

## 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, 16-pin SOIC, die form and wafer form

## Ordering Information

| Part No.    | Package                         |
|-------------|---------------------------------|
| PT8A977BPE  | Lead free 14-pin DIP            |
| PT8A977BWE  | Lead free and Green 14-pin SOIC |
| PT8A977BDE  | Die Form                        |
| PT8A977BUWF | Wafer Form                      |
| PT8A978BPE  | Lead free 16-pin DIP            |
| PT8A978BLWE | Lead free and Green 16-pin SOIC |
| PT8A978BDE  | Die Form                        |
| PT8A978BUWF | Wafer Form                      |

### Note:

Adding E= Pb-free or Pb-free and Green

Adding X suffix=Tape/Reel

## 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.

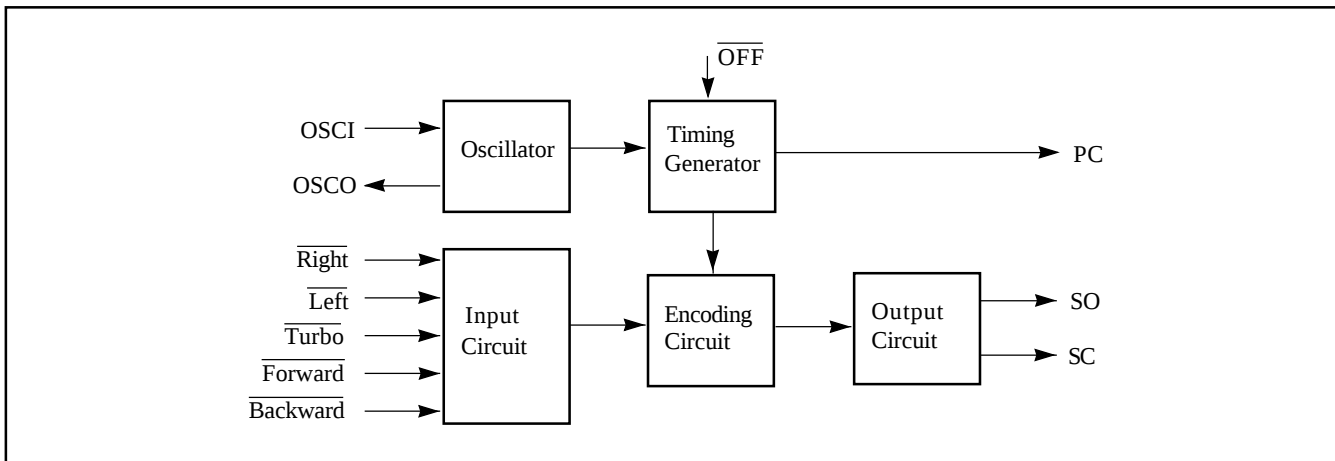
The PT8A978B (or 978BL) has five output pins corresponding with the five actions. The received signals are amplified by the three-stage amplifier, and then the appropriate amplified signals are sampled, fault-tolerantly checked and decoded to control the actions of the remote-controlled toy.

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  $\pm 25\%$ .

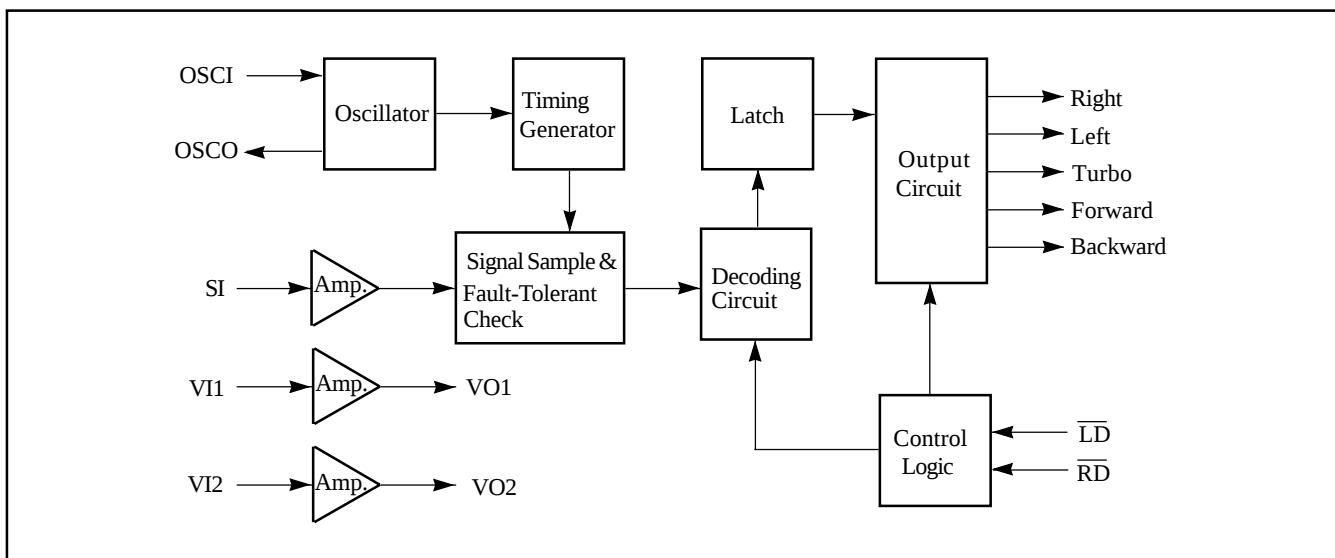
The auto-power-off function is achieved by an internal counter (977B). The PC output is used to control on/off state of the external power supply. Press on any function button will wake up the chip promptly.

