



# MIC7111

## 1.8V IttyBitty™ Rail-to-Rail Input/Output Op Amp

### Preliminary Information

#### General Description

The MIC7111 is a micropower operational amplifier featuring rail-to-rail input and output performance in Micrel's IttyBitty™ SOT-23-5 package. The MIC7111 is ideal for systems where small size is a critical consideration.

The MIC7111 is designed to operate from 1.8V to 11V power supplies.

The MIC7111 benefits small battery operated portable electronic devices where small size and the ability to place the amplifier close to the signal source are primary design concerns.

For other package options, please contact the factory.

#### Features

- Small footprint SOT-23-5 package
- Guaranteed performance at 1.8V, 2.7V, 5V, and 10V
- 15μA typical supply current at 1.8V
- 25kHz gain-bandwidth at 5V
- Output swing to within 1mV of rails with 1.8V supply and 100kΩ load
- Suitable for driving capacitive loads

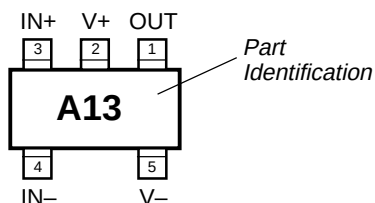
#### Applications

- Wireless and cellular communications
- GaAs RF amplifier bias amplifier
- Current sensing for battery chargers
- Reference voltage buffer
- Transducer linearization and interface
- Portable computing

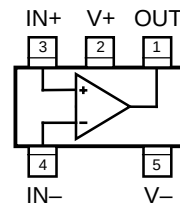
#### Ordering Information

| Part Number | Junction Temp. Range | Package  |
|-------------|----------------------|----------|
| MIC7111BM5  | −40°C to +85°C       | SOT-23-5 |

#### Pin Configuration



#### Functional Configuration



SOT-23-5 (M5)

#### Pin Description

| Pin Number | Pin Name | Pin Function       |
|------------|----------|--------------------|
| 1          | OUT      | Amplifier Output   |
| 2          | V+       | Positive Supply    |
| 3          | IN+      | Noninverting Input |
| 4          | IN−      | Inverting Input    |
| 5          | V−       | Negative Supply    |

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**Absolute Maximum Ratings (Note 1)**

|                                                      |                                    |
|------------------------------------------------------|------------------------------------|
| Supply Voltage ( $V_{V+} - V_{V-}$ )                 | 12V                                |
| Differential Input Voltage ( $V_{IN+} - V_{IN-}$ )   | $\pm(V_{V+} - V_{V-})$             |
| I/O Pin Voltage ( $V_{IN}, V_{OUT}$ ), <b>Note 2</b> | $V_{V+} + 0.3V$ to $V_{V-} - 0.3V$ |
| Junction Temperature ( $T_J$ )                       | +150°C                             |
| Storage Temperature                                  | -65°C to +150°C                    |
| Lead Temperature (soldering, 10 sec.)                | 260°C                              |
| ESD, <b>Note 5</b>                                   | 2kV                                |

**Operating Ratings (Note 1)**

|                                                             |                |
|-------------------------------------------------------------|----------------|
| Supply Voltage ( $V_{V+} - V_{V-}$ )                        | 1.8V to 11V    |
| Junction Temperature ( $T_J$ )                              | -40°C to +85°C |
| Max. Junction Temperature ( $T_{J(max)}$ ), <b>Note 3</b>   | +85°C          |
| Package Thermal Resistance ( $\theta_{JA}$ ), <b>Note 4</b> | 325°C/W        |
| Max. Power Dissipation                                      | <b>Note 3</b>  |

