



**Low Power Offset Voltage Quad Comparators**

**LM339** Low Power Offset Voltage Quad Comparators

**General Description**

The LM339 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 LM339 series is designed to directly interface with TTL and CMOS.

The LM339 series can be widely used in such applications as battery charger, cordless telephone, switching power supply, DC-DC module and PC motherboard.

The LM339 series are available in 2 Packages: DIP-14 and SOP-14.

**Features**

- Wide Supply Voltage Range
  - Single Supply: 2.0V to 36V
  - Dual Supplies:  $\pm 1.0V$  to  $\pm 18V$
- 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

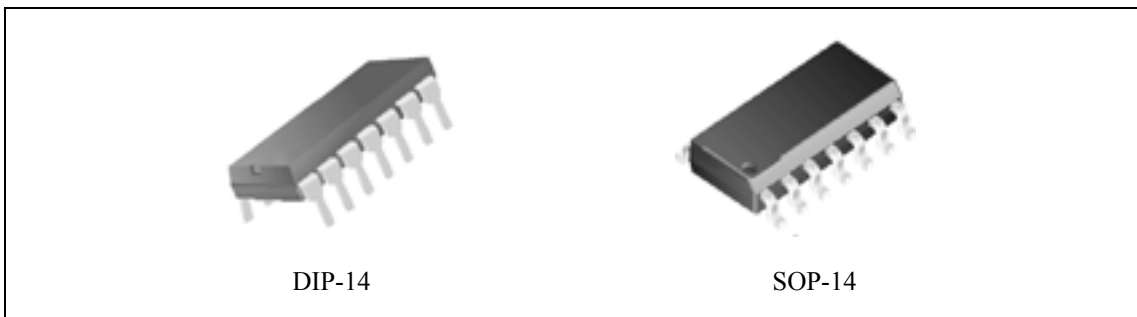


Figure 1. Package Types of LM339

# ELECTRICAL CHARACTERISTICS

## Pin Configuration

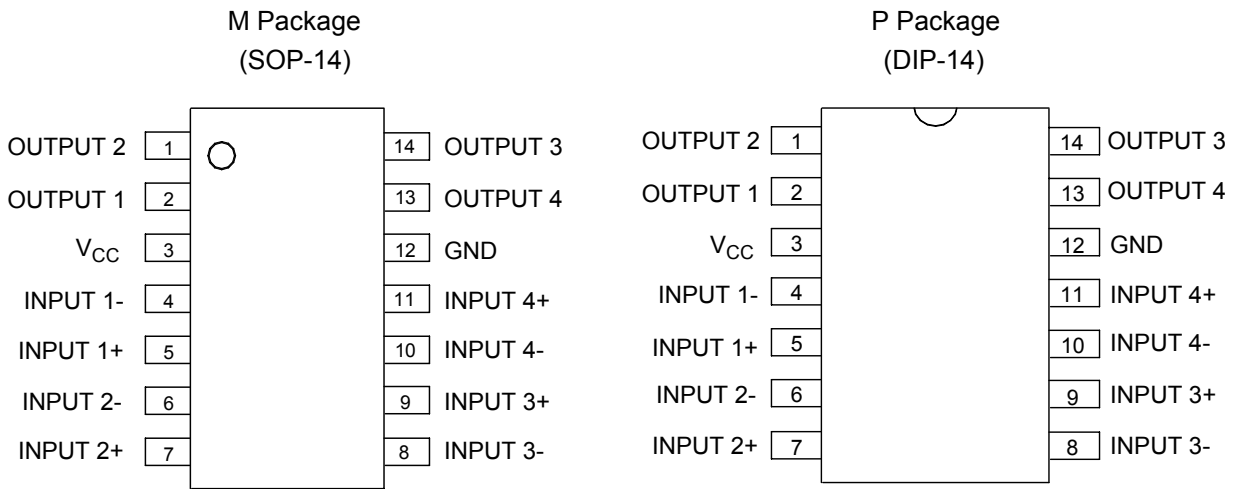


Figure 2. Pin Configuration of LM339 (Top View)

