

## Features

- PT8A977B works as encoder and PT8A9781 works as decoder
- Four control functions
- Operating power-supply voltage: 1.8V to 5.0V(977B) 1.0V to 1.5V (9781)
- Auto-power-off and oscillation-off if no press on any button (977B)
- Press on any button to wake up (977B)
- On-chip oscillator with an external resistor (977B)
- On-chip oscillator with an external resistor and capacitor (9781)
- On-chip amplifiers (9781)
- Low operating current
- Few external components needed

## Ordering Information

Part No.	Package
PT8A977BP	14-pin DIP
PT8A977BW	14-pin SOIC
PT8A977BDE	Die Form
PT8A9781W	16-pin SOIC
PT8A9781DE	Die Form

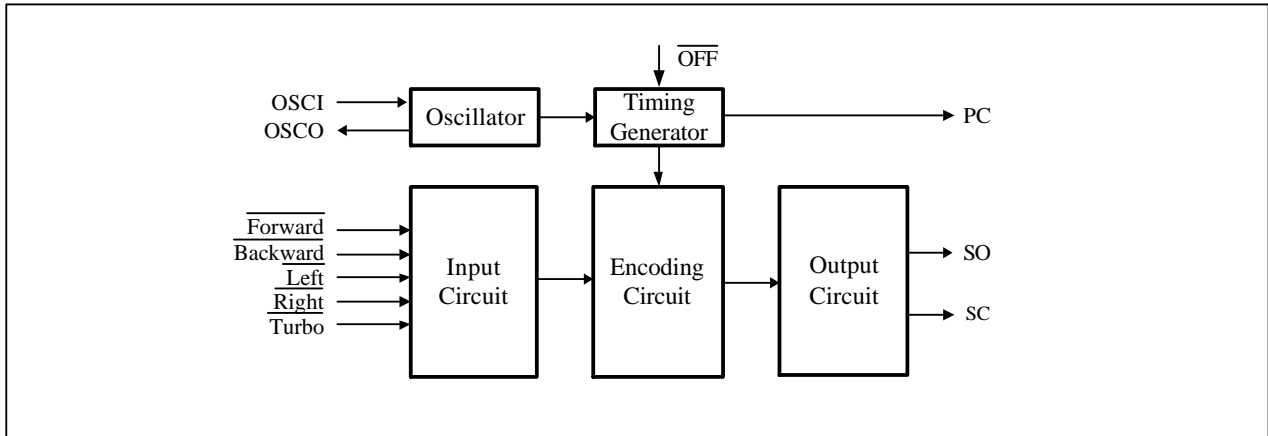
## General Description

The PT8A977B and PT8A9781 provide a complete control functions to the remote-controlled toy. The PT8A9781 has four output pins corresponding with the four actions i.e, forward, backward, right, left. The received signals are amplified by the three-stage amplifier, and then the appropriate amplified signals are sampled, fault-tolerantly checked and decoded to control the actions of the remote-controlled toy.

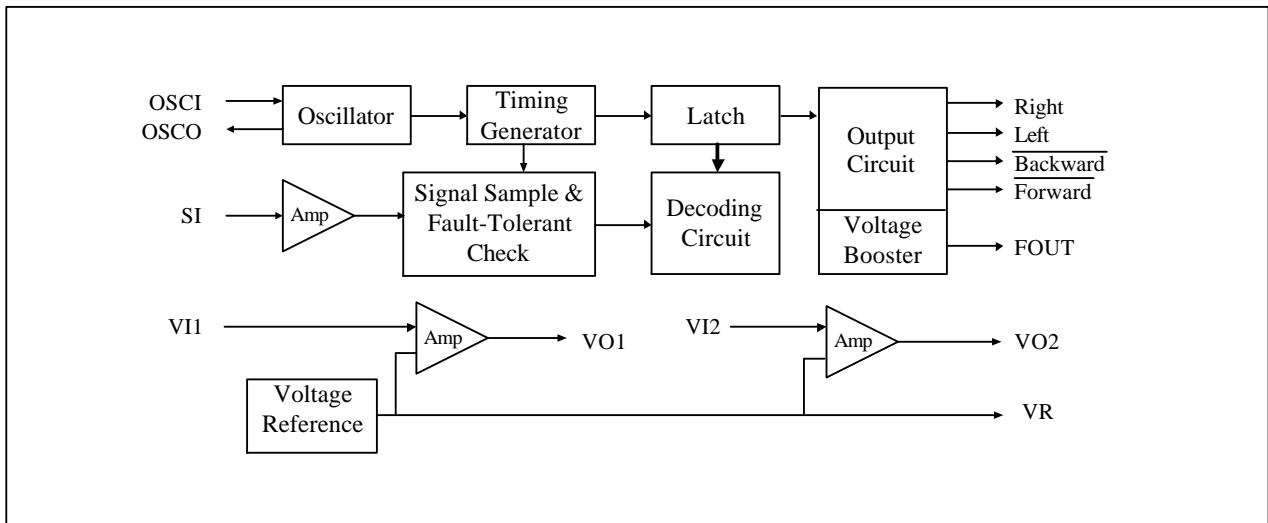
There is an internal oscillator in the PT8A9781. By adding an external resistor and capacitor conveniently, the oscillator will be constructed. The external resistor and capacitor can adjust the oscillator frequency. The relative error between the frequencies of the two on-chip oscillators in the PT8A977B and PT8A9781 must be less than  $\pm 25\%$ .

