

## Features

### Common features

- Operating power-supply voltage range: 2.0 to 5.5V
- Manual-power-on/off with ON/OFF button
- One output pin used for external power control
- On-chip oscillator with an external resistor
- On-chip reversing amplifiers
- Low operating current
- Few external components needed
- Package: 16-pin DIP and 16-pin SOIC

### PT8A976

- Four output pins for three functions
- Auto-power-off if no signals received in 6 minutes

### PT8A976A

- Four output pins for three functions
- Manual Power on/off function

### PT8A976B

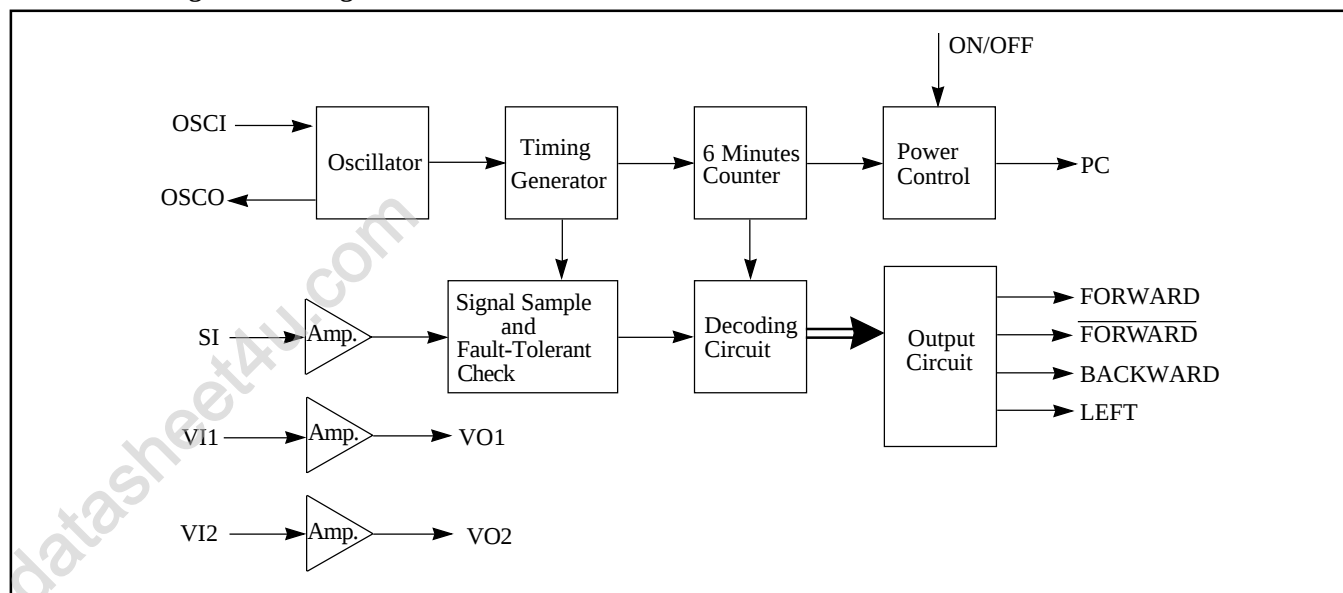
- Two output pins for three functions
- Compatible with RX3 and MR3

## Ordering Information

| Part No.             | Package     |
|----------------------|-------------|
| PT8A976P/976AP/976BP | 16-pin DIP  |
| PT8A976BW            | 16-pin SOIC |
| PT8A976BDE           | Die Form    |

## Logic Block Diagram

PT8A976's Logic Block Diagram



## Introduction

The PT8A976, PT8A976A and PT8A976B are CMOS LST designed for the remote controlled toy. The received signal is amplified by the three-stage amplifier, and then the appropriate amplified signal is sampled, fault-tolerantly checked and decoded to control the actions of the remote-controlled toy. There is an oscillator in all of the PT8A976, PT8A976A and PT8A976B. By adding an external resistor conveniently, the oscillator will be constructed. The oscillator frequency can be adjusted by the external resistor. Pressing the ON/OFF button can control the output level of the PC pin.

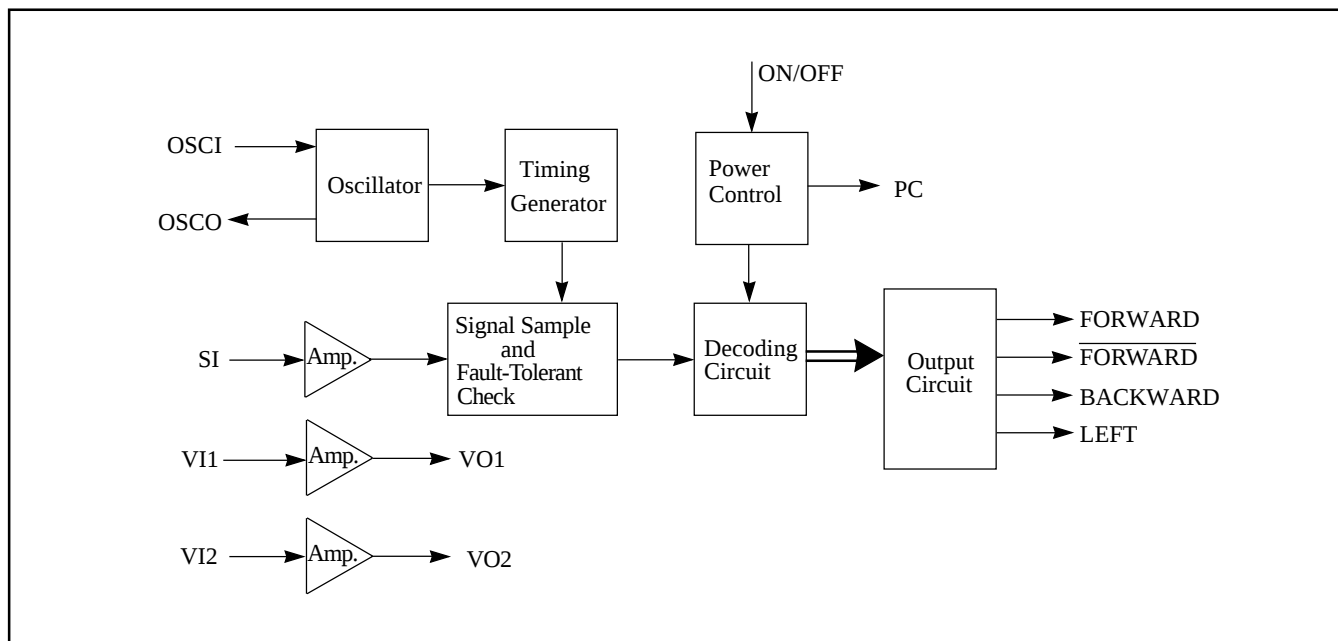
PT8A976, the auto-power-off function is achieved by an internal counter. When the PT8A976 is powered on the counter is reset and begin to count. Any received encoding signal also reset the counter. The PC output pin will keep on a high level until the counter counts up to about 6 minutes. The PC output is used to control on/off state of the external power supply.

