

Features

- The PT8A9702 works as the encoder and the PT8A973/974/973L/974L works as the decoder
- 8-direction control
- Operation power supply for PT8A9702: 3V to 12V (with series resistor)
- Auto power-off if no key pressed (PT8A9702)
- Motor current limit to meet toy safety standard HD271 (PT8A973/974/973L/974L)
- Low operating current
- On-chip oscillator with an external resistor
- On-chip reversing amplifiers
- Built-in 3.8V Zener (9702), 3.7V Zener (Vz) (973/974) and 3.1V Zener (Vz) (973L/974L)

- Few external components needed
- Pin to pin compatible with TX6/RX6

General Description

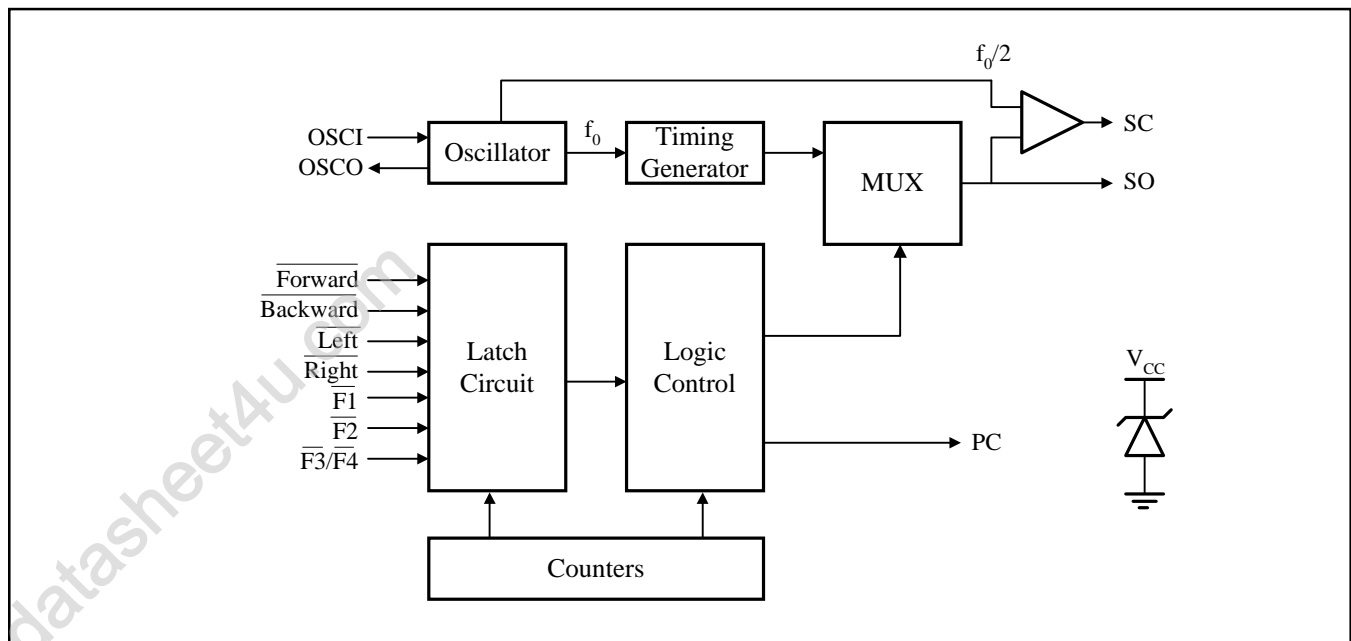
The PT8A9702P works as encoder, it can provide 8-direction remote control for toy car application with PT8A973/973L/PT8A974/974L together. Input 8-direction named F, FL, L, BL, BR, R, FR, and B they are combined with F, L, B, and R four signals. In decoder side, use output signal Left & Right to drive Right Motor, and use For & Back to drive Left Motor. Their detail relations please see truth table.