**Block Diagram**

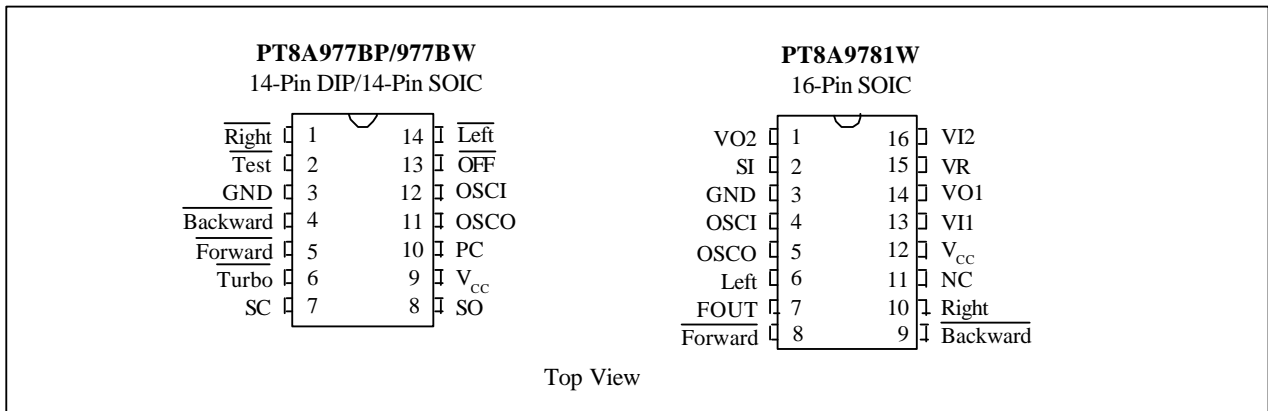
**Block Diagram of 977B**



**Block Diagram of 9781**

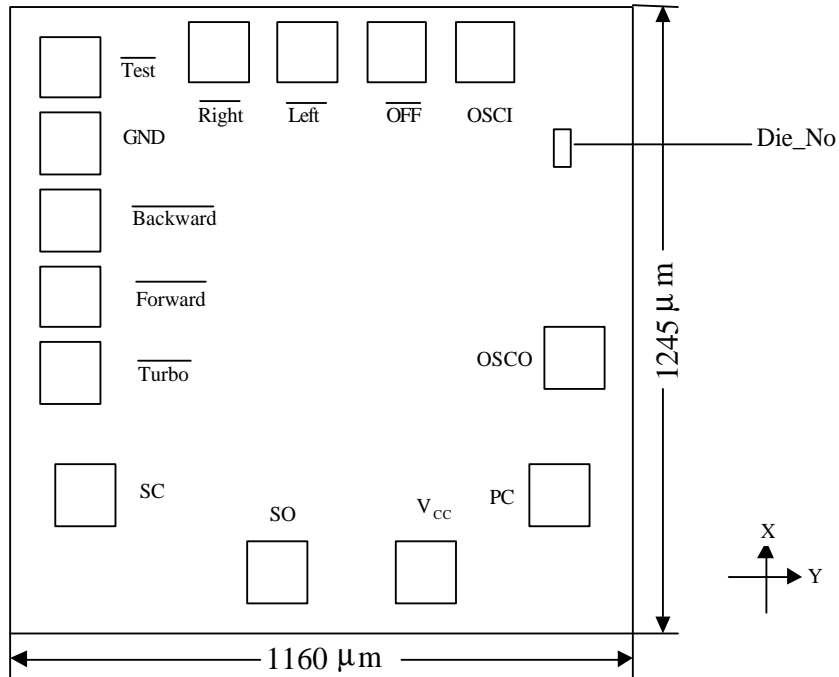


**Pin Configuration**



**Pad Location**

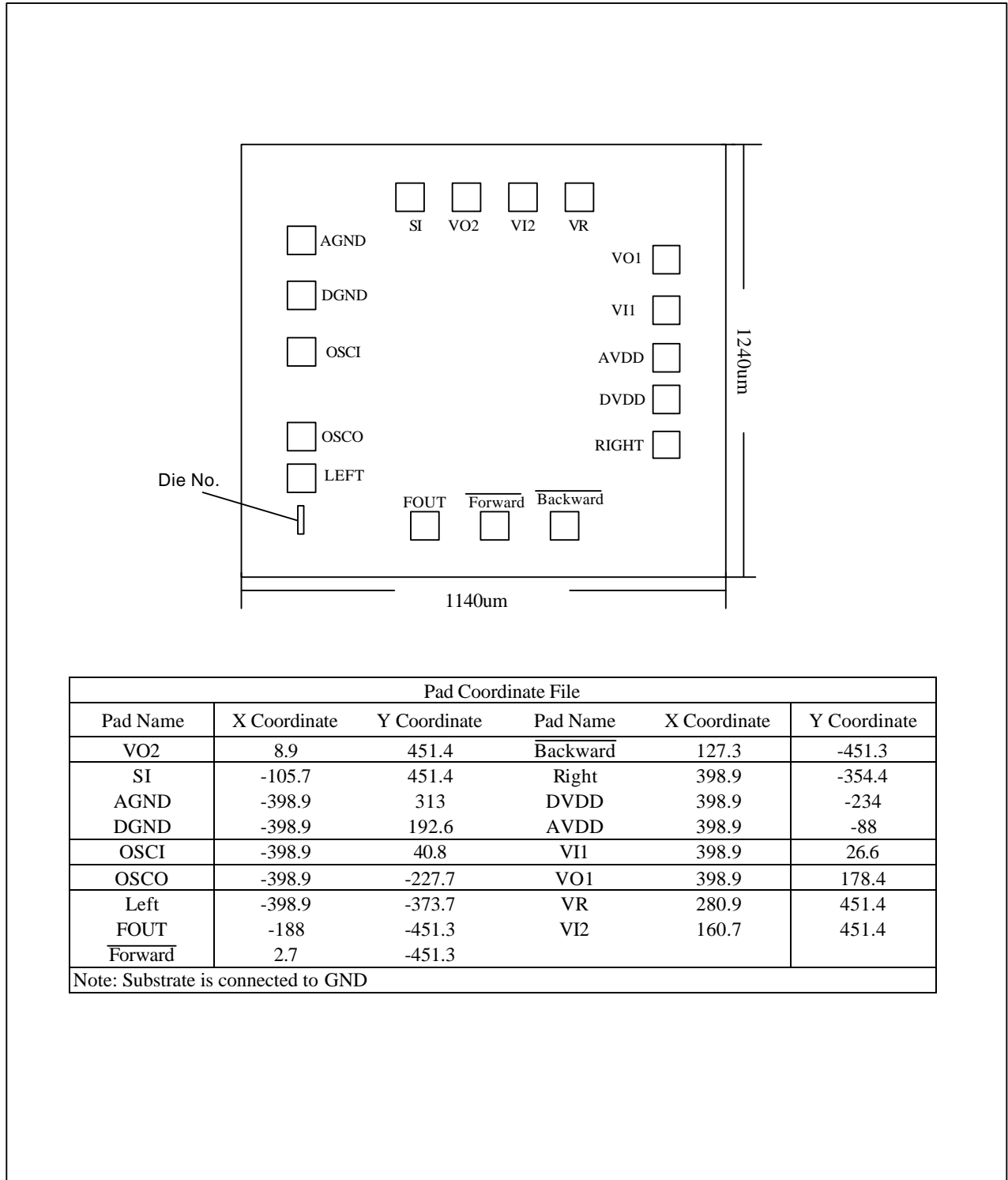
PT8A977BDE



Pad Coordinates					
Pad Name	X Coordinate	Y Coordinate	Pad Name	X Coordinate	Y Coordinate
Right	1048.5	388	SO	96	469.5
Test	1033	100	V <sub>CC</sub>	96	714
GND	903	100	PC	270	918.5
Backward	773	100	OSCO	510.5	937.5
Forward	643	100	OSCI	1048.5	790.5
Turbo	513	100	OFF	1048.5	658
SC	269.5	115	Left	1048.5	523
Note: Substrate is connected to V <sub>CC</sub>					

**Pad Location**

PT8A9781DE



Pad Coordinate File					
Pad Name	X Coordinate	Y Coordinate	Pad Name	X Coordinate	Y Coordinate
VO2	8.9	451.4	$\overline{\text{Backward}}$	127.3	-451.3
SI	-105.7	451.4	Right	398.9	-354.4
AGND	-398.9	313	DVDD	398.9	-234
DGND	-398.9	192.6	AVDD	398.9	-88
OSCI	-398.9	40.8	VII	398.9	26.6
OSCO	-398.9	-227.7	VO1	398.9	178.4
Left	-398.9	-373.7	VR	280.9	451.4
FOUT	-188	-451.3	VI2	160.7	451.4
$\overline{\text{Forward}}$	2.7	-451.3			

Note: Substrate is connected to GND

