Features

- The PT8A9701 works as the encoder and the PT8A973/973L works as the decoder
- Seven output pins, 5 for forward, backward, left, right and turbo functions, and 2 functional keys
- Operation power supply for PT8A9701: 3V to 12V (with series resistor)
- Auto power-off if no key pressed (PT8A9701)
- Motor current limit to meet toy safety standard HD271 (PT8A973/973L)
- Low operating current
- On-chip oscillator with an external resistor
- On-chip reversing amplifiers
- Built-in 3.7V Zener (Vz) (PT8A973) and 3.1V Zener (Vz) (PT8A973L)
- Few external components needed
- Pin to pin compatible with TX6/RX6

General Description

The PT8A9701 and PT8A973/973L is a pair of CMOS LSIs designed for remote controlled toy car application. They have seven control keys for controlling the corresponding motion (forward, backward, left, right, turbo and 2 functional keys) of the remote controlled car. They also have Forward (Backward) and Turbo combination application.

Ordering Information

Device Name	Encoder	Decoder			
Part No.	PT8A9701PE	PT8A973PE	PT8A973LPE	PT8A973DE	PT8A973LDE
Package	Lead free 16-pin DIP	Lead free 18-pin DIP		Die Form	

Note: Adding E= Pb-free or Pb-free and Green
Adding X suffix=Tape/Reel

Block Diagram

Figure 1. Block Diagram of PT8A9701

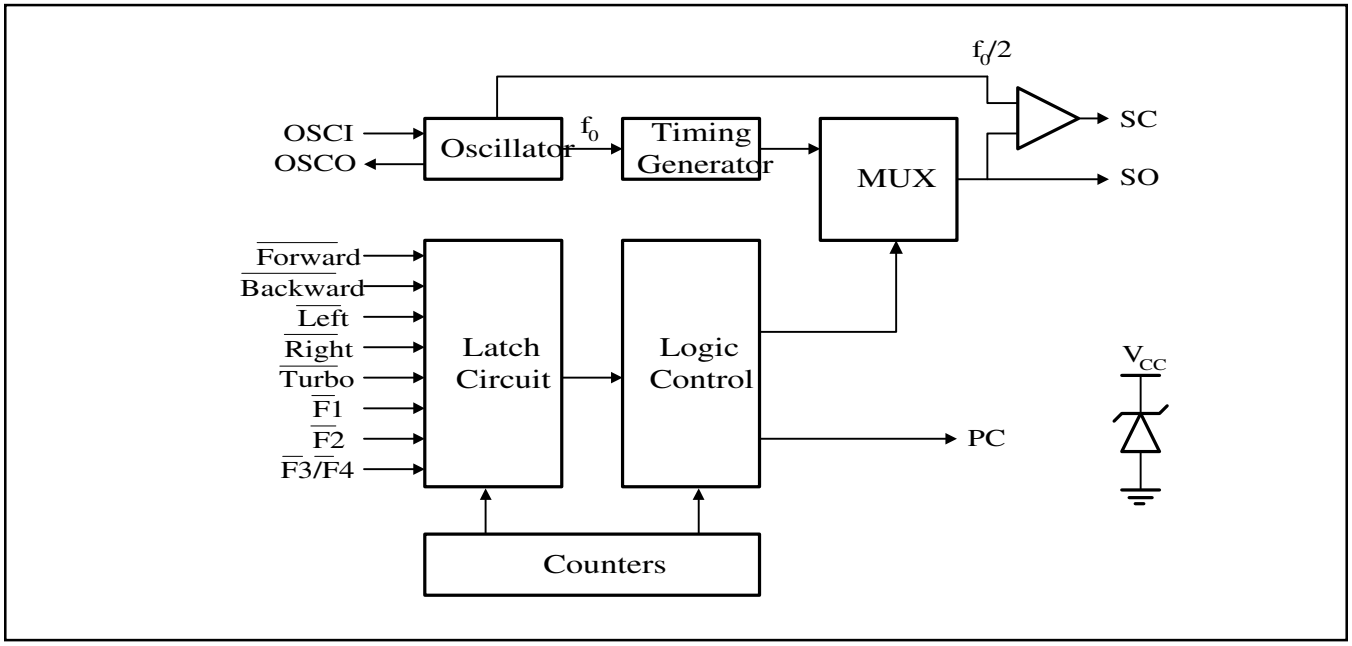
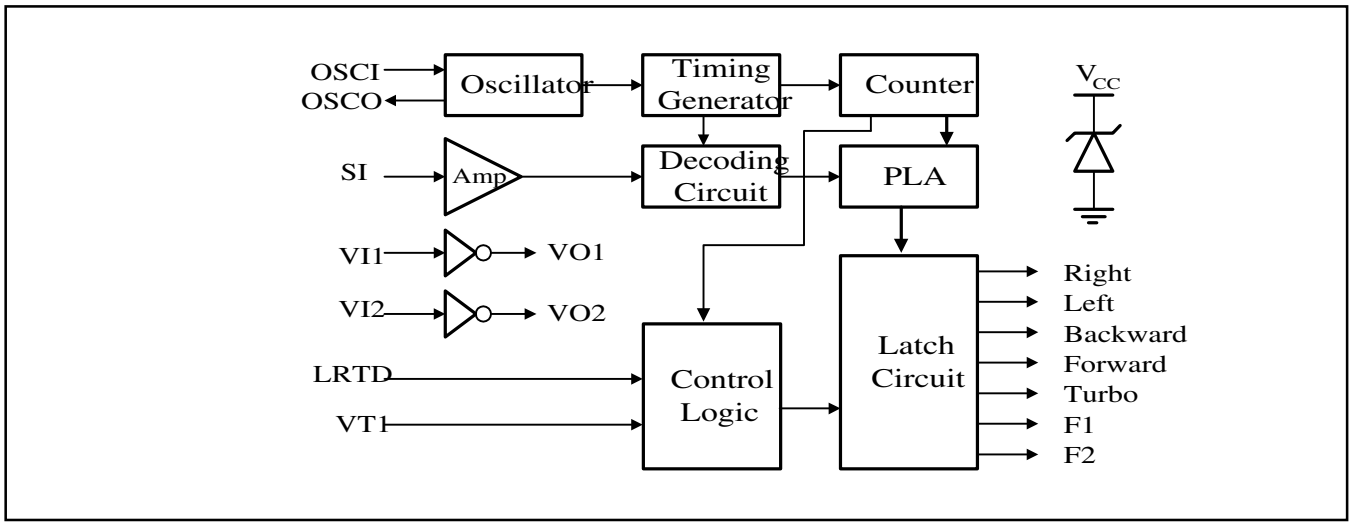
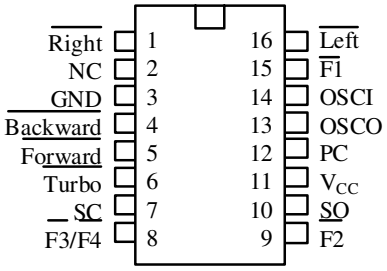


