# LOW POWER LOW OFFSET VOLTAGE QUAD COMPARATORS AZ339

## General Description

The AZ339 series consists of four independent precision voltage comparators with an offset voltage specification as low as 2mV. The input common mode voltage range of these comparators includes ground, even when operated from a single power supply voltage. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

The AZ339 series is designed to directly interface with TTL and CMOS.

The AZ339 series can be widely used in such applications as battery charger, cordless telephone, switching power supply, DC-DC module and PC motherboard.

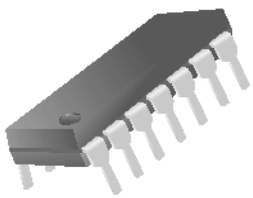
The AZ339 series are available in 2 Packages: DIP-14 and SOIC-14.

## Features

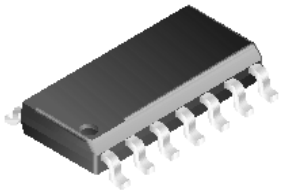
- Wide Supply Voltage Range
  - Single Supply: 2.0V to 18V
  - Dual Supplies: ±1.0V to ± 9V
- Very Low Supply Current Drain: 0.8mA
  - Independent of Supply Voltage
- Low Input Bias Current: 25nA (Typical)
- Low Input Offset Current: ±5nA (Typical)
- Low Input Offset Voltage: ±2mV (Typical)
- Input Common Mode Voltage Range Includes Ground
- Differential Input Voltage Range Equals to the Power Supply Voltage
- Low Output Saturation Voltage: 250mV at 4mA
- Open Collector Output

## Applications

- Battery Charger
- Cordless Telephone
- Switching Power Supply
- DC-DC Module
- PC Motherboard
- Communication Equipment



DIP-14



SOIC-14

Figure 1. Package Types of AZ339

## Pin Configuration

M Package/P Package
SOIC-14/DIP-14

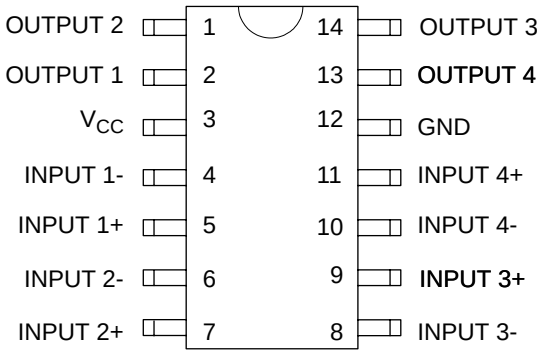



Figure 2. Pin Configuration of AZ339 (Top View)