## Pin/Pad Description

### Pin/Pad Description of 977B

Pin No.	Pin/Pad Name	Description
1	Right	With Pull-up resistor, rightward function selected if this pin connected to GND.
2	Test	With Pull-up resistor, this pin is used for testing mode.
3	GND	Negative power supply
4	Backward	With Pull-up resistor, backward function selected if this pin connected to GND.
5	Forward	With Pull-up resistor, forward function selected if this pin connected to GND.
6	Turbo	With Pull-up resistor, turbo function selected if this pin connected to GND.
7	SC	Output pin of the encoding signal with carrier frequency
8	SO	Output pin of the encoding signal without carrier frequency
9	V <sub>cc</sub>	Positive power supply
10	PC	Power control output pin
11	OSCO	Oscillator output pin
12	OSCI	Oscillator input pin
13	OFF	With Pull-up resistor, this pin is used to shut down the external power supply.
14	Left	With Pull-up resistor, leftward function selected if this pin connected to GND.

### Pin/Pad Description of 9781

Pin No.	Pin/Pad Name	Description	
1	VO2	Output pin for the amplifier 2	
2	SI	Input pin of the encoding signal	
3	GND	AGND	Analog ground, bonded to DGND as GND
		DGND	Digital ground, bonded to AGND as GND
4	OSCI	Oscillator input pin	
5	OSCO	Oscillator output pin	
6	Left	Leftward output pin	
7	FOUT	Output pulse with 50% duty cycle, fequency is about 64kHz.	
8	Backward	Backward output pin	
9	Forward	Forward output pin	
10	Right	Rightward output pin	
12	V <sub>cc</sub>	DVDD	Digital power supply, bonded to AVDD as V <sub>cc</sub>
		AVDD	Analog power supply, bonded to DVDD as V <sub>cc</sub>
13	VI1	Input pin for the amplifier 1	
14	VO1	Output pin for the amplifier 1	
15	VR	Amplifier bias voltage	
16	VI2	Input pin for the amplifier 2	

**Note:** additional V<sub>cc</sub> may be needed for on-chip analog circuit.

## 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) (977B) .....	-0.5 to +6.0V
Supply Voltage to Ground Potential (Outputs & D/O Only) (977B) .....	-0.5 to +6.0V
DC Input Voltage (977B) .....	-0.5 to +6.0V
Supply Voltage to Ground Potential (Inputs & V <sub>CC</sub> Only) (9781) .....	-0.5 to +5.0V
Supply Voltage to Ground Potential (Outputs & D/O Only) (9781) .....	-0.5 to +5.0V
DC Input Voltage (9781) .....	-0.5 to +5.0V
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.