**DC Electrical Characteristics (1.8V)**

$V_{V+} = +1.8V$ ,  $V_{V-} = 0V$ ,  $V_{CM} = V_{OUT} = V_{V+}/2$ ;  $R_L = 1M$ ;  $T_J = 25^\circ C$ , **bold** values indicate  $-40^\circ C \leq T_J \leq +85^\circ C$ ; unless noted

| Symbol     | Parameter                                     | Condition                                                                    | Min | Typ  | Max                     | Units            |
|------------|-----------------------------------------------|------------------------------------------------------------------------------|-----|------|-------------------------|------------------|
| $V_{OS}$   | Input Offset Voltage                          |                                                                              |     | 0.9  | <b>7</b><br><b>9</b>    | mV<br>mV         |
| $TCV_{OS}$ | Input Offset Voltage Temperature Drift        |                                                                              |     | 2.0  |                         | $\mu V/^\circ C$ |
| $I_B$      | Input Bias Current                            |                                                                              |     | 1    | <b>10</b><br><b>500</b> | pA<br>pA         |
| $I_{OS}$   | Input Offset Current                          |                                                                              |     | 0.01 | <b>0.5</b><br><b>75</b> | pA<br>pA         |
| $R_{IN}$   | Input Resistance                              |                                                                              |     | >10  |                         | $T\Omega$        |
| +PSRR      | Positive Power Supply Rejection Ratio         | $1.8V \leq V_{V+} \leq 5V$ , $V_{V-} = 0V$ ,<br>$V_{CM} = V_{OUT} = 0.9V$    | 60  | 85   |                         | dB               |
| -PSRR      | Negative Power Supply Rejection Ratio         | $-1.8V \leq V_{V-} \leq -5V$ , $V_{V+} = 0V$ ,<br>$V_{CM} = V_{OUT} = -0.9V$ | 60  | 85   |                         | dB               |
| CMRR       | Common-Mode Rejection Ratio                   | $V_{CM} = -0.2V$ to $+2.0V$                                                  | 50  | 70   |                         | dB               |
| $C_{IN}$   | Common Mode Input Capacitance                 |                                                                              |     | 3    |                         | pF               |
| $V_{OUT}$  | Output Voltage Swing                          | output high, $R_L = 100k$ ,<br>specified as $V_{V+} - V_{OUT}$               |     | 0.14 | <b>1</b><br><b>1</b>    | mV<br>mV         |
|            |                                               | output low, $R_L = 100k$                                                     |     | 0.14 | <b>1</b><br><b>1</b>    | mV<br>mV         |
|            |                                               | output high, $R_L = 2k$ ,<br>specified as $V_{V+} - V_{OUT}$                 |     | 6.8  | <b>23</b><br><b>34</b>  | mV<br>mV         |
|            |                                               | output low, $R_L = 2k$                                                       |     | 6.8  | <b>23</b><br><b>34</b>  | mV<br>mV         |
| $I_{SC}$   | Output Short Circuit Current<br><b>Note 6</b> | sourcing, $V_{OUT} = 0V$                                                     | 15  | 25   |                         | mA               |
|            |                                               | sinking, $V_{OUT} = 1.8V$                                                    | 15  | 25   |                         | mA               |
| $A_{VOL}$  | Voltage Gain                                  | sourcing                                                                     |     | 400  |                         | V/mV             |
|            |                                               | sinking                                                                      |     | 400  |                         | V/mV             |
| $I_s$      | Supply Current                                | $V_{V+} = 1.8V$ , $V_{OUT} = V_{V+}/2$                                       |     | 15   | 35                      | $\mu A$          |

**AC Electrical Characteristics (1.8V)**

$V_+ = +1.8V$ ,  $V_- = 0V$ ,  $V_{CM} = V_{OUT} = V_{V+}/2$ ;  $R_L = 1M$ ;  $T_J = 25^\circ C$ , **bold** values indicate  $-40^\circ C \leq T_J \leq +85^\circ C$ ; unless noted

|     |                        |                                                                      |  |       |  |            |
|-----|------------------------|----------------------------------------------------------------------|--|-------|--|------------|
| SR  | Slew Rate              | voltage follower, 1V step, $R_L = 100k@0.9V$<br>$V_{OUT} = 1V_{P-P}$ |  | 0.015 |  | V/ $\mu s$ |
| GBW | Gain Bandwidth Product |                                                                      |  | 25    |  | kHz        |