## Functional Block Diagram

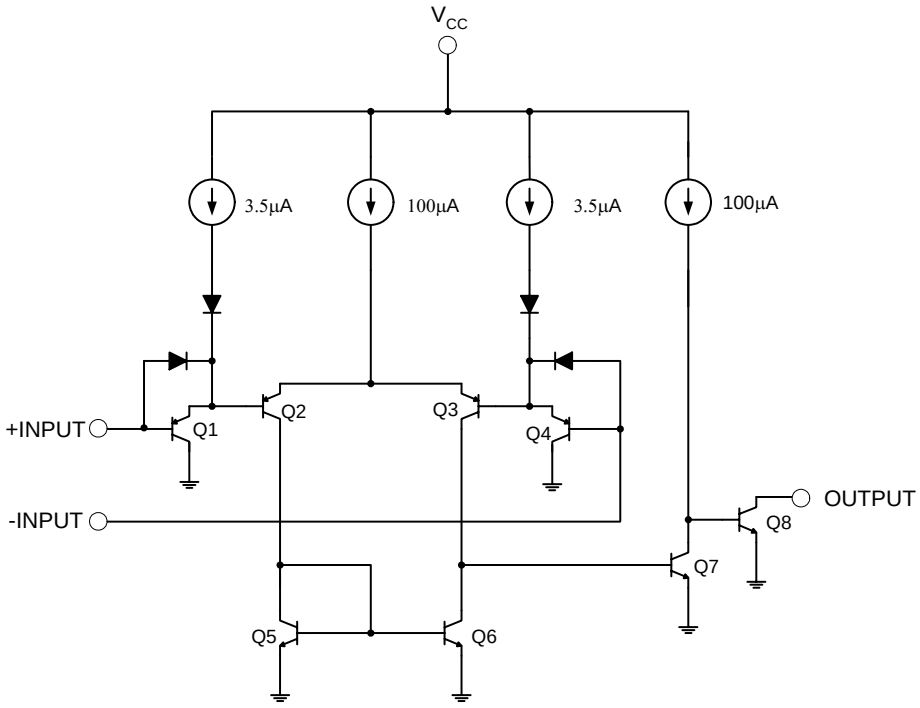
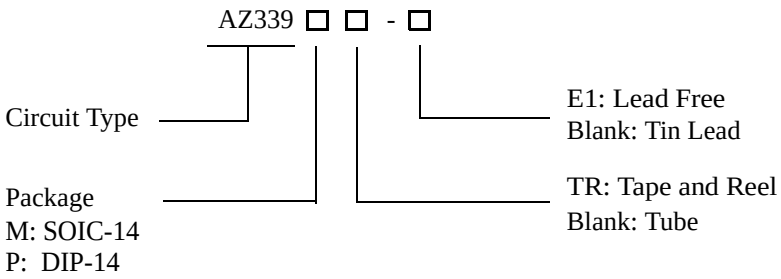



Figure 3. Functional Block Diagram of AZ339
(Each Comparator)

## Ordering Information




| Package | Temperature Range | Part Number | | Marking ID | | Packing Type |
|---|---|---|---|---|---|---|
| | | Tin Lead | Lead Free | Tin Lead | Lead Free | |
| SOIC-14 | -40 to 85 °C | AZ339M | AZ339M-E1 | AZ339M | AZ339M-E1 | Tube |
| | | AZ339MTR | AZ339MTR-E1 | AZ339M | AZ339M-E1 | Tape & Reel |
| DIP-14 | -40 to 85 °C | AZ339P | AZ339P-E1 | AZ339P | AZ339P-E1 | Tube |

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.

## Absolute Maximum Ratings (Note 1)

| Parameter | Symbol | Value | | Unit |
|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 20 | | V |
| Differential Input Voltage | $V_{ID}$ | 20 | | V |
| Input Voltage | $V_{IN}$ | -0.3 to 20 | | V |
| Input Current ($V_{IN}$ < -0.3V) (Note 2) | $I_{IN}$ | 50 | | mA |
| Power Dissipation ($T_A$=25°C) | $P_D$ | DIP-14 | 1050 | mW |
| | | SOIC-14 | 890 | |
| Output Short Circuit to Ground | | Continuous | | |
| Operating Junction Temperature | $T_J$ | 150 | | °C |
| Storage Temperature Range | $T_{STG}$ | -65 to 150 | | °C |
| Lead Temperature (Soldering, 10 seconds) | $T_{LEAD}$ | 260 | | °C |

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Note 2: This input current will only exist when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistors becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is also lateral NPN parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the comparators to go to the V+ voltage level (or to ground for a large overdrive) for the time duration that an input is driven negative. This is not destructive and normal output states will re-establish when the input voltage, which was negative, again returns to a value greater than -0.3 $V_{DC}$ (at 25°C).

## Recommended Operating Conditions

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 2 | 18 | V |
| Operating Temperature Range | $T_A$ | -40 | 85 | °C |

## Electrical Characteristics

$V_{CC}$=5V, GND=0V, $T_A$=25°C, unless otherwise specified.

| Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Input Offset Voltage | (Note 3) | | 2.0 | 5.0 | mV |
| Input Bias Current | $I_{IN}$+ or $I_{IN}$- with output in linear range, $V_{CM}$=0V (Note 4) | | 25 | 250 | nA |
| Input Offset Current | $I_{IN}$+-$I_{IN}$-, $V_{CM}$=0V | | 5.0 | 50 | nA |
| Input Common Mode Voltage Range | $V_{CC}$=15V (Note 5) | 0 | | $V_{CC}$-1.5 | V |
| Supply Current | $R_L$=∞ on all comparators | | 0.8 | 2.0 | mA |
| | $R_L$=∞, $V_{CC}$=18V | | 1.0 | 2.5 | |
| Voltage Gain | $R_L$≥15KΩ, $V_{CC}$=15V, $V_O$=1V to 11V | 50 | 200 | | V/mV |
| Large Signal Response Time | $V_{IN}$=TTL logic swing, $V_{REF}$=1.4V, $V_{RL}$=5V, $R_L$=5.1KΩ | | 300 | | ns |
| Response Time | $V_{RL}$=5V, $R_L$=5.1KΩ (Note 6) | | 1.3 | | μs |
| Output Sink Current | $V_{IN}$-=1V, $V_{IN}$+=0, $V_O$≤1.5V | 6.0 | 16 | | mA |
| Saturation Voltage | $V_{IN}$-=1V, $V_{IN}$+=0, $I_{SINK}$ ≤4mA | | 250 | 400 | mV |
| Output Leakage Current | $V_{IN}$-=0, $V_{IN}$+=1V, $V_O$=5V | | 0.1 | | nA |

Note 3: At output switch point, $V_O$=1.4V, $R_S$=0 with $V_{CC}$ from 5V to 15V, and over the full common-mode range (0V to $V_{CC}$-1.5V), at 25°C.

Note 4: The direction of the input current is out of the PNP input stage. This current is essentially constant, independent of the state of the output, so no loading charge exists on the reference of input lines.

Note 5: The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is $V_{CC}$-1.5V, but either or both inputs can go to +18V without damage, independent of the magnitude of $V_{CC}$.

Note 6: The response time specified is a 100mV input step with 5mV overdrive. For large overdrive signals 300ns can be obtained.