## Functional Block Diagram

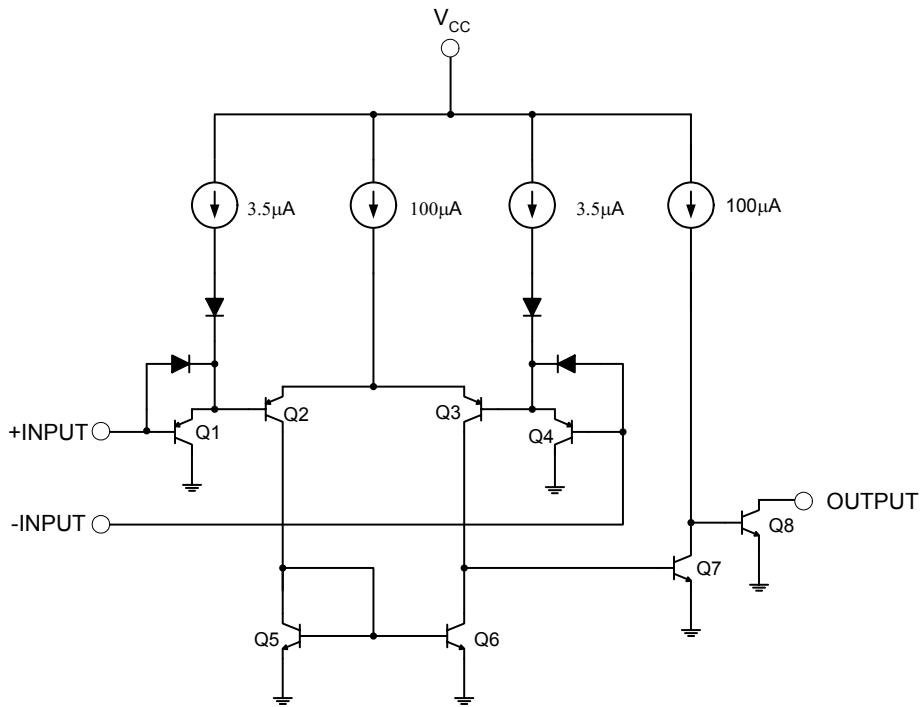


Figure 3. Functional Block Diagram of LM339 (Each Comparator)

## ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value		Unit
Supply Voltage	$V_{CC}$	36		V
Differential Input Voltage	$V_{ID}$	36		V
Input Voltage	$V_{IN}$	-0.3 to 36		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
		SOP-14	890	
Output Short Circuit to Ground		Continuous		
Maximum 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	36	V
Operating Temperature Range	$T_A$	-40	85	$^\circ C$

# ELECTRICAL CHARACTERISTICS

## 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	$R_L=\infty$ , $V_{CC}=5V$		0.8	2.0	mA
	$R_L=\infty$ , $V_{CC}=36V$		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
Thermal Resistance (Junction to Case)	DIP-14		40.60		$^{\circ}C/W$
	SOP-14		60.24		

Note 3: At output switch point,  $V_O=1.4V$ ,  $R_S=0$  with  $V_{CC}$  from  $5V$  to  $30V$ , 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.

