

## Features

- PT8A977B works as encoder and PT8A978B/978BL works as decoder
- Five pins for five control functions
- Operating power-supply voltage: 2.5V to 5.0V (978B), 2.0V to 5.0V (978BL), 1.8V to 5.0V(977B)
- Auto-power-off and oscillation-off if no press on any button (977B)
- Press on any button to wake up (977B)
- One output pin used for external power control (977B)
- On-chip oscillator with an external resistor
- On-chip reversing amplifiers (978B, 978BL)
- Low operating current
- Few external components needed
- Package: 14-pin DIP, 14-pin SOIC, 16-pin DIP and 16-pin SOIC

## Ordering Information

Part No.	Package
PT8A977BP	14-pin DIP
PT8A977BW	14-pin SOIC
PT8A977BDE	Die Form
PT8A978BP	16-pin DIP
PT8A978BLW	16-pin SOIC
PT8A978BDE	Die Form

## General Description

The PT8A977B and PT8A978B (or 978BL) provide complete control functions to the remote-controlled toy. The PT8A977B has five input pins corresponding with the five function buttons i.e, forward, backward, rightward, leftward and turbo. The encoding circuit in the PT8A977B sends digital codes to the two output pins SO and SC. The digital codes correspond to the definite function buttons or their combinations. The SO and SC outputs are used in wireless and infra-red applications respectively.

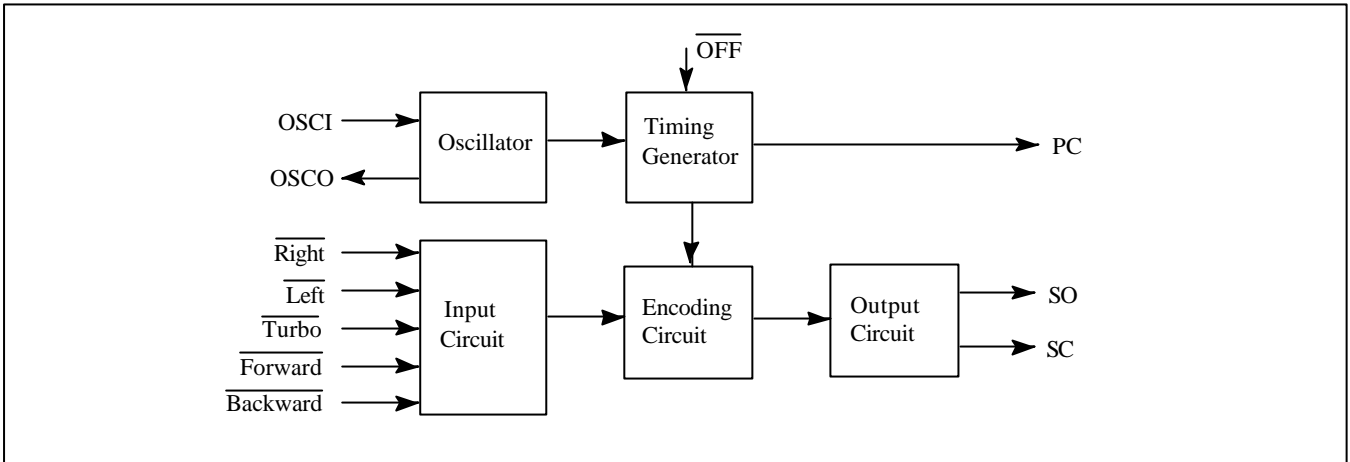
The PT8A978B (or 978BL) has five output pins corresponding with the five actions. The received signals are amplified by the three-stage amplifier, and then the appropriate amplified signals are sampled, fault-tolerantly checked and decoded to control the actions of the remote-controlled toy.

There is an internal oscillator in the PT8A977B and 978B/978BL respectively. By adding an external resistor conveniently, the oscillator will be constructed. The oscillator frequency can be adjusted by the external resistor. The relative error between the frequencies of the two on-chip oscillators in the PT8A977B and PT8A978B/978BL must be less than  $\pm 25\%$ .