## Block Diagram

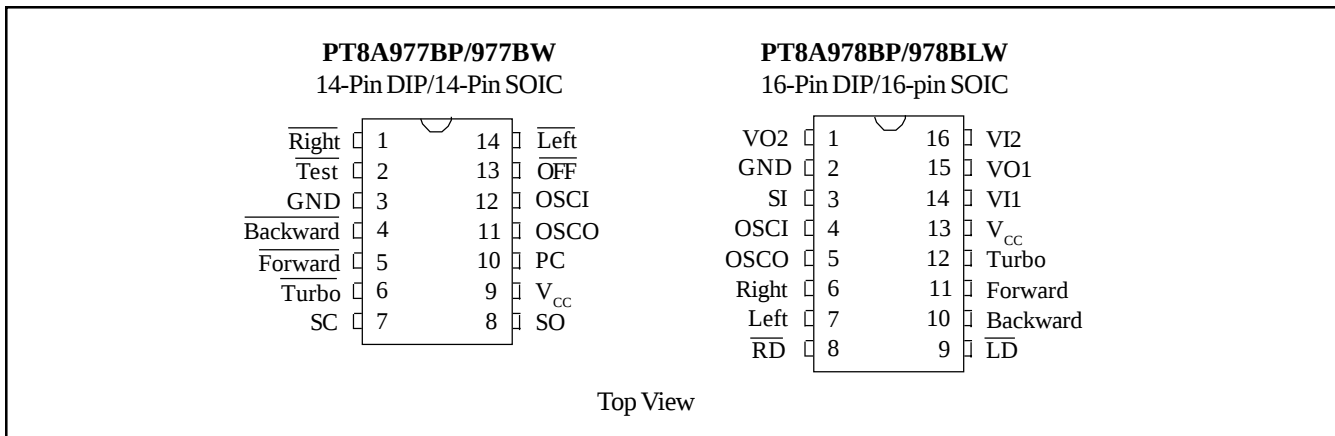
Block Diagram of 977B



Block Diagram of 978B/978BL

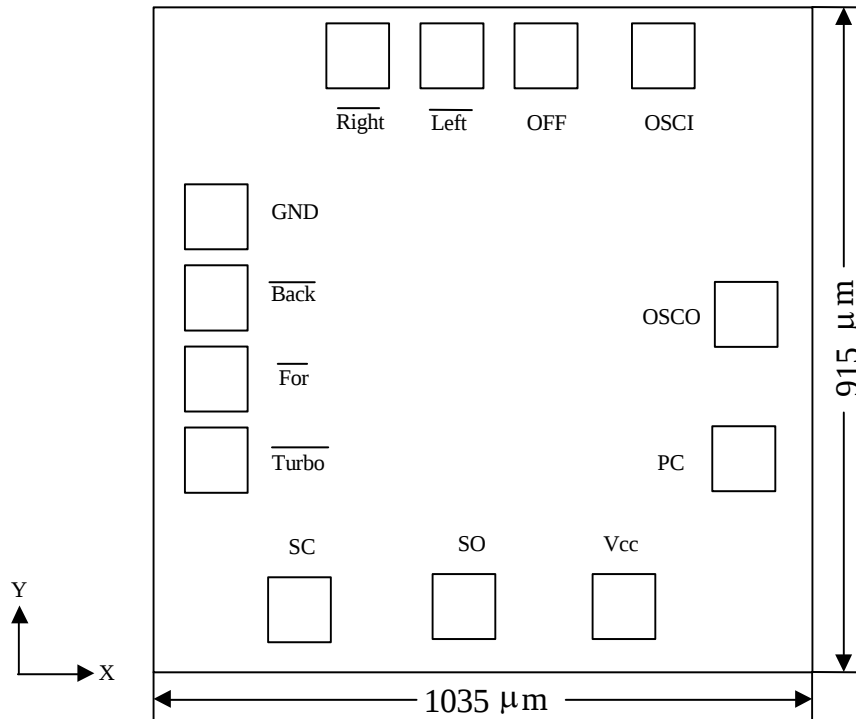


## Pin Configuration



## Pad Location

PT8A977BDE

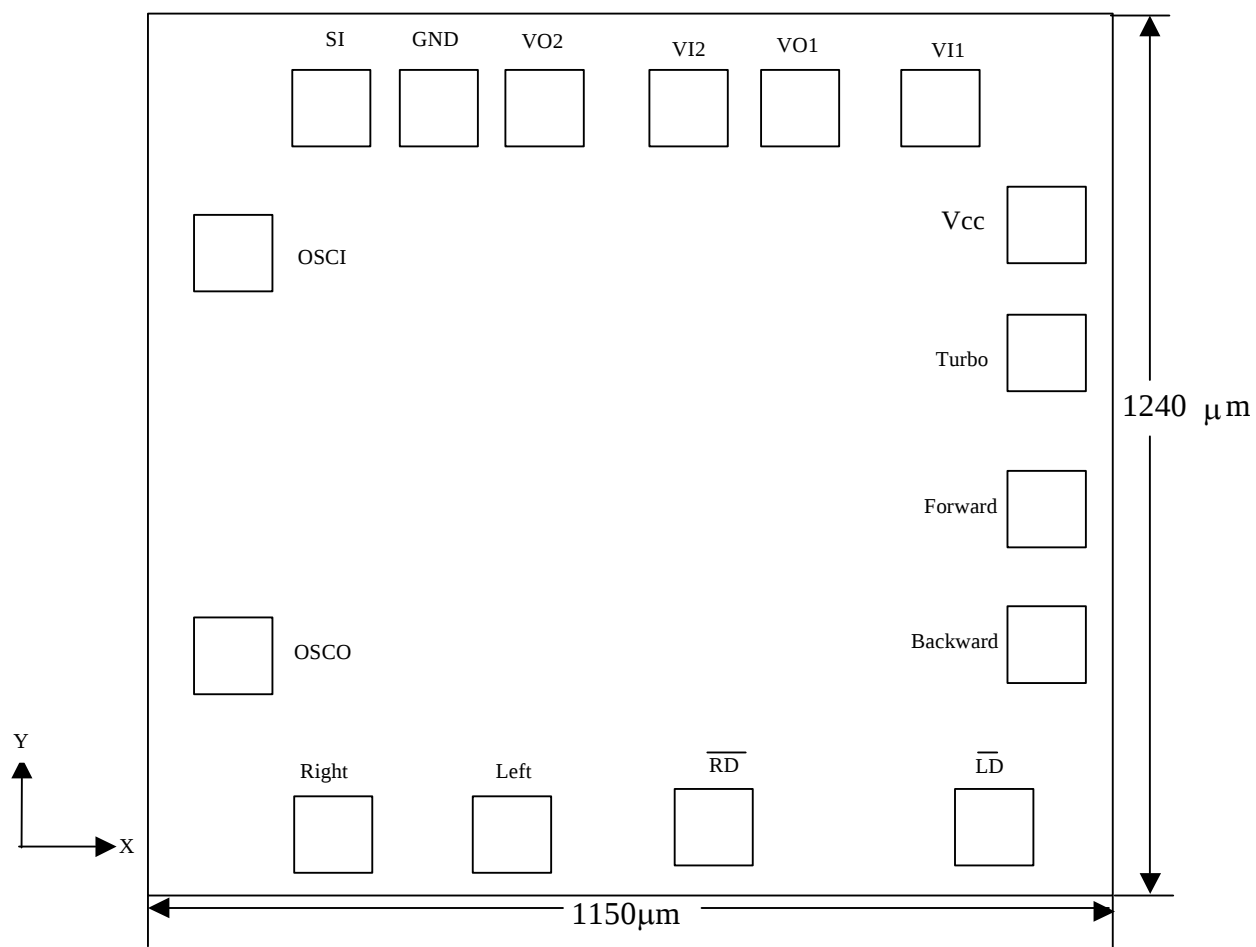


| Pad Coordinates |              |              |          |              |              |
|-----------------|--------------|--------------|----------|--------------|--------------|
| Pad Name        | X Coordinate | Y Coordinate | Pad Name | X Coordinate | Y Coordinate |
| Right           | 292.50       | 754.50       | Vcc      | 721.00       | 78.50        |
| GND             | 50.00        | 597.50       | PC       | 852.50       | 240.00       |
| Backward        | 50.00        | 466.50       | OSCO     | 852.50       | 428.50       |
| Forward         | 50.00        | 361.50       | OSCI     | 634.50       | 754.50       |
| Turbo           | 50.00        | 201.50       | OFF      | 492.50       | 754.50       |
| SC              | 243.00       | 73.00        | Left     | 392.50       | 754.50       |
| SO              | 479.00       | 73.00        |          |              |              |

Note: Substrate is connected to Vcc.  
Die size is 1035μm\*915μm included scribe line( 100um\*100um). Pad size is 80.0μm\*75.0μm.

