



# THE DATASHEET OF PT8A990APE



## 9-Function Remote Controller

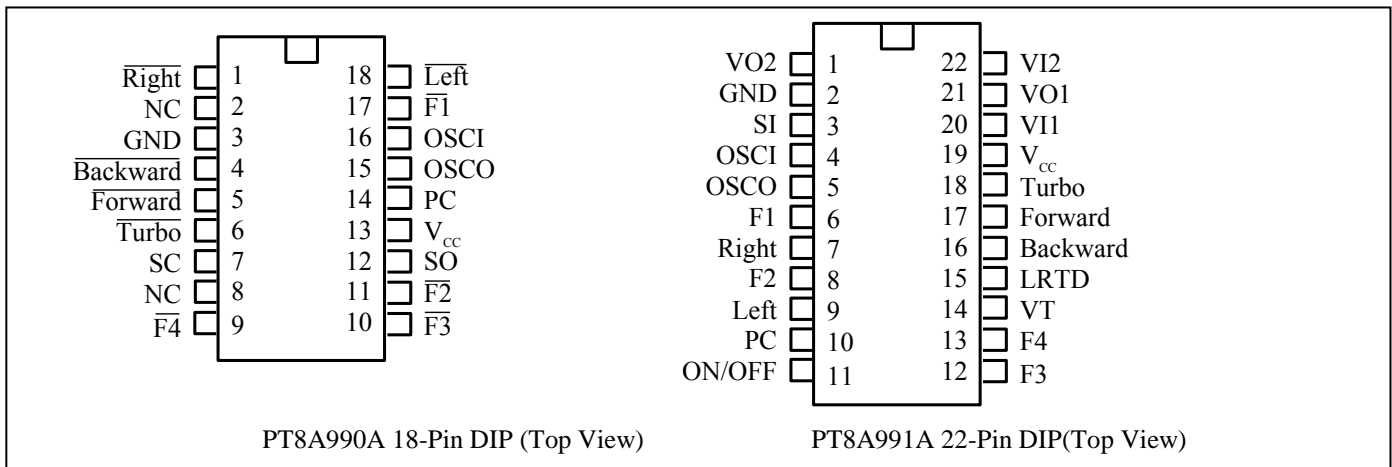
### Features

- The PT8A990A works as the encoder and the PT8A991A works as the decoder
- 9 output pins, 5 for forward, backward, left, right and turbo functions, and 4 functional keys
- Operation power supply: 3.0V to 5.5V
- Auto power-off if no key pressed (PT8A990A)
- Low operating current
- On-chip oscillator with an external resistor
- On-chip receiving amplifiers
- Few external components needed

### Description

The PT8A992A/993A is a pair of CMOS LSIs designed for remote controlled toy car application. They have 9 control keys for controlling the corresponding motion (i.e. forward, backward, left, right turbo and 4 other functional keys) of the remote controlled car. They also have Forward(Backward) and turbo combination application

