



Advanced Analog Circuits

Data Sheet

## 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:  $\pm 1.0V$  to  $\pm 9V$
- Very Low Supply Current Drain: 0.8mA
  - Independent of Supply Voltage
- Low Input Bias Current: 25nA (Typical)
- Low Input Offset Current:  $\pm 5nA$  (Typical)
- Low Input Offset Voltage:  $\pm 2mV$  (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



Figure 1. Package Types of AZ339



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**AZ339**

## Pin Configuration

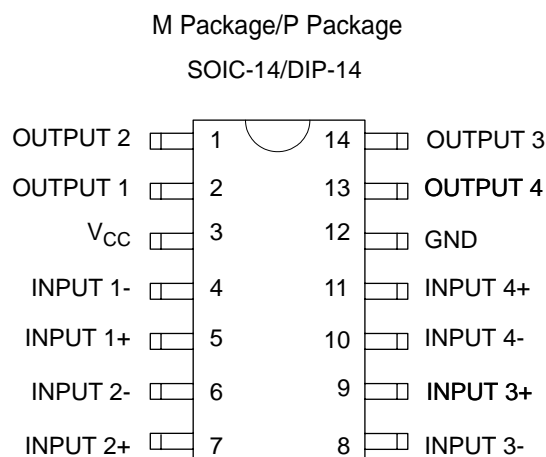


Figure 2. Pin Configuration of AZ339 (Top View)

## Functional Block Diagram

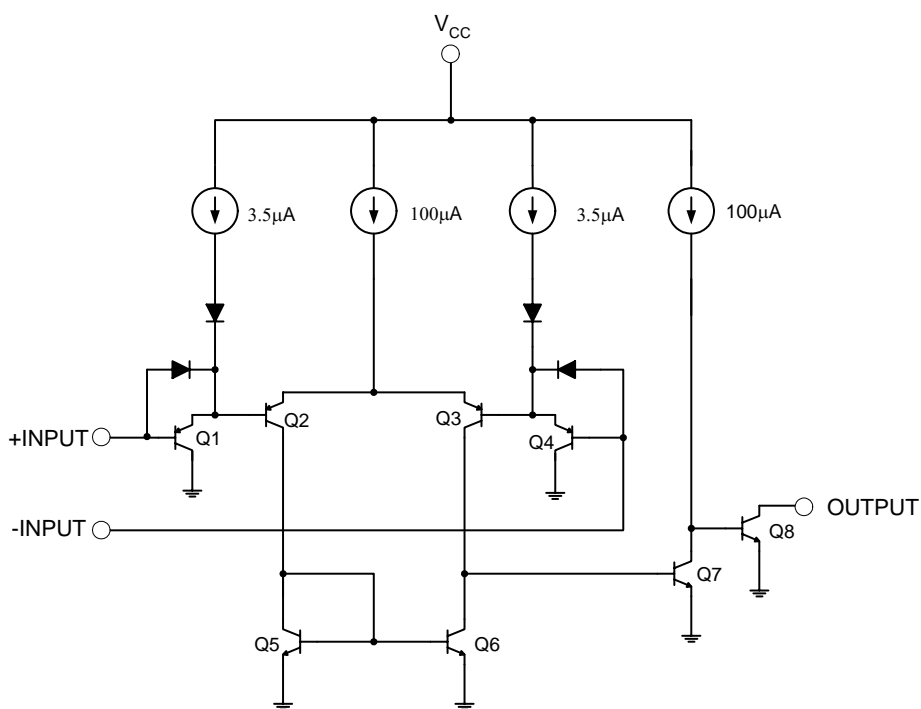


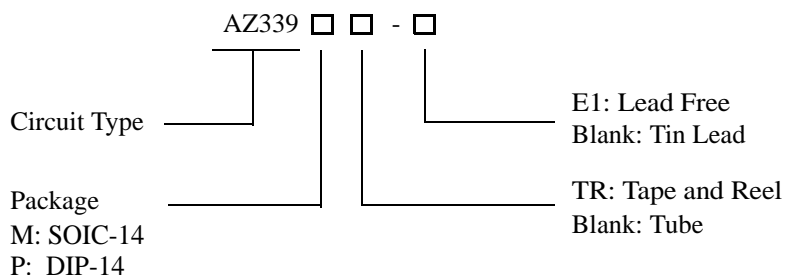
Figure 3. Functional Block Diagram of AZ339  
(Each Comparator)



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## 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.