## Typical Performance Characteristics

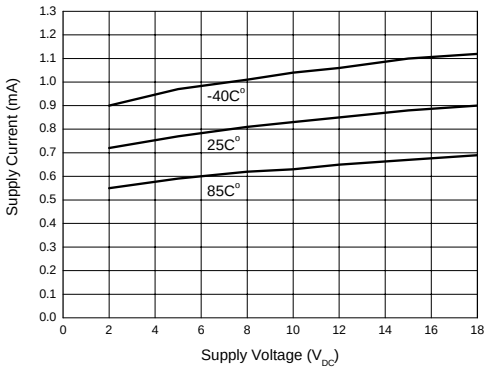



Figure 4. Supply Voltage vs. Supply Current

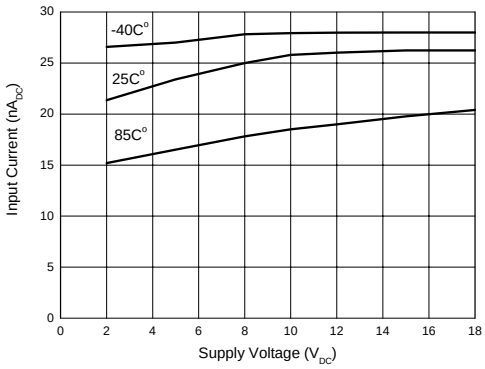



Figure 5. Supply Voltage vs. Input Current

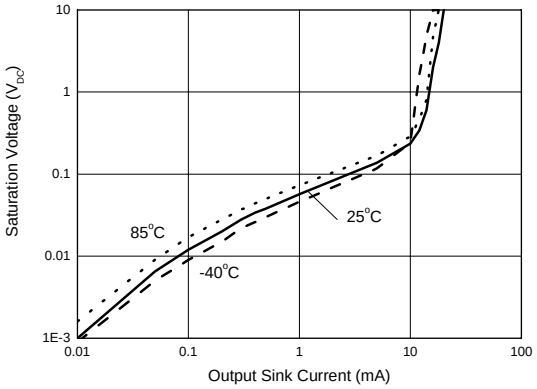



Figure 6. Output Sink Current vs. Saturation Voltage

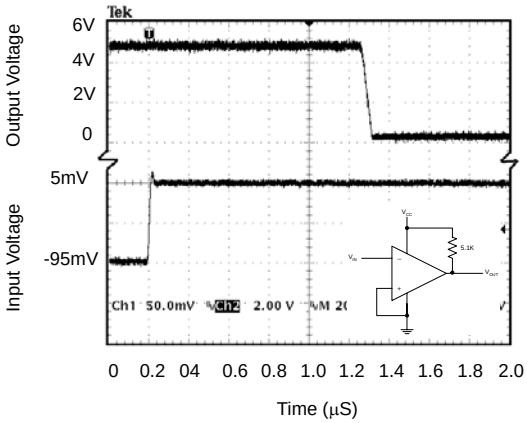



Figure 7. Response Time for 5mV Input Overdrive - Negative Transition