## DC Electrical Characteristics (2.7V)

$V_{V+} = +2.7V$ ,  $V_{V-} = 0V$ ,  $V_{CM} = V_{OUT} = V_{V+}/2$ ;  $R_L = 1M$ ;  $T_J = 25^\circ C$ , **bold** values indicate  $-40^\circ C \leq T_J \leq +85^\circ C$ ; unless noted

| Symbol     | Parameter                                     | Condition                                                                     | Min | Typ  | Max          | Units            |
|------------|-----------------------------------------------|-------------------------------------------------------------------------------|-----|------|--------------|------------------|
| $V_{OS}$   | Input Offset Voltage                          |                                                                               |     | 0.9  | <b>79</b>    | mV<br>mV         |
| $TCV_{OS}$ | Input Offset Voltage Temperature Drift        |                                                                               |     | 2.0  |              | $\mu V/^\circ C$ |
| $I_B$      | Input Bias Current                            |                                                                               |     | 1    | <b>10500</b> | pA<br>pA         |
| $I_{OS}$   | Input Offset Current                          |                                                                               |     | 0.01 | <b>0.575</b> | pA<br>pA         |
| $R_{IN}$   | Input Resistance                              |                                                                               |     | >10  |              | $T\Omega$        |
| +PSRR      | Positive Power Supply Rejection Ratio         | $2.7V \leq V_{V+} \leq 5V$ , $V_{V-} = 0V$ ,<br>$V_{CM} = V_{OUT} = 1.35V$    | 60  | 90   |              | dB               |
| -PSRR      | Negative Power Supply Rejection Ratio         | $-2.7V \leq V_{V-} \leq -5V$ , $V_{V+} = 0V$ ,<br>$V_{CM} = V_{OUT} = -1.35V$ | 60  | 90   |              | dB               |
| CMRR       | Common-Mode Rejection Ratio                   | $V_{CM} = -0.2V$ to $+2.9V$                                                   | 52  | 75   |              | dB               |
| $C_{IN}$   | Common Mode Input Capacitance                 |                                                                               |     | 3    |              | pF               |
| $V_{OUT}$  | Output Voltage Swing                          | output high, $R_L = 100k$ ,<br>specified as $V_{V+} - V_{OUT}$                |     | 0.2  | <b>11</b>    | mV<br>mV         |
|            |                                               | output low, $R_L = 100k$                                                      |     | 0.2  | <b>11</b>    | mV<br>mV         |
|            |                                               | output high, $R_L = 2k$ ,<br>specified as $V_{V+} - V_{OUT}$                  |     | 10   | <b>3350</b>  | mV<br>mV         |
|            |                                               | output low, $R_L = 2k$                                                        |     | 10   | <b>3350</b>  | mV<br>mV         |
| $I_{SC}$   | Output Short Circuit Current<br><b>Note 6</b> | sourcing, $V_{OUT} = 0V$                                                      | 30  | 50   |              | mA               |
|            |                                               | sinking, $V_{OUT} = 2.7V$                                                     | 30  | 50   |              | mA               |
| $A_{VOL}$  | Voltage Gain                                  | sourcing                                                                      |     | 400  |              | V/mV             |
|            |                                               | sinking                                                                       |     | 400  |              | V/mV             |
| $I_s$      | Supply Current                                | $V_{V+} = 2.7V$ , $V_{OUT} = V_{V+}/2$                                        |     | 17   | 42           | $\mu A$          |