PT8A976A/976B not provide auto-power-off function.

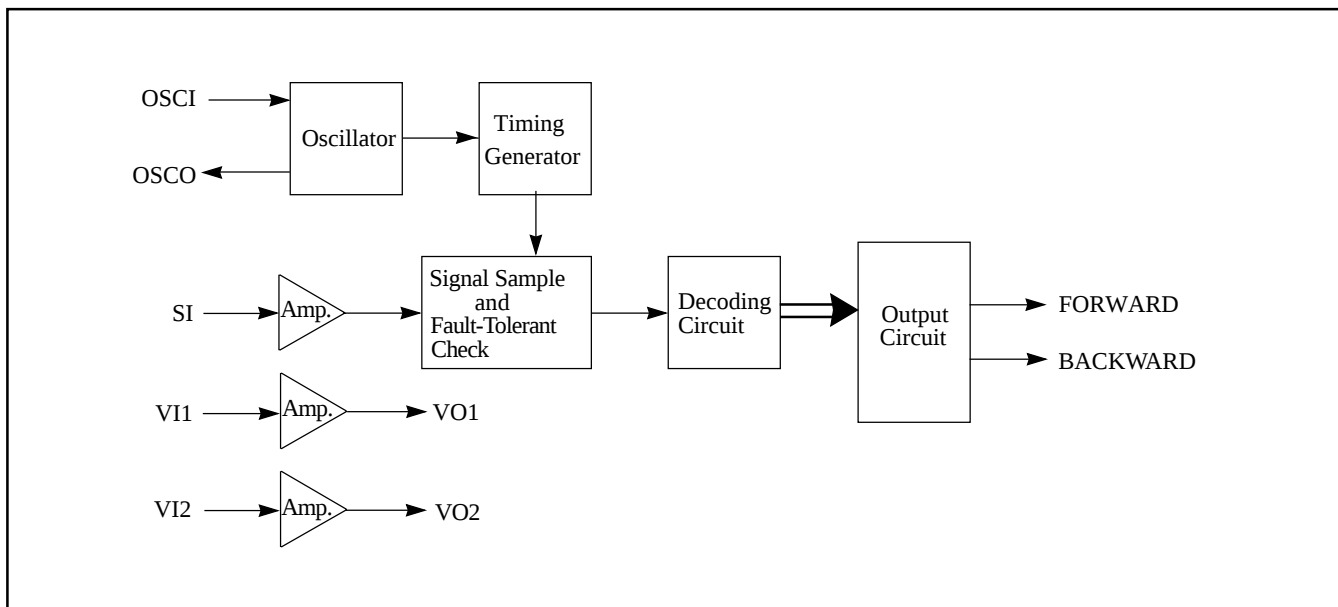
PT8A976/976A have four output pins corresponding with the three actions: Forward ( $\overline{\text{Forward}}$ ), Backward and Left.

PT8A976B has only two output pins corresponding with the two actions: Forward and Backward.

PT8A976A's Logic Block Diagram



PT8A976B's Logic Block Diagram



**Product Pin Configuration and Description**

**PT8A976P/976AP Pin Configuration**

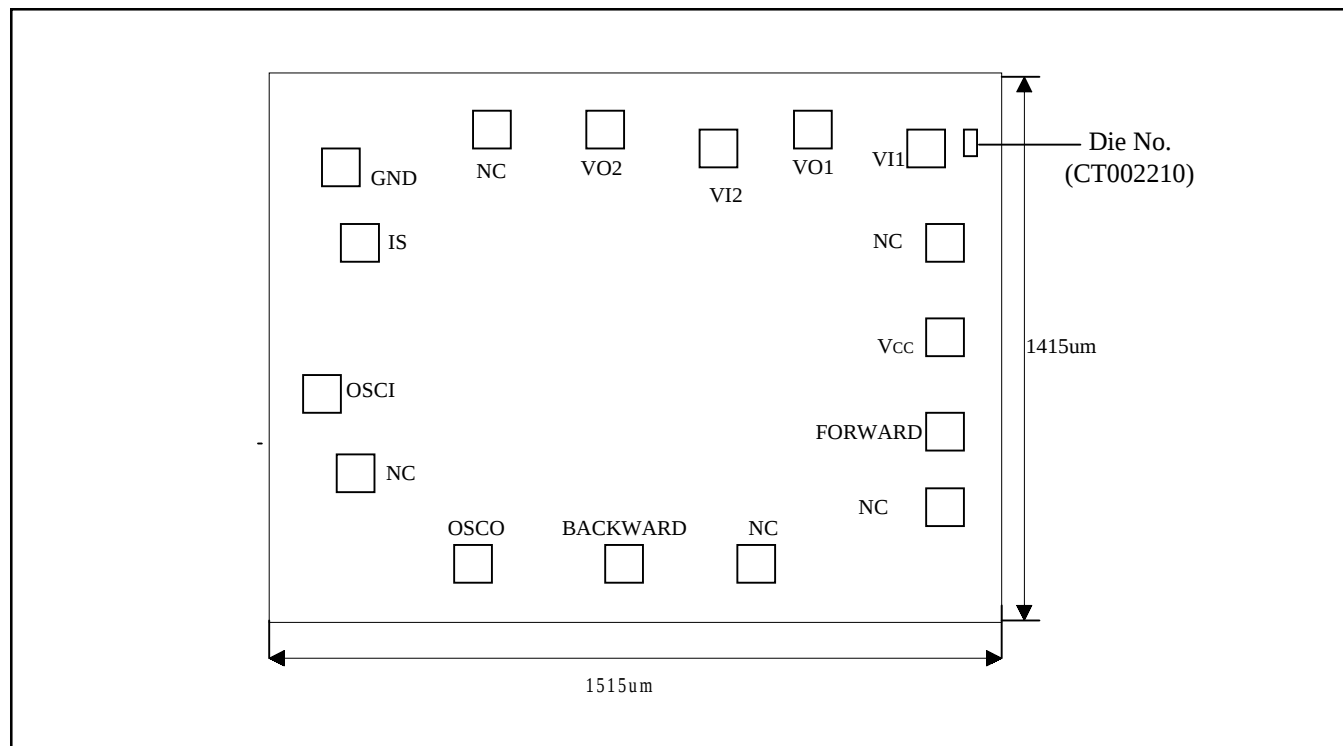
|          |   |    |                 |
|----------|---|----|-----------------|
| VO2      | 1 | 16 | VI2             |
| PC       | 2 | 15 | VO1             |
| GND      | 3 | 14 | VI1             |
| SI       | 4 | 13 | ON/OFF          |
| OSCI     | 5 | 12 | V <sub>CC</sub> |
| NC       | 6 | 11 | FORWARD         |
| OSCO     | 7 | 10 | FORWARD         |
| BACKWARD | 8 | 9  | LEFT            |