### Pin Configuration



### Pin Description

#### Pin description for PT8A990A

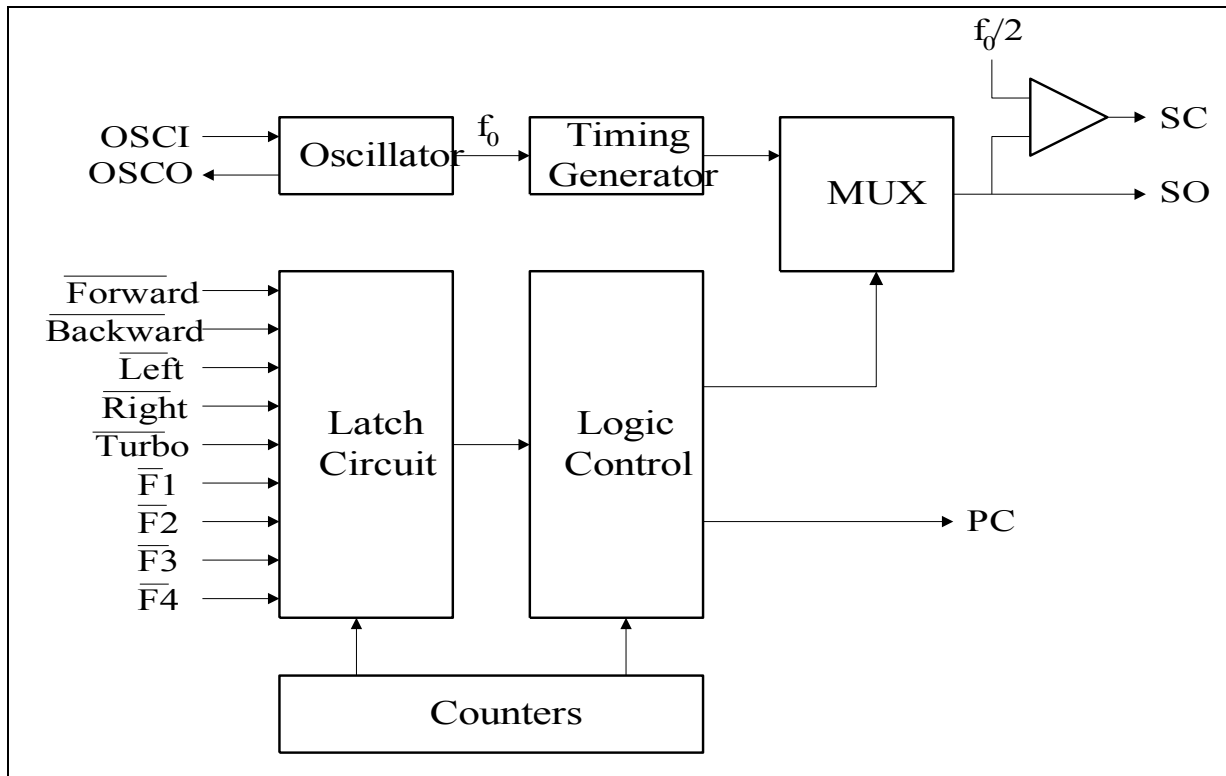
| Pin No | Pin Name | Type | Description                                                  |
|--------|----------|------|--------------------------------------------------------------|
| 1      | Right    | I    | The rightward function selected if this pin connected to GND |
| 2      | NC       | -    | No connection                                                |
| 3      | GND      | GND  | Ground                                                       |
| 4      | Backward | I    | Backward function selected if this pin connected to GND      |
| 5      | Forward  | I    | Forward function selected if this pin connected to GND       |
| 6      | Turbo    | I    | Turbo function selected if this pin connected to GND         |
| 7      | SC       | O    | Output pin of the encoding signal with carrier frequency     |
| 8      | NC       | I    | No connection                                                |
| 9      | F4       | I    | Function 4 selected if connected to GND                      |
| 10     | F3       | I    | Function 3 selected if connected to GND                      |
| 11     | F2       | I    | Function 2 selected if connected to GND                      |
| 12     | SO       | O    | Output pin of the encoding signal without carrier frequency  |
| 13     | Vcc      | P    | Power supply                                                 |
| 14     | PC       | O    | Power control output pin                                     |
| 15     | OSCO     | O    | Oscillator output pin                                        |
| 16     | OSCI     | I    | Oscillator input pin                                         |
| 17     | F1       | I    | Function 1 selected if connected to GND                      |
| 18     | Left     | I    | Leftward function selected if this pin connected to GND      |

Pin description for PT8A993A

| Pin No | Pin Name | Type | Description                                                                                                                                           |
|--------|----------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1, 21  | 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     | VT       | I    | Auto shut off input pin: if the voltage on this pin keeps higher than 0.095V <sub>cc</sub> for 3 seconds, all outputs will be shut off automatically. |
| 15     | LRTD     | I    | Left/Right turbo disable pin                                                                                                                          |
| 16     | Backward | O    | Backward output pin                                                                                                                                   |
| 17     | Forward  | O    | Forward output pin                                                                                                                                    |
| 18     | Turbo    | O    | Turbo output pin                                                                                                                                      |
| 19     | Vcc      | P    | Power supply                                                                                                                                          |
| 20, 22 | VI1, VI2 | I    | Input pins of invertors 1 and 2 for signal amplifier                                                                                                  |

Block Diagram

Block diagram for PT8A990A



## Maximum Ratings

|                                                                         |                |
|-------------------------------------------------------------------------|----------------|
| Storage Temperature.....                                                | -25°C to +85°C |
| Ambient Temperature with Power Applied.....                             | 0°C to +70°C   |
| Supply Voltage to Ground Potential (Inputs & V <sub>cc</sub> 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.