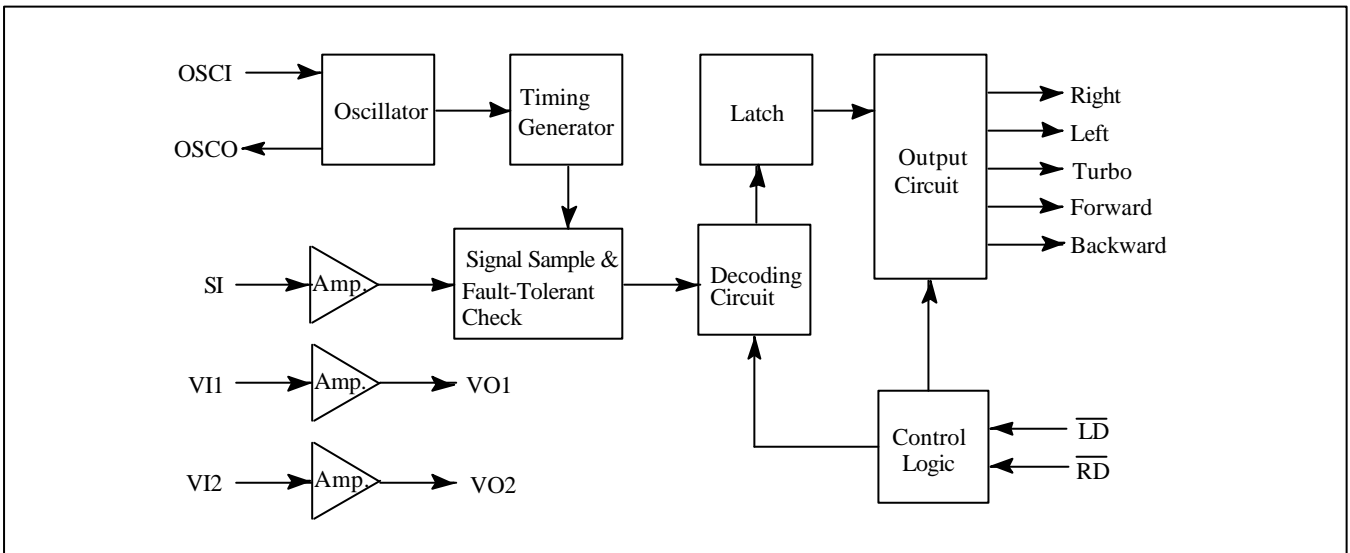
The auto-power-off function is achieved by an internal counter (977B). The PC output is used to control on/off state of the external power supply. Press on any function button will wake up the chip promptly.

