data Code = | F | B | T | R | L | F1 | F3 | F4 | F2 |

F = Forward B = Backward T = Turbo
R = Right L = Left F1= Function 1
F2 = Function 2 F3 = Function 3 F4 = Function4

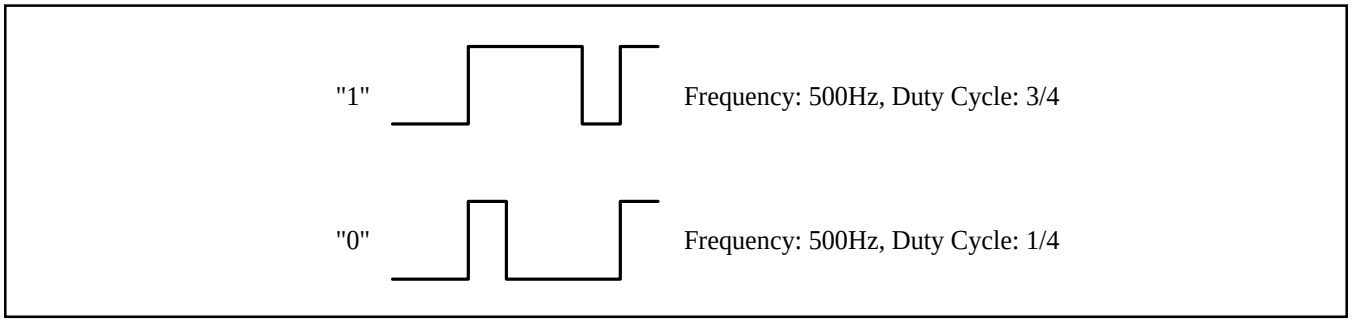
Parity Code = Even parity check result
End Code is for data latch.

Data code can be any combination of F, B, T, R, L, F1, F2, F3 and F4 except F&B and R&L.

Table 3

Input to PT8A970P	Output from PT8A974P/974LP		
	Forward	Backward	Turbo
Forward	60Hz	Low	Low
Backward	Low	60Hz	Low
Forward + Turbo	High	Low	High
Backward + Turbo	Low	High	High

Figure 4. Data Format



Maximum Ratings

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

Maximum Ratings PT8A9701P

Storage Temperature	-25°C to +85°C
Ambient Temperature with Power Applied	0°C to +70°C
Supply Voltage to Ground Potential (Inputs & V_{CC} Only)	-0.5 to +5.5V
Supply Voltage to Ground Potential (Outputs & D/O Only)	-0.5 to +5.5V
DC Input Voltage	-0.5 to +5.5V
DC Output Current	20mA
Power Dissipation	500mW

Maximum Ratings PT8A974P

Storage Temperature	-25°C to +85°C
Ambient Temperature with Power Applied	0°C to +70°C
Supply Voltage to Ground Potential (Inputs & V_{CC} Only)	-0.5 to +5.5V
Supply Voltage to Ground Potential (Outputs & D/O Only)	-0.5 to +5.5V
DC Input Voltage	-0.5 to +5.5V
DC Output Current	30mA
Power Dissipation	500mW

Maximum Ratings PT8A974LP

Storage Temperature	-25°C to +85°C
Ambient Temperature with Power Applied	0°C to +70°C
Supply Voltage to Ground Potential (Inputs & V_{CC} Only)	-0.5 to +5.0V
Supply Voltage to Ground Potential (Outputs & D/O Only)	-0.5 to +5.0V
DC Input Voltage	-0.5 to +5.0V
DC Output Current	30mA
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.

Recommended Operation Conditions

Table 4. Recommended Operation Conditions

Sym	Description	Min	Typ	Max	Units
I_{CC}	Supply Current for PT8A974P			30	mA
	Supply Current for PT8A974LP			30	mA
V_{IH}	Input HIGH Voltage	$0.7V_{CC}$			V
V_{IL}	Input LOW Voltage		0	$0.3V_{CC}$	V
F_{OSC}	Oscillator Frequency	109	128	146	kHz
T_A	Operation Temperature	0		70	^{O}C