## AC Electrical Characteristics (2.7V)

$V_{V+} = +2.7V$ ,  $V_{V-} = 0V$ ,  $V_{CM} = V_{OUT} = V_{V+}/2$ ;  $R_L = 1M$ ;  $T_J = 25^\circ C$ , **bold** values indicate  $-40^\circ C \leq T_J \leq +85^\circ C$ ; unless noted

| Symbol | Parameter              | Condition                                                             | Min | Typ   | Max | Units      |
|--------|------------------------|-----------------------------------------------------------------------|-----|-------|-----|------------|
| SR     | Slew Rate              | voltage follower, 1V step, $R_L = 100k@1.35V$<br>$V_{OUT} = 1V_{P-P}$ |     | 0.015 |     | V/ $\mu s$ |
| GBW    | Gain Bandwidth Product |                                                                       |     | 25    |     | kHz        |

## DC Electrical Characteristics (5V)

$V_{V+} = +5.0V$ ,  $V_{V-} = 0V$ ,  $V_{CM} = V_{OUT} = V_{V+}/2$ ;  $R_L = 1M$ ;  $T_J = 25^{\circ}C$ , **bold** values indicate  $-40^{\circ}C \leq T_J \leq +85^{\circ}C$ ; unless noted

| Symbol     | Parameter                                     | Condition                                                                | Min | Typ  | Max           | Units             |
|------------|-----------------------------------------------|--------------------------------------------------------------------------|-----|------|---------------|-------------------|
| $V_{OS}$   | Input Offset Voltage                          |                                                                          |     | 0.9  | <b>79</b>     | mV                |
| $TCV_{OS}$ | Input Offset Voltage Temperature Drift        |                                                                          |     | 2.0  |               | $\mu V/^{\circ}C$ |
| $I_B$      | Input Bias Current                            |                                                                          |     | 1    | <b>10500</b>  | pA                |
| $I_{OS}$   | Input Offset Current                          |                                                                          |     | 0.01 | <b>0.575</b>  | pA                |
| $R_{IN}$   | Input Resistance                              |                                                                          |     | >10  |               | $T\Omega$         |
| +PSRR      | Positive Power Supply Rejection Ratio         | $5V \leq V_{V+} \leq 10V$ , $V_{V-} = 0V$ , $V_{CM} = V_{OUT} = 2.5V$    | 65  | 95   |               | dB                |
| -PSRR      | Negative Power Supply Rejection Ratio         | $-5V \leq V_{V-} \leq -10V$ , $V_{V+} = 0V$ , $V_{CM} = V_{OUT} = -2.5V$ | 65  | 95   |               | dB                |
| CMRR       | Common-Mode Rejection Ratio                   | $V_{CM} = -0.2V$ to $+5.2V$                                              | 57  | 80   |               | dB                |
| $C_{IN}$   | Common Mode Input Capacitance                 |                                                                          |     | 3    |               | pF                |
| $V_{OUT}$  | Output Voltage Swing                          | output high, $R_L = 100k$ , specified as $V_{V+} - V_{OUT}$              |     | 0.3  | <b>1.51.5</b> | mV                |
|            |                                               | output low, $R_L = 100k$                                                 |     | 0.3  | <b>1.51.5</b> | mV                |
|            |                                               | output high, $R_L = 2k$ , specified as $V_{V+} - V_{OUT}$                |     | 15   | <b>5075</b>   | mV                |
|            |                                               | output low, $R_L = 2k$                                                   |     | 15   | <b>5075</b>   | mV                |
| $I_{SC}$   | Output Short Circuit Current<br><b>Note 6</b> | sourcing, $V_{OUT} = 0V$                                                 | 80  | 100  |               | mA                |
|            |                                               | sinking, $V_{OUT} = 5V$                                                  | 80  | 100  |               | mA                |
| $A_{VOL}$  | Voltage Gain                                  | sourcing                                                                 |     | 500  |               | V/mV              |
|            |                                               | sinking                                                                  |     | 500  |               | V/mV              |
| $I_S$      | Supply Current                                | $V_{V+} = 5V$ , $V_{OUT} = V_{V+}/2$                                     |     | 20   | 50            | $\mu A$           |

