

Features

- The PT8A992P works as the encoder and the PT8A993P works as the decoder
- 11 output pins, 4 for forward, backward, left and right functions, and 7 functional keys
- Operation power supply: 3.0V to 5.5V
- Auto power-off if no key pressed within 2s (PT8A992P)
- Auto shut-down if keep pressing a key for more than 4 minutes (PT8A992P)
- Auto shut down if no signal input for more than 5 minute (PT8A993P)
- Low operating current
- On-chip oscillator with an external resistor
- On-chip receiving amplifiers
- Few external components needed

General Description

The PT8A992P/993P is a pair of CMOS LSIs designed for remote controlled toy car application. They have 11 control keys for controlling the corresponding motion (i.e. forward, backward, left, right and 7 other functions) of the remote controlled car.

Block Diagram

Figure 1. Block Diagram of PT8A992P

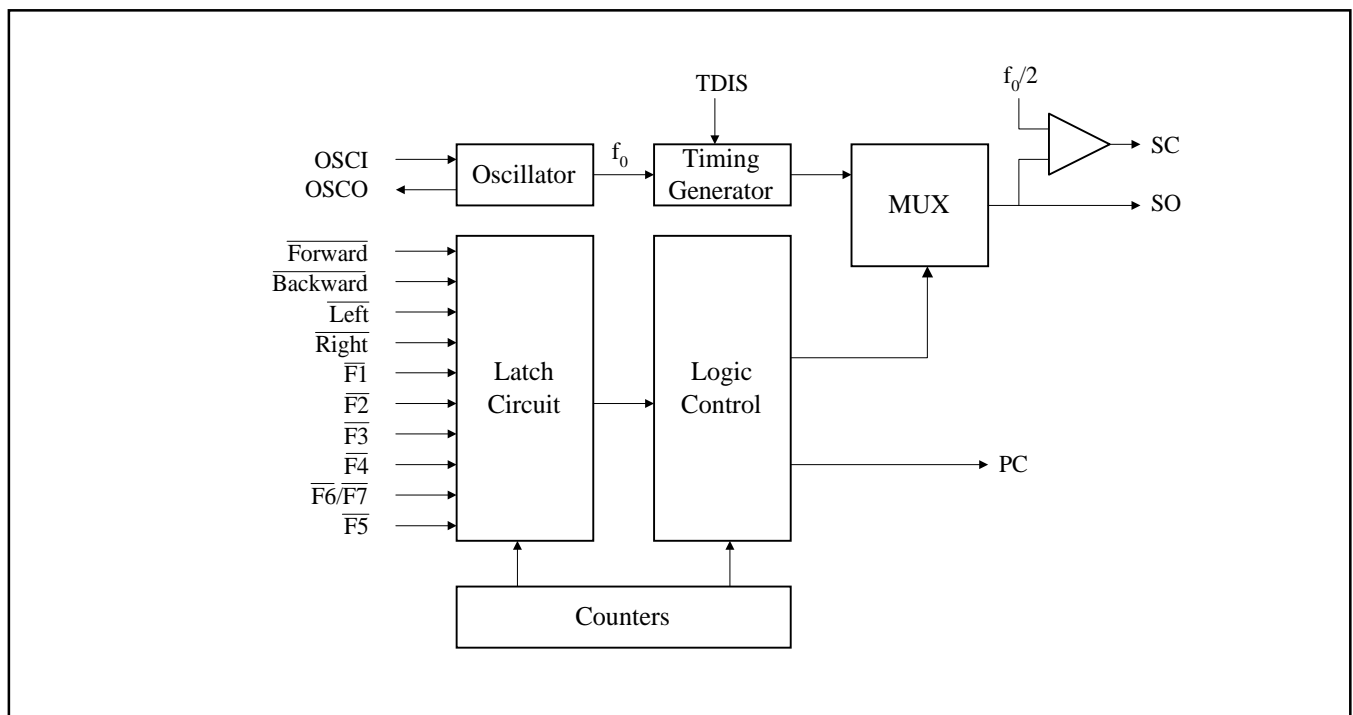
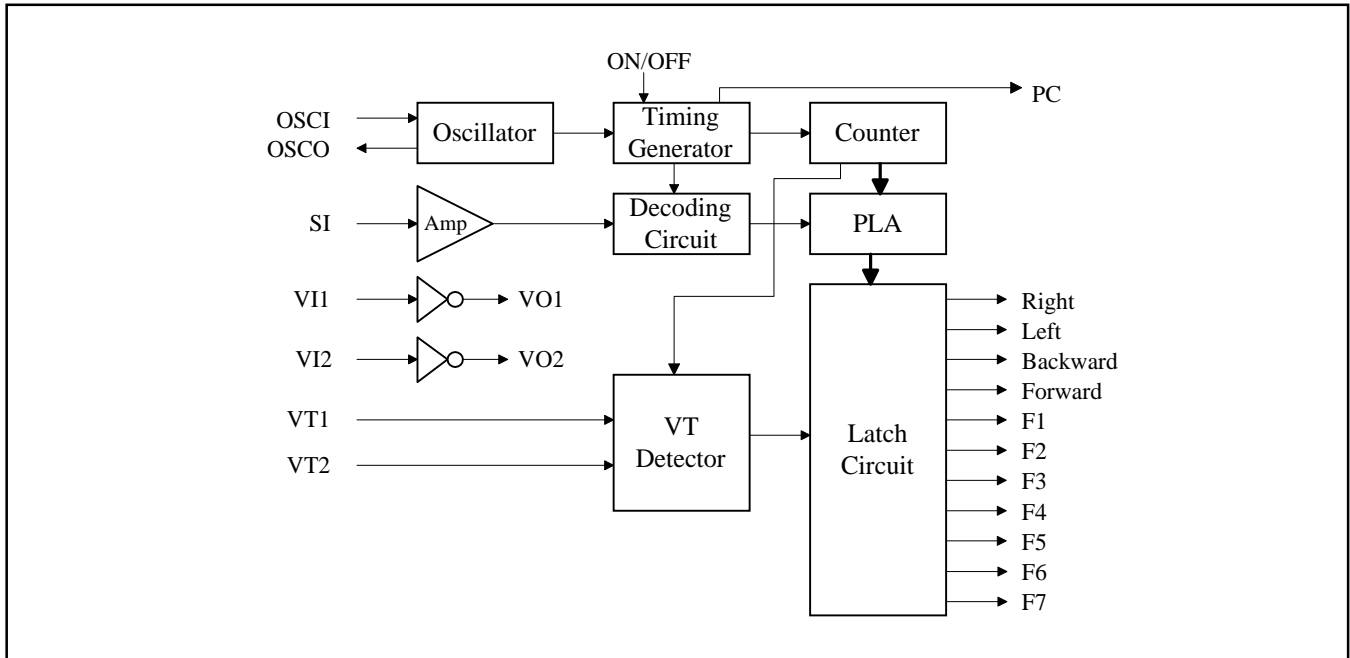
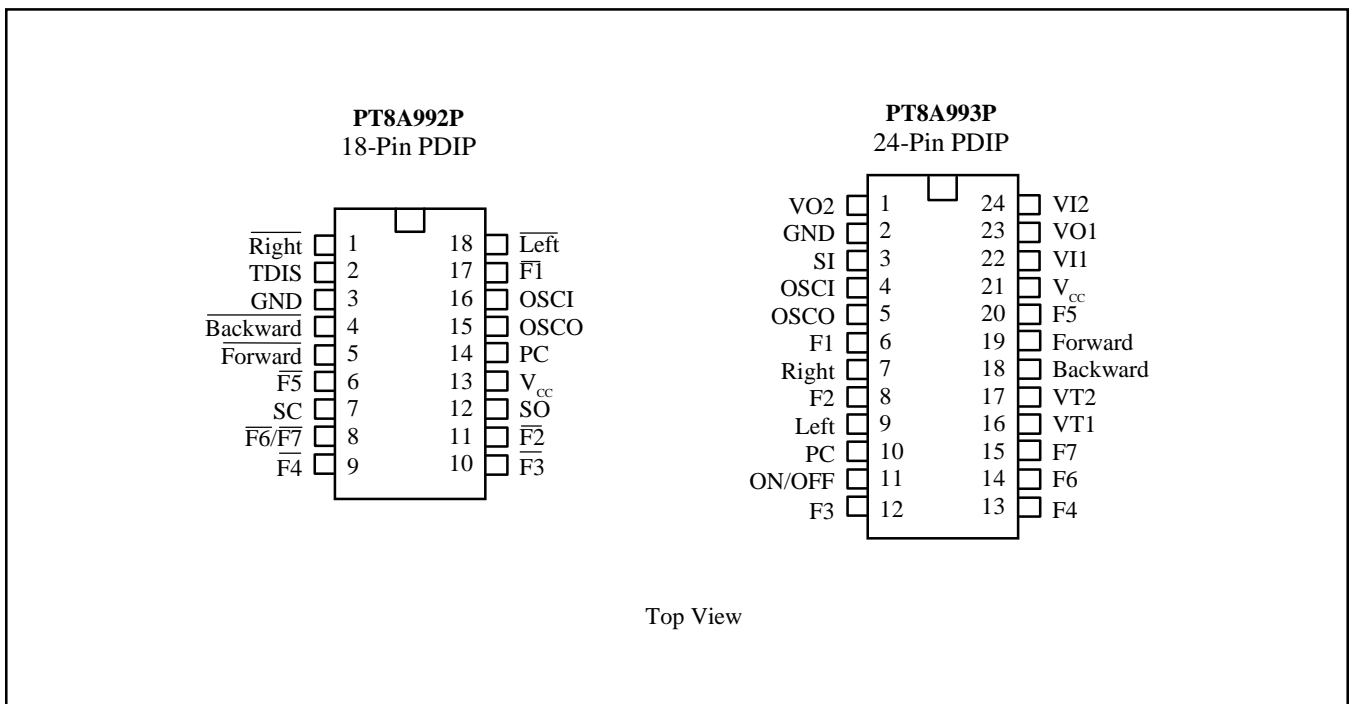