## Block Diagram

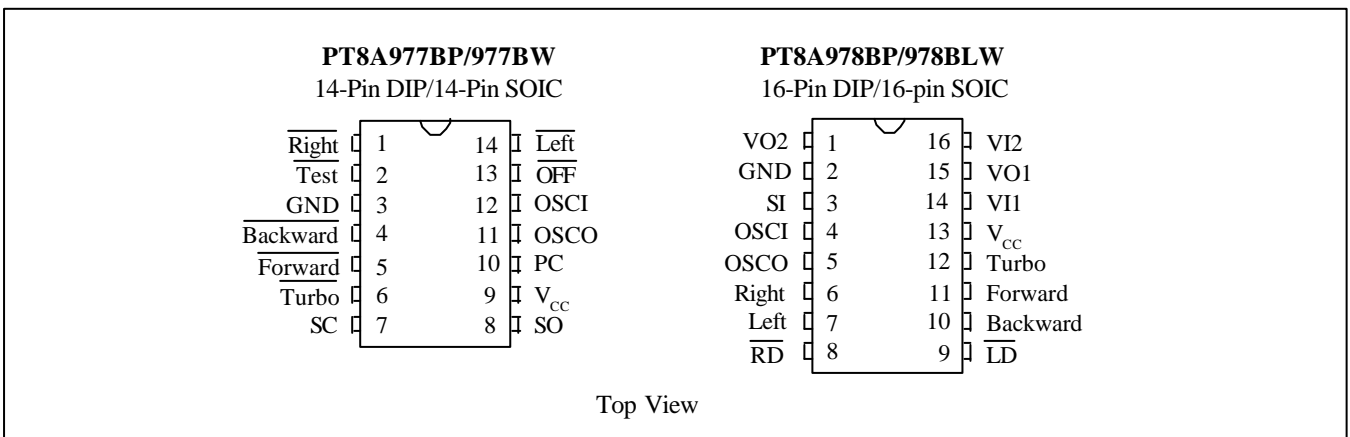
Block Diagram of 977B



Block Diagram of 978B/978BL

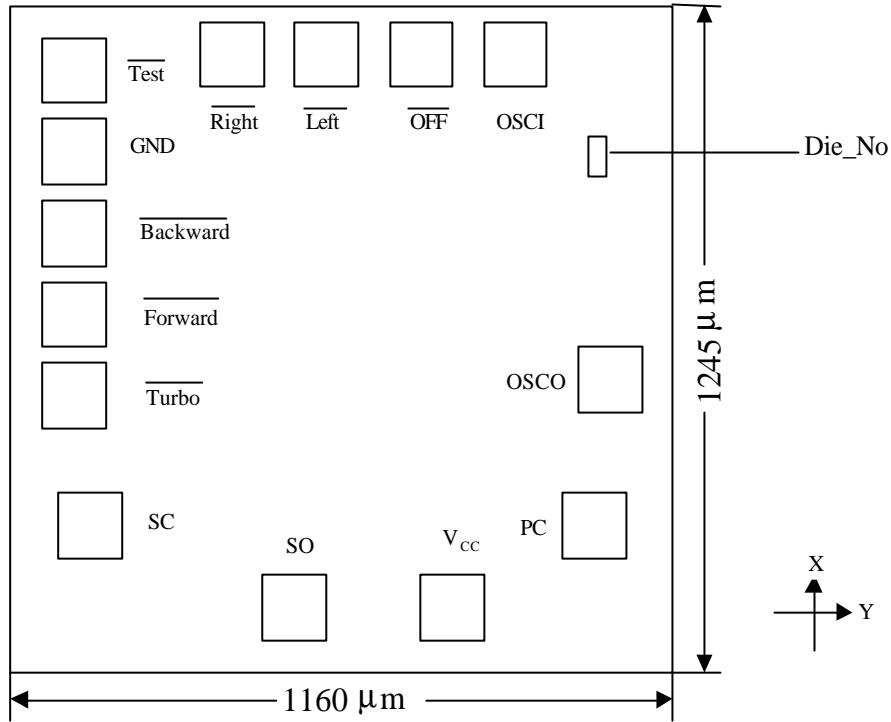


## Pin Configuration



**Pad Location**

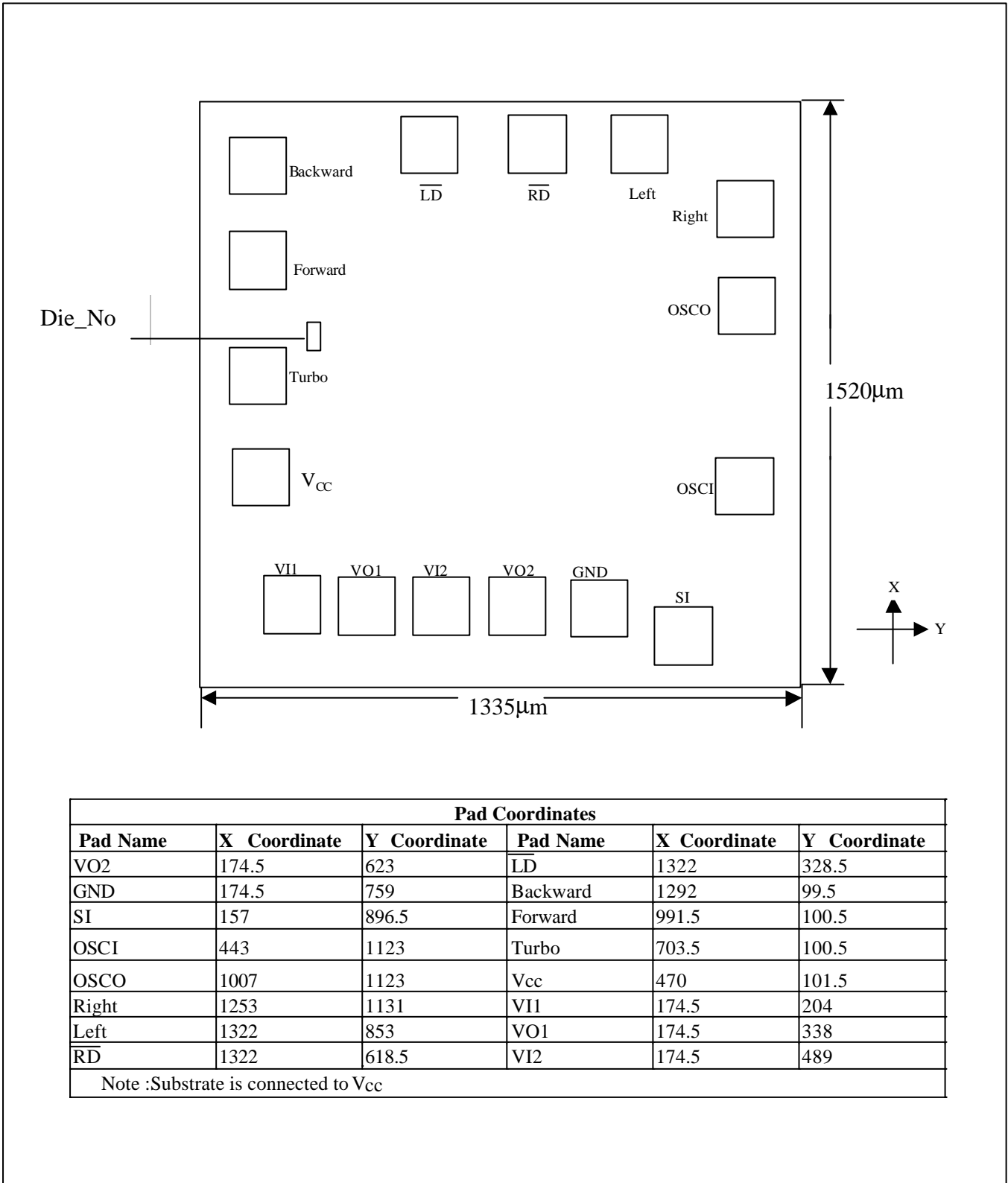
PT8A977BDE



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**

PT8A978BDE



Pad Coordinates					
Pad Name	X Coordinate	Y Coordinate	Pad Name	X Coordinate	Y Coordinate
VO2	174.5	623	$\overline{\text{LD}}$	1322	328.5
GND	174.5	759	Backward	1292	99.5
SI	157	896.5	Forward	991.5	100.5
OSCI	443	1123	Turbo	703.5	100.5
OSCO	1007	1123	Vcc	470	101.5
Right	1253	1131	VI1	174.5	204
Left	1322	853	VO1	174.5	338
$\overline{\text{RD}}$	1322	618.5	VI2	174.5	489

Note :Substrate is connected to Vcc

## Pin/Pad Description

### Pin/Pad Description of 977B

Pin No.	Pin/Pad Name	Description
1	$\overline{\text{Right}}$	With Pull-up resistor, rightward function selected if this pin connected to GND.
2	$\overline{\text{Test}}$	With Pull-up resistor, this pin is used for testing mode.
3	GND	Negative power supply
4	$\overline{\text{Backward}}$	With Pull-up resistor, backward function selected if this pin connected to GND.
5	$\overline{\text{Forward}}$	With Pull-up resistor, forward function selected if this pin connected to GND.
6	$\overline{\text{Turbo}}$	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	$\overline{\text{OFF}}$	With Pull-up resistor, this pin is used to shut down the external power supply.
14	$\overline{\text{Left}}$	With Pull-up resistor, leftward function selected if this pin connected to GND.

### Pin/Pad Description of 978B/978BL

Pin No.	Pin/Pad Name	Description
1	VO2	Output pin for the amplifier 2
2	GND	Negative power supply
3	SI	Input pin of the encoding signal
4	OSCI	Oscillator input pin