Figure 2. Block Diagram of PT8A973/973L

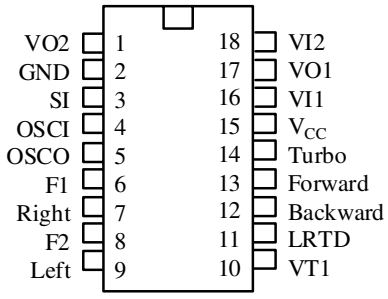


Pin Configuration

PT8A9701PE
16-Pin PDIP



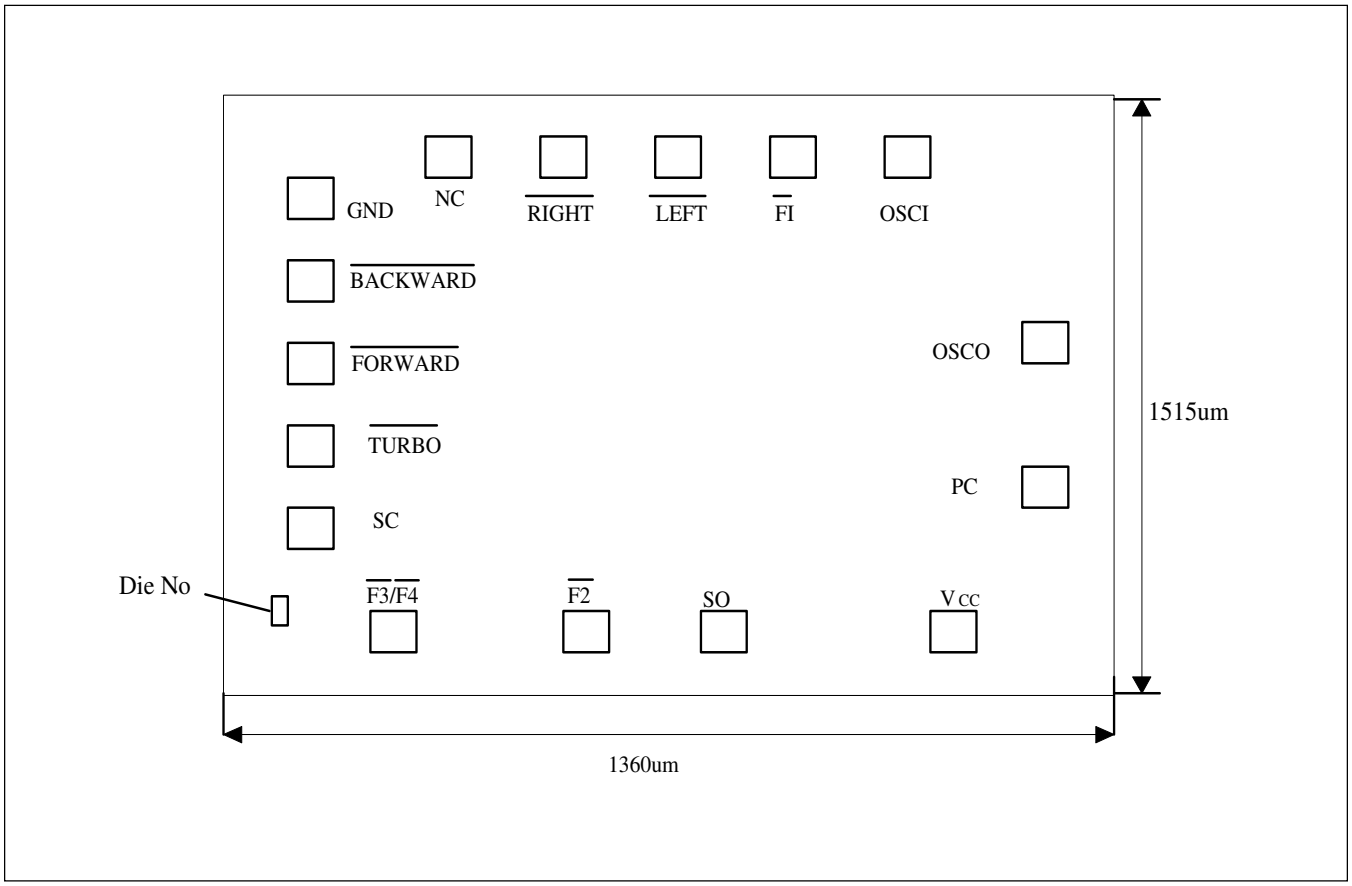
PT8A973P/973LPE
18-Pin PDIP



Top View

Pad Location

PT8A9701DE



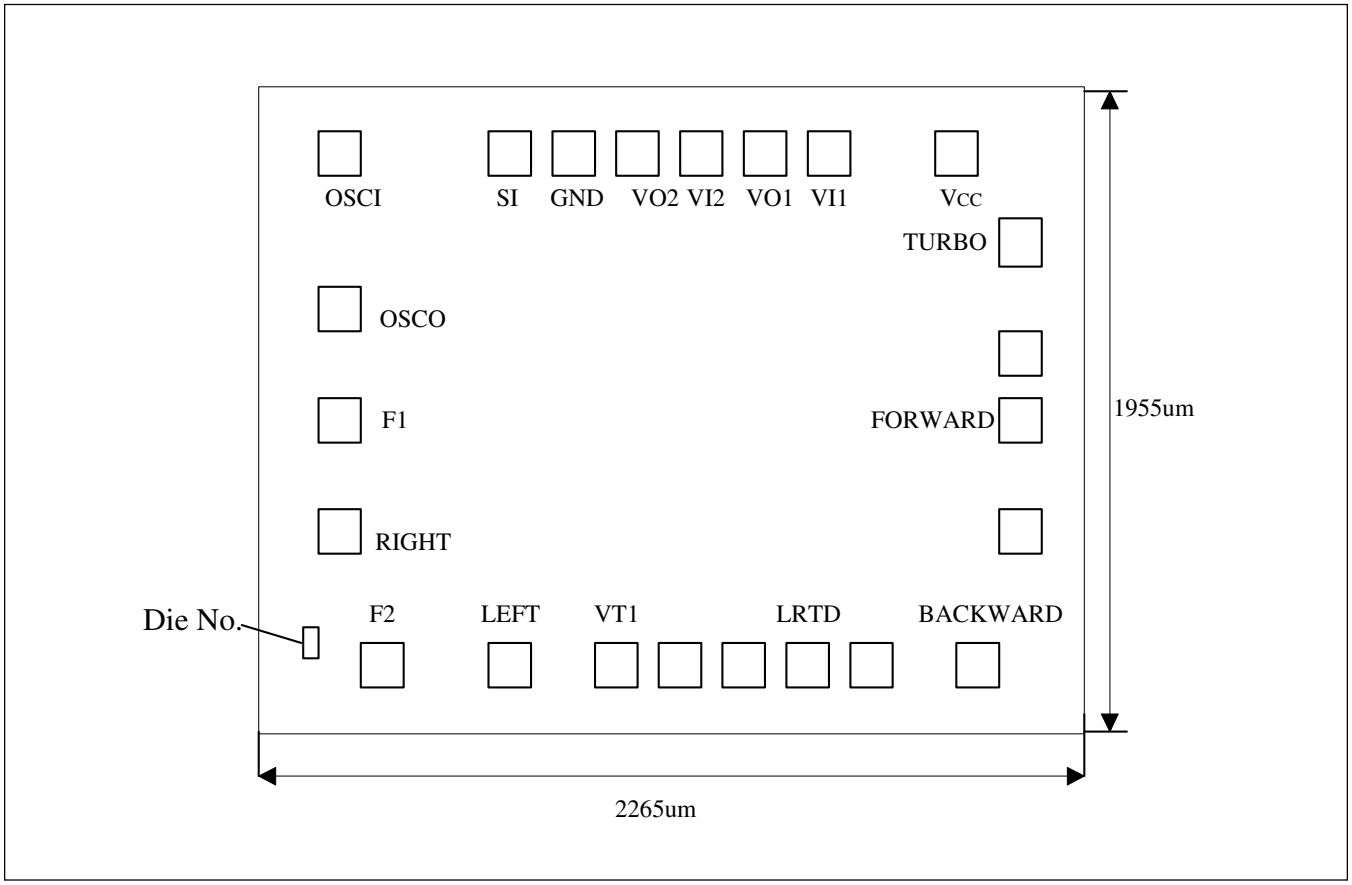
Pad Coordinates

Pad Name	X Coordinate	Y Coordinate	Pad Name	X Coordinate	Y Coordinate
RIGHT	457.5	1300.5	F2	363.5	97.5
NC	317.5	1300.5	SO	627	108
GND	115.5	1202	Vcc	972	98
BACKWARD	98	1053	PC	1152	339.5
FORWARD	98	903	OSCO	1146	728.5
TURBO	98	763	OSCI	961.5	1300.5
SC	108.5	460	F1	812.5	1300.5
F3/F4	171.5	145.5	LEFT	658	1300.5

Note: Substrate is connected to Vcc

Pad Location

PT8A973DE



Pad Coordinates

Pad Name	X Coordinate	Y Coordinate	Pad Name	X Coordinate	Y Coordinate
VO2	1024.1	1654.4	VT1	1003.1	147.5
GND	854.6	1654.4	LRTD	1433.1	147.5
SI	687.6	1671.9	BACKWARD	1898.1	136
OSCI	138.5	1653.3	FORWARD	1922.7	990.1
OSCO	138.5	1089.3	TURBO	1922.7	1487.2
F1	136.5	836.8	V_{cc}	1831.3	1654.8
RIGHT	136.5	447.8	VI1	1475.6	1654.4
F2	360.6	136	VO1	1341.6	1654.4
LEFT	749.6	136	VI2	1158.1	1654.4

Note: Substrate is connected to Vcc

Pin/Pad Description

Table 1. Pin/Pad Description of PT8A9701

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

Table 2. Pin/Pad 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

LRTD Function

LRTD Status	Key Selected	Output Function
High (Open)	Forward + Left (Right) + Turbo	Forward + Left (Right) + Turbo
Low	Forward + Left (Right) + Turbo	Forward + Left (Right)