Ordering Information

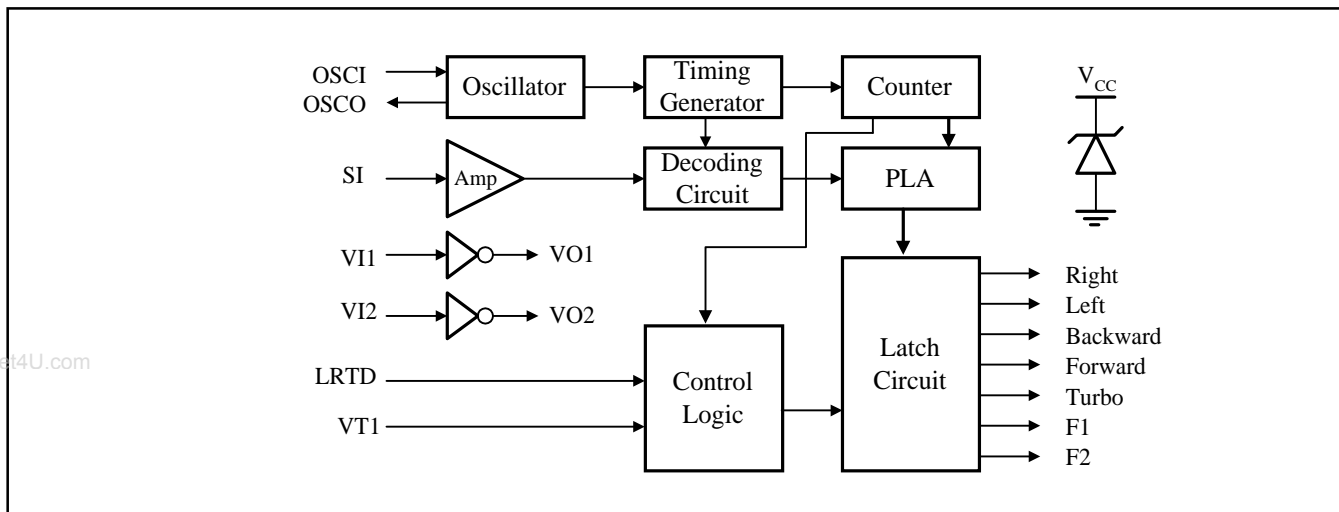
| Device Name | Encoder | Decoder | | | |
|-------------|-------------|-------------|-----------|-------------|-----------|
| Part No. | PT8A9702P | PT8A973P | PT8A973LP | PT8A974P | PT8A974LP |
| Package | 16-pin PDIP | 18-pin PDIP | | 20-pin PDIP | |

