

**LOW POWER LOW OFFSET VOLTAGE SINGLE COMPARATOR****AS331****General Description**

The AS331 consists of a single precision voltage comparator with a typical input offset voltage of 1.0mV and high voltage gain. It is specifically designed to operate from a single power supply over wide range of voltages. Operation from split power supply is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

The AS331 is available in standard SOT-23-5 package.

**Features**

- Wide Supply Voltage Range
  - Single Supply: 2V to 36V
  - Dual Supplies:  $\pm 1V$  to  $\pm 18V$
- Low Supply Current at  $V_{CC}=5V$ : 0.4mA
- Low Input Bias Current: 25nA (Typical)
- Low Input Offset Current: 5nA (Typical)
- Low Input Offset Voltage: 1mV (Typical)
- Input Common Mode Voltage Range Includes Ground
- Differential Input Voltage Range Equals to the Power Supply Voltage
- Low Output Saturation Voltage at 4mA: 200mV (Typical)
- Open Collector Output

**Applications**

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

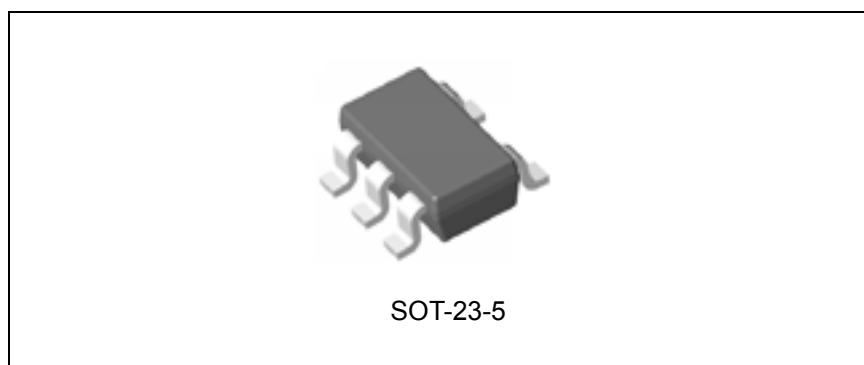


Figure 1. Package Type of AS331

**LOW POWER LOW OFFSET VOLTAGE SINGLE COMPARATOR AS331**

**Pin Configuration**

K Package  
(SOT-23-5)

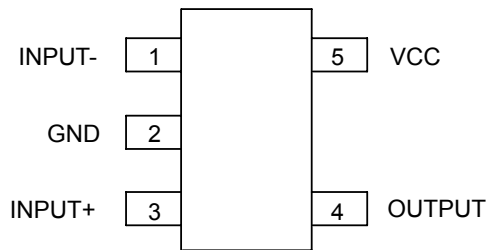


Figure 2. Pin Configuration of AS331 (Top View)

**Functional Block Diagram**

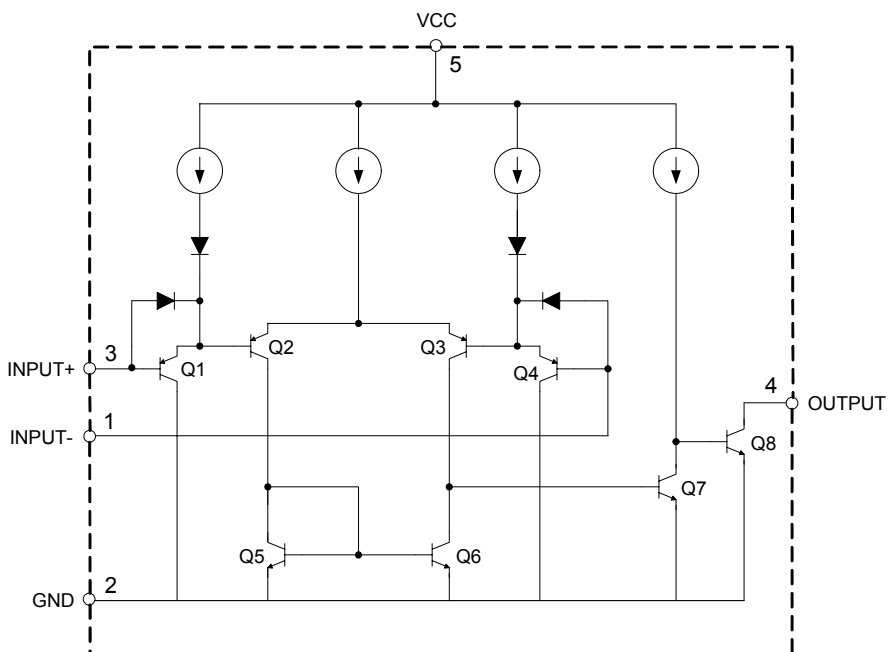
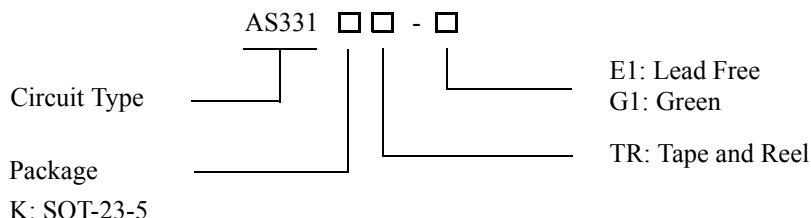