## Pad Location

PT8A978BDE



| Pad Coordinates |               |               |          |               |               |
|-----------------|---------------|---------------|----------|---------------|---------------|
| Pad Name        | X Coordinates | Y Coordinates | Pad Name | X Coordinates | Y Coordinates |
| SI              | 262.00        | 1010.00       | Forward  | 978.00        | 454.00        |
| OSCI            | 89.50         | 701.00        | Turbo    | 978.00        | 666.00        |
| OSCO            | 81.00         | 187.00        | Vcc      | 979.00        | 820.50        |
| Right           | 262.00        | 72.50         | VI1      | 888.50        | 1010.00       |
| Left            | 466.00        | 72.50         | VO1      | 746.00        | 1010.00       |
| RDB             | 638.00        | 74.50         | VI2      | 633.00        | 1010.00       |
| LDB             | 929.00        | 74.50         | VO2      | 490.50        | 1010.00       |
| Backward        | 978.00        | 250.00        | GND      | 378.50        | 1010.00       |

Note: Substrate is connected to Vcc.

Die size is 1035mm\*915mm included scribe line( 100um\*100um). Pad size is 80.0mm\*75.0mm.

## 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       | GND             | Negative power supply                                                            |
| 3       | Backward        | With Pull-up resistor, backward function selected if this pin connected to GND.  |
| 4       | Forward         | With Pull-up resistor, forward function selected if this pin connected to GND.   |
| 5       | Turbo           | With Pull-up resistor, turbo function selected if this pin connected to GND.     |
| 6       | SC              | Output pin of the encoding signal with carrier frequency                         |
| 7       | SO              | Output pin of the encoding signal without carrier frequency                      |
| 8       | V <sub>cc</sub> | Positive power supply                                                            |
| 9       | PC              | Power control output pin                                                         |
| 10      | OSCO            | Oscillator output pin                                                            |
| 11      | OSCI            | Oscillator input pin                                                             |
| 12      | OFF             | With Pull-up resistor, this pin is used to shut down the external power supply.  |
| 13      | 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       | RD              | With Pull-up resistor, rightward function disabled if this pin connected to GND. |
| 9       | 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, 3, 4, 5, 13<br>V <sub>IL</sub> = 0V, ON state |      |      | -60  | uA    |
| I <sub>IH</sub>  | Input High Current  | Pin 1, 3, 4, 5, 13<br>V <sub>IH</sub> = 4V, ON state |      |      | 10   | uA    |
| I <sub>I</sub>   | Input Current       | Pin 11<br>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 6, 7, 9<br>V <sub>OUT</sub> = 3.5 V              | -1.0 |      |      | mA    |
|                  |                     | Pin 10<br>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<br>V <sub>IL</sub> = 0V, ON state    |      |      | -60  | uA    |
| I <sub>IH</sub>  | Input High Current        | Pin 3<br>V <sub>IH</sub> = 4V, ON state          |      |      | 60   | uA    |
|                  | Input High Current        | Pin 8, 9<br>V <sub>IH</sub> = 4V, ON state       |      |      | 10   | uA    |
| I <sub>I</sub>   | Input Current             | Pin 14, 16<br>V <sub>IH</sub> = 0 ~ 4V, ON state |      |      | ± 10 | uA    |
| I <sub>OL</sub>  | Output Low Current        | Pin 1, 15<br>V <sub>OUT</sub> = 0.5 V            | 200  |      |      | uA    |
|                  |                           | Pin 5<br>V <sub>OUT</sub> = 0.5 V                | 500  |      |      | uA    |
|                  |                           | Pin 6, 7, 10, 11, 12<br>V <sub>OUT</sub> = 0.5 V | 1    |      |      | mA    |
| I <sub>OH</sub>  | Output High Current       | Pin 1, 15<br>V <sub>OUT</sub> = 3.5 V            | -200 |      |      | uA    |
|                  |                           | Pin 5<br>V <sub>OUT</sub> = 3.5 V                | -500 |      |      | uA    |
|                  |                           | Pin 6, 7, 10, 11, 12<br>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%.