## Recommended Operation Conditions

| Sym              | Description           | Min                | Typ | Max                | Unit |
|------------------|-----------------------|--------------------|-----|--------------------|------|
| V <sub>CC</sub>  | Supply Voltage        | 3                  | 4   | 5                  | V    |
| V <sub>IH</sub>  | Input HIGH Voltage    | 0.7V <sub>CC</sub> | 4   | -                  | V    |
| V <sub>IL</sub>  | Input LOW Voltage     | -                  | 0   | 0.3V <sub>CC</sub> | V    |
| F <sub>OSC</sub> | Oscillator frequency  | 109                | 128 | 146                | kHz  |
| T <sub>A</sub>   | Operation temperature | 0                  | -   | 70                 | °C   |

## DC Electrical Characteristics

PT8A990A (Unless otherwise noted, V<sub>CC</sub> = 4.0V, T<sub>A</sub> = 0 ~ 70 °C)

| Sym              | Description                                                                               | Test conditions                                                                  | Min  | Typ | Max  | Unit |
|------------------|-------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------|-----|------|------|
| I <sub>STB</sub> | Stand by current                                                                          | T <sub>A</sub> = 70 °C, Off state                                                | -    | -   | 2    | μA   |
| I <sub>CC</sub>  | Supply Current                                                                            | Output Unload                                                                    | -    | -   | 300  | μA   |
| I <sub>OH</sub>  | Output HIGH Current - PC and SO Pins                                                      | V <sub>OH</sub> =3.5V, T <sub>A</sub> = 25 °C                                    | -1   | -2  | -    | mA   |
|                  | Output HIGH Current - SC Pin                                                              |                                                                                  | -3   | -4  | -    | mA   |
|                  | Output HIGH Current - OSCO Pin                                                            |                                                                                  | -400 | -   | -    | μA   |
| I <sub>OL</sub>  | Output LOW Current - PC and SO Pins                                                       | V <sub>OL</sub> =0.5V, T <sub>A</sub> = 25 °C                                    | 1    | 4   | -    | mA   |
|                  | Output LOW Current - SC Pins                                                              |                                                                                  | 1.5  | 5   | -    | mA   |
|                  | Output LOW Current - OSCO Pin                                                             |                                                                                  | 400  | -   | -    | μA   |
| I <sub>IH</sub>  | Input HIGH Current - Forward, Backward, Left, Right, F1, F2, F3, F4, Turbo, NC, OSCI Pins | V <sub>CC</sub> =5.5V, V <sub>IH</sub> =V <sub>CC</sub> , T <sub>A</sub> = 25 °C | -    | -   | 10   | μA   |
| I <sub>IL</sub>  | Input HIGH Current - Forward, Backward, Left, Right, F1, F2, F3, F4, Turbo, NC Pins       | V <sub>CC</sub> =5.5V, V <sub>IL</sub> =0V, T <sub>A</sub> = 25 °C               | -10  | -25 | -100 | μA   |
|                  | Input LOW Current - OSCI Pin                                                              |                                                                                  | -    | -1  | -10  | μA   |

PT8A991A (Unless otherwise noted,  $V_{CC} = 4.0V$ ,  $T_A = 0 \sim 70 \text{ }^\circ\text{C}$ )