**LOW POWER LOW OFFSET VOLTAGE QUAD COMPARATORS****AZ339****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 ( $T_A=25^\circ C$ )	$P_D$	DIP-14	1050	mW
		SOIC-14	890	
Output Short Circuit to Ground		Continuous		
Operating Junction Temperature	$T_J$	150		$^\circ C$
Storage Temperature Range	$T_{STG}$	-65 to 150		$^\circ C$
Lead Temperature (Soldering, 10 seconds)	$T_{LEAD}$	260		$^\circ C$

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  $25^\circ C$ ).

**Recommended Operating Conditions**

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



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## Electrical Characteristics

 $V_{CC}=5V$ ,  $GND=0V$ ,  $T_A=25^{\circ}C$ , 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	$R_L=\infty$ on all comparators		0.8	2.0	mA
	$R_L=\infty$ , $V_{CC}=18V$		1.0	2.5	
Voltage Gain	$R_L \geq 15K\Omega$ , $V_{CC}=15V$ , $V_O=1V$ to $11V$	50	200		V/mV
Large Signal Response Time	$V_{IN}$ =TTL logic swing, $V_{REF}=1.4V$ , $V_{RL}=5V$ , $R_L=5.1K\Omega$		300		ns
Response Time	$V_{RL}=5V$ , $R_L=5.1K\Omega$ (Note 6)		1.3		$\mu s$
Output Sink Current	$V_{IN-}=1V$ , $V_{IN+}=0$ , $V_O \leq 1.5V$	6.0	16		mA
Saturation Voltage	$V_{IN-}=1V$ , $V_{IN+}=0$ , $I_{SINK} \leq 4mA$		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  $25^{\circ}C$ .

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.



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## Typical Performance Characteristics