5	OSCO	Oscillator output pin
6	Right	Rightward output pin
7	Left	Leftward output pin
8	$\overline{\text{RD}}$	With Pull-up resistor, rightward function disabled if this pin connected to GND.
9	$\overline{\text{LD}}$	With Pull-up resistor, leftward function disabled if this pin connected to GND.
10	Backward	Backward output pin
11	Forward	Forward output pin
12	Turbo	Turbo output pin
13	V <sub>cc</sub>	Positive power supply
14	VI1	Input pin for the amplifier 1
15	VO1	Output pin for the amplifier 1
16	VI2	Input pin for the amplifier 2

## 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) ....	-0.5 to +6.0V
Supply Voltage to Ground Potential (Outputs & D/O Only)	-0.5 to +6.0V
DC Input Voltage .....	-0.5 to +6.0V
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 978B/978BL

Parameters	Description	Test Condition	Min.	Type	Max.	Units
V <sub>CC</sub>	Operating Voltage - 978B		2.5	4.0	5.0	V
	Operating Voltage - 978BL		2.0		5.0	V
I <sub>CC</sub>	Supply Current	Output unloaded			1	mA
I <sub>STB</sub>	Stand-by Current	OFF State			10	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 3, 8, 9 V <sub>IL</sub> = 0V, ON state			-60	uA
I <sub>IH</sub>	Input High Current	Pin 3 V <sub>IH</sub> = 4V, ON state			60	uA
	Input High Current	Pin 8, 9 V <sub>IH</sub> = 4V, ON state			10	uA
I <sub>I</sub>	Input Current	Pin 14, 16 V <sub>IH</sub> = 0 ~ 4V, ON state			± 10	uA
I <sub>OL</sub>	Output Low Current	Pin 1, 15 V <sub>OUT</sub> = 0.5 V	200			uA
		Pin 5 V <sub>OUT</sub> = 0.5 V	500			uA
		Pin 6, 7, 10, 11, 12 V <sub>OUT</sub> = 0.5 V	1			mA
I <sub>OH</sub>	Output High Current	Pin 1, 15 V <sub>OUT</sub> = 3.5 V	-200			uA
		Pin 5 V <sub>OUT</sub> = 3.5 V	-500			uA
		Pin 6, 7, 10, 11, 12 V <sub>OUT</sub> = 2.5 V	-600			uA