**PT8A976BP/976BW Pin Configuration**

|          |   |    |                 |
|----------|---|----|-----------------|
| VO2      | 1 | 16 | VI2             |
| NC       | 2 | 15 | VO1             |
| GND      | 3 | 14 | VI1             |
| SI       | 4 | 13 | NC              |
| OSCI     | 5 | 12 | V <sub>CC</sub> |
| NC       | 6 | 11 | FORWARD         |
| OSCO     | 7 | 10 | NC              |
| BACKWARD | 8 | 9  | NC              |

**Pad Location**

**PT8A976BDE Pad Location 1 (Die Number: CT002210)**



**Pad Coordinates**

| Pad Name                             | X Coordinate | Y Coordinate | Pad Name        | X Coordinate | Y Coordinate |
|--------------------------------------|--------------|--------------|-----------------|--------------|--------------|
| VO2                                  | 589          | 1195.5       | NC              | -            | -            |
| NC                                   | -            | -            | NC              | -            | -            |
| GND                                  | 122          | 1090.5       | FORWARD         | 1315         | 528          |
| SI                                   | 158          | 946.5        | V <sub>CC</sub> | 1315         | 749.5        |
| OSCI                                 | 101          | 578.5        | NC              | -            | -            |
| NC                                   | -            | -            | VI1             | 1259         | 1150         |
| OSCO                                 | 426          | 120.5        | VO1             | 1019         | 1195.5       |
| BACKWARD                             | 798          | 101.5        |                 | 829          | 1150         |
| Note: Substrate is connected to Vcc. |              |              |                 |              |              |

**PT8A976/976A/976B Pin/Pad Description**

| Pin No. | Pin/Pad Name    | Description                                                                  |
|---------|-----------------|------------------------------------------------------------------------------|
| 1       | VO2             | Output pin for the amplifier 2                                               |
| 2*      | PC              | Power control output pin                                                     |
| 3       | GND             | Negative power supply                                                        |
| 4       | SI              | Input pin of the encoding signal                                             |
| 5       | OSCI            | Oscillator input pin                                                         |
| 6       | NC              | No connection                                                                |
| 7       | OSCO            | Oscillator output pin                                                        |
| 8       | BACKWARD        | Backward output pin                                                          |
| 9*      | LEFT            | Left output pin                                                              |
| 10*     | <u>FORWARD</u>  | Reversing output of the forward pin                                          |
| 11      | FORWARD         | Forward output pin                                                           |
| 12      | V <sub>CC</sub> | Positive power supply                                                        |
| 13*     | ON/OFF          | Input pin used to control the output level of the PC, with pull-up resistor. |
| 14      | VI1             | Input pin for the amplifier 1                                                |
| 15      | VO1             | Output pin for the amplifier 1                                               |
| 16      | VI2             | Input pin for the amplifier 2                                                |

**Note:** \*These pins of PT8A976B are NC (no connection)

### Absolutely 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) | -0.5V to +6.5V |
| Supply Voltage to Ground Potential (Outputs & D/O Only)            | -0.5V to +6.5V |
| DC Input Voltage                                                   | -0.5V to +6.5V |
| DC Output Current                                                  | 20 mA          |
| Power Dissipation                                                  | 500mW          |

#### Note:

Stresses greater than those listed under MAXIMUM RATING 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.

### Electrical Characteristics of PT8A976/976A/976B

**DC Electrical Characteristics** (Over the Operating Rating, T<sub>A</sub> = -10°C to +40°C, V<sub>CC</sub> = 4.0V ± 10%)