Figure 3. Functional Block Diagram of AS331



**LOW POWER LOW OFFSET VOLTAGE SINGLE COMPARATOR AS331**

**Ordering Information**



| Package  | Temperature Range | Part Number |             | Marking ID |       | Packing Type |
|----------|-------------------|-------------|-------------|------------|-------|--------------|
|          |                   | Lead Free   | Green       | Lead Free  | Green |              |
| SOT-23-5 | -40 to 85°C       | AS331KTR-E1 | AS331KTR-G1 | EEA        | GEA   | Tape & Reel  |

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green package.

**Absolute Maximum Ratings (Note 1)**

| Parameter                                       | Symbol            | Value      | Unit |
|---|-------------------|------------|------|
| Supply Voltage                                  | V <sub>CC</sub>   | 40         | V    |
| Differential Input Voltage                      | V <sub>ID</sub>   | 40         | V    |
| Input Voltage                                   | V <sub>IN</sub>   | -0.3 to 40 | V    |
| Input Current (V <sub>IN</sub> <-0.3V) (Note 2) | I <sub>IN</sub>   | 50         | mA   |
| Output Short-circuit Current to Ground          |                   | Continuous |      |
| Power Dissipation (T <sub>A</sub> =25°C)        | P <sub>D</sub>    | 620        | mW   |
| Operating Junction Temperature                  | T <sub>J</sub>    | 150        | °C   |
| Storage Temperature                             | T <sub>STG</sub>  | -65 to 150 | °C   |
| Lead Temperature (Soldering, 10sec)             | T <sub>LEAD</sub> | 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 -0.3V (at 25°C).



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**Recommended Operating Conditions**

| Parameter                           | Symbol   | Min | Max | Unit |
|-------------------------------------|----------|-----|-----|------|
| Supply Voltage                      | $V_{CC}$ | 2   | 36  | V    |
| Operating Ambient Temperature Range | $T_A$    | -40 | 85  | °C   |

**Electrical Characteristics**

$V_{CC}=5V$ ,  $GND=0V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified. **Bold** typeface applies over  $T_A=-40$  to  $85^{\circ}C$  (Note 3)