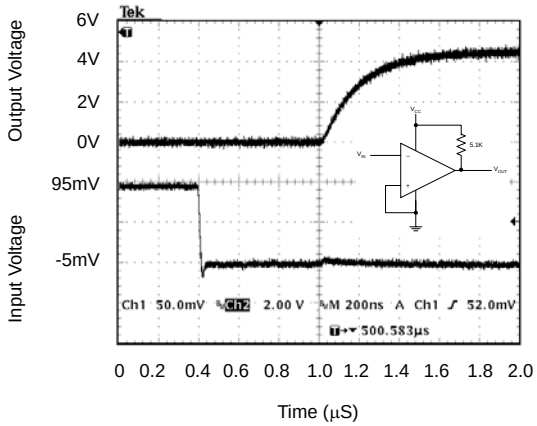



Figure 8. Response Time for 5mV Input Overdrive - Positive Transition

## Typical Applications

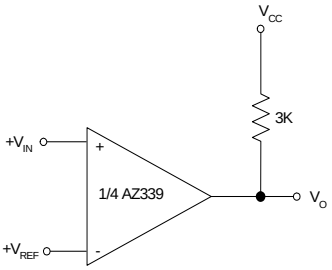



Figure 9. Basic Comparator

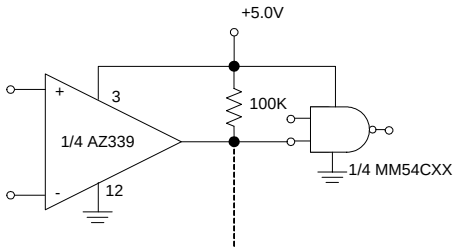



Figure 10. Driving CMOS/TTL

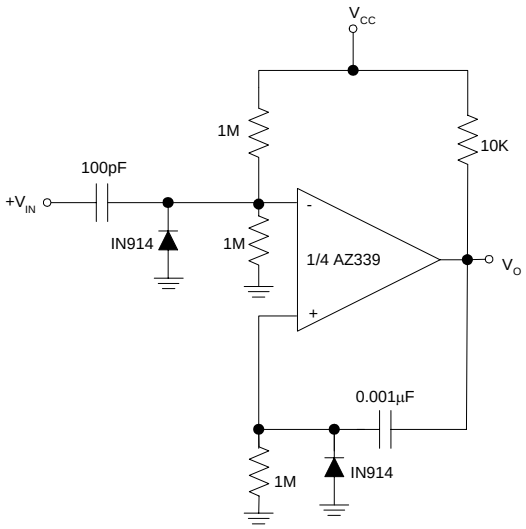



Figure 11. One Shot Multivibrator

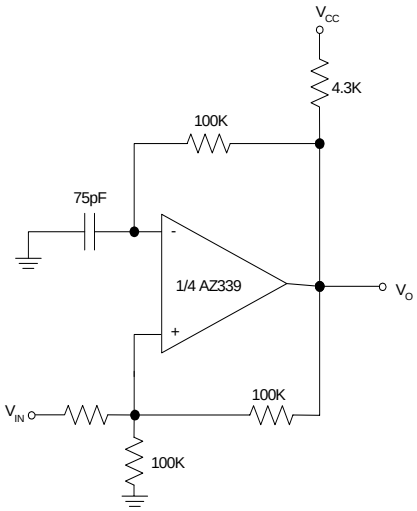
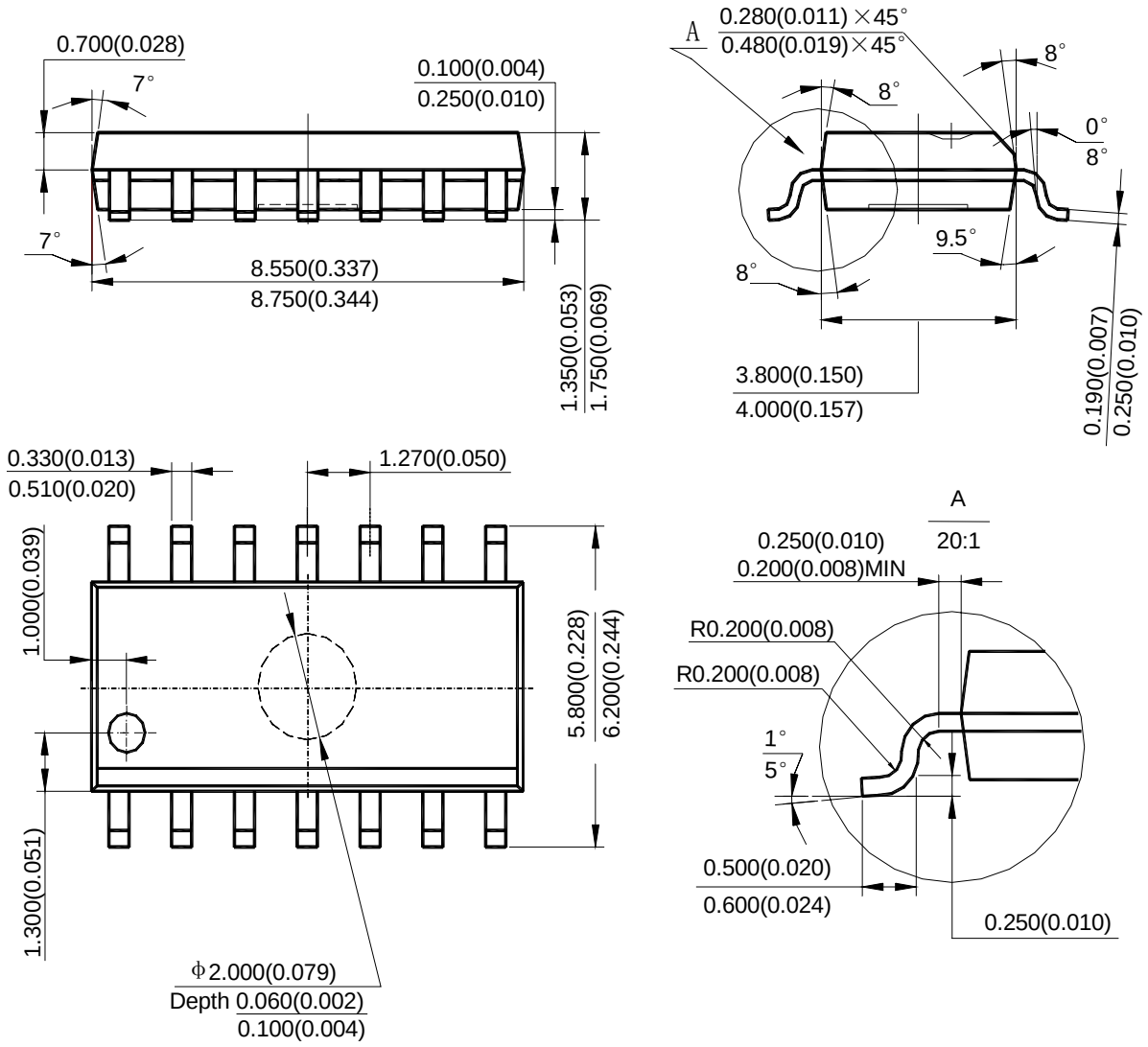