Block Diagram

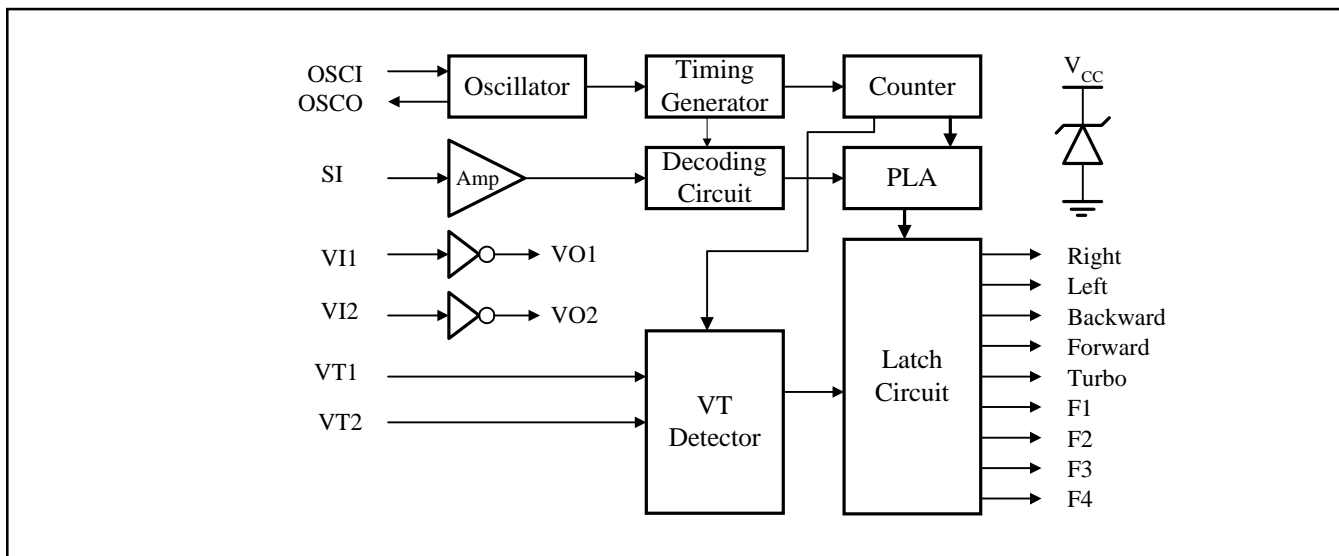
Block Diagram of PT8A9702



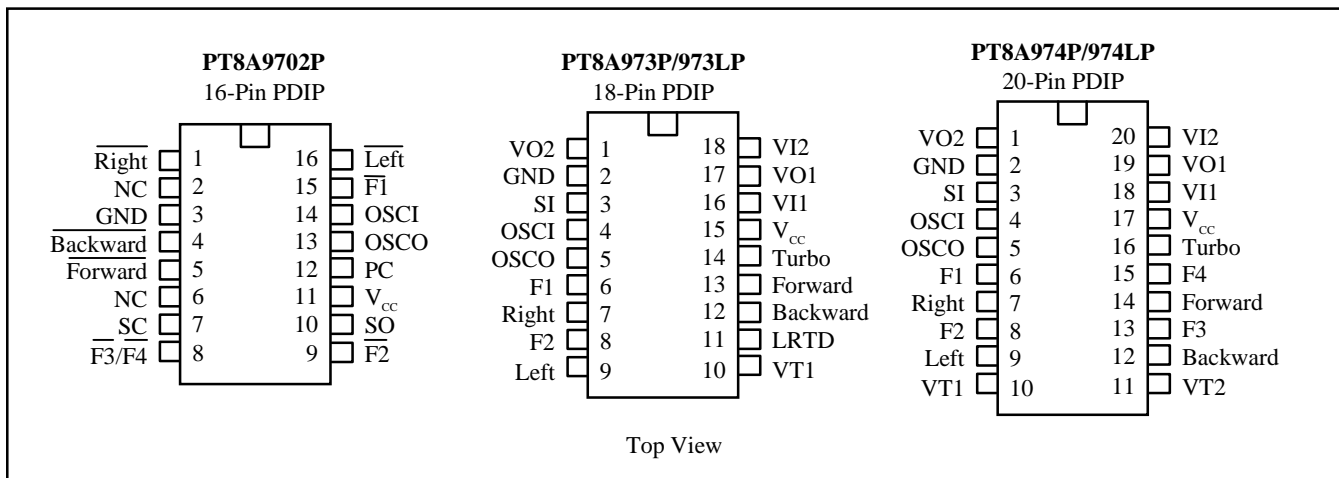
Block Diagram of PT8A973/973L



Block Diagram of PT8A974P/974LP



Pin Configuration



Pin Description

Pin Description of PT8A9702

| Pin No | Pin/Pad Name | Type | Description |
|--------|------------------------------|------|--|
| 1 | $\overline{\text{Right}}$ | I | Rightward function selected if this pin connected to GND |
| 2, 6 | 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 |
| 7 | SC | O | Output pin of the encoding signal with carrier frequency |
| 8 | $\overline{\text{F3/F4}}$ | 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 frequency |
| 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 |

Truth Table

| Input of 9702 | | | | Output of 973/973L/974/974L | | | |
|---------------|----------|-------|------|-----------------------------|----------|-------------|------|
| Forward | Backward | Right | Left | Forward | Backward | Right | Left |
| 0 | 1 | 1 | 1 | H | L | H | L |
| 0 | 1 | 1 | 0 | L | L | H | L |
| 1 | 1 | 1 | 0 | L | H | H | L |
| 1 | 0 | 1 | 0 | L | L | L | H |
| 1 | 0 | 1 | 1 | L | H | L | H |
| 1 | 0 | 0 | 1 | L | H | L | L |
| 1 | 1 | 0 | 1 | H | L | L | H |
| 0 | 1 | 0 | 1 | H | L | L | L |
| | | | | Left Motor | | Right Motor | |

* Note: 0 -- active, 1 -- inactive.