| Parameter                                | Symbol     | Conditions  | Min         | Typ          | Max          | Unit       |    |
|--|------------|---|-------------|--------------|--------------|------------|----|
| Input Offset Voltage                     | $V_{OS}$   | $V_{OUT}=1.4V$ , $V_{CC}=5$ to $30V$                            |             | 1            | 5            | mV         |    |
|  |            |   |             |              | <b>7.0</b>   |            |    |
| Input Bias Current                       | $I_B$      | $I_{IN+}$ or $I_{IN-}$ with output in linear range, $V_{CM}=0V$ |             | 25           | 250          | nA         |    |
|  |            |   |             |              | <b>400</b>   |            |    |
| Input Offset Current                     | $I_{IO}$   | $I_{IN+}-I_{IN-}$ , $V_{CM}=0V$                                 |             | 5            | 50           | nA         |    |
|  |            |   |             |              | <b>200</b>   |            |    |
| Input Common Mode Voltage Range (Note 4) |            | $V_{CC}=30V$  | 0           |              | $V_{CC}-1.5$ | V          |    |
| Supply Current                           | $I_{CC}$   | $R_L=\infty$  | $V_{CC}=5V$ |              | 0.4          | 1.0        | mA |
|  |            |   |             |              |              | <b>2.0</b> |    |
|  |            |   |             | $V_{CC}=30V$ |              | 0.5        |    |
|  |            |   |             |              |              | <b>3.0</b> |    |
| Voltage Gain                             | $G_V$      | $V_{CC}=15V$ , $R_L \geq 15k\Omega$ , $V_{OUT}=1$ to $11V$      | 50          | 200          |              | V/mV       |    |
| Large Signal Response Time               |            | $V_{IN} = \text{TTL Logic Swing}$ , $R_L=5.1k\Omega$            |             | 200          |              | ns         |    |
| Response Time                            |            | $R_L=5.1k\Omega$  |             | 1.3          |              | $\mu s$    |    |
| Output Sink Current                      | $I_{SINK}$ | $V_{IN-}=1V$ , $V_{IN+}=0V$ , $V_{OUT}=1.5V$                    | 6.0         | 16           |              | mA         |    |
| Output Leakage Current                   | $I_{LEAK}$ | $V_{IN-}=0V$ , $V_{IN+}=1V$ , $V_{OUT}=5V$                      |             | 0.1          |              | nA         |    |
|  |            | $V_{IN-}=0V$ , $V_{IN+}=1V$ , $V_{OUT}=30V$                     |             |              | <b>1</b>     | $\mu A$    |    |
| Saturation Voltage                       | $V_{SAT}$  | $V_{IN-}=1V$ , $V_{IN+}=0V$ , $I_{SINK} \leq 4mA$               |             | 200          | 400          | mV         |    |
|  |            |   |             |              | <b>500</b>   |            |    |

Note 3: These specifications are limited to  $-40^{\circ}C \leq T_A \leq 85^{\circ}C$ . Limits over temperature are guaranteed by design, but not tested in production.

Note 4: The input common mode voltage of either input signal voltage should not be allowed to go negatively by more than 0.3V (at 25°C). The upper end of the common mode voltage range is  $V_{CC}-1.5V$  (at 25°C), but either or both inputs can go to +36V without damages, independent of the magnitude of the  $V_{CC}$ .



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**Typical Performance Characteristics**