# Typical Performance Characteristics

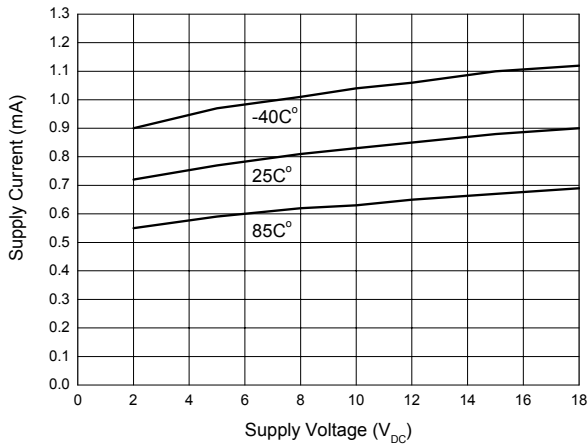


Figure 4. Supply Voltage vs. Supply Current

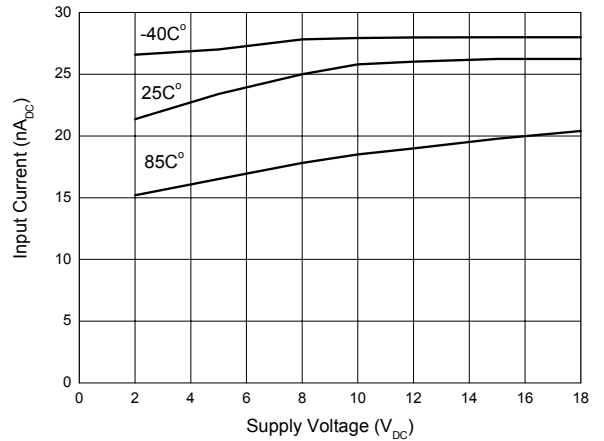


Figure 5. Supply Voltage vs. Input Current

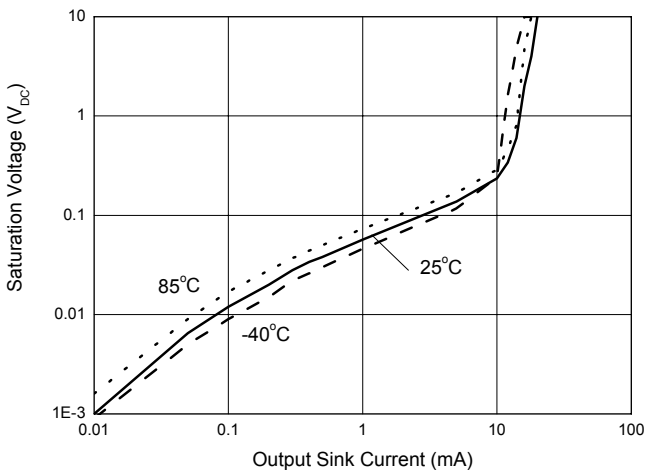


Figure 6. Output Sink Current vs. Saturation Voltage