## DC Electrical Characteristics

### DC Electrical Characteristics of 977B

Parameters	Description	Test Condition	Min.	Type	Max.	Units
V <sub>CC</sub>	Operating Voltage		1.8	4.0	5.0	V
I <sub>CC</sub>	Supply Current	Output unloaded			100	uA
I <sub>STB</sub>	Stand-by Current	OFF State			5	uA
V <sub>IL</sub>	Input Low Voltage	Guaranteed Logic LOW level			0.8	V
V <sub>IH</sub>	Input High Voltage	Guaranteed Logic HIGH level	3.0			V
I <sub>IL</sub>	Input Low Current	Pin 1, 4, 5, 6, 14 V <sub>IL</sub> = 0V, ON state			-60	uA
I <sub>IH</sub>	Input High Current	Pin 1, 4, 5, 6, 14 V <sub>IH</sub> = 4V, ON state			10	uA
I <sub>I</sub>	Input Current	Pin 12 V <sub>IH</sub> = 0 ~ 4V, ON state			± 10	uA
I <sub>OL</sub>	Output Low Current	V <sub>OUT</sub> = 0.5 V	150			uA
I <sub>OH</sub>	Output High Current	Pin 7, 8, 10 V <sub>OUT</sub> = 3.5 V	-1.0			mA
		Pin 11 V <sub>OUT</sub> = 3.5 V	-500			uA

**Note:** Over the Operating Rating, 0°C ≤ T<sub>A</sub> ≤ 70°C, V<sub>CC</sub> = 4V

### DC Electrical Characteristics of 9781

Sym	Description	Test Conditions	Min.	Type	Max.	Unit
V <sub>CC</sub>	Operating Voltage		1.0	1.2	1.5	V
I <sub>CC</sub>	Supply Current	Output load *	-	-	3.0	mA
V <sub>OH1</sub>	Output High Level1	Forward,Backward, (I <sub>OH1</sub> =-150uA)	V <sub>CC</sub> -0.2	-	-	V
V <sub>OL1</sub>	Output Low Level1	Forward,Backward,(I <sub>OL1</sub> =4mA)	-	-	0.2	V
V <sub>OH2</sub>	Output High Level2	Left, Right, FOUT, (I <sub>OH2</sub> =-1mA)	V <sub>CC</sub> -0.2	-	-	V
V <sub>OL2</sub>	Output Low Level2	Left, Right, FOUT, (I <sub>OL2</sub> =150uA)	-	-	0.2	V
I <sub>OH1</sub>	Output High Current1	Forward,Backward, (V <sub>OUT</sub> =V <sub>CC</sub> -0.2V)	-150	-	-	uA
I <sub>OL1</sub>	Output Low Current1	Forward,Backward, (V <sub>OUT</sub> =0.2V)	4	-	-	mA
I <sub>OH2</sub>	Output High Current2	Left, Right, FOUT (V <sub>OUT</sub> =V <sub>CC</sub> -0.2V)	-0.8	-	-	mA
I <sub>OL2</sub>	Output Low Current2	Left, Right, FOUT(V <sub>OUT</sub> =0.2V)	150	-	-	uA

T<sub>A</sub> = 10~40°C, V<sub>cc</sub> = 1.0V~1.5V

\* 2.2MΩ feedback resistors for the two reversing amplifiers; 9.1kΩ external resistor and a 180pf capacitor for the on-chip oscillator.

## AC Electrical Characteristics

### AC Electrical Characteristics of 977B

Parameters	Description	Test Condition	Min.	Type	Max.	Units
f <sub>osc</sub>	Oscillator Frequency *	T <sub>A</sub> = 25°C, R = 200 kΩ	102	128	154	kHz
f <sub>max</sub> -f <sub>min</sub>	Oscillator Frequency Fluctuation	T <sub>A</sub> =25°C, V <sub>CC</sub> = 1.8 ~ 5V			15	kHz
t <sub>FUN</sub>	Cycle Time of Function Code	f <sub>osc</sub> = 102 to 154 kHz	0.8	1	1.2	ms
t <sub>STA</sub>	Cycle Time of Start Code	f <sub>osc</sub> = 102 to 154 kHz	1.6	2	2.4	ms
f <sub>csc</sub>	Carrier Frequency of SC Pin	f <sub>osc</sub> = 102 to 154 kHz	51	64	77	kHz

**Note:** Over the Operating Rating, 0°C ≤ T<sub>A</sub> ≤ 70°C, V<sub>CC</sub> = 4V

\* The relative error between the frequencies of the two on-chip oscillators in the PT8A977B and PT8A9781 must be less than ± 25%.