| Sym       | Description                                                   | Test conditions                                     | Min  | Typ | Max  | Unit          |
|-----------|---------------------------------------------------------------|-----------------------------------------------------|------|-----|------|---------------|
| $I_{STB}$ | Stand by current                                              | $T_A = 70 \text{ }^\circ\text{C}$ , Off state       | -    | -   | 20   | $\mu\text{A}$ |
| $I_{CC}$  | Supply Current                                                | Output Unload                                       | -    | -   | 700  | $\mu\text{A}$ |
| $I_{OH}$  | Output HIGH Current - VO1, VO2 and OSCO Pins                  | $V_{OH} = 3.5V$ , $T_A = 25 \text{ }^\circ\text{C}$ | -300 | -   | -    | $\mu\text{A}$ |
|           | Output HIGH Current - Forward, Backward, Left and Right Pins  |                                                     | -2   | -5  | -    | $\text{mA}$   |
|           | Output HIGH Current – Turbo, F1, F2, F3, F4 Pins              |                                                     | -2   | -5  | -    | $\text{mA}$   |
|           | Output HIGH Current - PC Pin                                  |                                                     | -2   | -3  | -    | $\text{mA}$   |
| $I_{OL}$  | Output LOW Current - VO1, VO2 and OSCO Pins                   | $V_{OL} = 0.5V$ , $T_A = 25 \text{ }^\circ\text{C}$ | 150  | -   | -    | $\mu\text{A}$ |
|           | Output LOW Current - Forward, Backward, Left and Right Pins   |                                                     | 1    | 3   | -    | $\text{mA}$   |
|           | Output LOW Current – Turbo, F1, F2, F3, F4 Pins               |                                                     | 1    | 3   | -    | $\text{mA}$   |
|           | Output LOW Current - PC Pin                                   |                                                     | 2    | -   | -    | $\text{mA}$   |
| $I_{IH}$  | Input HIGH Current - VT Pins                                  | $V_I = V_{CC}$ , $T_A = 25 \text{ }^\circ\text{C}$  | 20   | 30  | 100  | $\mu\text{A}$ |
|           | Input HIGH Current - SI, VI1, VI2, LRTD, ON/OFF and OSCI Pins |                                                     | -    | -   | 10   | $\mu\text{A}$ |
| $I_{IL}$  | Input LOW Current - SI, VI1, VI2, VT and OSCI Pins            | $V_I = 0V$ , $T_A = 25 \text{ }^\circ\text{C}$      | -    | -   | -10  | $\mu\text{A}$ |
|           | Input LOW Current - ON/OFF and LRTD Pin                       |                                                     | -20  | -30 | -100 | $\mu\text{A}$ |
| VT        | Over Current Limit VT Pins                                    | Forward is high                                     | 0.35 | -   | 0.45 | V             |

## AC Electrical Characteristics

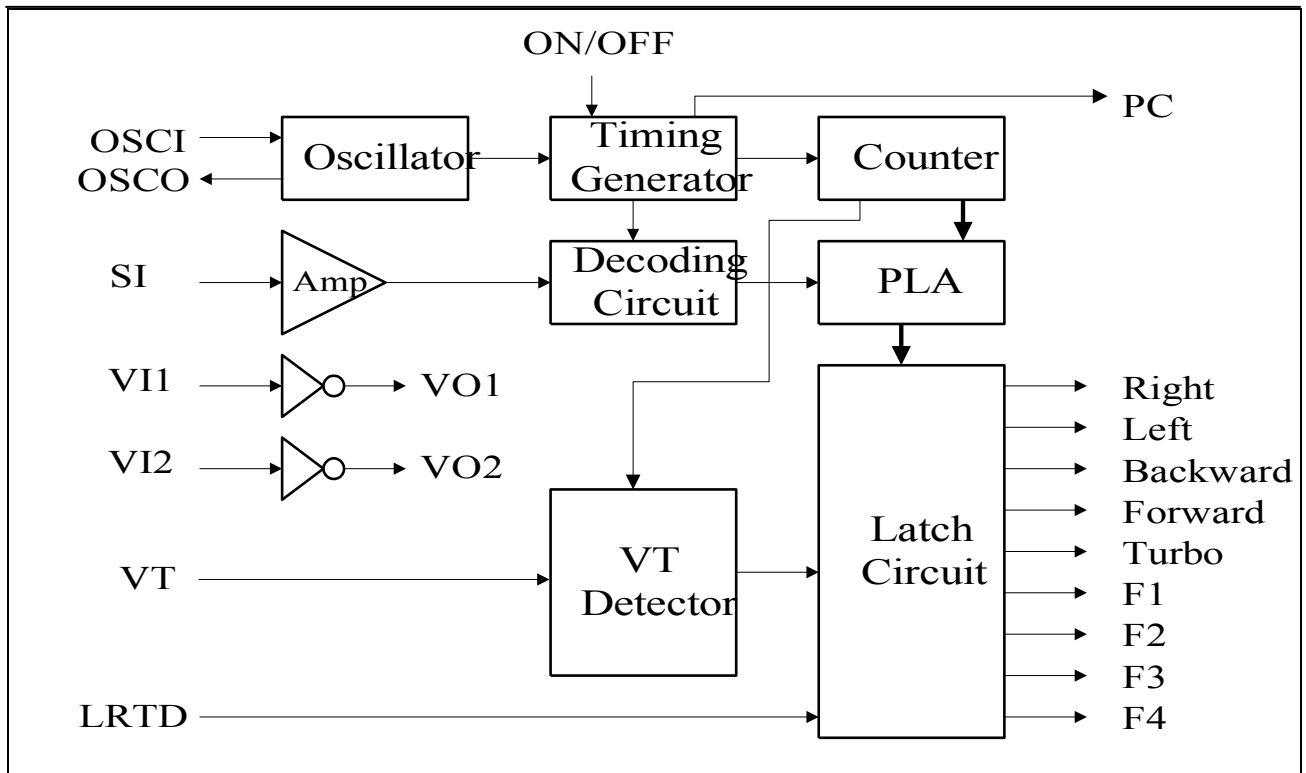
PT8A992A (Unless otherwise noted,  $V_{CC} = 4.0$ ,  $T_A = 0 \sim 70 \text{ }^\circ\text{C}$ )