Figure 2. Block Diagram of PT8A993P



Package and Pin Assignment

Figure 3. Package and Pin Assignment



Pin Description

Table 1. Pin Description of PT8A992P

Pin No	Pin Name	Type	Description
1	$\overline{\text{Right}}$	I	The rightward function selected if this pin connected to GND
2	TDIS	I	For timer enable: opened or connected to V_{CC} , For timer disable: connected to GND, For test mode: connected to $1/2 V_{CC}$
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	$\overline{\text{F5}}$	I	Function 5 select if this pin connected to GND
7	SC	O	Output pin of the encoding signal with carrier frequency
8	$\overline{\text{F6/F7}}$	I	Connect to GND to toggle between F6 and F7 of PT8A993 when working with PT8A993
9	$\overline{\text{F4}}$	I	Function 4 selected if connected to GND
10	$\overline{\text{F3}}$	I	Function 3 selected if connected to GND
11	$\overline{\text{F2}}$	I	Function 2 selected if connected to GND
12	SO	O	Output pin of the encoding signal without carrier frequency
13	V_{CC}	P	Power supply
14	PC	O	Power control output pin
15	OSCO	O	Oscillator output pin
16	OSCI	I	Oscillator input pin
17	$\overline{\text{F1}}$	I	Function 1 selected if connected to GND
18	$\overline{\text{Left}}$	I	Leftward function selected if this pin connected to GND

Table 2. Pin Description of PT8A993P

Pin No	Pin Name	Type	Description
1, 23	VO1, VO2	O	Output pins of inverter 1 and 2 for Signal amplifier
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	PC	O	Power control pin
11	ON/OFF	I	ON/OFF pin
12	F3	O	F3 function output pin
13	F4	O	F4 function output pin
14	F6	O	F6 function output pin
15	F7	O	F7 function output pin
16	VT1	I	Auto shut off input pin: if the voltage on this pin keeps higher than $0.095V_{CC}$ for 3 seconds, all outputs will be shut off automatically.
17	VT2	I	Auto shut off input pin: if the voltage on this pin keeps higher than $0.095V_{CC}$ for 3 seconds, all outputs will be shut off automatically.
18	Backward	O	Backward output pin
19	Forward	O	Forward output pin
20	F5	O	F5 function output pin
21	V_{CC}	P	Power supply
22, 24	VII,VI2	I	Input pins of inverter 1 and 2 for signal amplifier