### AC Electrical Characteristics of 9781

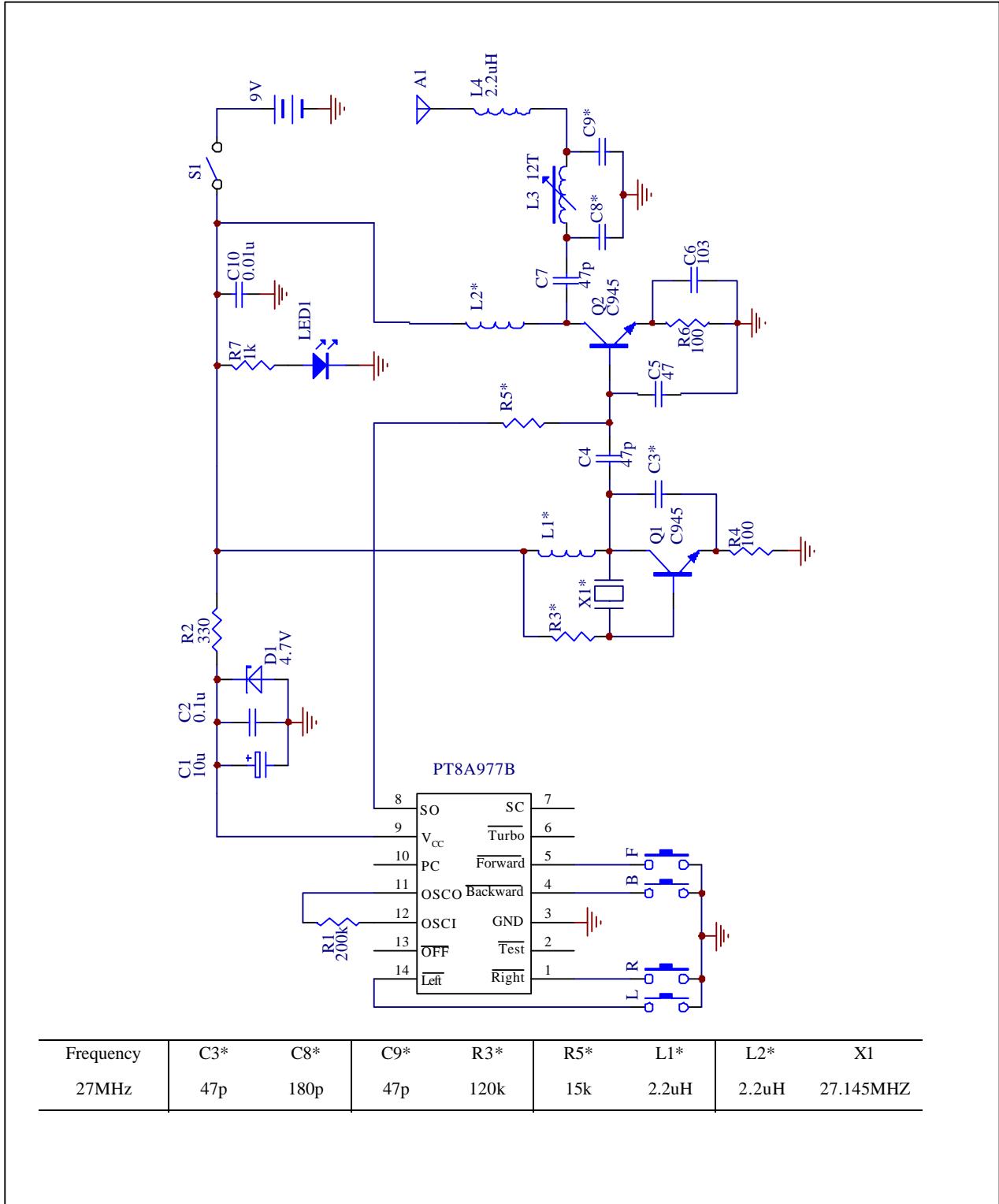
Sym	Description	Test Conditions	Min.	Type	Max.	Unit
f <sub>OSC</sub>	Oscillator Frequency*	R=9.1kΩ, C=180pf, V <sub>CC</sub> = 1.0 ~ 1.5V	119.04	131	136.96	kHz
f <sub>FOUT</sub>	Frequency of FOUT			65.5		kHz
D <sub>FOUT</sub>	Duty Cycle of FOUT		45	50	55	%
V <sub>SI</sub>	SI Pin Receive Sensitivity	Guaranteed Effective Decoding	-	-	300	mV
T <sub>FUN</sub>	Cycle Time of Function Code	-	0.75	1	1.25	ms
T <sub>STA</sub>	Cycle Time of Start Code	-	1.5	2	2.5	ms