| Sym                | Description          | Test conditions                                               | Min | Typ | Max | Unit |
|--------------------|----------------------|---------------------------------------------------------------|-----|-----|-----|------|
| $f_{OSC}^{(Note)}$ | Oscillator Frequency | $R_f = 180k\Omega$ , $T_A = 25 \text{ }^\circ\text{C}$        | 109 | 128 | 146 | kHz  |
| $t_{FUN}$          | Period Function Code | $f_{OSC} = 128\text{kHz}$ , $T_A = 25 \text{ }^\circ\text{C}$ | 1.7 | 2   | 2.3 | ms   |
| $f_{OSC}$          | Carrier Frequency    | $f_{OSC} = 128\text{kHz}$ , $T_A = 25 \text{ }^\circ\text{C}$ | -   | 64  | -   | kHz  |

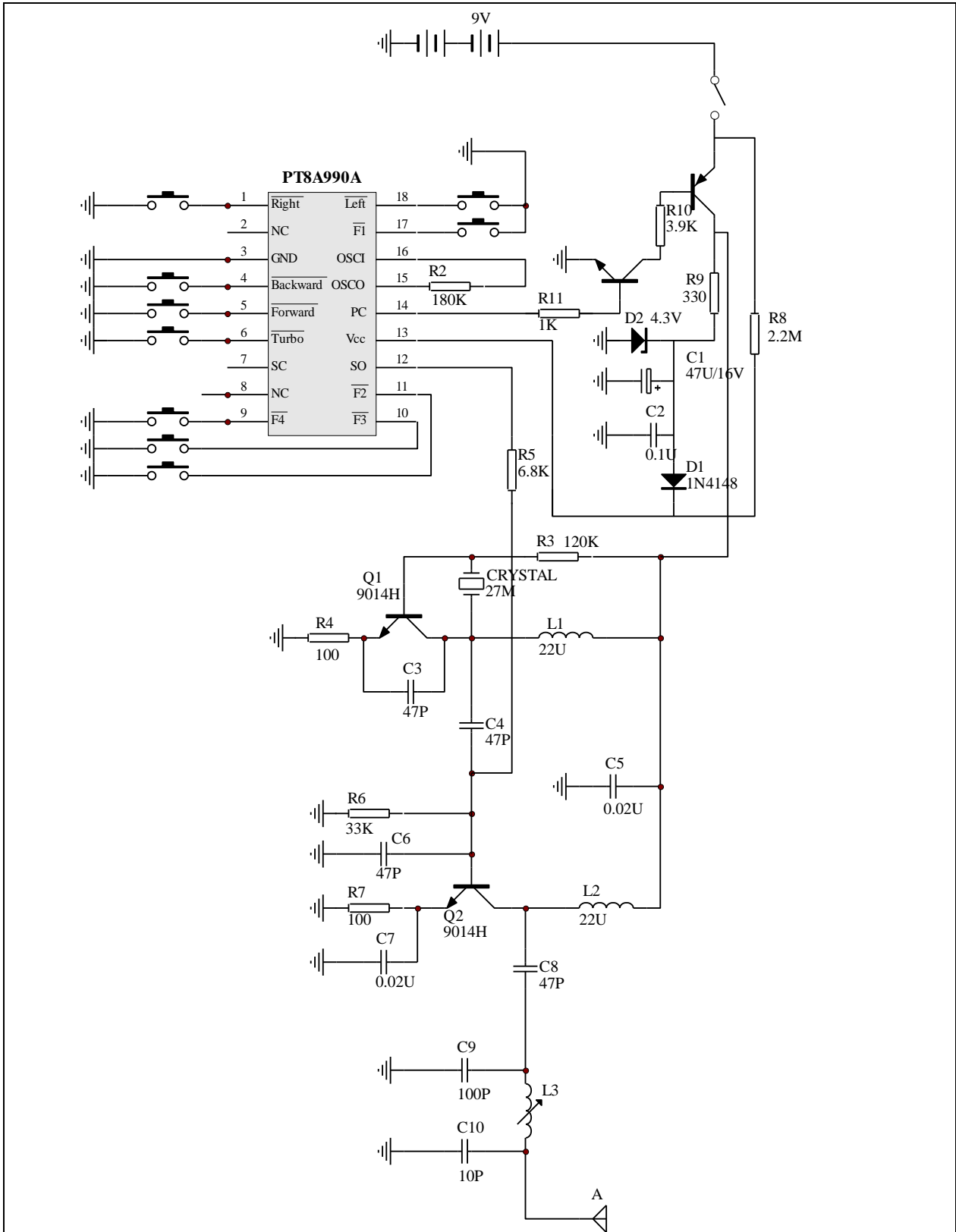
PT8A993A (Unless otherwise noted,  $V_{CC} = 4.0$ ,  $T_A = 0 \sim 70 \text{ }^\circ\text{C}$ )