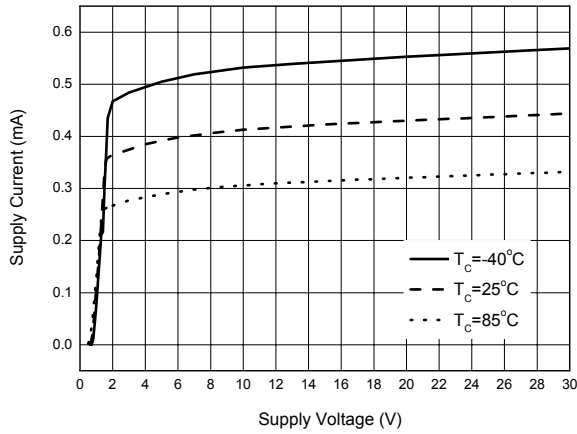


Figure 4. Supply Current vs. Supply Voltage

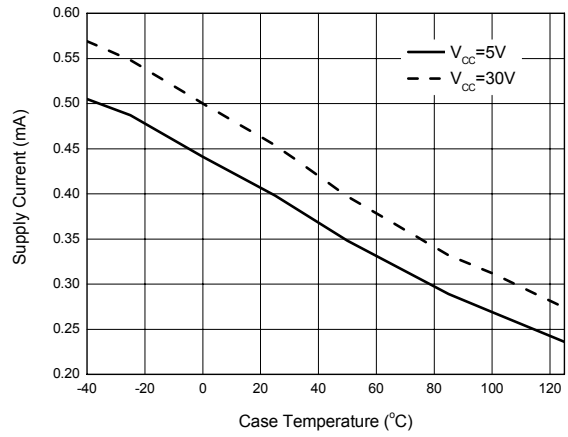


Figure 5. Supply Current vs. Case Temperature

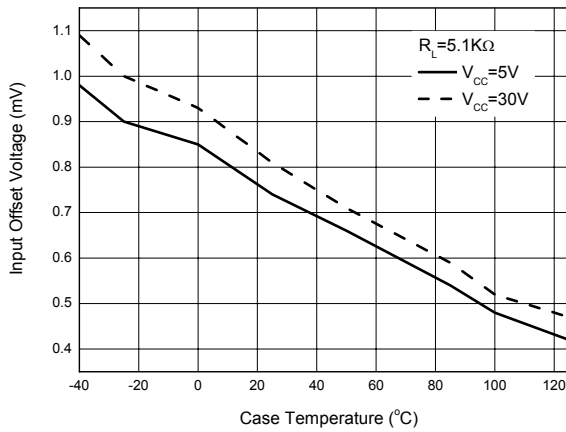


Figure 6. Input Offset Voltage vs. Case Temperature

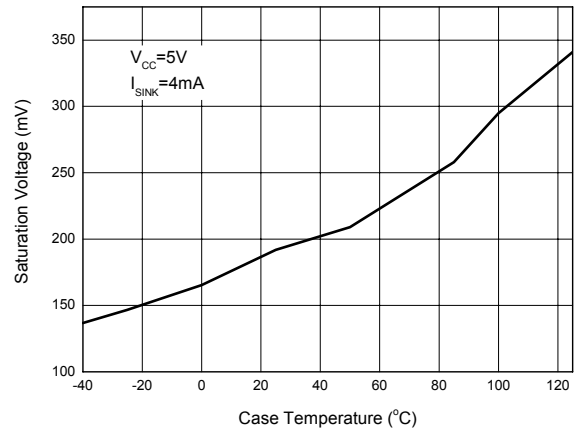


Figure 7. Saturation Voltage vs. Case Temperature



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**Typical Performance Characteristics (Continued)**