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

## AC Electrical Characteristics

### AC Electrical Characteristics of 977B

Parameters	Description	Test Condition	Min.	Type	Max.	Units
fosc	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
tFUN	Cycle Time of Function Code	fosc = 102 to 154 kHz	0.8	1	1.2	ms
tSTA	Cycle Time of Start Code	fosc = 102 to 154 kHz	1.6	2	2.4	ms
fcsc	Carrier Frequency of SC Pin	fosc = 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 PT8A978B (or 978BL) must be less than ±25%.

### AC Electrical Characteristics of 978B/978BL

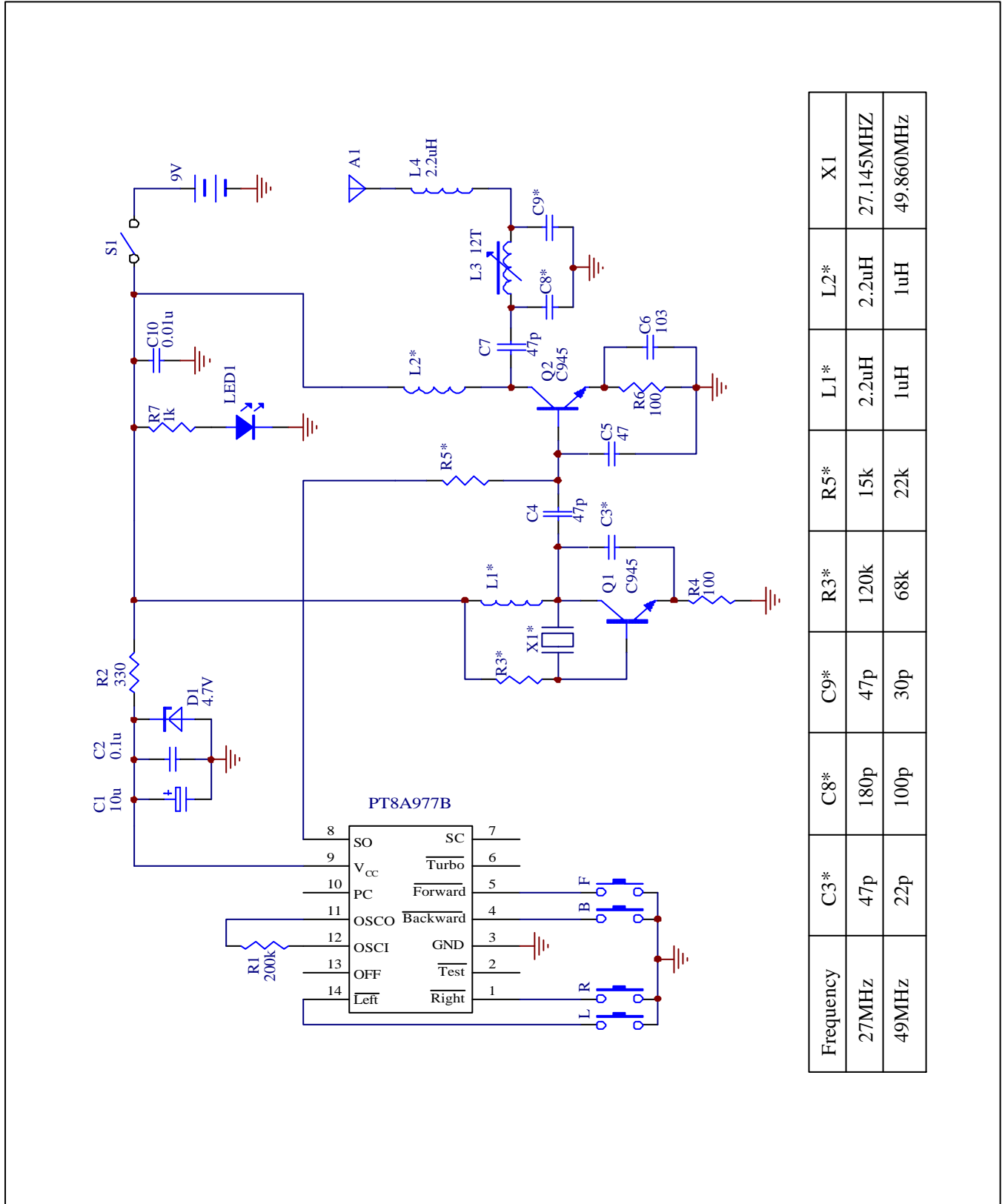
Parameters	Description	Test Condition	Min.	Type	Max.	Units
fosc	Oscillator Frequency *	T <sub>A</sub> = 25°C, R = 200 kΩ	102	128	154	kHz
f <sub>max</sub> -f <sub>min</sub>	Oscillator Frequency Fluctuation - 978B	T <sub>A</sub> =25°C, V <sub>CC</sub> =2.5 ~ 5V			15	kHz
	Oscillator Frequency Fluctuation - 978BL	T <sub>A</sub> =25°C, V <sub>CC</sub> =2.0 ~ 5V			10	kHz
V <sub>SI</sub>	SI Pin Receive Sensitivity (V <sub>PP</sub> )	Guaranteed Effective Decoding	300			mV
tFUN	Cycle Time of Function Code	fosc = 128 kHz	0.75	1	1.25	ms
tSTA	Cycle Time of Start Code	fosc = 128 kHz	1.5	2	2.5	ms