| Parameter        | Description                                                    | Test Condition                                   | Min                  | Type | Max | Unit |
|------------------|----------------------------------------------------------------|--------------------------------------------------|----------------------|------|-----|------|
| V <sub>CC</sub>  | Supply voltage                                                 |                                                  | 2.0                  | 4.0  | 5.5 | V    |
| I <sub>CC</sub>  | Supply current with the feedback resistor of the amplifier     | V <sub>CC</sub> =4.0V, T=25°C*                   |                      |      | 3.0 | mA   |
|                  | Supply current without the feedback resistor of the amplifier  | V <sub>CC</sub> =4.0V, T=25°C**                  |                      |      | 3.0 | mA   |
| I <sub>STB</sub> | Standby current with the feedback resistor of the amplifier    | V <sub>CC</sub> =4.0V, T=25°C, OFF STATE         |                      |      | 20  | uA   |
|                  | Standby current without the feedback resistor of the amplifier | V <sub>CC</sub> =4.0V, T=25°C, OFF STATE         |                      |      | 10  | uA   |
| I <sub>IL</sub>  | Input LOW current                                              | For ON/OFF pin, V <sub>IN</sub> =0V              |                      |      | -60 | uA   |
| I <sub>IH</sub>  | Input HIGH current                                             | For ON/OFF pin, V <sub>IN</sub> =V <sub>CC</sub> |                      |      | ±1  | uA   |
| V <sub>IL</sub>  | Input low voltage                                              | Guaranteed Logic LOW level on ON/OFF pin         |                      |      | 0.5 | V    |
| V <sub>IH</sub>  | Input high voltage                                             | Guaranteed Logic HIGH level on ON/OFF pin        | V <sub>CC</sub> -0.5 |      |     | V    |
| V <sub>OH</sub>  | Output high voltage                                            | I <sub>OUT</sub> = 1.5mA                         | V <sub>CC</sub> -0.5 |      |     | V    |
| V <sub>OL</sub>  | Output low voltage                                             | I <sub>OUT</sub> = 200uA                         |                      |      | 0.5 | V    |
| I <sub>OH</sub>  | Output high current                                            | V <sub>OUT</sub> = V <sub>CC</sub> - 0.5V        | -1.5                 |      |     | mA   |
| I <sub>OL</sub>  | Output low current                                             | V <sub>OUT</sub> = 0.5V                          | 100                  |      |     | uA   |

**Note:** \* Output unload; 2.2MΩ feedback resistors for the two reversing amplifiers; 300KΩ external resistor for the on-chip oscillator.

\*\* Output unload; VI1 pin, VI2 pin and SI pin connect to GND; 300KΩ external resistor for the on-chip oscillator.

**AC Eletrical Characteristics** (Over the Operating Rating,  $T_A = -10^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ ,  $V_{CC} = 4\text{V} \pm 10\%$ )

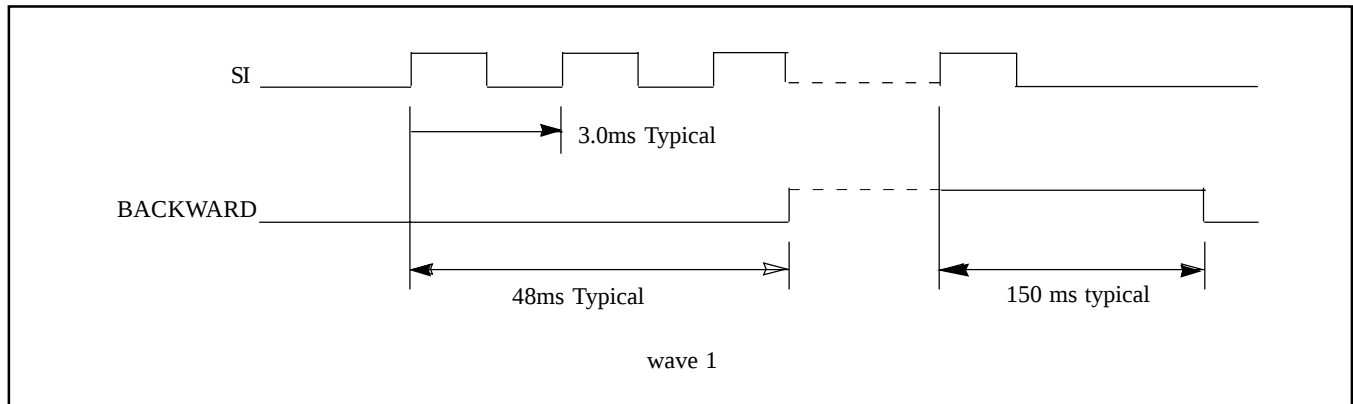
| Sym            | Description                 | Test Conditions                                                                  | Min | Typ | Max | Units  |
|----------------|-----------------------------|----------------------------------------------------------------------------------|-----|-----|-----|--------|
| $F_{OSC}$      | Oscillator Frequency        | $R_f = 300\text{k Ohm}$ , $T_A = 25^{\circ}\text{C}$ ,<br>$V_{CC} = 4.0\text{V}$ |     | 88  |     | kHz    |
| $F_{BACL}$     | Frequency of Backword Code  | $F_{OSC} = 88\text{kHz}$                                                         | 0.2 |     | 0.4 | kHz    |
| $F_{FOR}$      | Frequency of Forward Code   | $F_{OSC} = 88\text{kHz}$                                                         | 0.8 |     | 1.2 | kHz    |
| $F_{LEFT}^*$   | Frequency of Leftward Code  | $F_{OSC} = 88\text{kHz}$                                                         | 2.4 |     | 3.6 | kHz    |
| $V_{SI}$       | SI Pin $V_{pp}$ Sensitivity | Guaranteed Effective Decode                                                      | 200 |     |     | mV     |
| $T_{OFF}^{**}$ | Time of Auto-Power-off      | $F_{OSC} = 70$ to $106\text{kHz}$                                                | 4.8 | 6.0 | 7.2 | Minute |

**Note:** \* PT8A976B has no LEFT function.

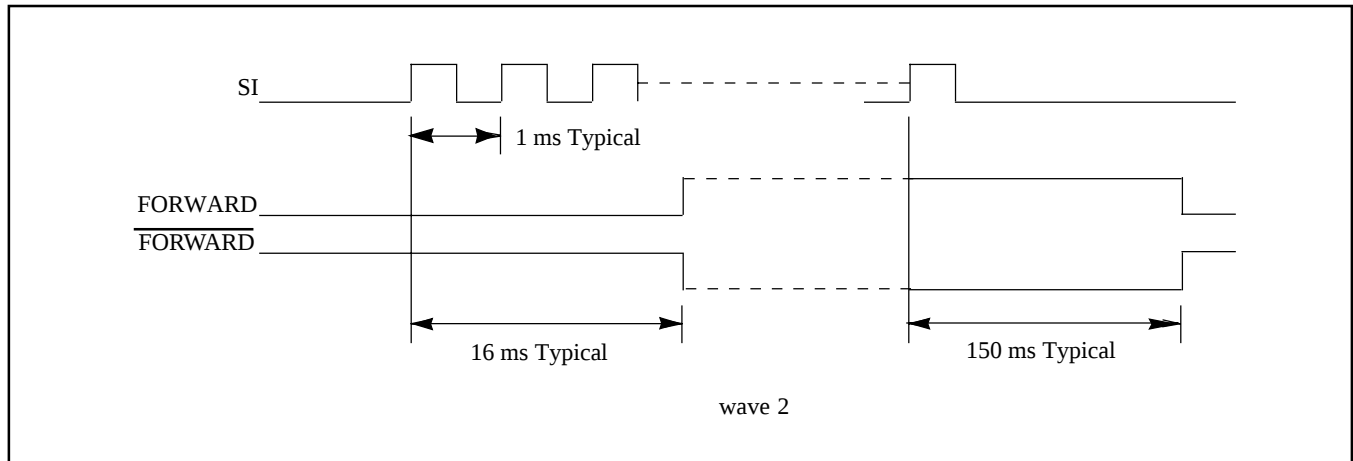
\*\* The Auto-power-off time will change according to the external oscillator resister. PT8A976A and PT8A976B have no auto-power-off function.