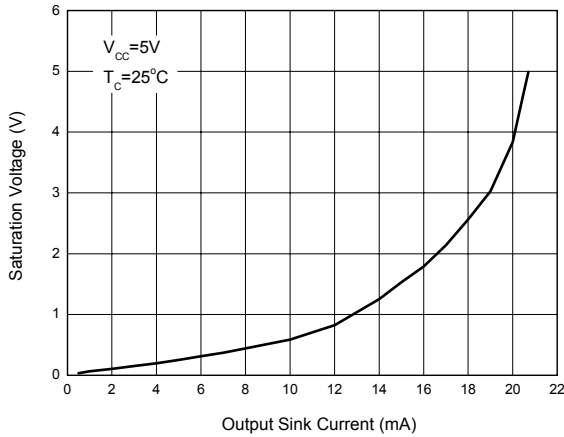


Figure 8. Saturation Voltage vs. Output Sink Current

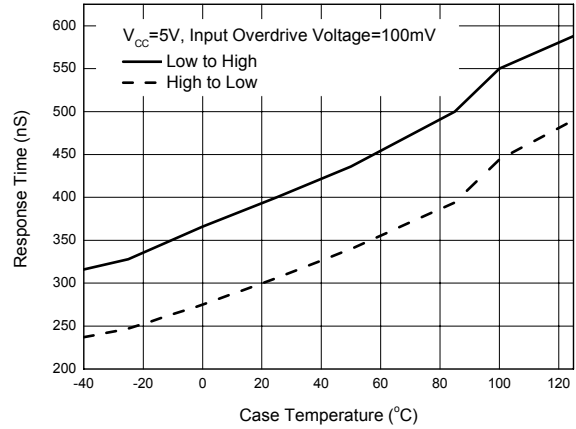


Figure 9. Response Time vs. Case Temperature

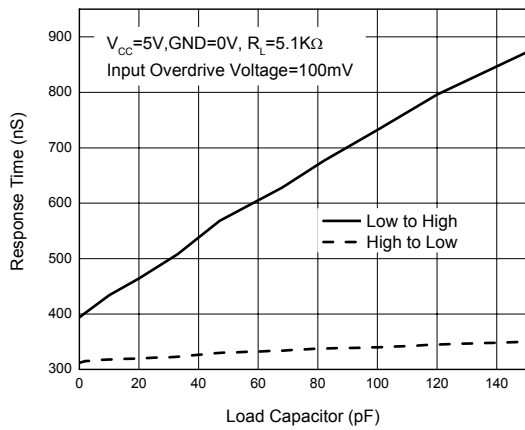


Figure 10. Response Time vs. Load Capacitor

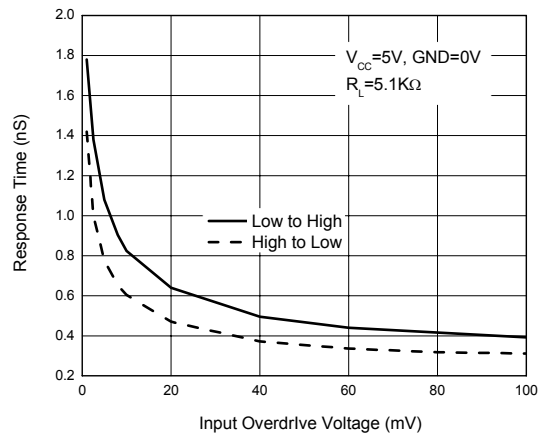


Figure 11. Response Time vs. Input Overdrive Voltage



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**Typical Performance Characteristics (Continued)**