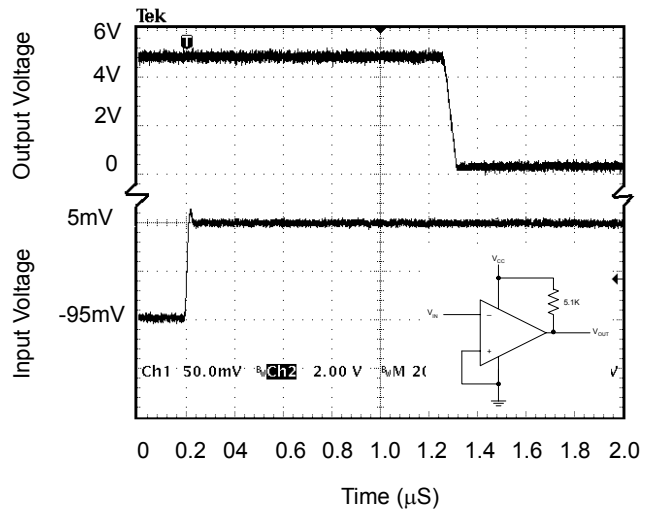


Figure 7. Response Time for 5mV Input Overdrive - Negative Transition

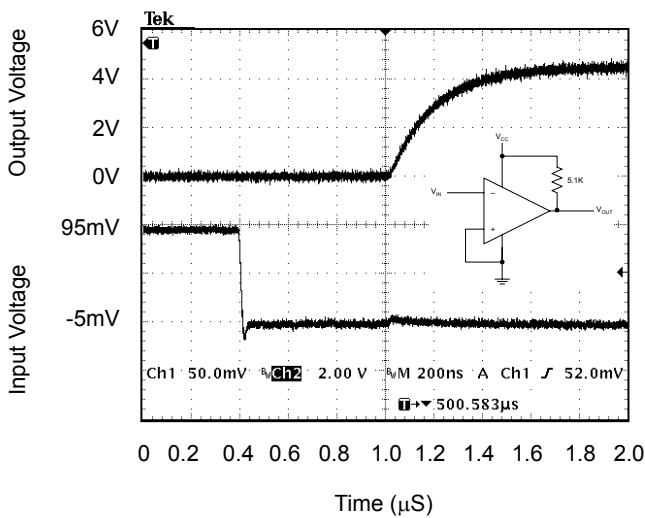


Figure 8. Response Time for 5mV Input Overdrive - Positive Transition

## Typical Application

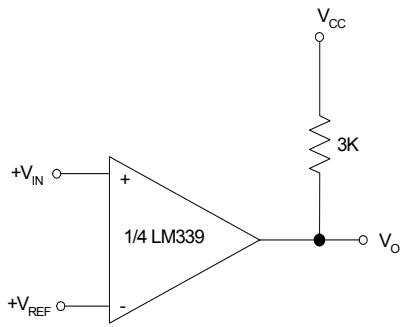