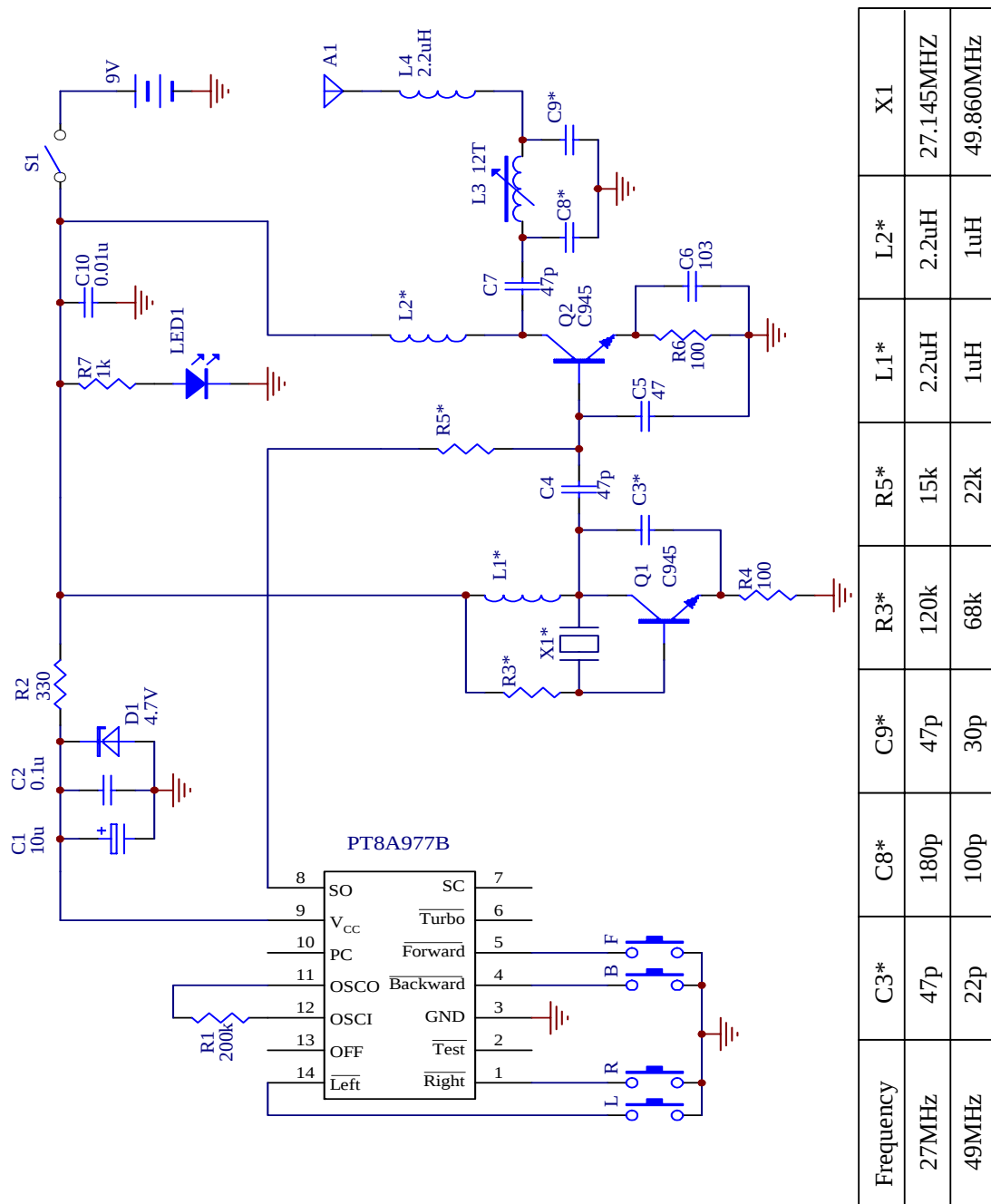
### AC Electrical Characteristics of 978B/978BL

| 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    |

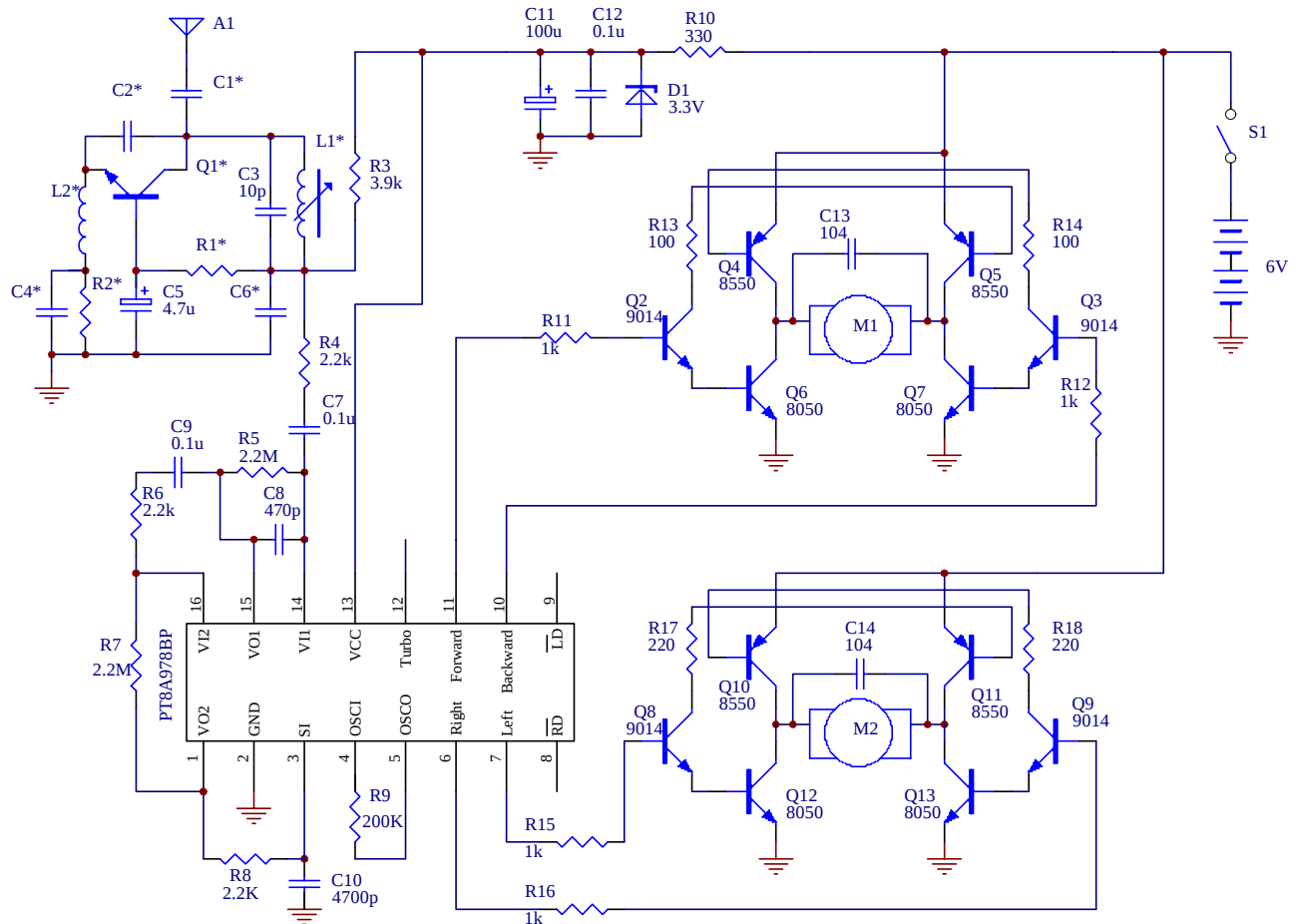
**Note:** Over the Operating Rating, 0°C ≤ T<sub>A</sub> ≤ 70°C, V<sub>CC</sub> = 4V