DC Electrical Characteristics

Table 5. DC Electrical Characteristics of PT8A9701P

Sym	Description	Test Conditions	Min	Typ	Max	Units
V_Z	Voltage of Zenner	I_Z = 2~30mA	3.4	3.7	4.0	V
I_{OH}	Output HIGH Current - PC Pin	$V_{OH} = V_{CC}$-0.5V	-3	-5		mA
	Output HIGH Currentl - SC and SO Pins		-3	-5		mA
	Output HIGH Current - OSCO Pin		-200		-1000	uA
I_{OL}	Output LOW Current - PC Pin	V_{OL} = 0.5V	2	3		mA
	Output LOW Currentl - SC and SO Pins		2	3		mA
	Output LOW Current - OSCO Pin		200		1000	uA
I_{IH}	Input HIGH Current - Forward, Backward, Left, Right, Turbo, F1, F2, F3/F4 and OSCI Pins	$V_{IH} = V_{CC}$			1	uA
I_{IL}	Input LOW Current - Forward, Backward, Left, Right, Turbo, F1, F2 and F3/F4 Pins	V_{IL} = 0V	-20	-40	-100	uA
	Input LOW Current - OSCI Pin				-10	uA

Note: These specifications apply for V_{CC} = 3.5V and $T_A = 25^{O}C$, unless otherwise specified.

Table 6. DC Electrical Characteristics of PT8A974P/974LP

Sym	Description	Test Conditions	Min	Typ	Max	Units
I_{OH}	Output HIGH Current - VO1, VO2 and OSCO Pins	$V_{OH} = V_{CC}$-0.5V	-300		-800	uA
	Output HIGH Current - Forward, Backward, Left and Right Pins		-3			mA
	Output HIGH Current - Turbo, F1, F2, F3 and F4 Pins		-3			
I_{OL}	Output LOW Current - VO1, VO2 and OSCO Pins	V_{OL} = 0.5V	200		1000	uA
	Output LOW Current - Forward, Backward, Left, Right and Turbo Pins		2	3		mA
	Output LOW Current - F1, F2, F3 and F4 Pins		2	3		
I_{IH}	Input HIGH Current - OSCI, VI1, VI2 and SI Pins	$V_{IN} = V_{CC}$			10	uA
	Input HIGH Current - VT1 and VT2 Pins				50	uA
I_{IL}	Input LOW Current - OSCI, VT1, VT2, VI1, VI2 and SI Pin	V_{IN} = 0V			-10	uA
VT	Over-Current Limit - VT1 and VT2 Pins for 974P		0.30		0.40	V
	Over-Current Limit - VT1 and VT2 Pins for 974LP		0.25		0.35	V
V_Z	Voltage of Zenner - V_{CC} Pin of PT8A974P	I_Z = 2~30mA	3.4	3.7	4	V
	Voltage of Zenner - V_{CC} of PT8A974LP		2.8	3.1	3.4	V

Note: These specifications apply for T_A = 25°C, V_{CC} = 3.5V (974P), V_{CC} = 3.0V (974LP), unless otherwise specified.

AC Electrical Characteristics

Table 7. AC Electrical Characteristics of PT8A9701P

Sym	Description	Test Conditions	Min	Typ	Max	Units
f_{OSC} (Note2)	Oscillator Frequency	R_f = 200kΩ	109	128	146	kHz
t_{FUN}	Period of Function Code	f_{OSC} = 128kHz	1.7	2	2.3	ms
t_{STA}	Start-Code Period	f_{OSC} = 128kHz	1.7	2	2.3	ms
f_{CSC}	Carrier Frequency	f_{OSC} = 128kHz		64		kHz
t_{OFF}	Auto-off Time	f_{OSC} = 128kHz		2		s
V_{CC}	Power Supply Range	-	3	9	12	V
I_{CC}	Supply Current	Output Unloaded			30	mA

Notes:
1. These specifications apply for V_{CC} = 3.5V and T_A = 25°C, unless otherwise specified.
2. The frequency of standard samples is tested on standard testing-board.