## Output Timing

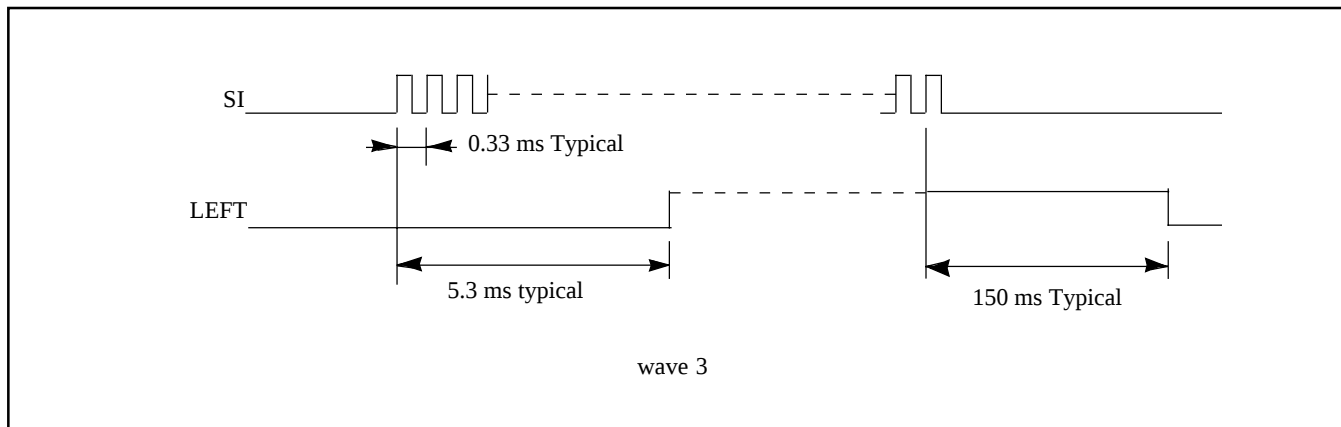
### Backward Output Timing (PT8A976/976A/976B)



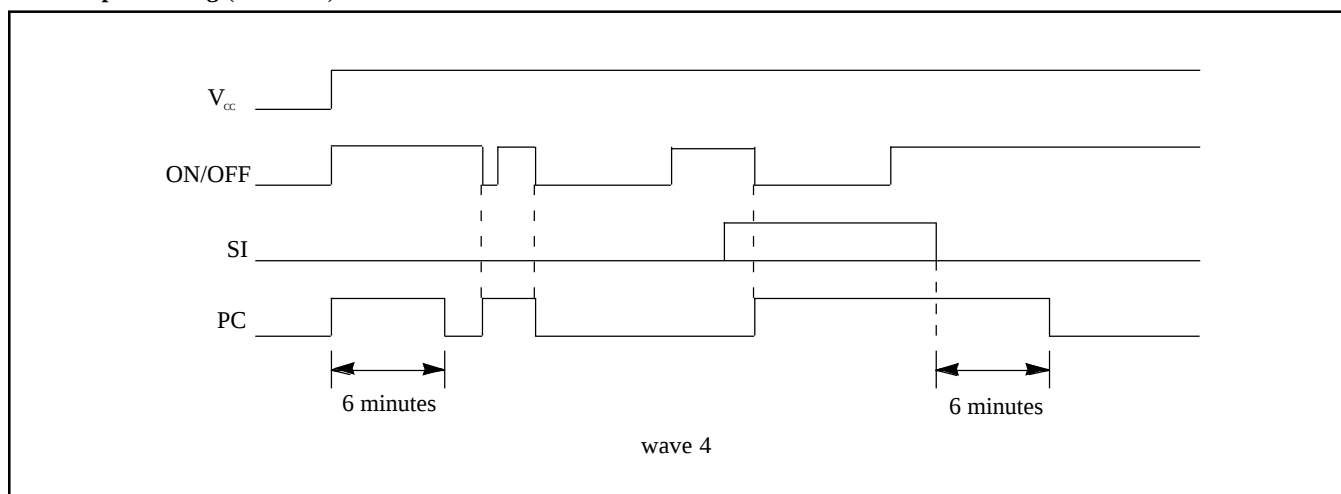
### Forward Output Timing (PT8A976/976A/976B)