Figure 9. Basic Comparator

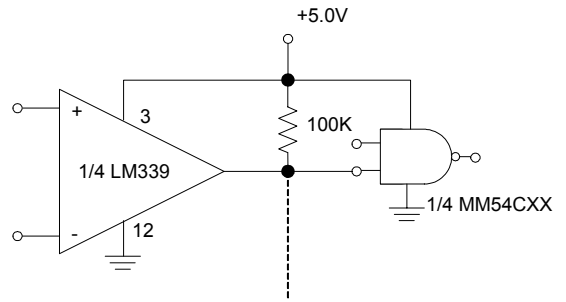


Figure 10. Driving CMOS/TTL

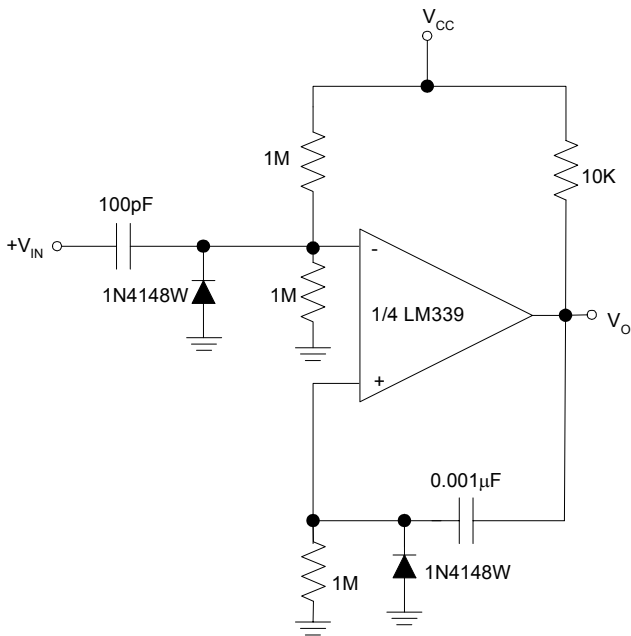


Figure 11. One Shot Multivibrator

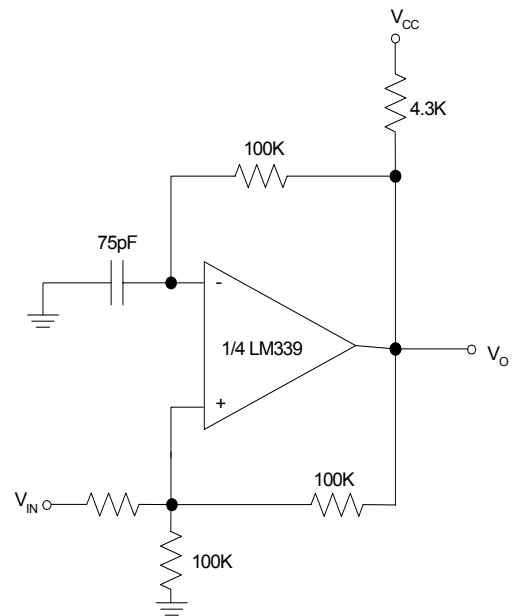
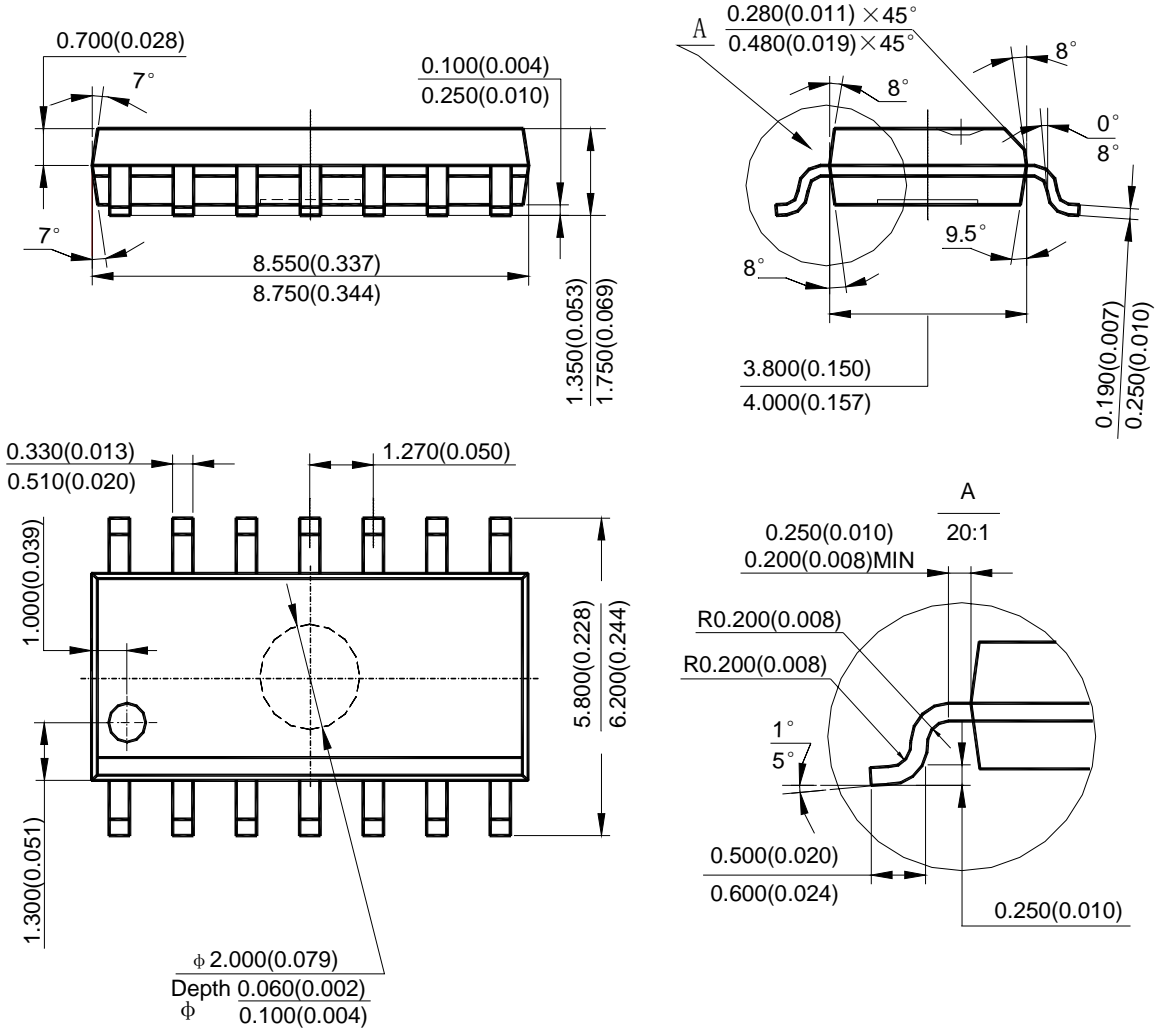