Table 8. AC Electrical Characteristics of PT8A974P/974LP

Sym	Description	Test Conditions	Min	Typ	Max	Units
f_{OSC} (Note2)	Oscillator Frequency	R_f = 200kΩ	109	128	146	kHz
t_{FUN}	Period of Function Code	f_{OSC} = 128kHz	1.7	2	2.3	ms
t_{STA}	Start-Code Period	f_{OSC} = 128kHz	1.7	2	2.3	ms
I_{CC}	Supply Current	Output Unloaded			30	mA

Notes:
1. These specifications apply for T_A = 25°C, V_{CC} = 3.5V (974P), V_{CC} = 3.0V (974LP), unless otherwise specified.
2. The frequency of standard samples is tested on standard testing-board.

Figure 5. Typical Application Circuit of PT8A9701P

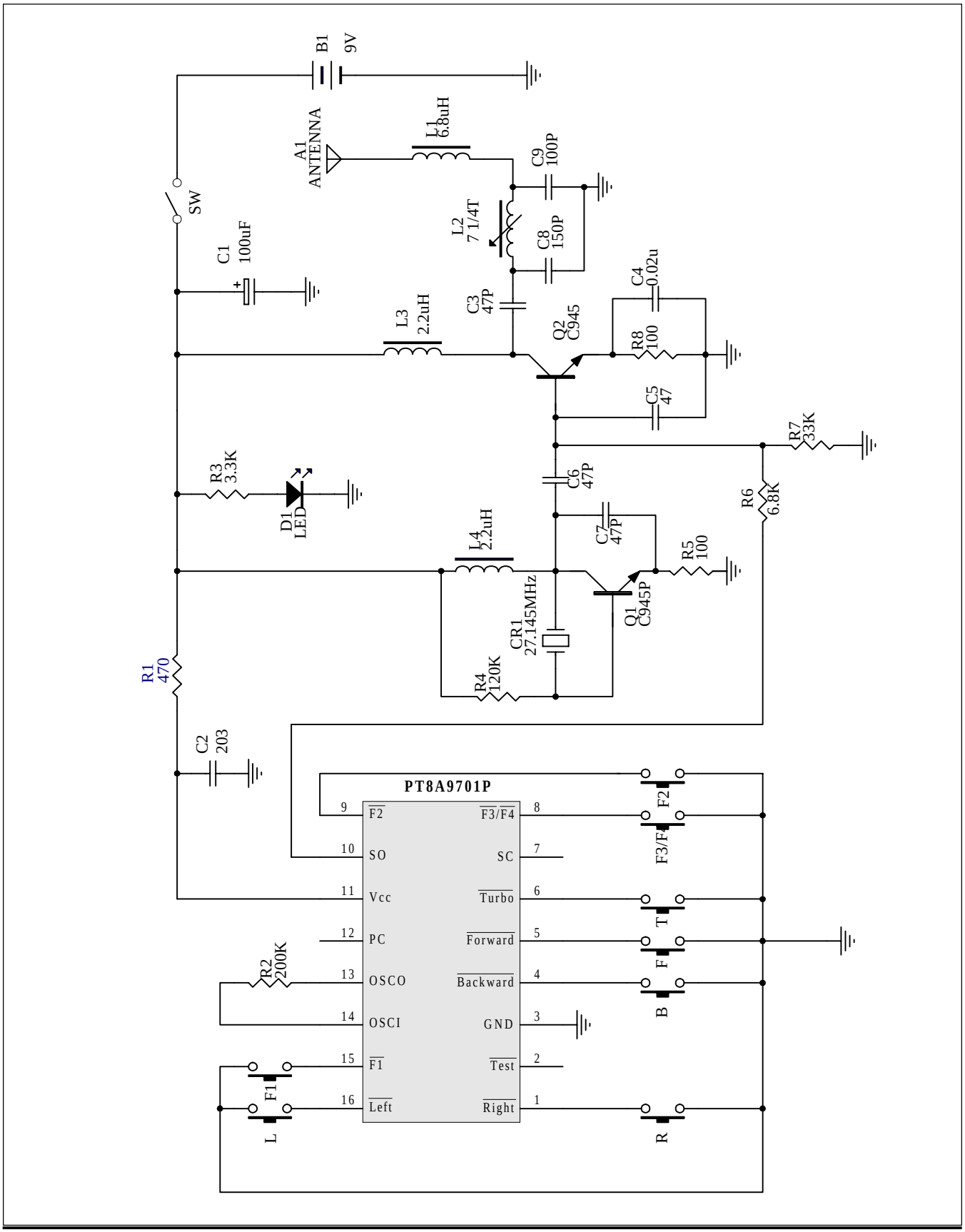
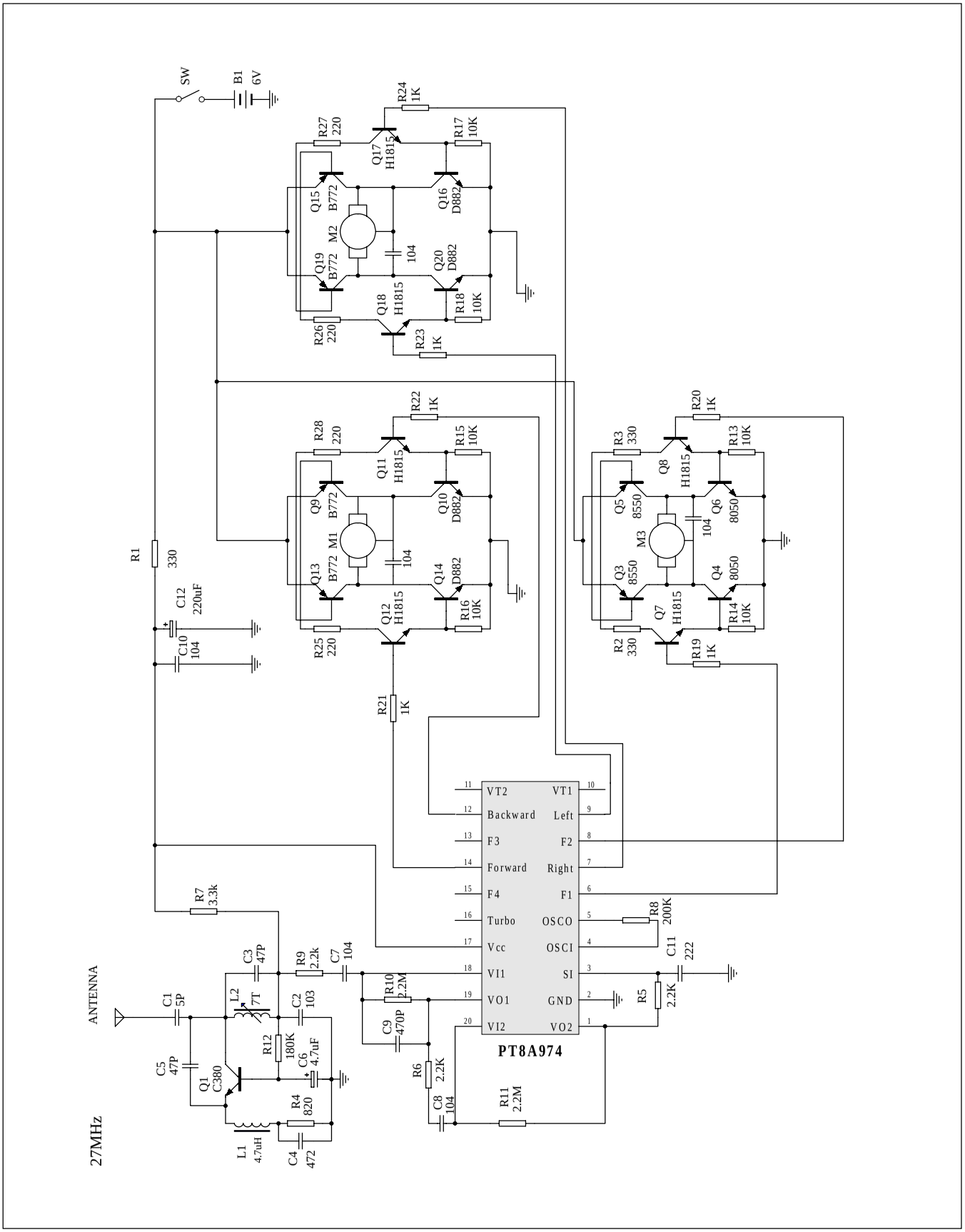


Figure 6. Typical Application Circuit of PT8A974P



Notes

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