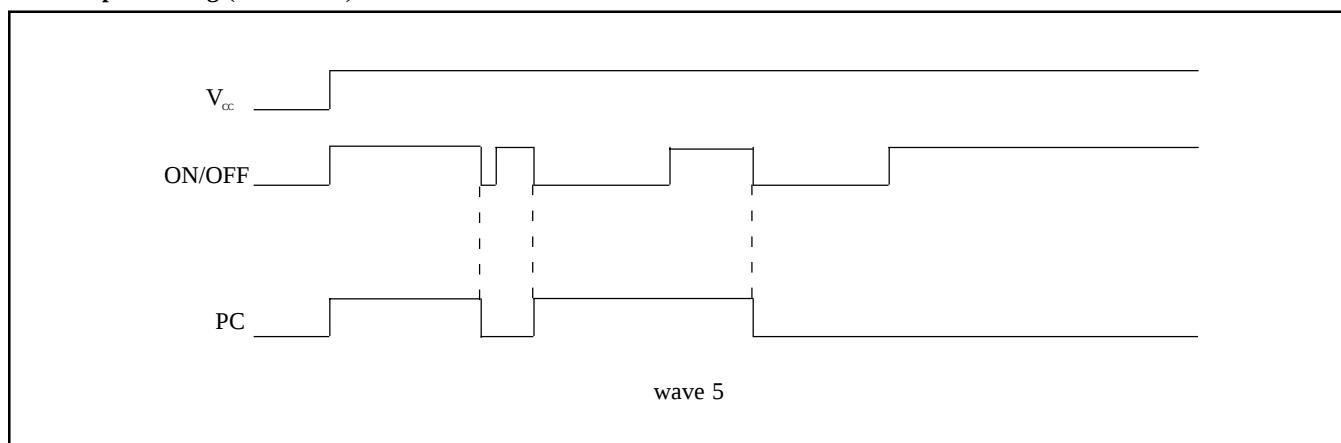
**Left Output Timing (PT8A976/976A)**



**PC Output Timing (PT8A976)**

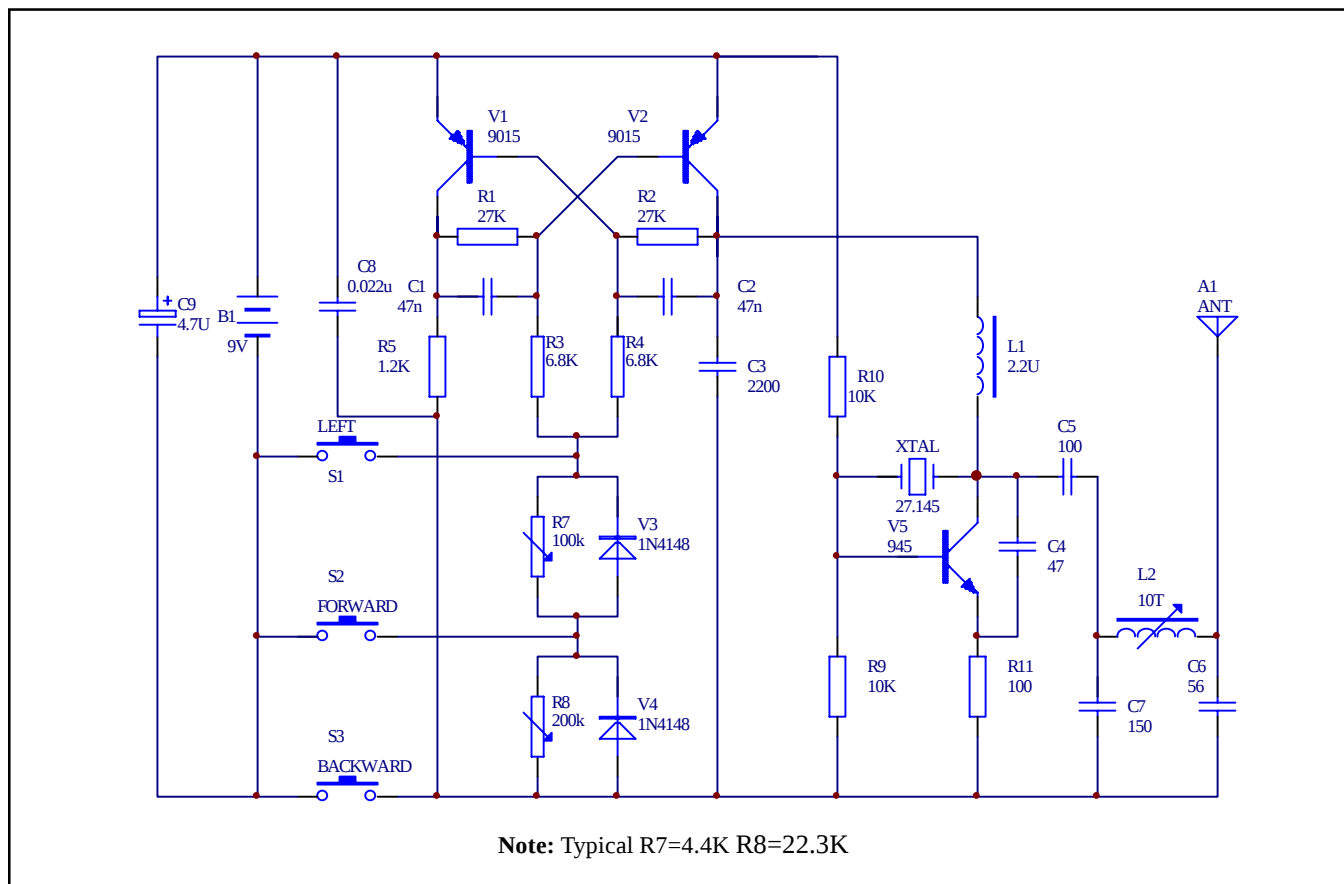