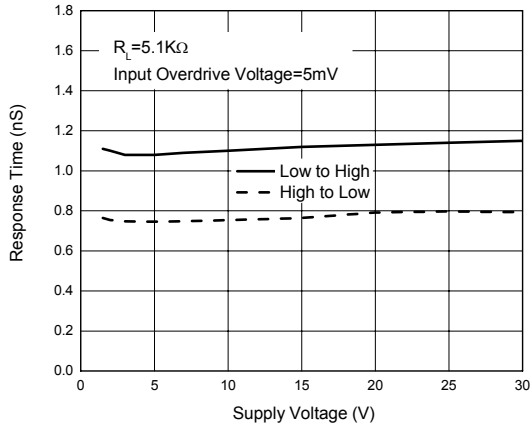


Figure 12. Response Time vs. Supply Voltage

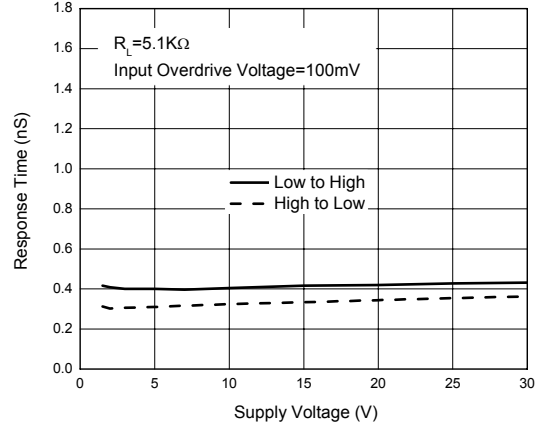


Figure 13. Response Time vs. Supply Voltage

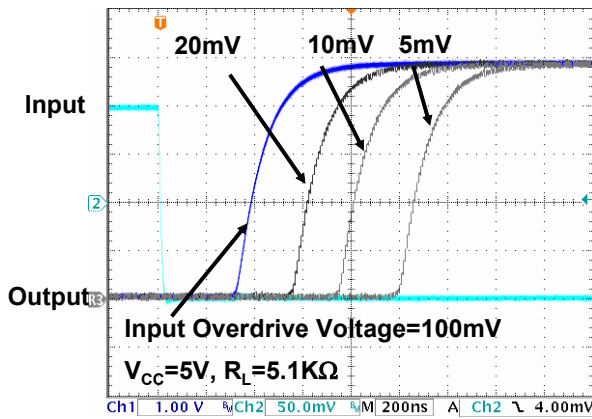


Figure 14. Response Time for Positive Transition

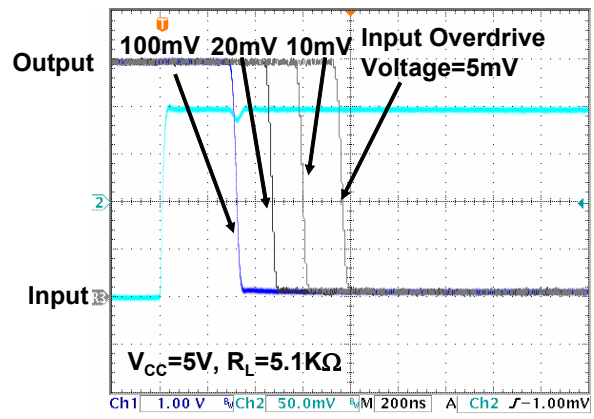


Figure 15. Response Time for Negative Transition

**Typical Performance Characteristics (Continued)**

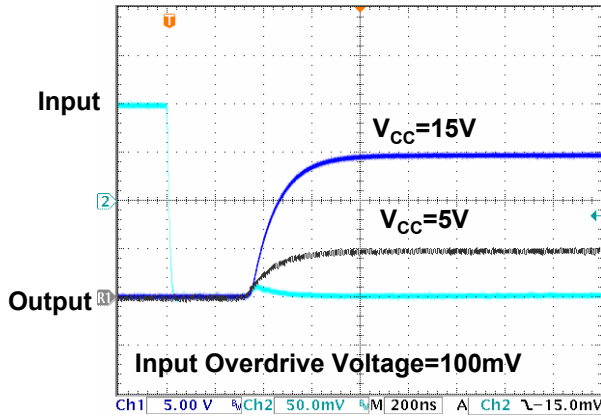