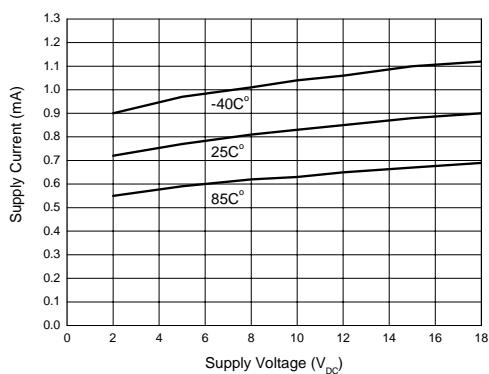


Figure 4. Supply Voltage vs. Supply Current

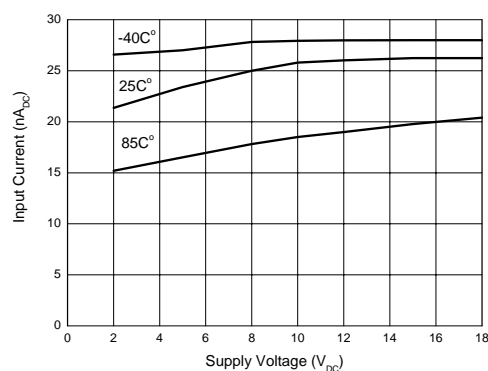


Figure 5. Supply Voltage vs. Input Current

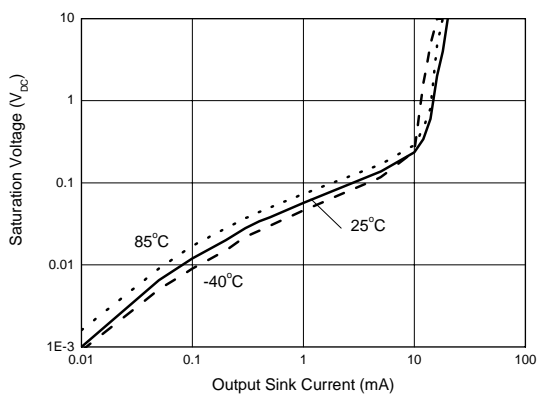


Figure 6. Output Sink Current vs. Saturation Voltage

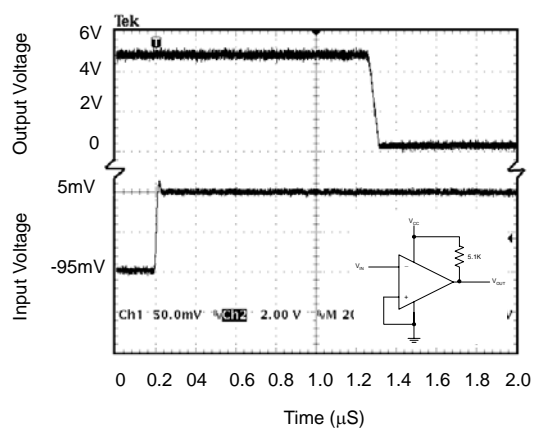


Figure 7. Response Time for 5mV Input Overdrive - Negative Transition

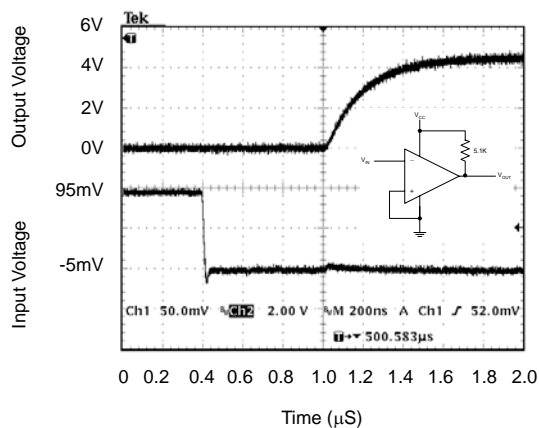


Figure 8. Response Time for 5mV Input Overdrive - Positive Transition