**PC Output Timing (PT8A976A)**

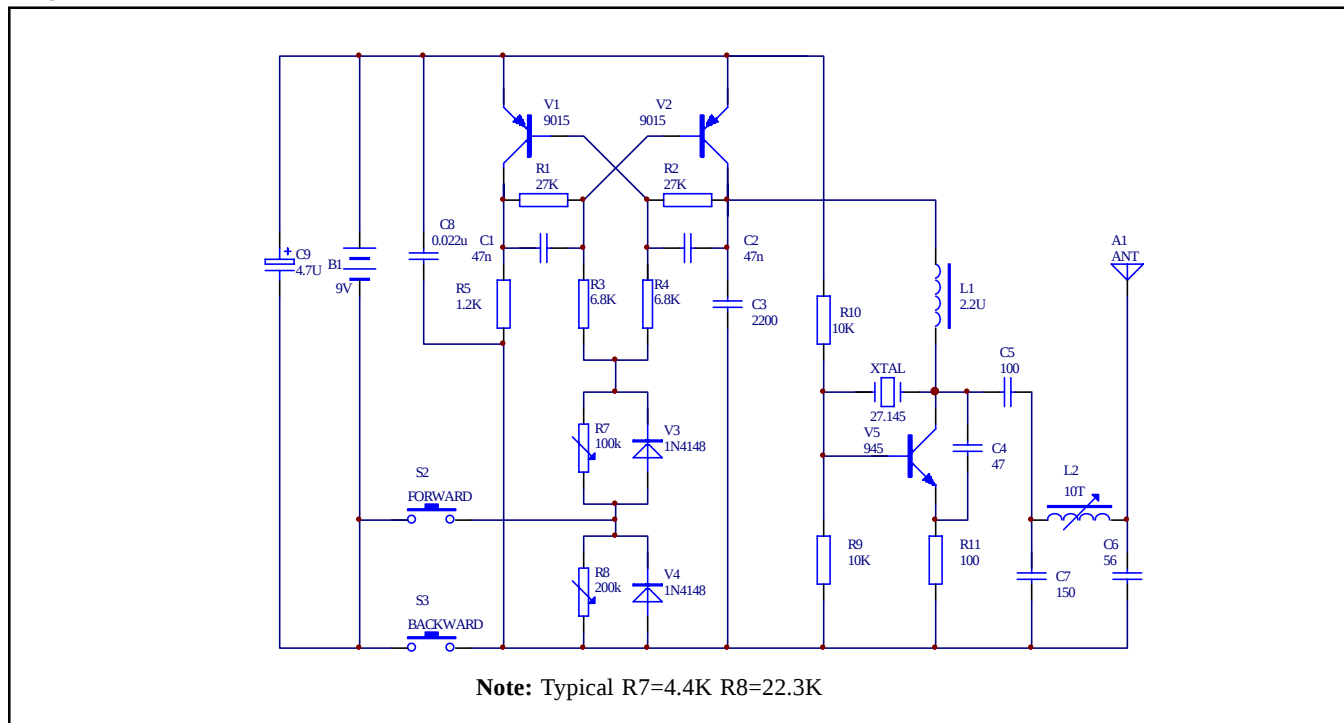


**Typical application circuit**

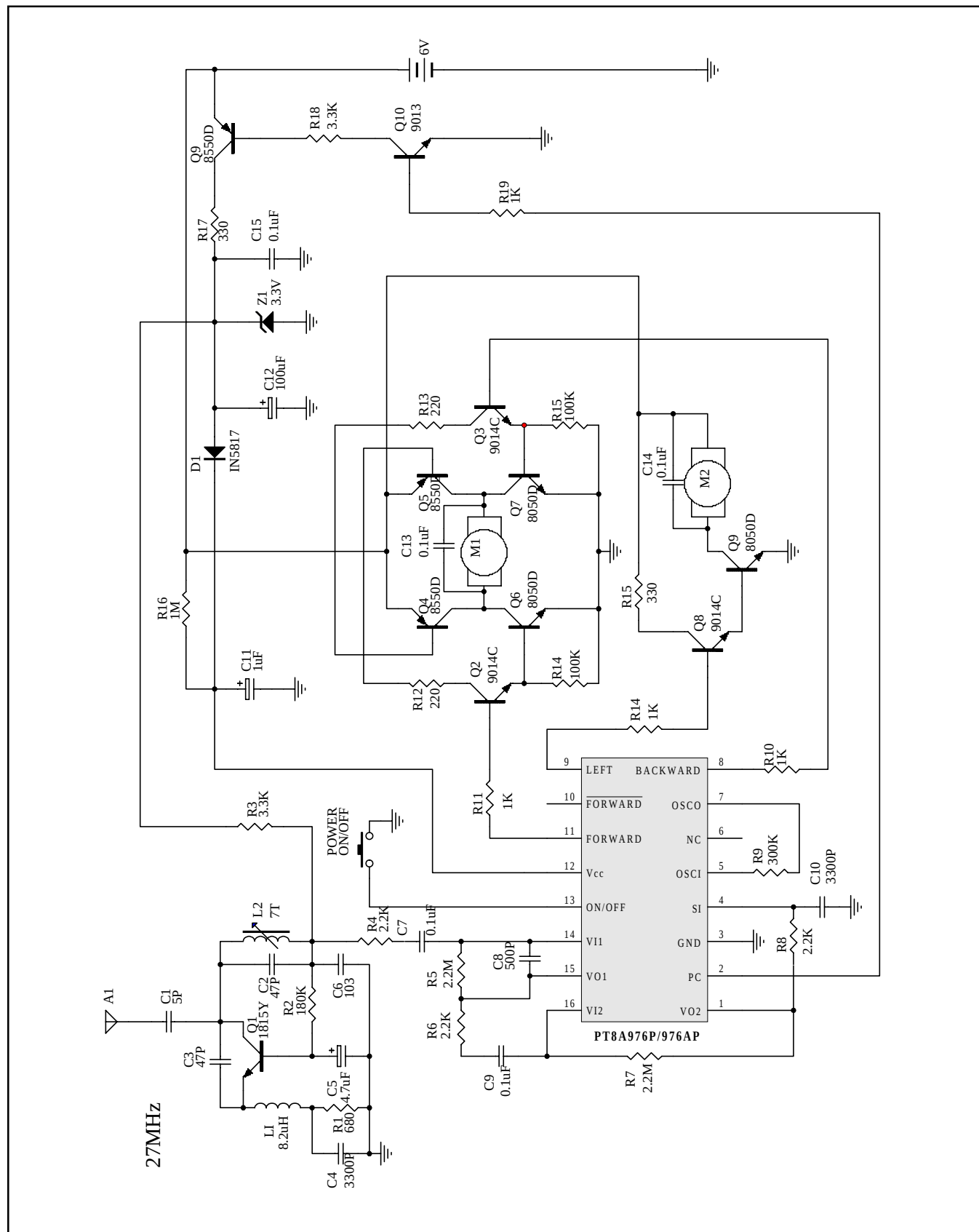
**Figure 1. The Sender Circuit (for PT8A976/976A)**