Maximum Ratings

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

Maximum Ratings PT8A9701

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

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

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

Table 4. Recommended Operating Conditions

Sym	Description	Min	Typ	Max	Units
I_{CC}	Supply Current for PT8A973P			30	mA
	Supply Current for PT8A973LP			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	^{O}C

DC Electrical Characteristics

Table 5. DC Electrical Characteristics of PT8A9701

Sym	Description	Test Conditions	Min	Typ	Max	Units
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 - $\overline{Forward}$, $\overline{Backward}$, $\overline{Left}$, $\overline{Right}$, $\overline{Turbo}$, $\overline{F1}$, $\overline{F2}$, $\overline{F3}$/$\overline{F4}$ and OSCI Pins	$V_{IH} = V_{CC}$			1	uA
I_{IL}	Input LOW Current - $\overline{Forward}$, $\overline{Backward}$, $\overline{Left}$, $\overline{Right}$, $\overline{Turbo}$, $\overline{F1}$, $\overline{F2}$ and $\overline{F3}$/$\overline{F4}$ 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 $T_A = 25^{O}C$, unless otherwise specified.

Table 6. DC Electrical Characteristics of PT8A973/973L

Sym	Description	Test Conditions	Min	Typ	Max	Units
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 - OSCI, VI1, VI2 ,LRTD and SI Pins	$V_{IN} = V_{CC}$			10	uA
	Input HIGH Current -VT1				50	uA
I_{IL}	Input LOW Current - OSCI, VT1, VI1, VI2 and SI Pins	V_{IN} = 0V			-10	uA
	Input LOW Current - LRTD Pins				-50	uA
VT	Over-Current Limit - VT1 Pins for PT8A973		0.30		0.40	V
	Over-Current Limit - VT1 Pins for PT8A973L		0.25		0.35	V
V_Z	Voltage of Zenner - PT8A973	I_Z = 2~30mA	3.4	3.7	4	V
	Voltage of Zenner - PT8A973L		2.8	3.1	3.4	V

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

AC Electrical Characteristics

Table 7. AC Electrical Characteristics of PT8A9701

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
t_{OFF}	Auto-off Time	f_{OSC} = 128kHz		2		s
V_{CC}	Power Supply Range	-	3	9	12	V
I_{CC}	Supply Current	Output Unloaded			30	mA

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.

Table 8. AC Electrical Characteristics of PT8A973/973L

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
I_{CC}	Supply Current	Output Unloaded			30	mA