# LOW POWER LOW OFFSET VOLTAGE QUAD COMPARATORS

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## Typical Applications

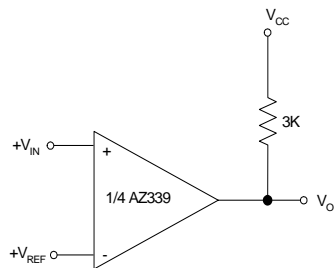


Figure 9. Basic Comparator

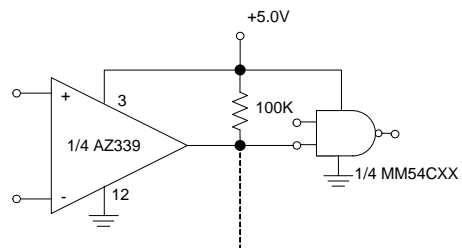


Figure 10. Driving CMOS/TTL

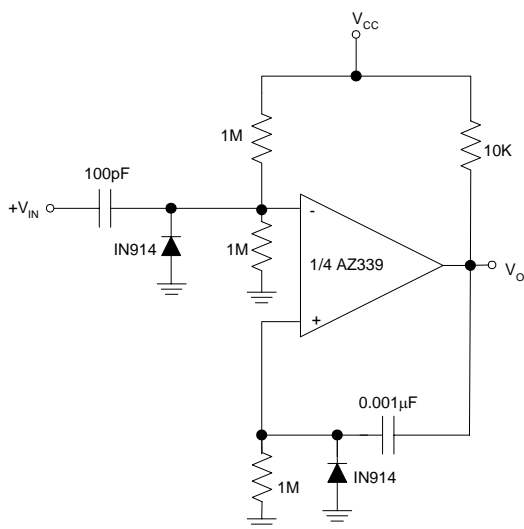


Figure 11. One Shot Multivibrator

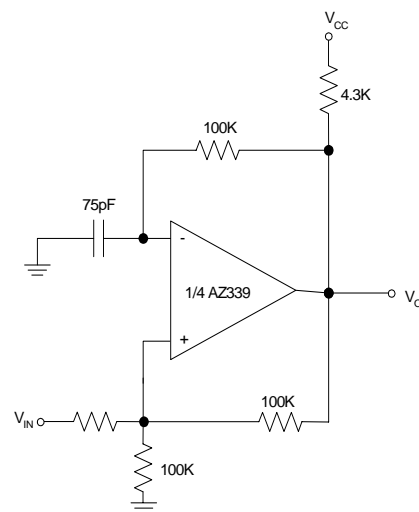


Figure 12. Squarewave Oscillator



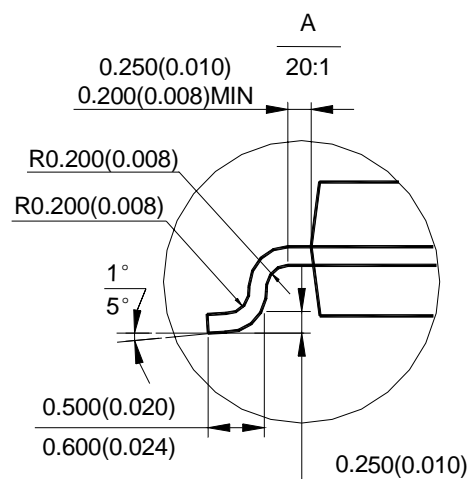
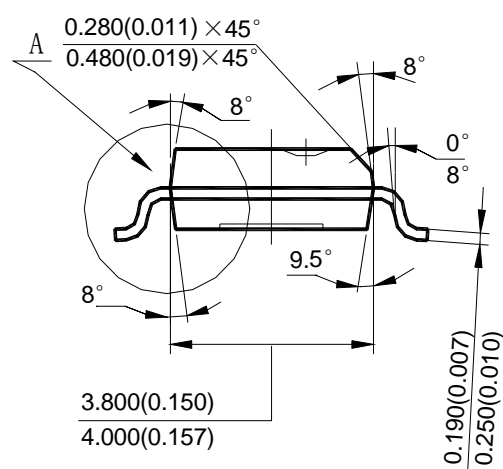
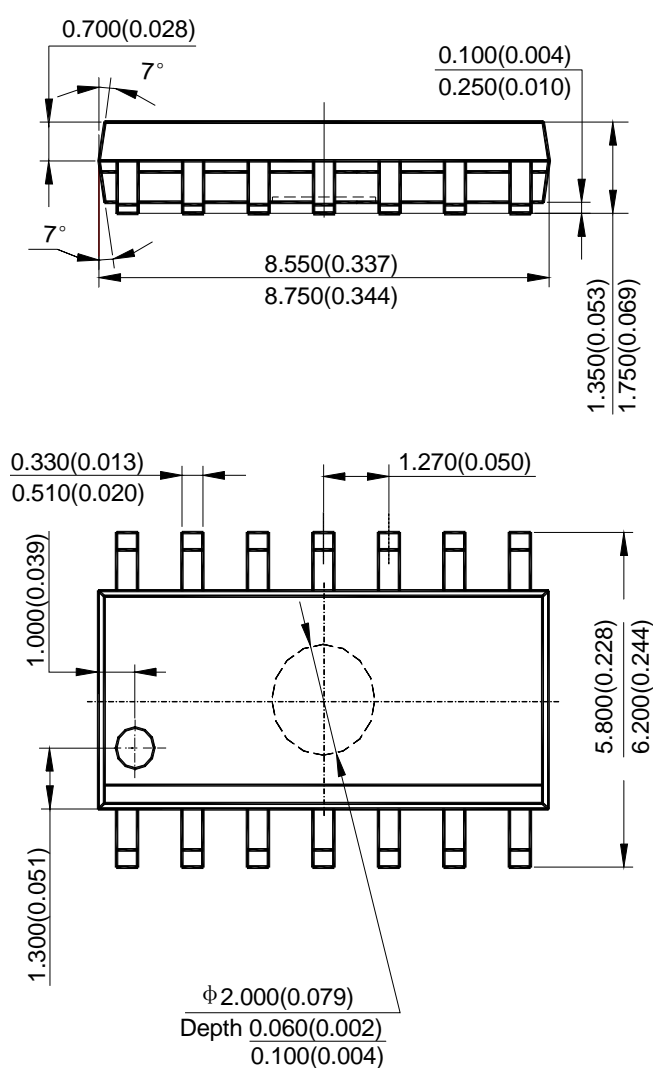
**LOW POWER LOW OFFSET VOLTAGE QUAD COMPARATORS**