Functional Description

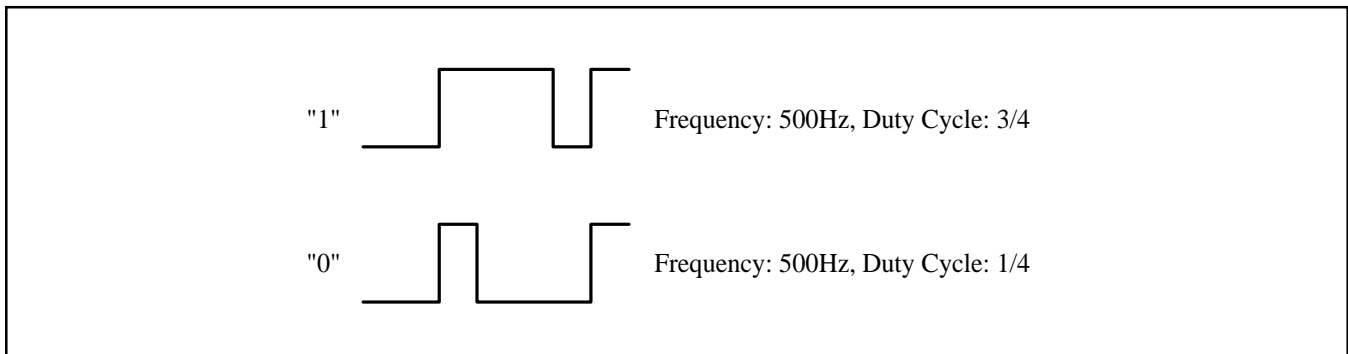
For PT8A992P, a PC pin is used to control on or off of external power supply. When pressing any key, the PC output pin will keeps on a high level. If none of keys is pressed within 2 seconds, the PT8A992 will shut down automatically and no level output on the PC pin. On the other hand, if any of keys is kept pressed for 4 minutes, the PT8A992P will also shut down to save battery power.

The PT8A993P also features Auto Power Off function when no any signal received within 5 minutes. Two over-current protection pins VT1 and VT2 are used for current limit in accordance with the toy safety standard HD271. They act to shut down the output level if the input voltage keeps more than 0.095V_{CC} for 3 seconds.

Data Format

See Figure 4.

Figure 4. Data Format



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	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

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.

Coding Method

Each trigger pin is triggered by corresponding bit of data in format of "1". The data string is 18-bit and divided to four segments, i.e., Start Code, Data Code, Parity Code and End code, where

Start Code = 11110.

Data Code =

F3	F4	F	B	F5	R	L	F1	F6	F7	F2
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- | | | |
|-----------------|-----------------|-----------------|
| F = Forward | B = Backward | F5 = Function 5 |
| R = Right | L = Left | F1 = Function 1 |
| F2 = Function 2 | F3 = Function 3 | F4 = Function 4 |
| F6 = Function 6 | F7 = Function 7 | |

Parity Code = Even parity check result

End Code is for data latch.

Data code can be any combination of F, B, F5, R, L, F1, F2, F3, F4, F6 and F7 except F&B and R&L.

Recommended Operation Conditions

Table 3. Recommended Operation Conditions

Sym	Description	Test Conditions	Min	Typ	Max	Units
V _{CC}	Supply Voltage		3	4	5	V
V _{IH}	Input HIGH Voltage		0.7V _{CC}	4	-	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	°C

DC Electrical Characteristics

Table 4. DC Electrical Characteristics of PT8A992P

Sym	Description	Test Conditions	Min	Typ	Max	Units
I _{STB}	Stand-by Current	T _A = 70°C, Off State		1	3	uA
I _{OH}	Output HIGH Current - PC and SO Pins	V _{OH} = 3.5V, T _A = 25°C	2	3		mA
	Output HIGH Currentl - SC Pin		4	5		mA
	Output HIGH Current - OSCO Pin		220		600	uA
I _{OL}	Output LOW Current - PC and SO Pins	V _{OL} = 0.5V, T _A = 25°C	2	4		mA
	Output LOW Currentl - SC Pin		4	5		mA
	Output LOW Current - OSCO Pin		220		600	uA
I _{IH}	Input HIGH Current - Forward, Backward, Left, Right, F1, F2, F3, F4, F5, F6/F7, OSCI and TDIS Pins	V _{CC} = 5.5V, V _{IH} = V _{CC} , T _A = 25°C		1	10	uA
I _{IL}	Input LOW Current - Forward, Backward, Left, Right, F1, F2, F3, F4, F5, F6/F7 and TDIS Pins	V _{CC} = 5.5V, V _{IL} = 0V, T _A = 25°C	10	25	100	uA
	Input LOW Current - OSCI Pin			1	10	

Note: These specifications apply for V_{CC} = 4.0V and 0°C ≤ T_A ≤ 70°C, unless otherwise specified.