**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 PT8A978B (or 978BL) must be less than ±25%.

**Application Circuits**

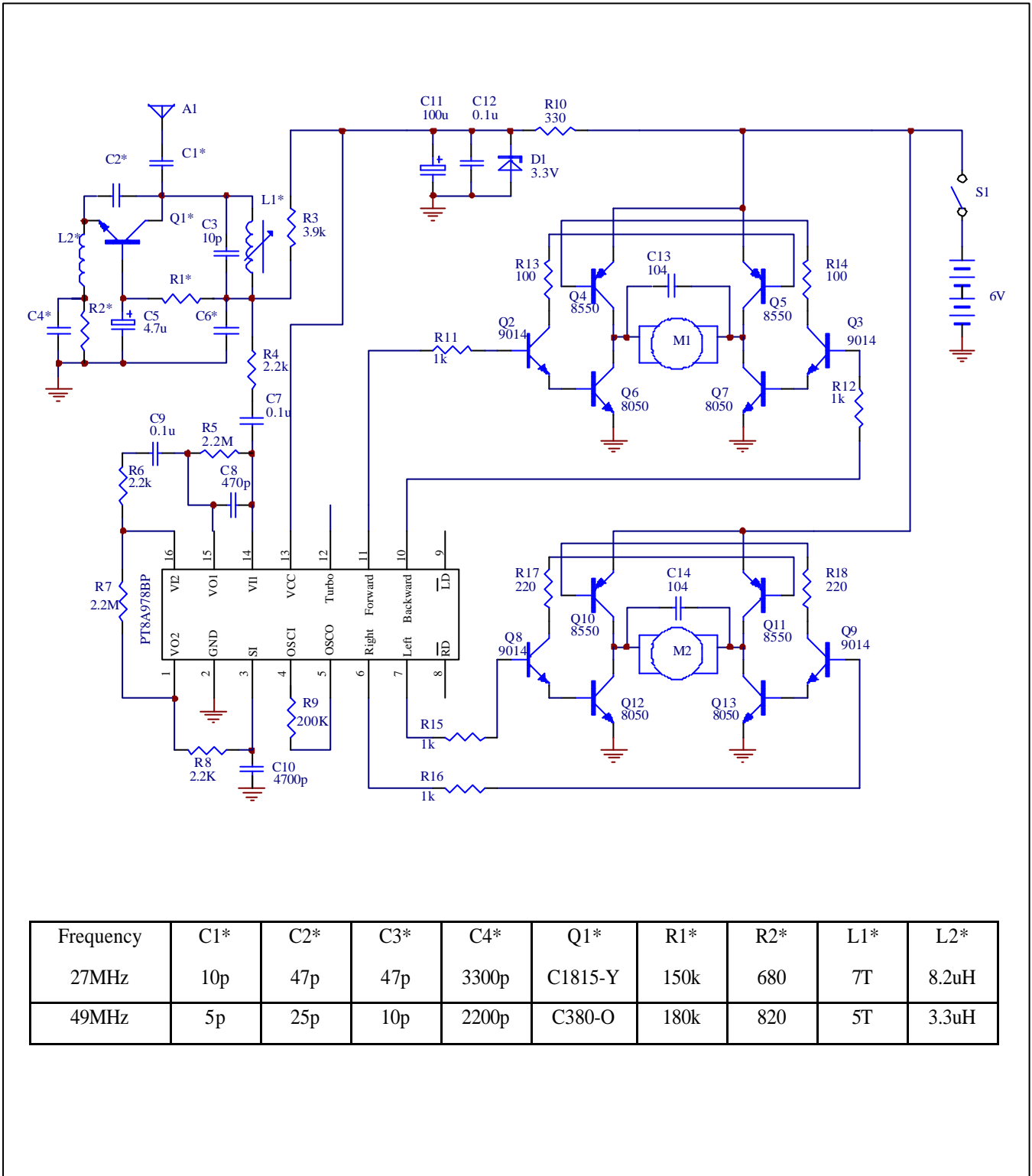
Typical Application of PT8A977B For Transmit Circuit