T<sub>A</sub> = 10~40° C, V<sub>cc</sub> = 1.0V~1.5V

\* The relative error between the frequencies of the two on-chip oscillators in the PT8A977B and PT8A9781 must be less than ± 25%.

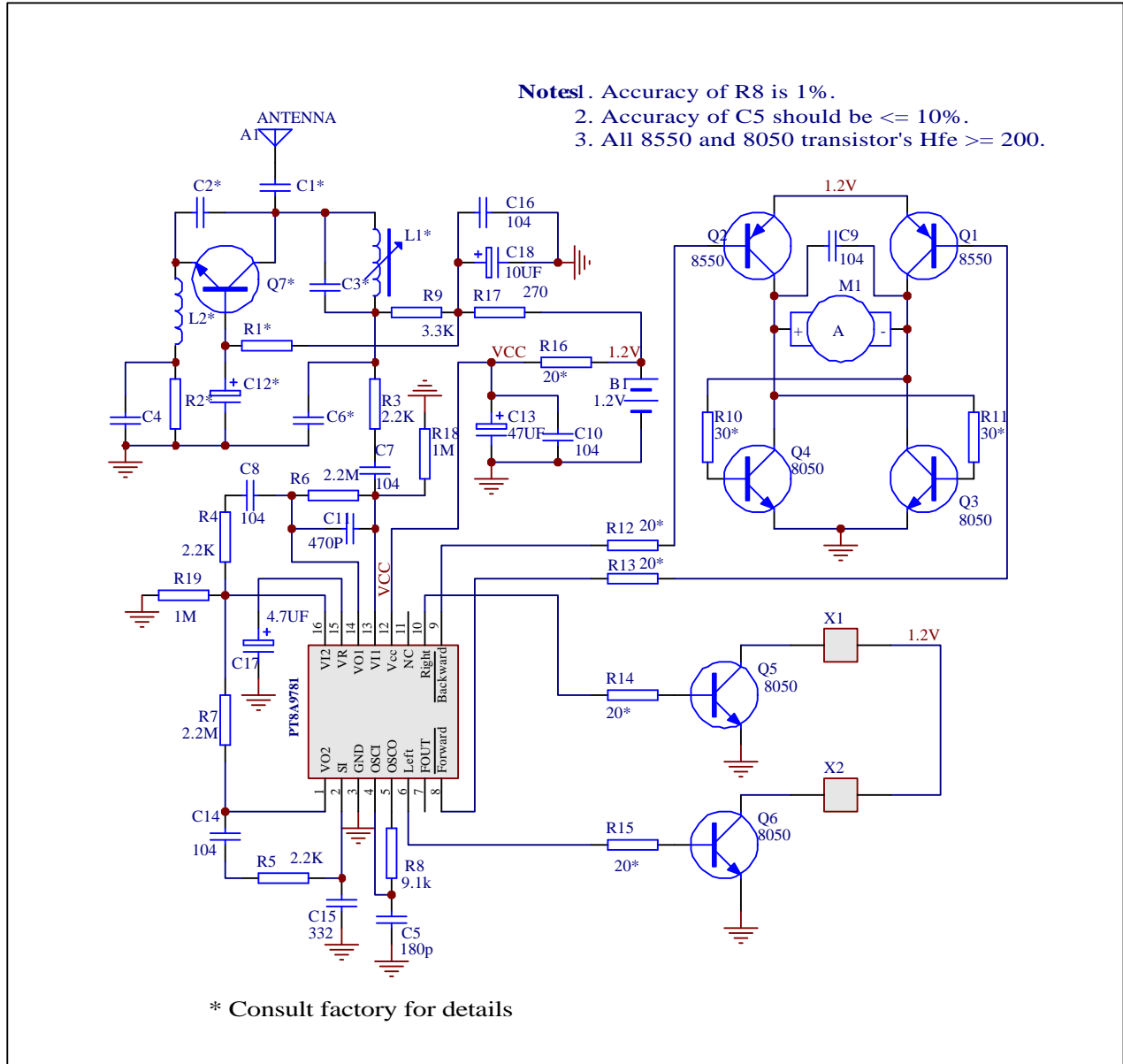