Figure 16. Response Time for Positive Transition

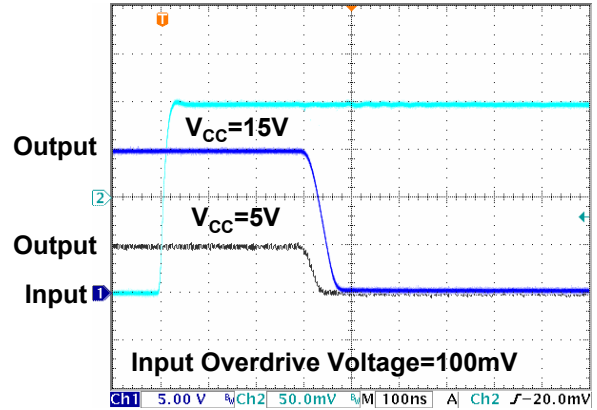


Figure 17. Response Time for Negative Transition

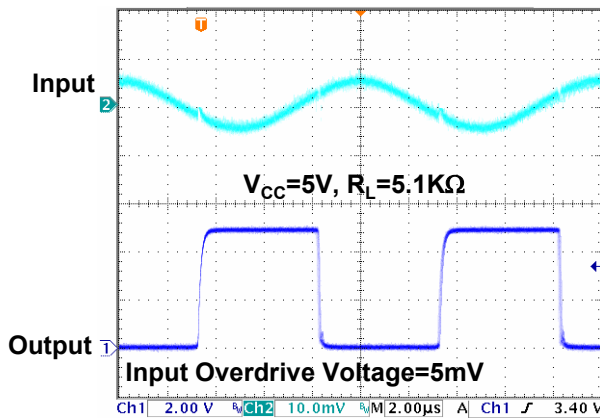


Figure 18. 100kHz Response

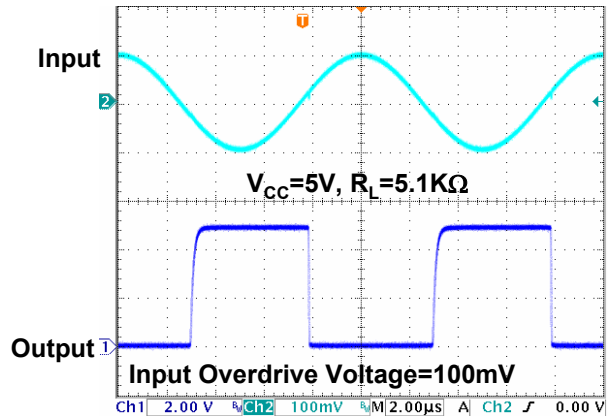


Figure 19. 100kHz Response



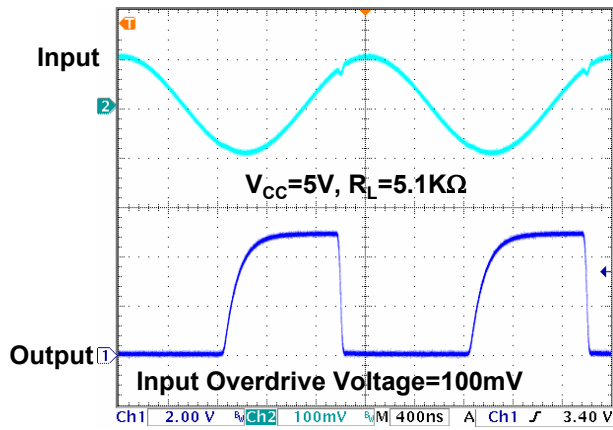
**Typical Performance Characteristics (Continued)**