Pin Description of PT8A973/973L

| Pin No | Pin/Pad Name | Type | Description |
|--------|--------------|------|---|
| 1, 17 | 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 | LRTD | I | Left/Right turbo disable pin |
| 12 | Backward | O | Backward output pin |
| 13 | Forward | O | Forward output pin |
| 14 | Turbo | O | Turbo output pin |
| 15 | V_{CC} | P | Power supply |
| 16, 18 | VI1,VI2 | I | Input pins of amplifiers 1 and 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 | VII,VI2 | I | Input pins of amplifiers 1 and 2 |

Maximum Ratings

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

Maximum Ratings PT8A9702

| | |
|--|----------------|
| 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 PT8A973/974

| | |
|--|----------------|
| 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 PT8A973L/974L

| | |
|--|----------------|
| 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 Operating Conditions

Recommended Operating Conditions

| Sym | Description | Min | Typ | Max | Units |
|------------------|----------------------------------|--------------------|-----|--------------------|-------|
| I _{CC} | Supply Current for PT8A973/974 | | | 30 | mA |
| | Supply Current for PT8A973L/974L | | | 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 | °C |

DC Electrical Characteristics

DC Electrical Characteristics of PT8A9702

| Sym | Description | Test Conditions | Min | Typ | Max | Units |
|-----------------|---|---|------|-----|-------|-------|
| I _{CC} | Supply Current | Output Unloaded | | | 30 | mA |
| 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, $\overline{F1}$, $\overline{F2}$, $\overline{F3/F4}$ and OSCI Pins | V _{IH} = V _{CC} | | | 1 | uA |
| I _{IL} | Input LOW Current - Forward, Backward, Left, Right, $\overline{F1}$, $\overline{F2}$ and $\overline{F3/F4}$ 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°C, unless otherwise specified.

DC Electrical Characteristics of PT8A973/973L/974/974L

| Sym | Description | Test Conditions | Min | Typ | Max | Units |
|----------|--|--------------------------|------|-----|------|-------|
| I_{CC} | Supply Current | Output Unloaded | | | 30 | mA |
| 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 and F2 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 and F2 Pins | | 2 | 3 | | |
| I_{IH} | Input HIGH Current - OSC1, V11, V12, LRTD and SI Pins | $V_{IN} = V_{CC}$ | | | 10 | uA |
| | Input HIGH Current - VT1 | | | | 50 | uA |
| I_{IL} | Input LOW Current - OSC1, VT1, V11, V12 and SI Pins | $V_{IN} = 0V$ | | | -10 | uA |
| | Input LOW Current - LRTD Pins | | | | -50 | uA |
| VT | Over-Current Limit - VT1 Pins for PT8A973/974 | | 0.30 | | 0.40 | V |
| | Over-Current Limit - VT1 Pins for PT8A973L/974L | | 0.25 | | 0.35 | V |
| V_Z | Voltage of Zenner - PT8A973/974 | $I_Z = 2\sim 30mA$ | 3.4 | 3.7 | 4 | V |
| | Voltage of Zenner - PT8A973L/974L | | 2.8 | 3.1 | 3.4 | V |

Note: These specifications apply for $T_A = 25^\circ C$, $V_{CC} = 3.5V$ (973/974), $V_{CC} = 3.0V$ (973L/974L), unless otherwise specified.

AC Electrical Characteristics

AC Electrical Characteristics of PT8A9702

| 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 |

Note:

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.