Table 5. DC Electrical Characteristics of PT8A993P

Sym	Description	Test Conditions	Min	Typ	Max	Units
I_{STB}	Stand-by Current	Off State		3	5	uA
I_{OH}	Output HIGH Current - VO1, VO2 and OSCO Pins	$V_{OH} = 3.5V, T_A = 25^{\circ}C$	300		850	uA
	Output HIGH Current - Forward, Backward, Left and Right Pins		6	10	mA	
	Output HIGH Current - F1, F2, F3 F4, F5 and F6 Pins		3	6		
	Output HIGH Current - PC Pin		2	5		
I_{OL}	Output LOW Current - VO1, VO2 and OSCO Pins	$V_{OL} = 0.5V, T_A = 25^{\circ}C$	300		850	uA
	Output LOW Current - Forward, Backward, Left and Right Pins		3	5	mA	
	Output LOW Current - F1, F2, F3, F4, F5 and F6 Pins		6	11		
	Output LOW Current - PC Pin		2	9		
I_{IH}	Input HIGH Current - VT1 and VT2 Pins	$V_I = V_{CC}, T_A = 25^{\circ}C, \text{On state}$	20	30	100	uA
	Input HIGH Current - SI, VI1, VI2, ON/OFF and OSCI Pins			1	10	
I_{IL}	Input LOW Current - SI, VI1, VI2, VT1, VT2 and OSCI Pins	$V_I = 0V, T_A = 25^{\circ}C, \text{On state}$		1	10	uA
	Input LOW Current - ON/OFF Pin		15	30	100	
I_{DR}	Pull-Down Resistor Current - VI1 and VI2 Pins	$V_I = 4.0V, \text{Off State}$	100		290	uA
I_{UR}	Pull-Up Resistor Current - SI Pin	$V_I = 0V, \text{Off State}$	20		100	uA
V_{OH}	Output HIGH Voltage - VO1 and VO2 Pins	VI1, VI2 = 1.5V	3.5			V
V_{OL}	Output LOW Voltage - VO1 and VO2 Pins	VI1, VI2 = 2.5V			0.5	V
VT	Over-Current Limit - VT1 and VT2 Pins	Forward is high.	0.35		0.45	V

Note: These specifications apply for $V_{CC} = 4.0V$ and $0^{\circ}C \leq T_A \leq 70^{\circ}C$, unless otherwise specified.

AC Electrical Characteristics

Table 6. AC Electrical Characteristics of PT8A992P

Sym	Description	Test Conditions	Min	Typ	Max	Units
f_{OSC} (Note2)	Oscillator Frequency	$T_A = 25\text{ C}, R_f = 200k\Omega$	109	128	146	kHz
t_{FUN}	Period of Function Code	$f_{OSC} = 128kHz, T_A = 25^\circ\text{C}$	1.7	2	2.3	ms
t_{STA}	Start-Code Period	$f_{OSC} = 128kHz, T_A = 25^\circ\text{C}$	1.7	2	2.3	ms
f_{CSC}	Carrier Frequency	$f_{OSC} = 128kHz, T_A = 25^\circ\text{C}$		64	-	kHz
t_{OFF}	Auto-off Time	$f_{OSC} = 128kHz, T_A = 25^\circ\text{C}$		2		s
V_{CC}	Power Supply Range	-	3	4	5.5	V
I_{CC}	Supply Current	Output Unloaded			300	uA

Table 7. AC Electrical Characteristics of PT8A993P

Sym	Description	Test Conditions	Min	Typ	Max	Units
f_{OSC} (Note2)	Oscillator Frequency	$T_A = 25\text{ C}, R_f = 200k\Omega$	109	128	146	kHz
t_{FUN}	Period of Function Code	$f_{OSC} = 128kHz, T_A = 25^\circ\text{C}$	1.7	2	2.3	ms
t_{STA}	Start-Code Period	$f_{OSC} = 128kHz, T_A = 25^\circ\text{C}$	1.7	2	2.3	ms
t_{OFF}	Auto-off Time	$f_{OSC} = 128kHz, T_A = 25^\circ\text{C}$		5		minute
V_{CC}	Power Supply Range	-	3	4	5.5	V

Note:

1. These specifications apply for $V_{CC} = 4.0V$ and $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$, unless otherwise specified.
2. The frequency of standard samples is tested on standard testing-board.