Frequency	C3*	C8*	C9*	R3*	R5*	L1*	L2*	X1
27MHz	47p	180p	47p	120k	15k	2.2uH	2.2uH	27.145MHZ
49MHz	22p	100p	30p	68k	22k	1uH	1uH	49.860MHZ

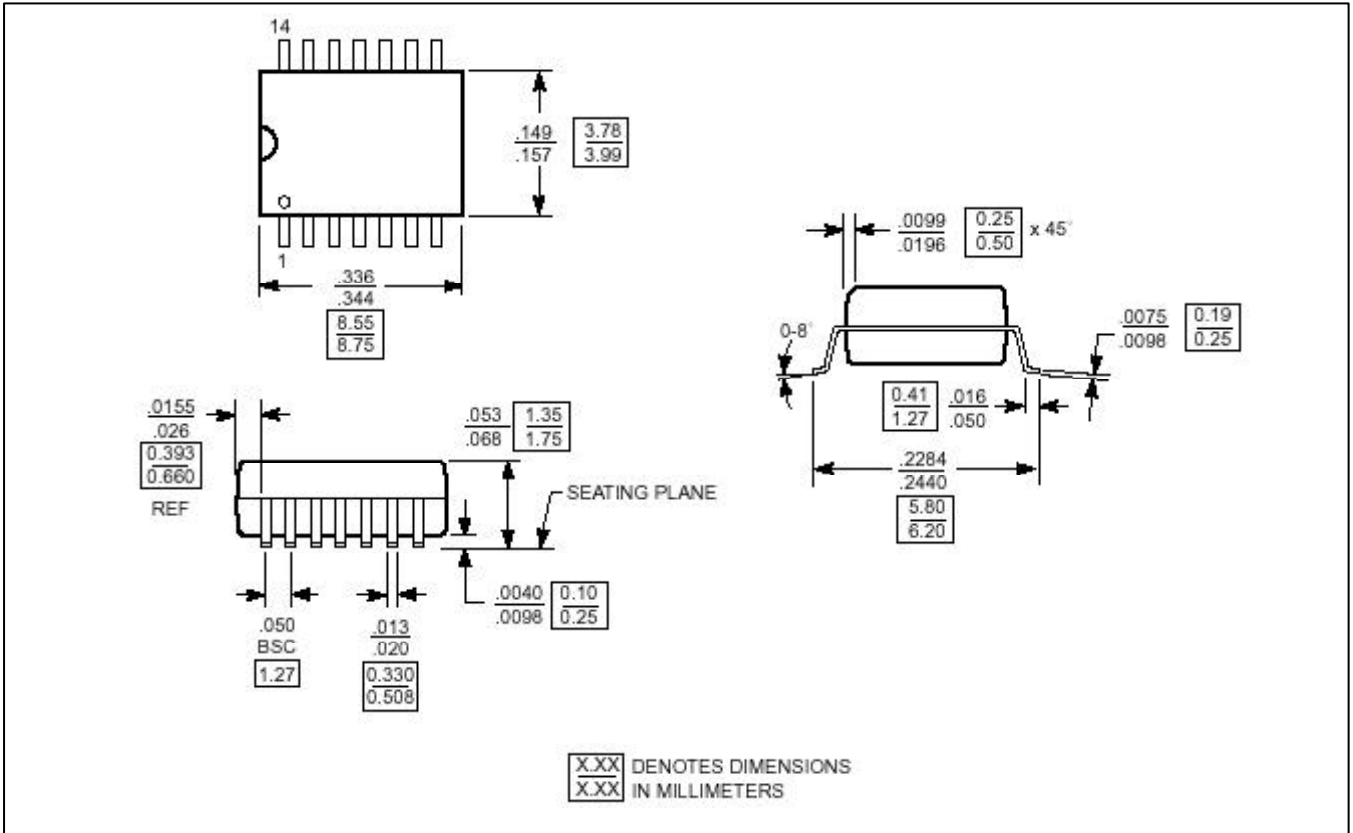


**Typical Application of PT8A978B/978BL For Transmit Circuit**

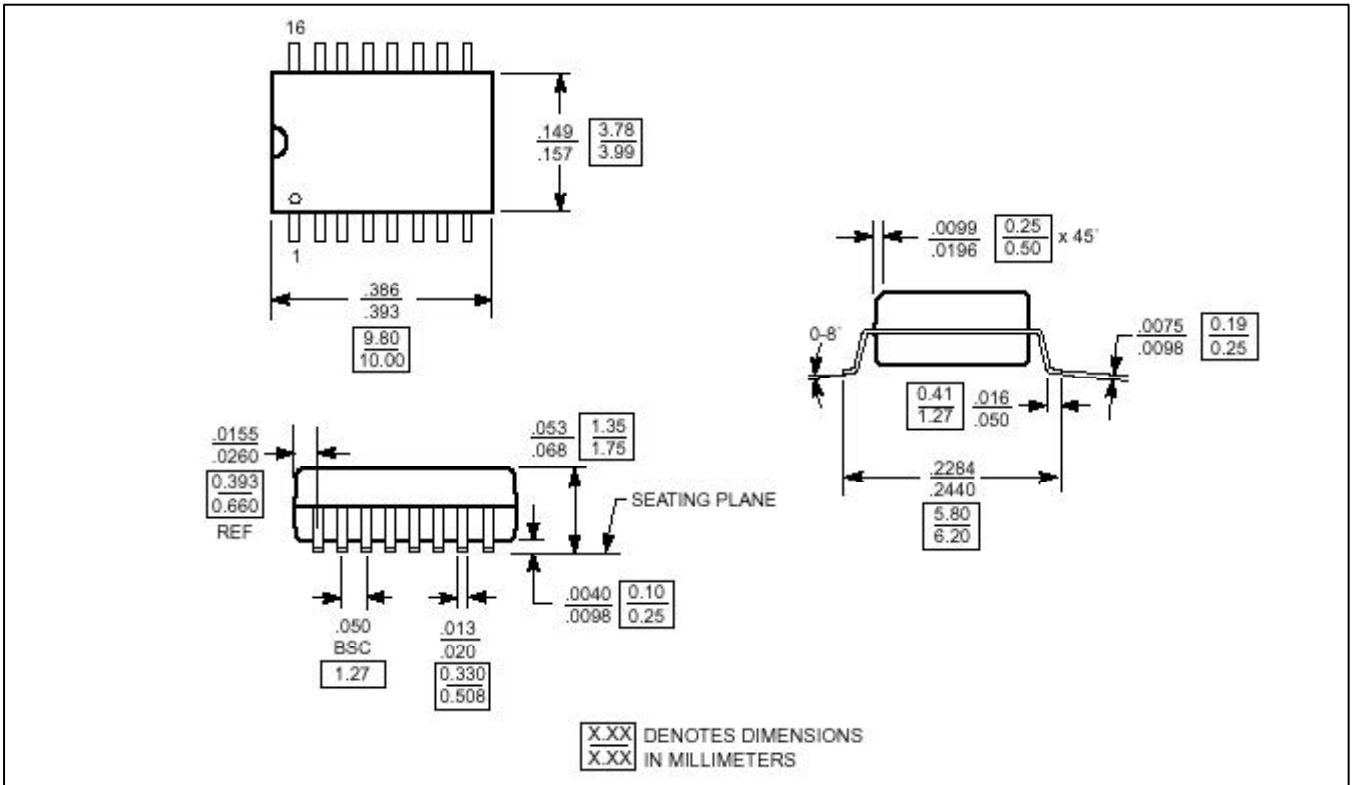


Frequency	C1*	C2*	C3*	C4*	Q1*	R1*	R2*	L1*	L2*
27MHz	10p	47p	47p	3300p	C1815-Y	150k	680	7T	8.2uH
49MHz	5p	25p	10p	2200p	C380-O	180k	820	5T	3.3uH

**Mechanical Diagram of 14-pin SOIC**



**Mechanical Diagram of 16-pin SOIC**



**Notes**

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