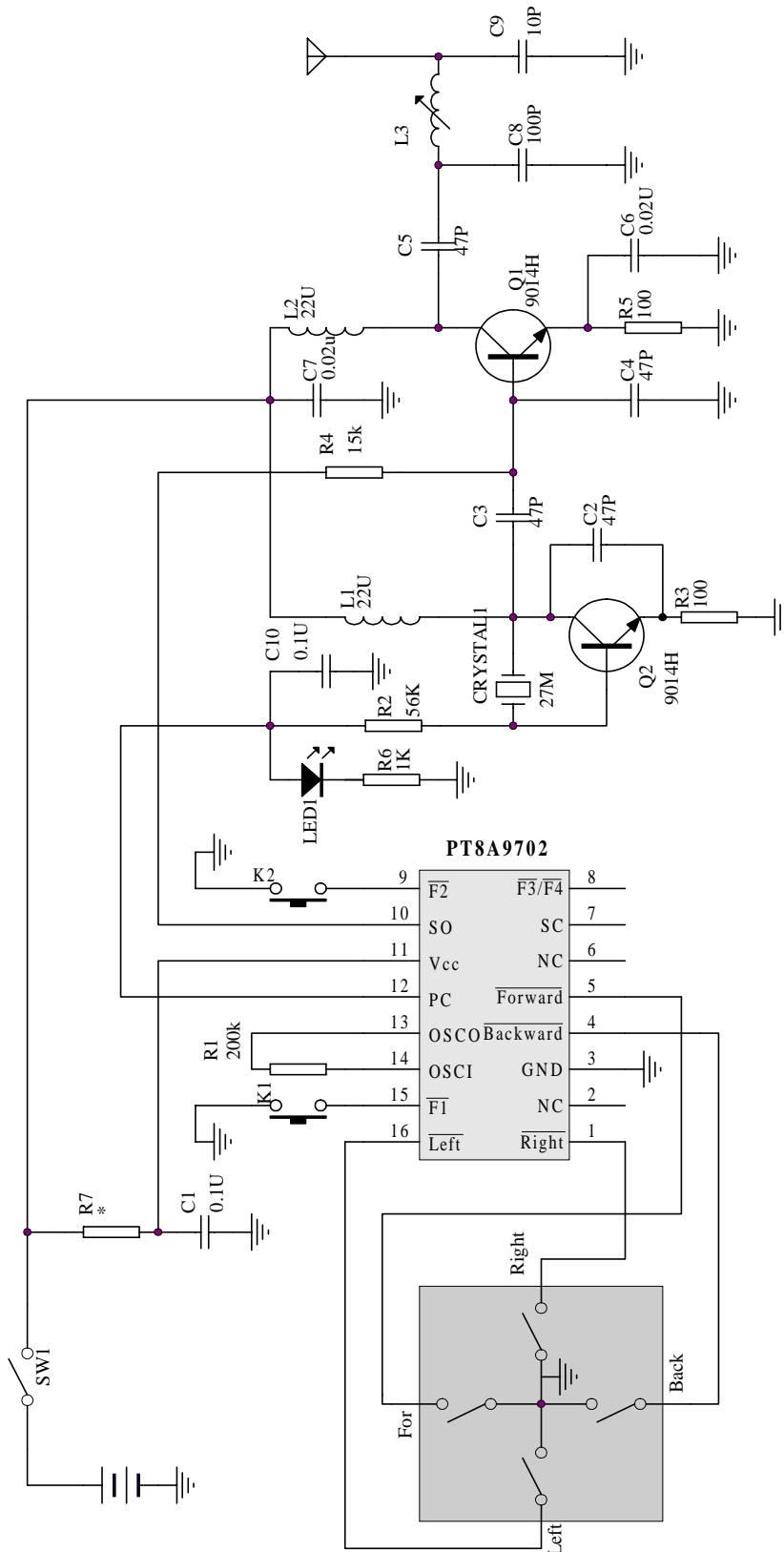
AC Electrical Characteristics of PT8A973/973L/974/974L