**Application Circuits**

Typical Application of PT8A977B For Transmit Circuit

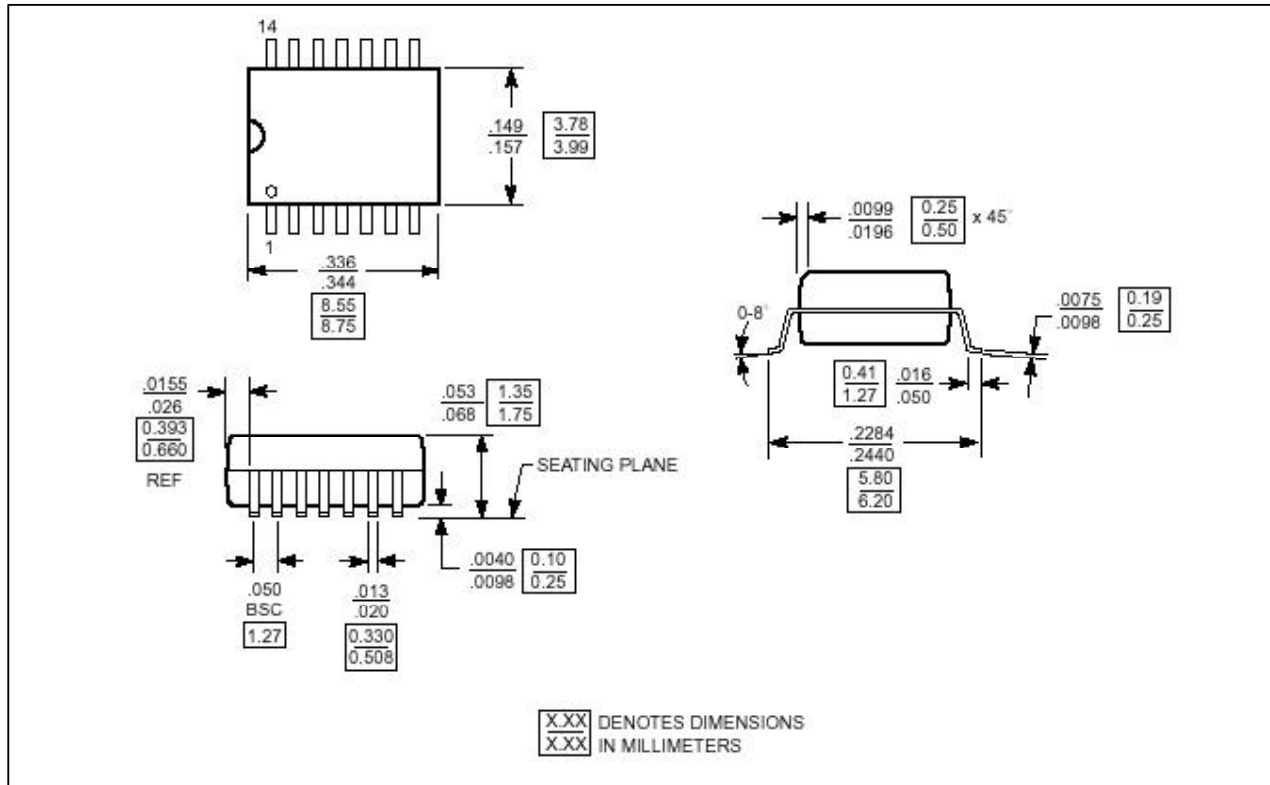




**Typical Application of PT8A9781 For Receive Circuit**



**Mechanical Diagram of 14-pin SOIC**



**Notes**

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