\* The relative error between the frequencies of the two on-chip oscillators in the PT8A977B and PT8A978B (or 978BL) must be less than ±25%.

### Typical Application of PT8A977B For Transmit Circuit



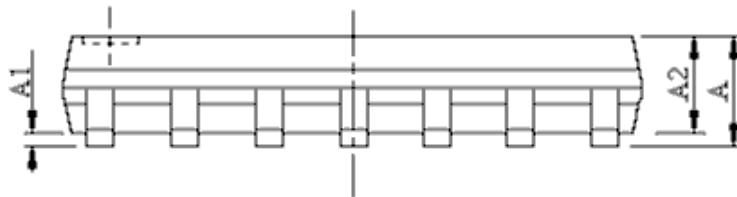
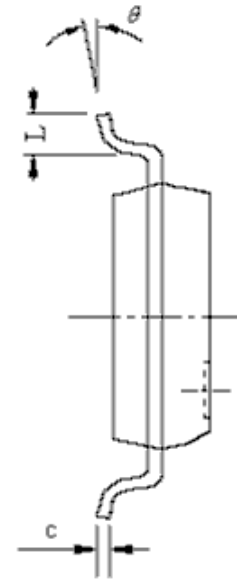
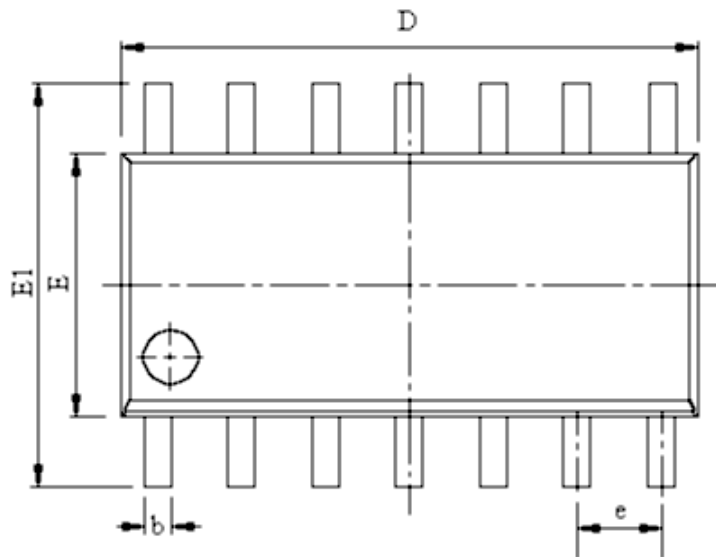
**Typical Application of PT8A978B/978BL For Transmit Circuit**