| 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 |

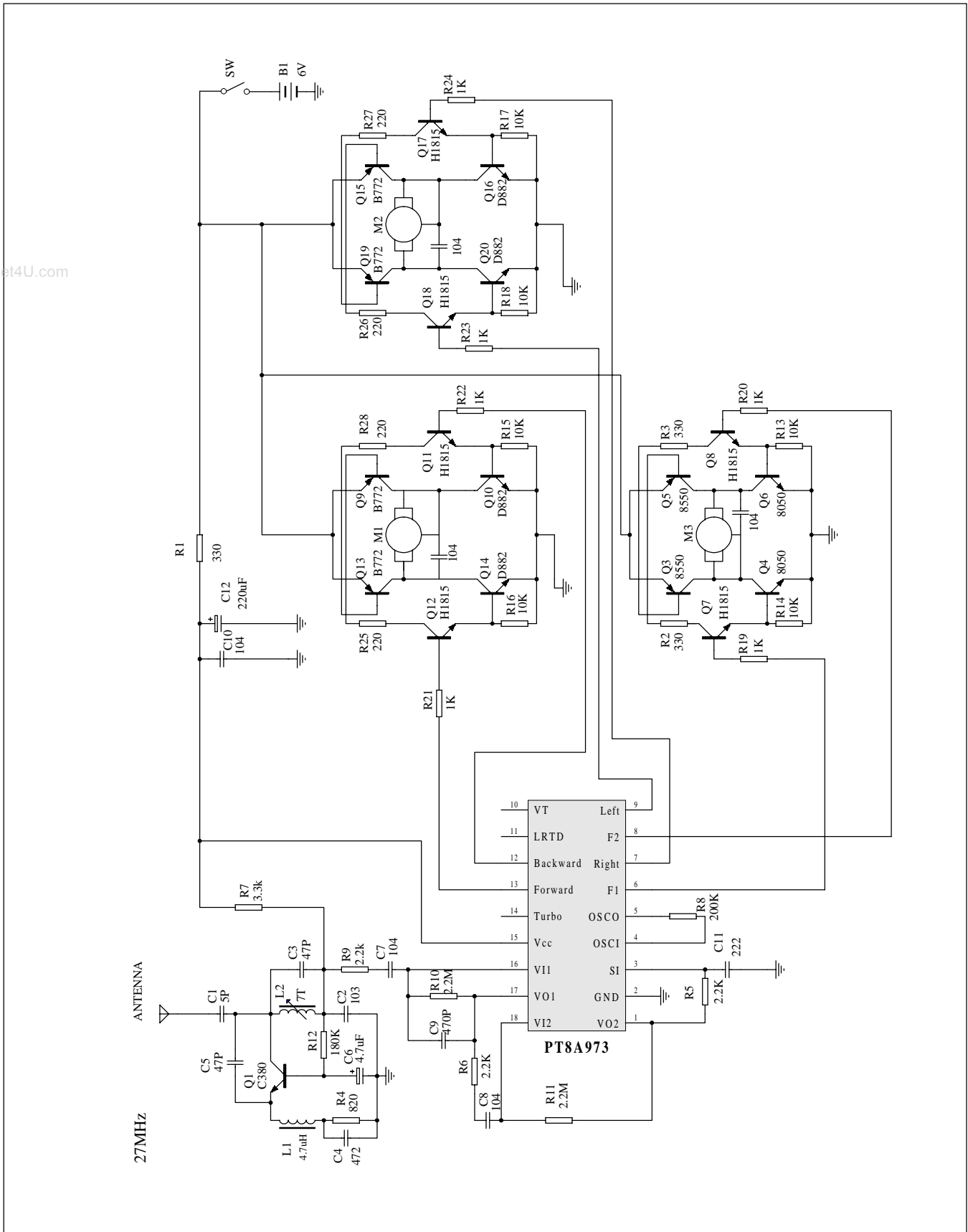
Notes:

1. These specifications apply for T_A = 25°C, V_{CC} = 3.5V (973/974), V_{CC} = 3.0V (973L/974L), unless otherwise specified.
2. The frequency of standard samples is tested on standard testing-board.

Typical Application Circuit of PT8A9702



Typical Application Circuit of PT8A973



Notes

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Pericom Technology Inc.

Email: support@pti.com.cn Web Site: www.pti.com.cn, www.pti-ic.com

China: No. 20 Building, 3/F, 481 Guiping Road, Shanghai, 200233, China
Tel: (86)-21-6485 0576 Fax: (86)-21-6485 2181

Asia Pacific: Unit 1517, 15/F, Chevalier Commercial Centre, 8 Wang Hoi Rd, Kowloon Bay, Hongkong
Tel: (852)-2243 3660 Fax: (852)- 2243 3667

U.S.A.: 2380 Bering Drive, San Jose, California 95131, USA
Tel: (1)-408-435 0800 Fax: (1)-408-435 1100

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