Figure 12. Squarewave Oscillator

# SOP-14 Package Outline Dimensions

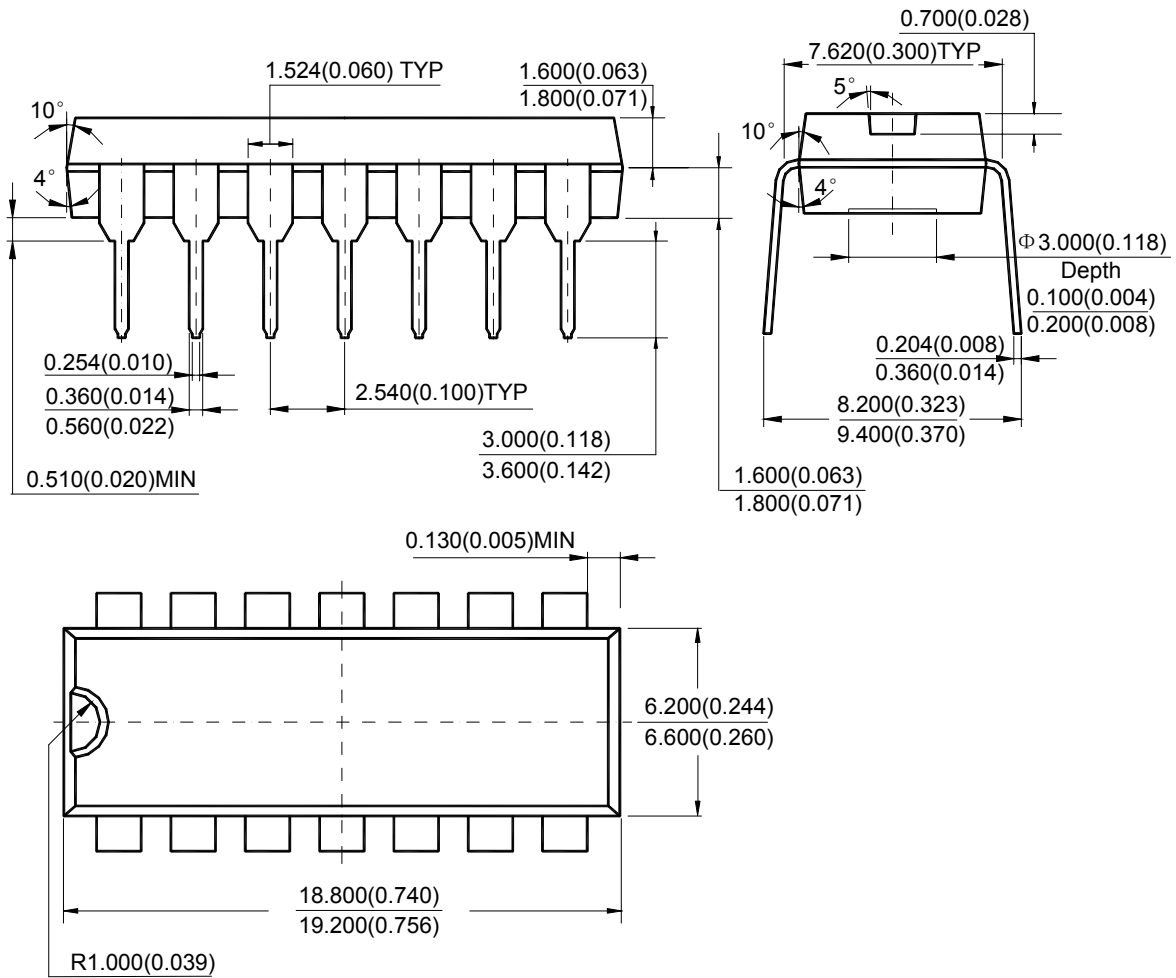
Unit: mm(inch)



Note: Eject hole, oriented hole and mold mark is optional.

# DIP-14 Package Outline Dimensions

Unit: mm(inch)



Note: Eject hole, oriented hole and mold mark is optional.



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