| 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 Information

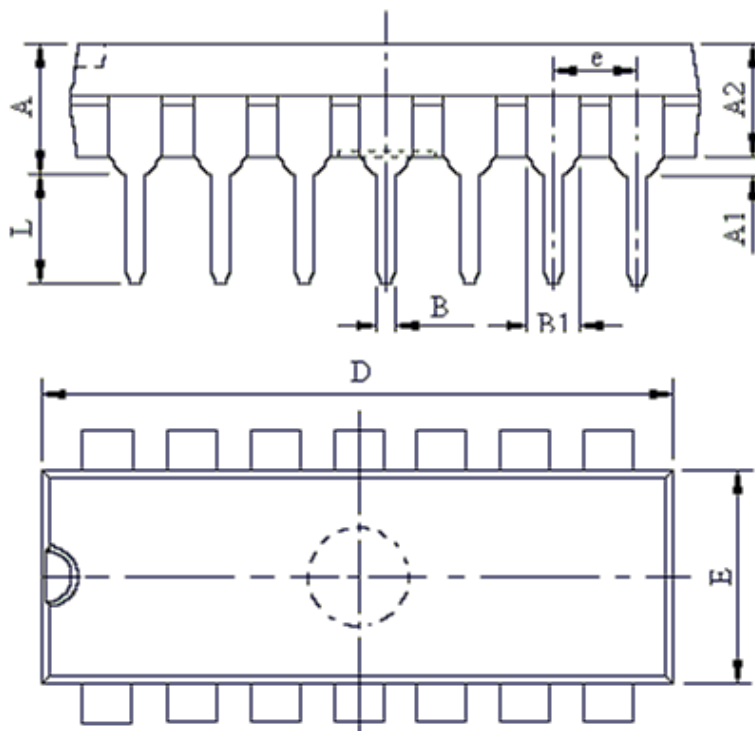
14-pin SOIC



**Note:**

- 1) Controlling dimensions in millimeters.
- 2) Ref: JEDEC MS-012E/AB

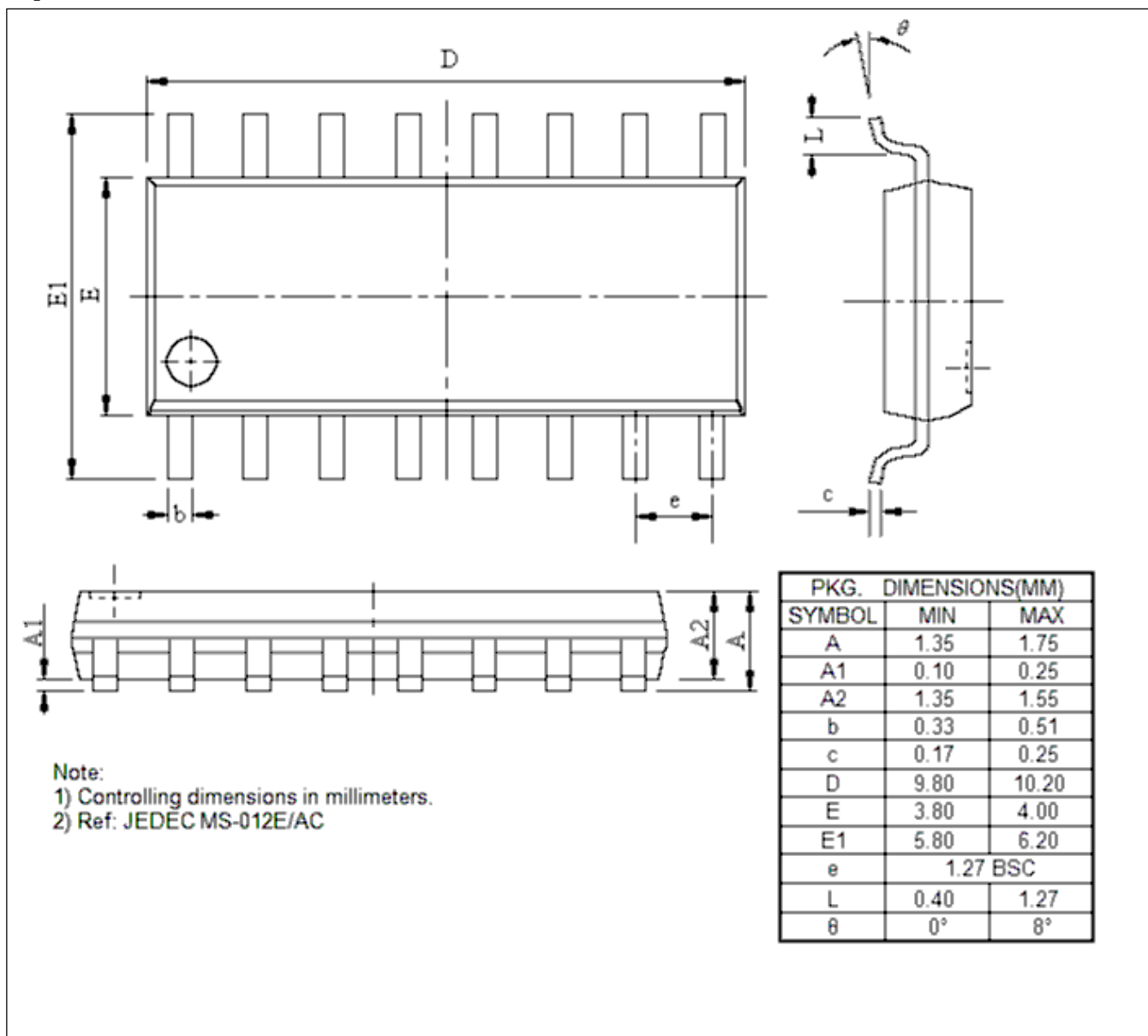
| PKG. DIMENSIONS(MM) |          |      |
|---------------------|----------|------|
| SYMBOL              | MIN      | MAX  |
| A                   | 1.35     | 1.80 |
| A1                  | 0.08     | 0.28 |
| A2                  | 1.20     | 1.60 |
| b                   | 0.33     | 0.51 |
| c                   | 0.19     | 0.26 |
| D                   | 8.45     | 8.85 |
| E                   | 3.70     | 4.10 |
| E1                  | 5.80     | 6.30 |
| e                   | 1.27 TYP |      |
| L                   | 0.40     | 1.27 |
| θ                   | 0°       | 8°   |