Figure 5. Typical Application Circuit of PT8A992P

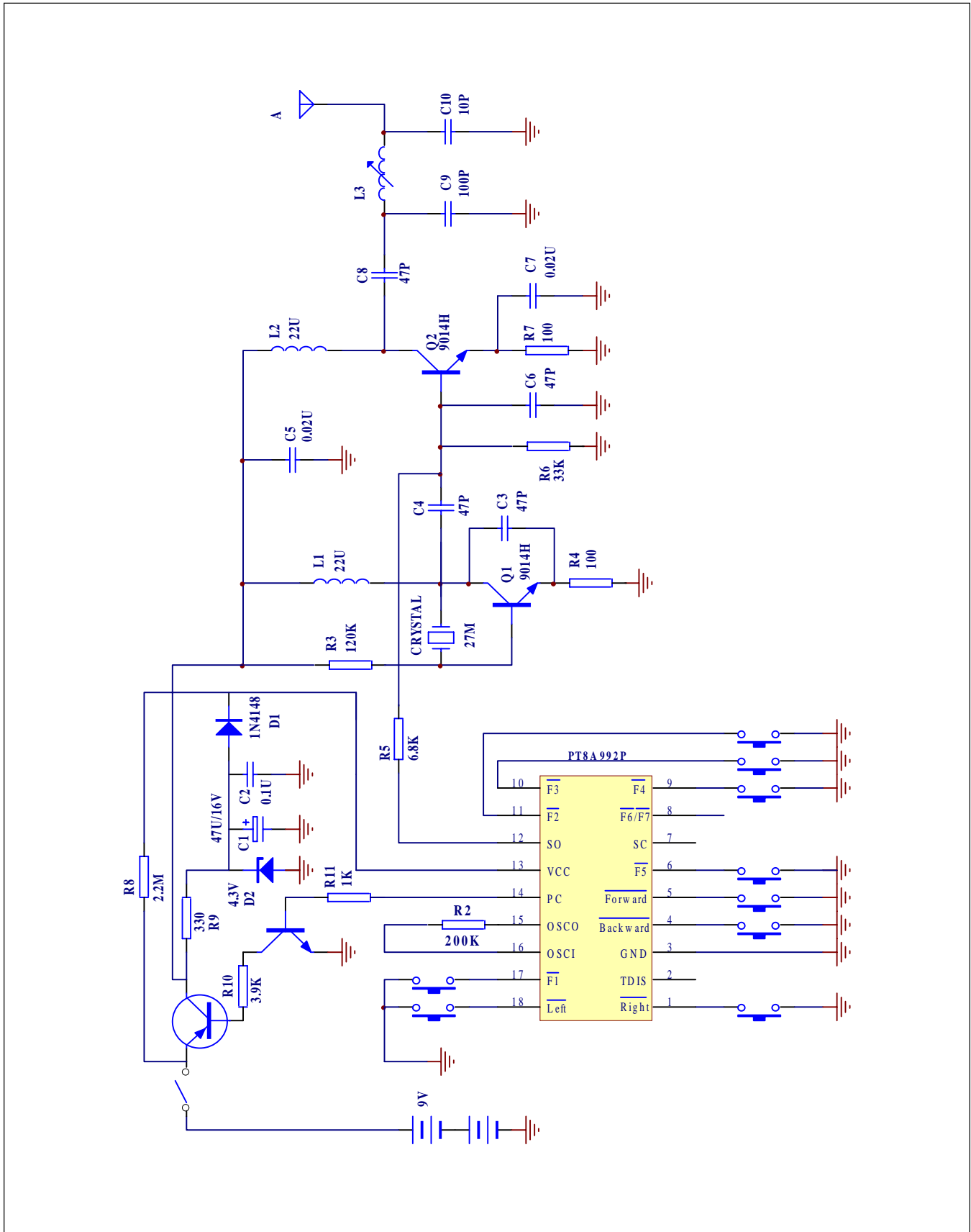
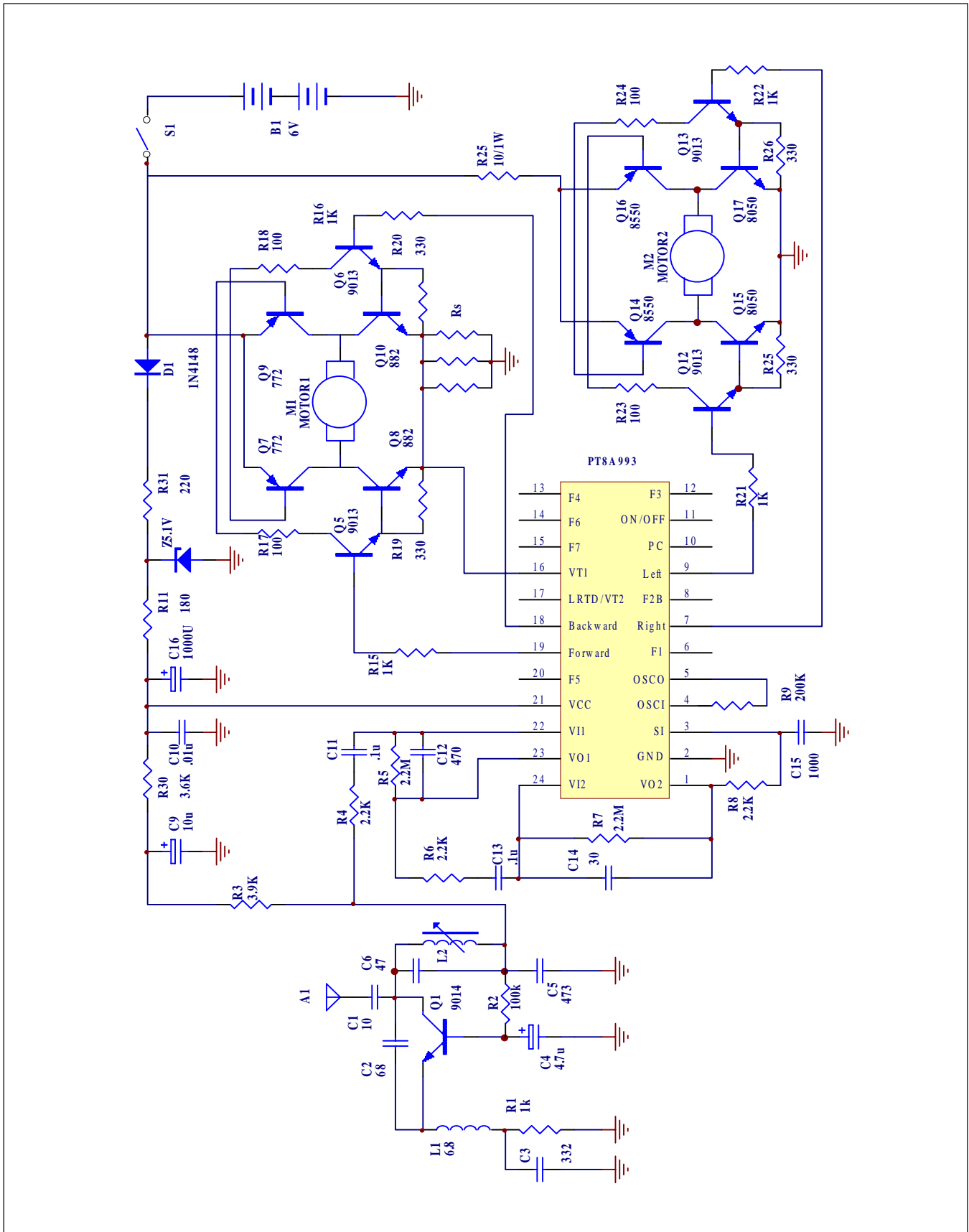


Figure 6. Typical Application Circuit of PT8A993P



Notes

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