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**Mechanical Dimensions**

**SOIC-14**

**Unit: mm(inch)**

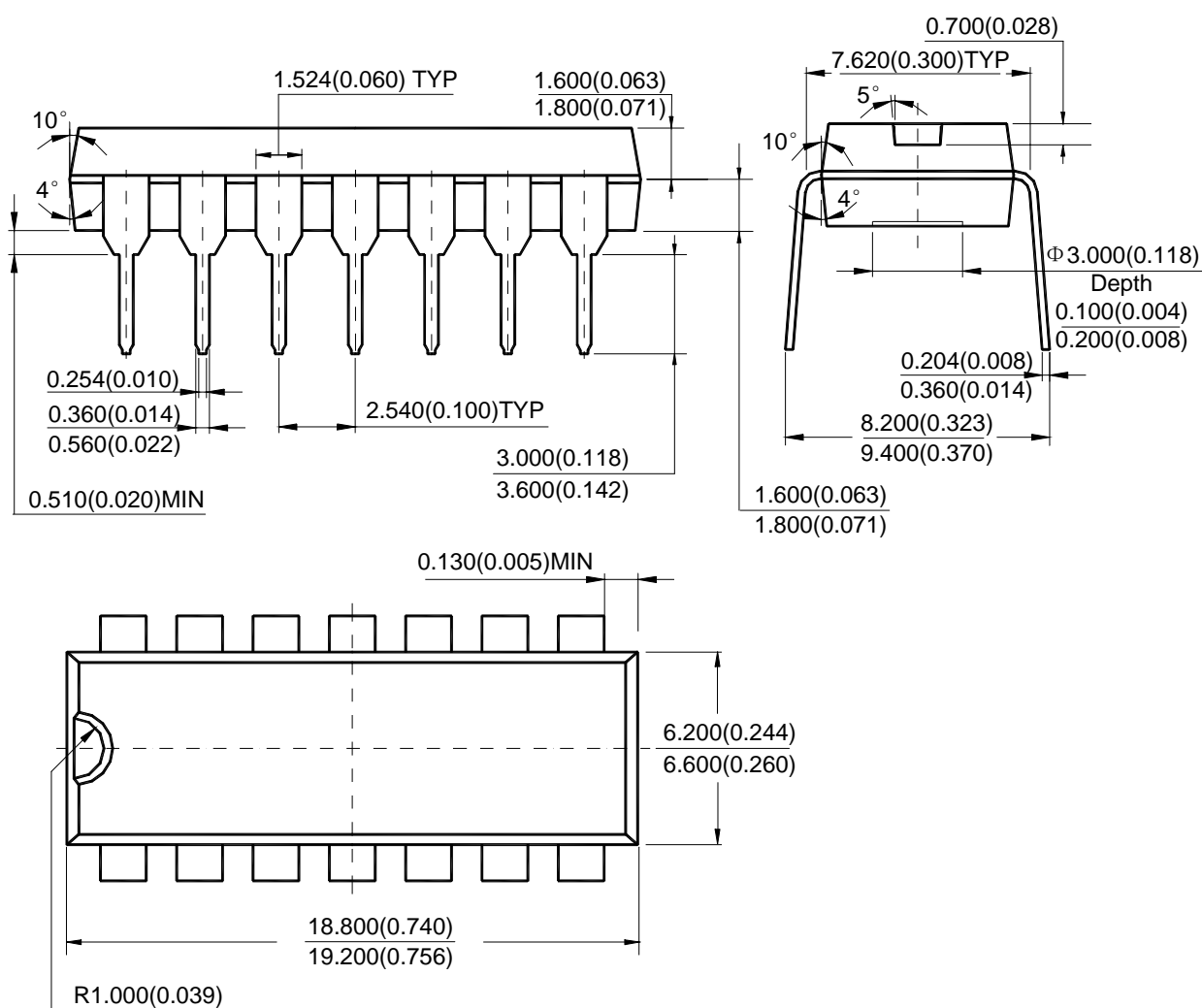






### Mechanical Dimensions (Continued)

Unit: mm(inch)





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