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

Figure 5. Typical Application Circuit of PT8A9701

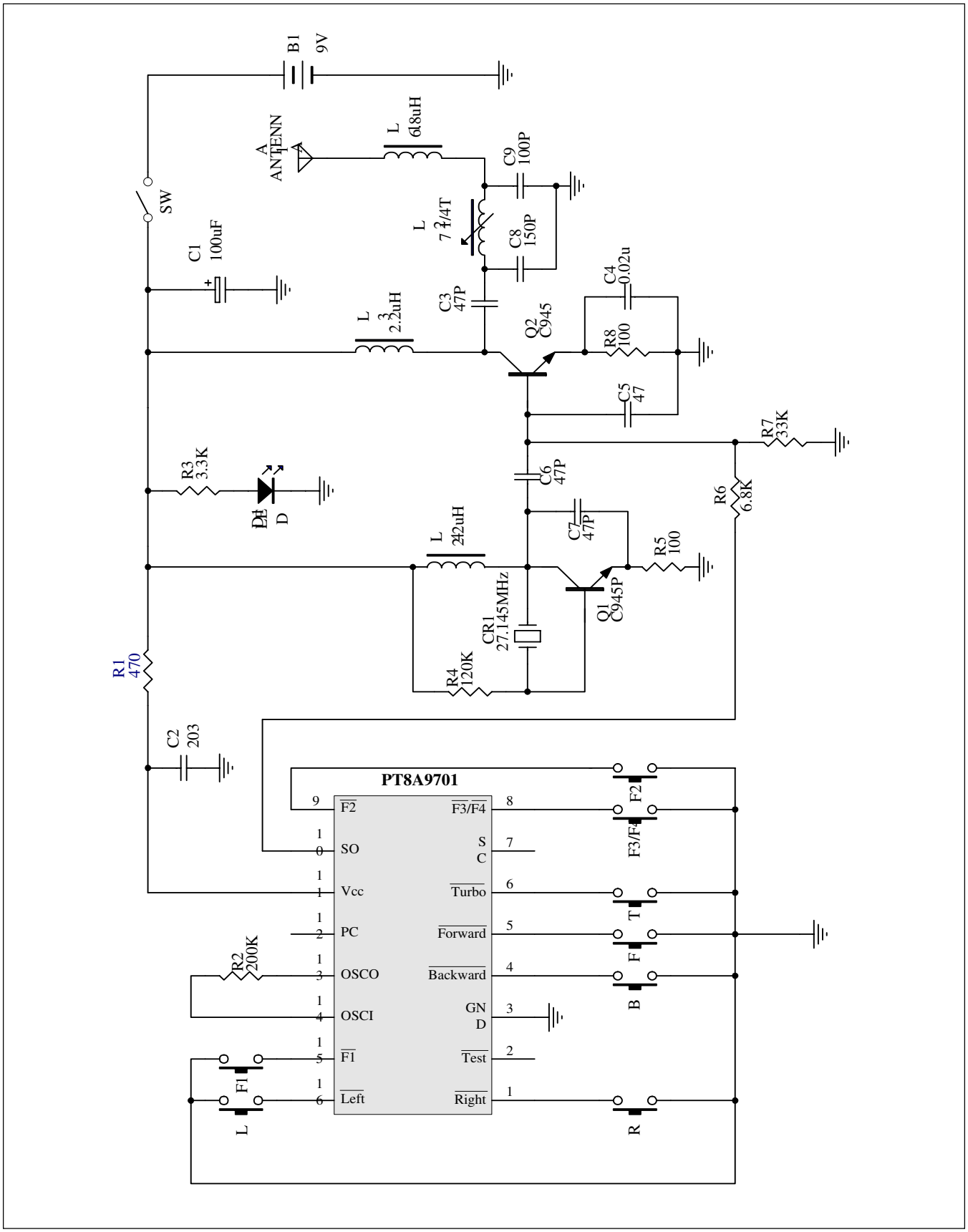
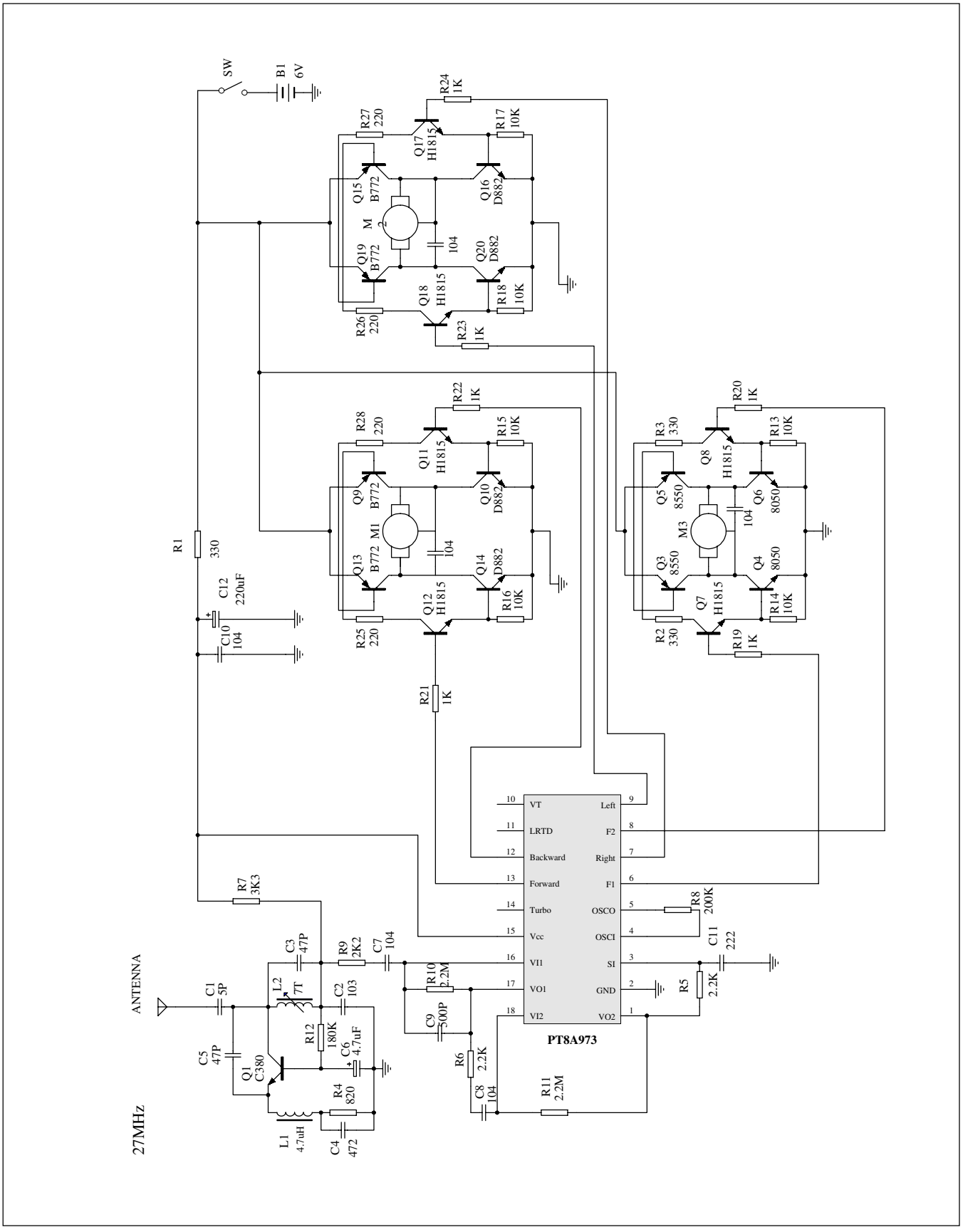
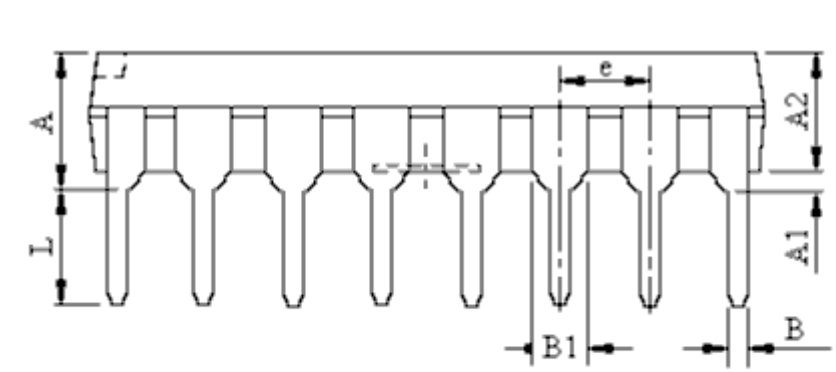