| Sym                | Description          | Test conditions                                               | Min | Typ | Max | Unit |
|--------------------|----------------------|---------------------------------------------------------------|-----|-----|-----|------|
| $f_{OSC}^{(Note)}$ | Oscillator Frequency | $R_f = 180k\Omega$ , $T_A = 25 \text{ }^\circ\text{C}$        | 109 | 128 | 146 | kHz  |
| $t_{FUN}$          | Period Function Code | $f_{OSC} = 128\text{kHz}$ , $T_A = 25 \text{ }^\circ\text{C}$ | 1.7 | 2   | 2.3 | ms   |

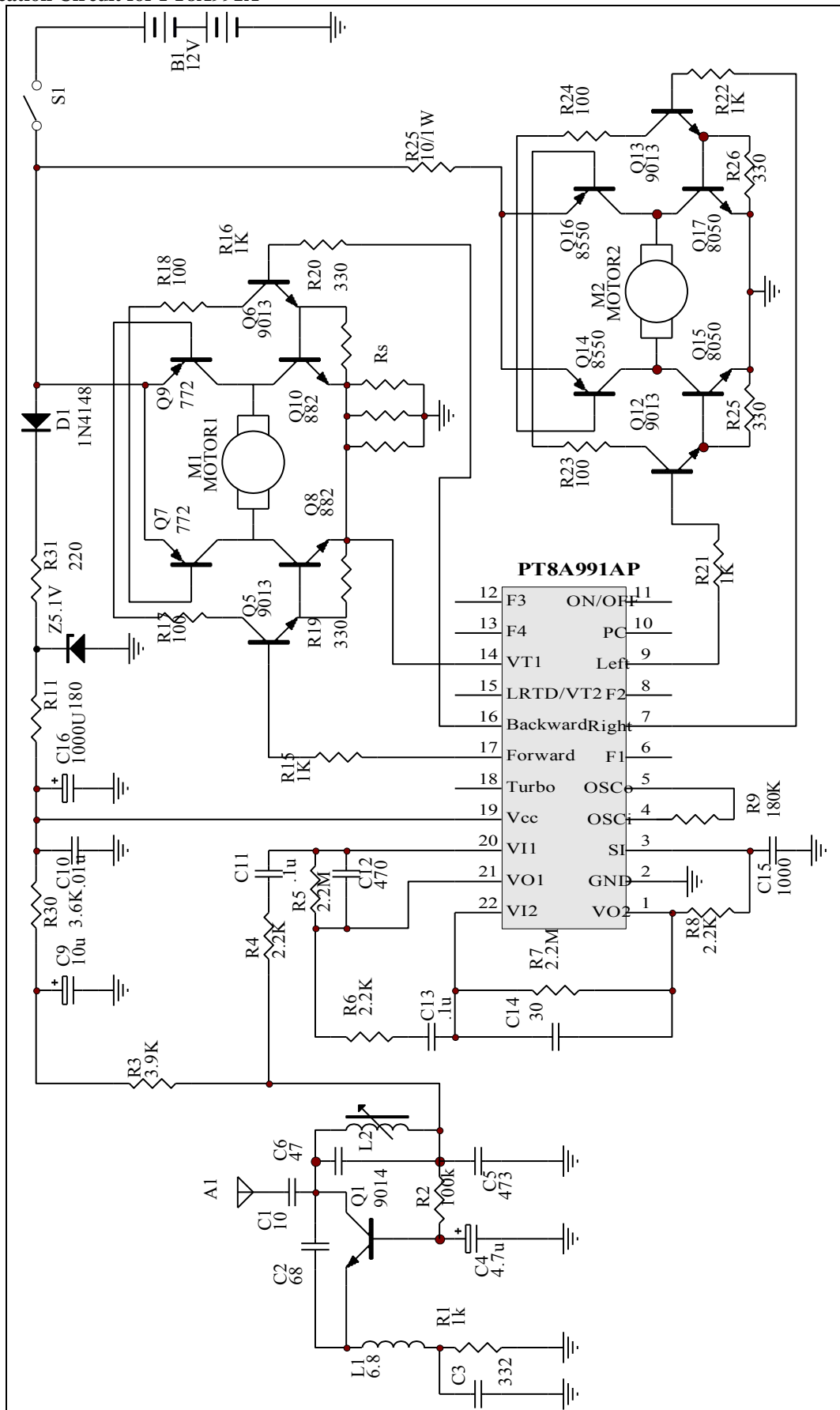
Note: The frequency of standard samples is tested on standard testing-board.