Figure 20. 500kHz Response

**Typical Application**

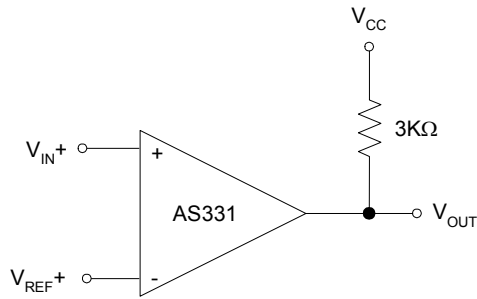


Figure 21. Basic Comparator

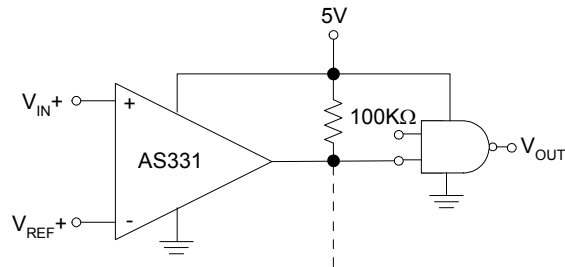


Figure 22. Driving CMOS

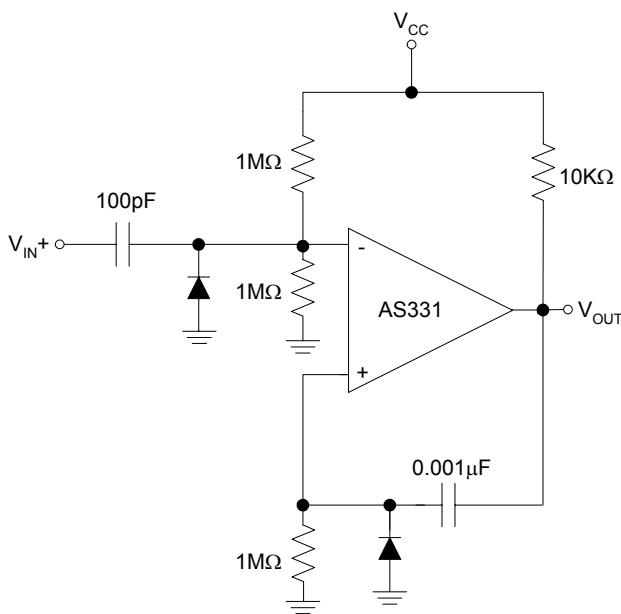


Figure 23. One Shot Multivibrator

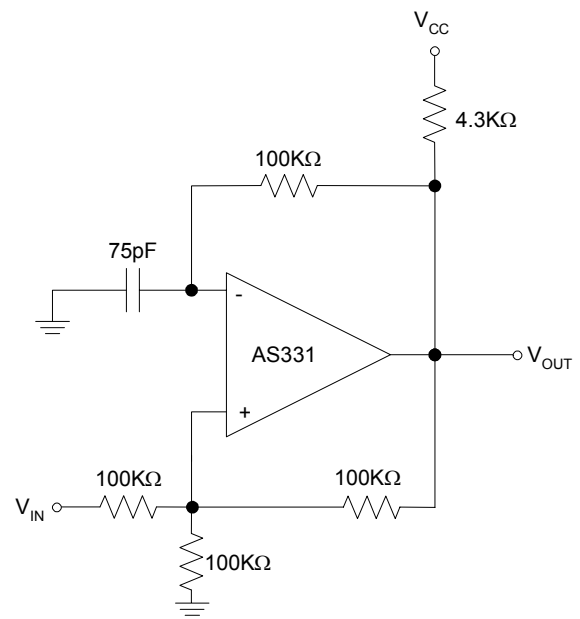


Figure 24. Squarewave Oscillator

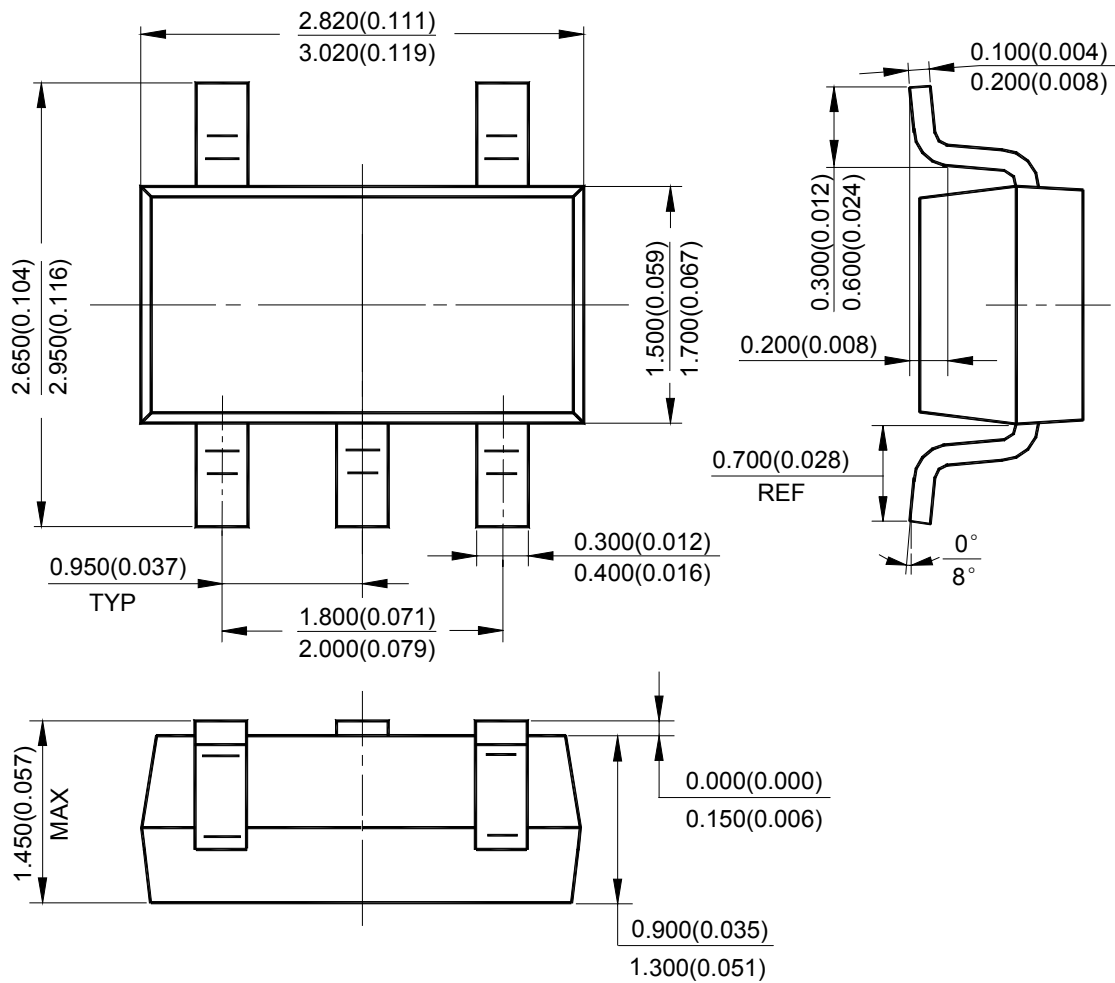


**LOW POWER LOW OFFSET VOLTAGE SINGLE COMPARATOR** **AS331**

**Mechanical Dimensions**

**SOT-23-5**

**Unit: mm(inch)**





## **BCD Semiconductor Manufacturing Limited**

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