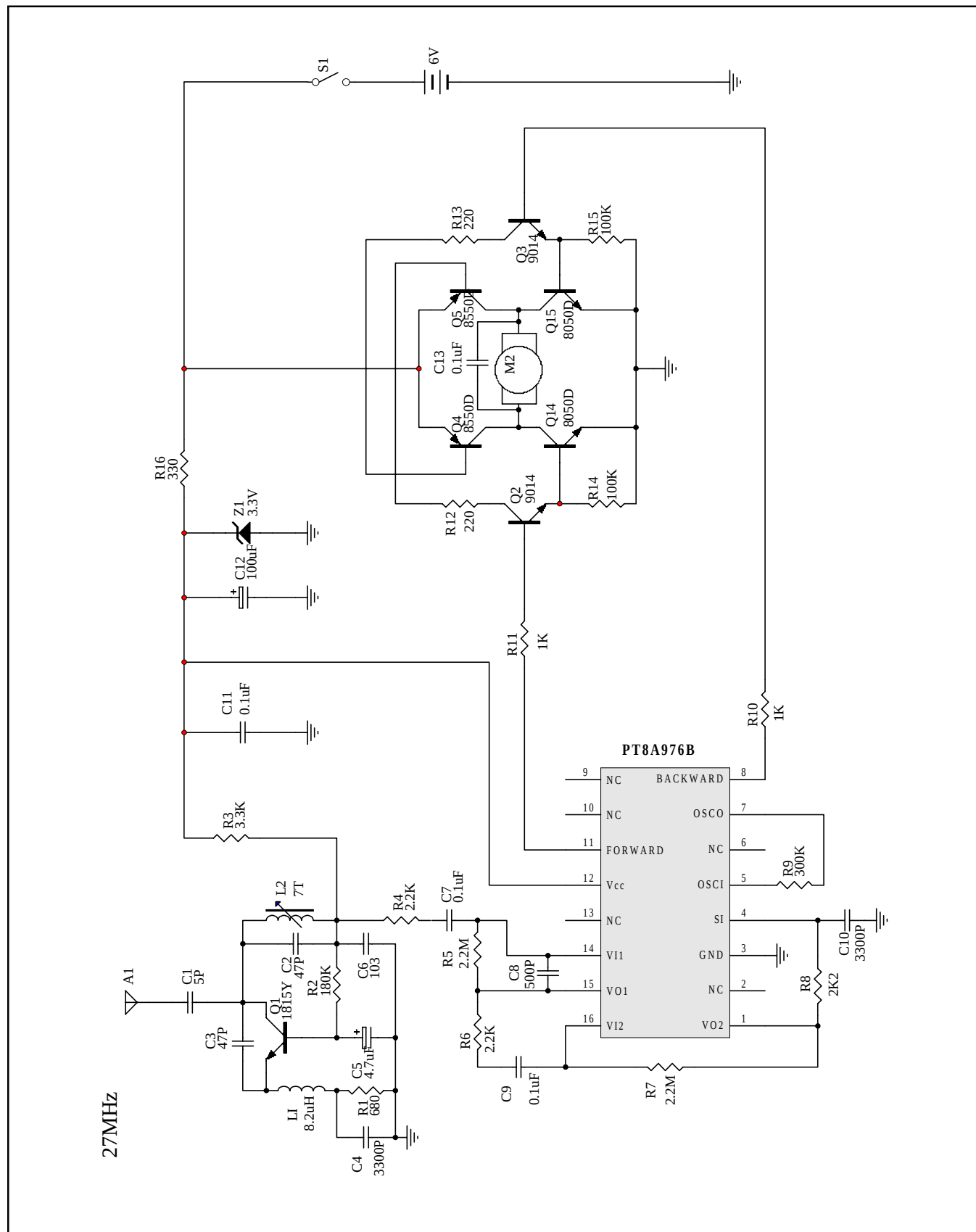
**Figure 2. The sender circuit (for PT8A976B)**



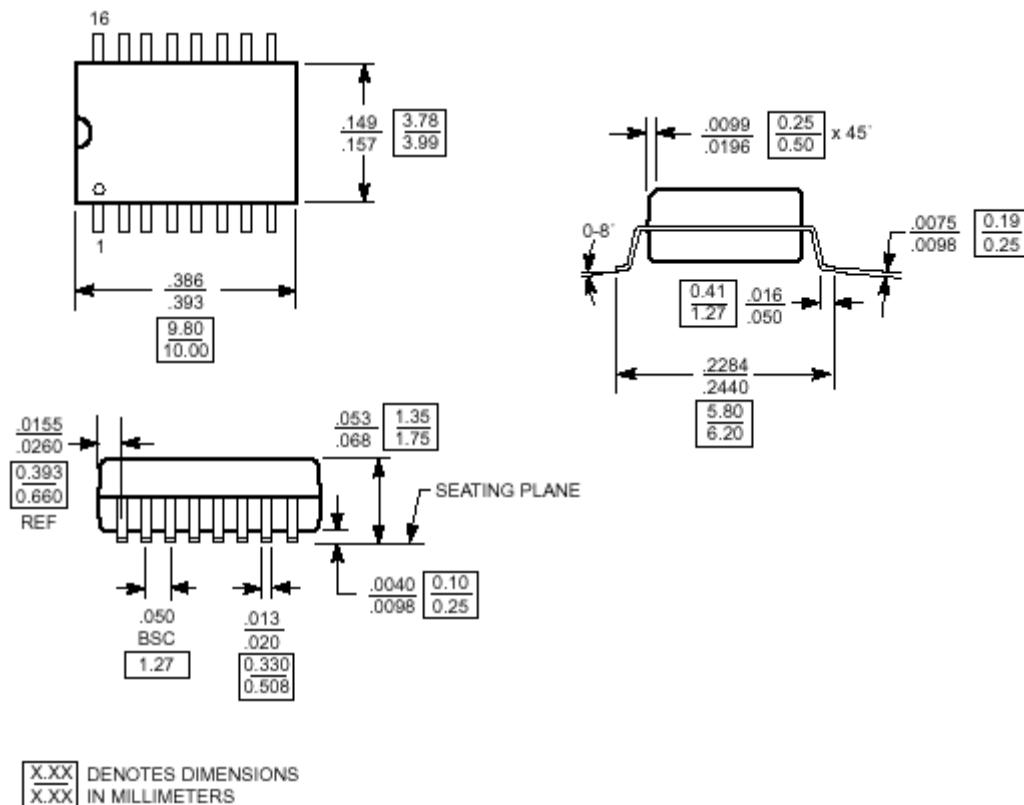
**Figure 3. The PT8A976/976A Application Circuit**



**Figure 4. The PT8A976B Application Circuit**



**Mechanical Diagram of 16-pin SOIC**



**Notes**

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