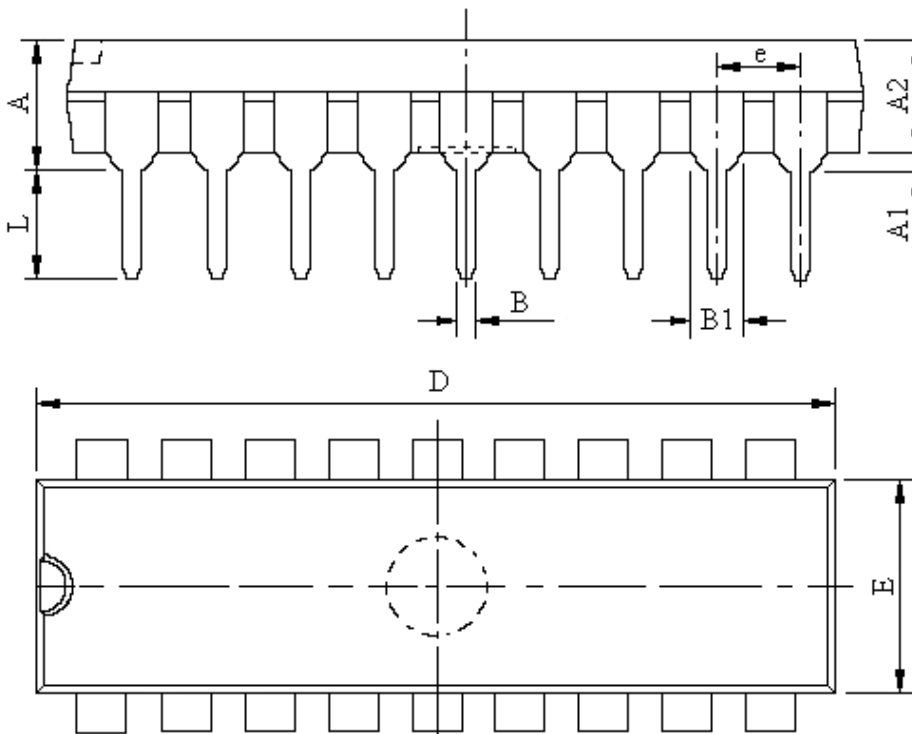
**Block diagram for PT8A991A**


### Typical Application Circuit Typical Application Circuit for PT8A990A



Typical Application Circuit for PT8A991A



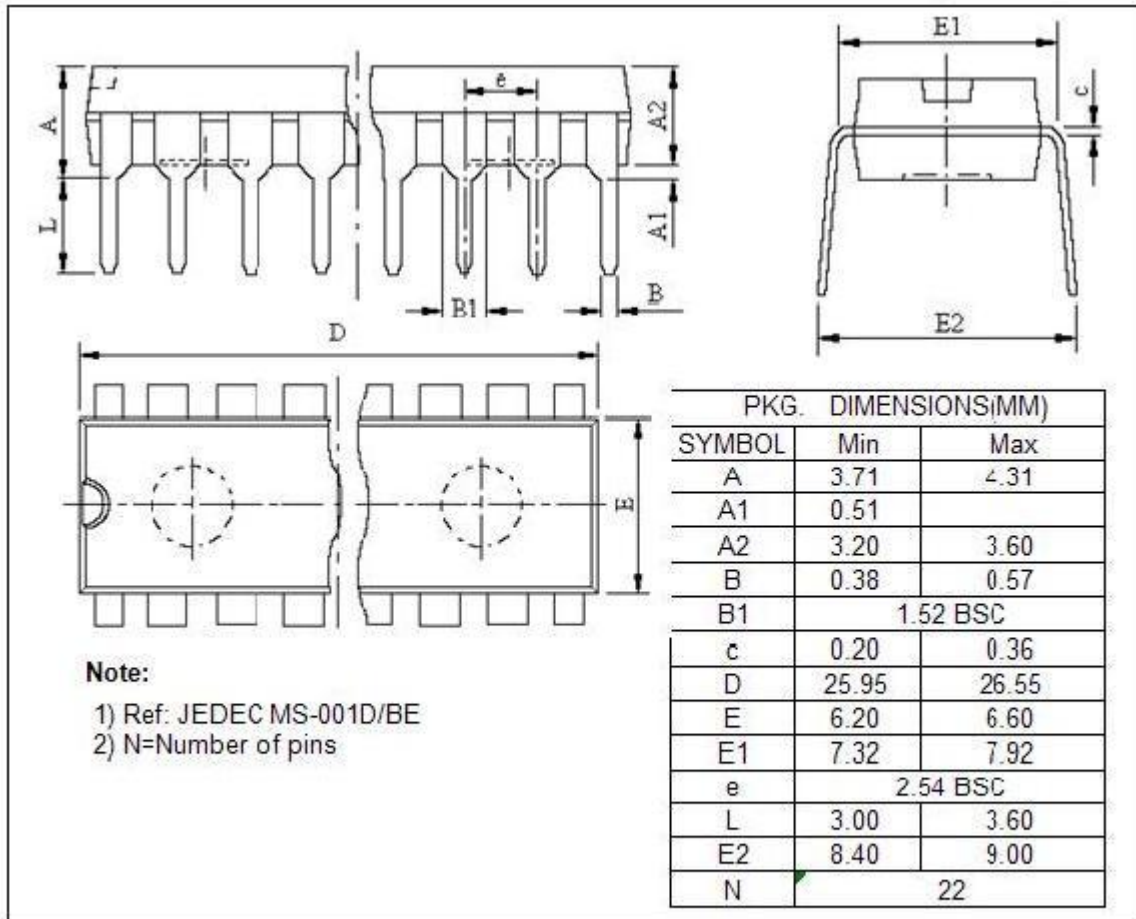
**Mechanical Information**
**DIP-18**


| PKG. DIMENSIONS(MM) |          |       |
|---------------------|----------|-------|
| SYMBOL              | Min      | Max   |
| A                   | 3.71     | 4.31  |
| A1                  | 0.51     |       |
| A2                  | 3.20     | 3.60  |
| B                   | 0.38     | 0.57  |
| B1                  | 1.52 BSC |       |
| c                   | 0.20     | 0.36  |
| D                   | 22.64    | 23.04 |
| E                   | 6.20     | 6.60  |
| E1                  | 7.32     | 7.92  |
| e                   | 2.54 BSC |       |
| L                   | 3.00     | 3.60  |
| E2                  | 8.40     | 9.00  |

**Note:**

- 1) Controlling dimensions in millimeters.
- 2) Ref: JEDEC MS-001D/BB

DIP-22



## Ordering Information

| Part No.   | Package Code | Package          |
|------------|--------------|------------------|
| PT8A990APE | P            | Lead free DIP-18 |
| PT8A991APE | P            | Lead free DIP-22 |

**Note:**

- E = Pb-free.
- Adding X Suffix= Tape/Reel

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