Figure 12. Squarewave Osillator

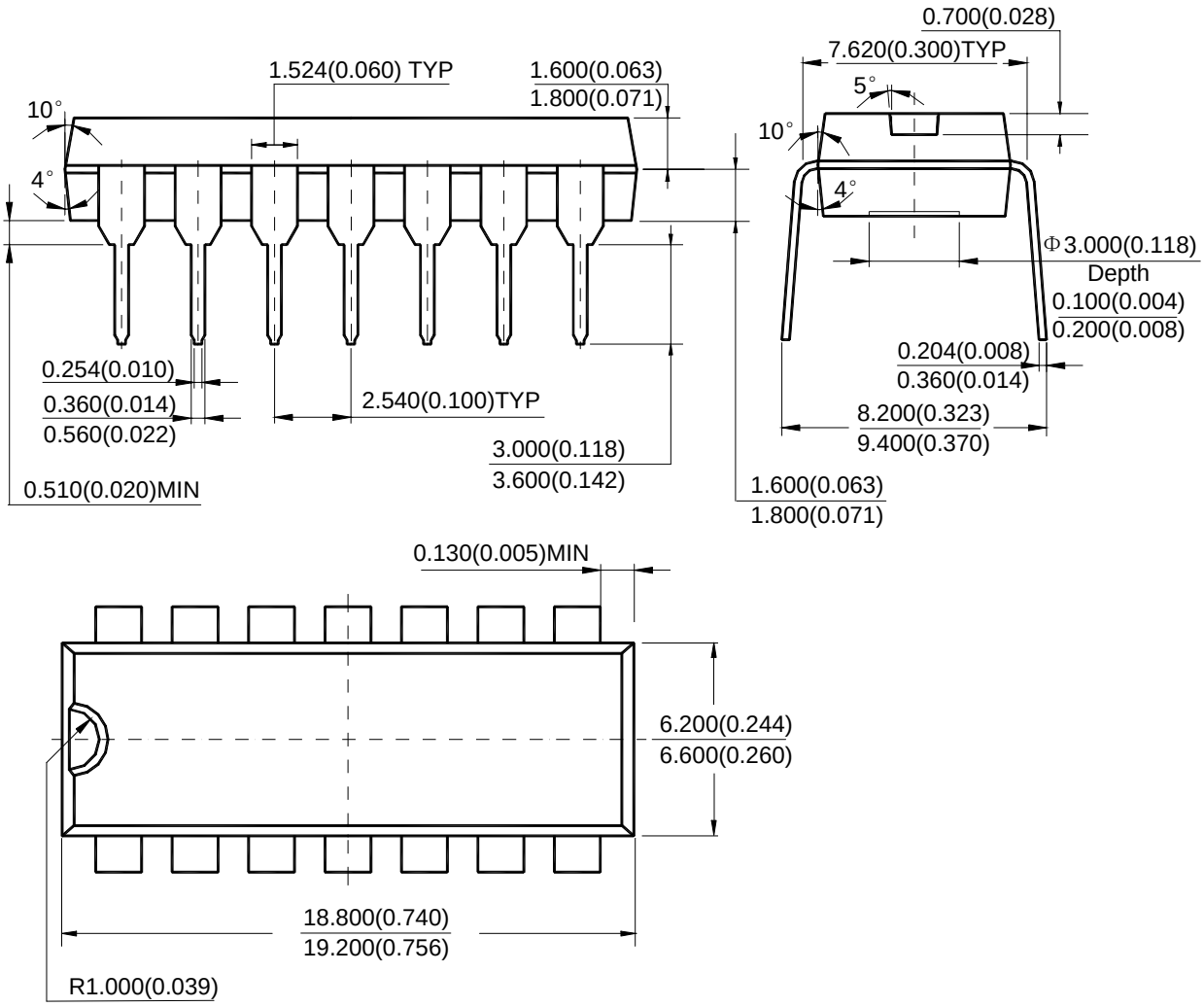
## Mechanical Dimensions

**SOIC-14** **Unit: mm(inch)**



## Mechanical Dimensions (Continued)

**DIP-14** **Unit: mm(inch)**



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