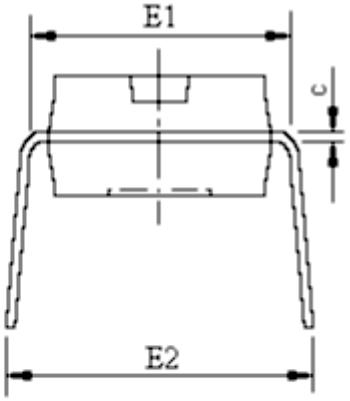
Figure 6. Typical Application Circuit of PT8A973

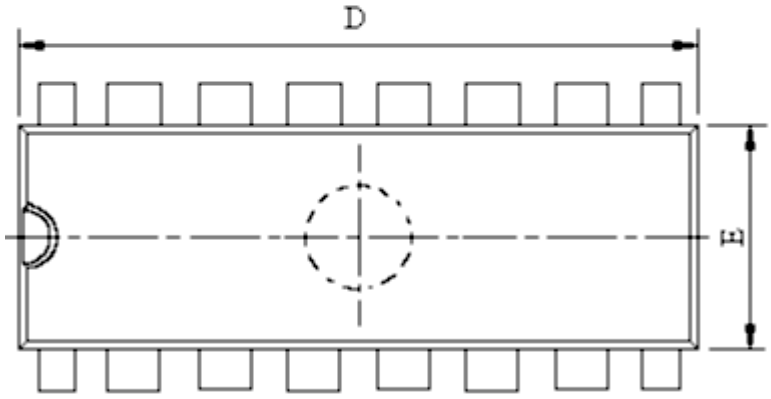


Mechanical Information

16-pin DIP



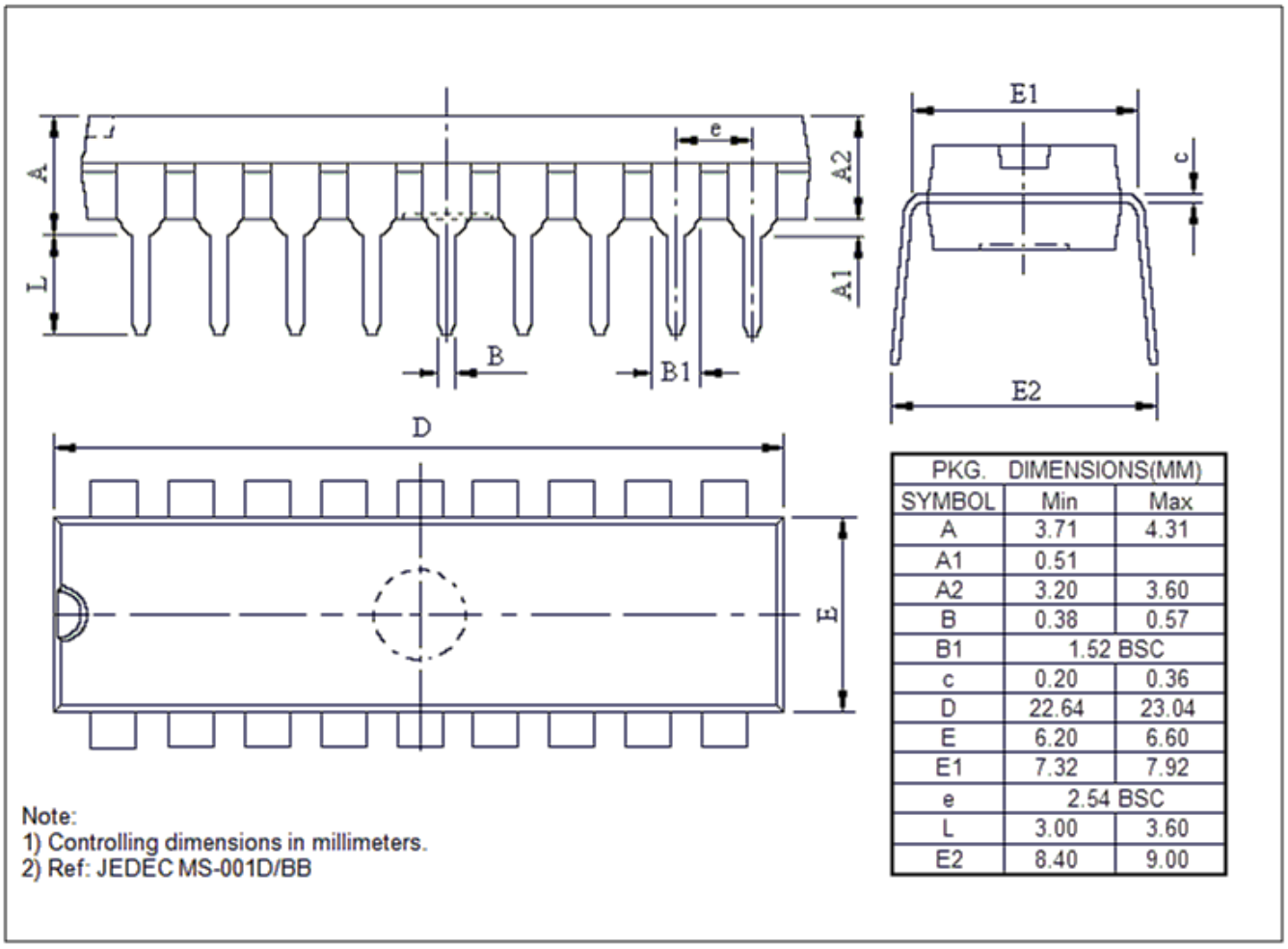




Note:
1) Controlling dimensions in millimeters.
2) Ref: JEDEC MS-001D/BB

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	18.80	19.20
E	6.20	6.60
E1	7.32	7.92
e	2.54 BSC	
L	3.00	3.60
E2	8.40	9.00

18-pin DIP



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

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