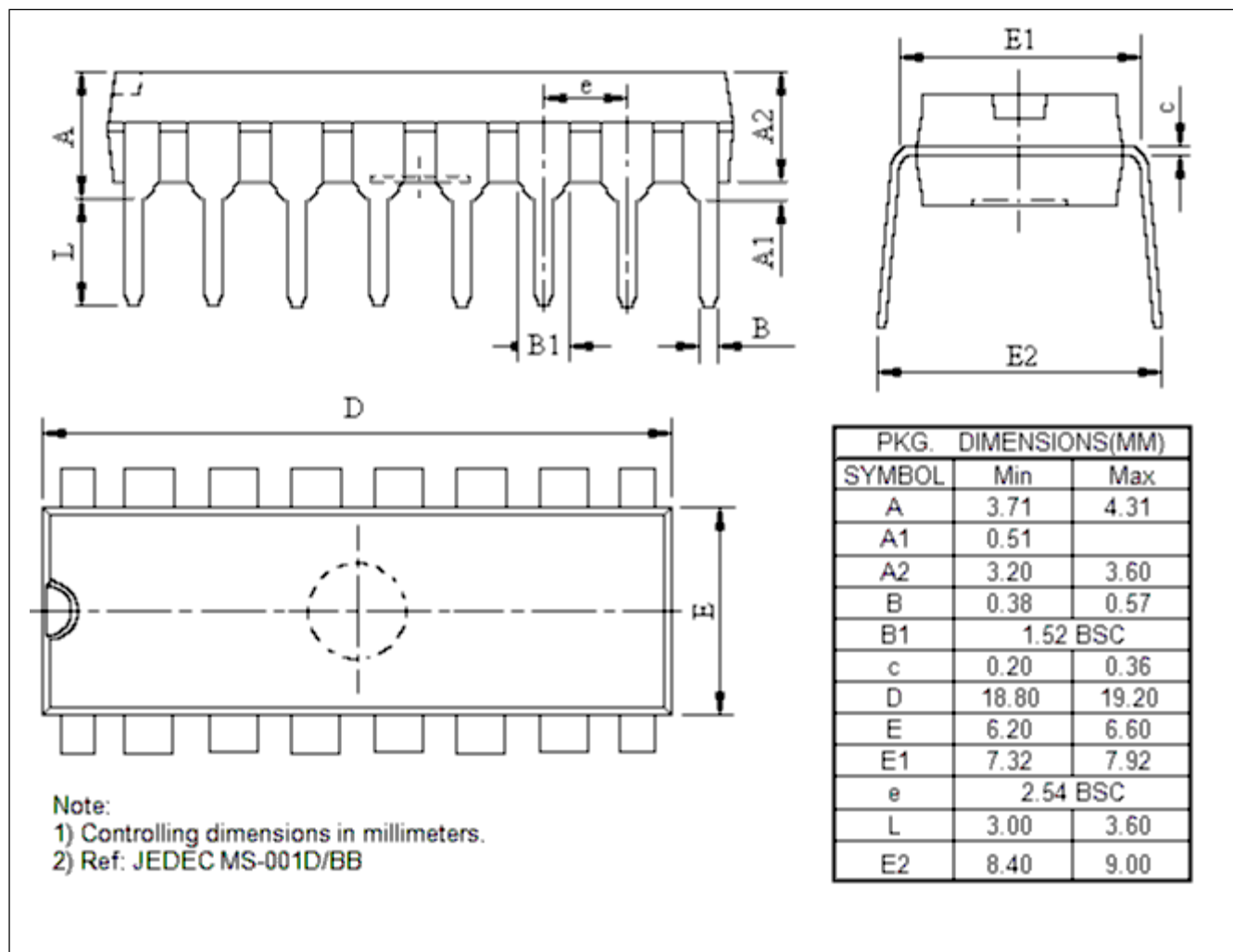
**14-pin DIP**

**Note:**

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

| 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  |

16-pin SOIC



**16-pin DIP**


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