## AC Electrical Characteristics (5V)

$V_{V+} = +5V$ ,  $V_{V-} = 0V$ ,  $V_{CM} = V_{OUT} = V_{V+}/2$ ;  $R_L = 1M$ ;  $T_J = 25^{\circ}C$ , **bold** values indicate  $-40^{\circ}C \leq T_J \leq +85^{\circ}C$ ; unless noted

| Symbol | Parameter              | Condition                                                            | Min | Typ  | Max | Units      |
|--------|------------------------|----------------------------------------------------------------------|-----|------|-----|------------|
| SR     | Slew Rate              | voltage follower, 1V step, $R_L = 100k@1.5V$<br>$V_{OUT} = 1V_{P-P}$ |     | 0.02 |     | V/ $\mu s$ |
| GBW    | Gain Bandwidth Product |                                                                      |     | 25   |     | kHz        |

## DC Electrical Characteristics (10V)

$V_{V+} = +10V$ ,  $V_{V-} = 0V$ ,  $V_{CM} = V_{OUT} = V_{V+}/2$ ;  $R_L = 1M$ ;  $T_J = 25^{\circ}C$ , **bold** values indicate  $-40^{\circ}C \leq T_J \leq +85^{\circ}C$ ; unless noted

| Symbol     | Parameter                              | Condition | Min | Typ | Max       | Units             |
|------------|----------------------------------------|-----------|-----|-----|-----------|-------------------|
| $V_{OS}$   | Input Offset Voltage                   |           |     | 0.9 | <b>79</b> | mV                |
| $TCV_{OS}$ | Input Offset Voltage Temperature Drift |           |     | 2.0 |           | $\mu V/^{\circ}C$ |

| Symbol    | Parameter                                     | Condition                                                                   | Min | Typ  | Max               | Units     |
|-----------|-----------------------------------------------|-----------------------------------------------------------------------------|-----|------|-------------------|-----------|
| $I_B$     | Input Bias Current                            |                                                                             |     | 1    | 10<br><b>500</b>  | pA<br>pA  |
| $I_{OS}$  | Input Offset Current                          |                                                                             |     | 0.01 | 0.5<br><b>75</b>  | pA<br>pA  |
| $R_{IN}$  | Input Resistance                              |                                                                             |     | >10  |                   | $T\Omega$ |
| +PSRR     | Positive Power Supply Rejection Ratio         | $5V \leq V_{V+} \leq 10V$ , $V_{V-} = 0V$ ,<br>$V_{CM} = V_{OUT} = 2.5V$    | 65  | 95   |                   | dB        |
| –PSRR     | Negative Power Supply Rejection Ratio         | $-5V \leq V_{V-} \leq -10V$ , $V_{V+} = 0V$ ,<br>$V_{CM} = V_{OUT} = -2.5V$ | 65  | 95   |                   | dB        |
| CMRR      | Common-Mode Rejection Ratio                   | $V_{CM} = -0.2V$ to $+10.2V$                                                | 60  | 85   |                   | dB        |
| $C_{IN}$  | Common Mode Input Capacitance                 |                                                                             |     | 3    |                   | pF        |
| $V_{OUT}$ | Output Voltage Swing                          | output high, $R_L = 100k$ ,<br>specified as $V_{V+} - V_{OUT}$              |     | 0.45 | 2.5<br><b>2.5</b> | mV<br>mV  |
|           |                                               | output low, $R_L = 100k$                                                    |     | 0.45 | 2.5<br><b>2.5</b> | mV<br>mV  |
|           |                                               | output high, $R_L = 2k$ ,<br>specified as $V_{V+} - V_{OUT}$                |     | 24   | 80<br><b>120</b>  | mV<br>mV  |
|           |                                               | output low, $R_L = 2k$                                                      |     | 24   | 80<br><b>120</b>  | mV<br>mV  |
| $I_{SC}$  | Output Short Circuit Current<br><b>Note 6</b> | sourcing, $V_{OUT} = 0V$                                                    | 100 | 200  |                   | mA        |
|           |                                               | sinking, $V_{OUT} = 10V$                                                    | 100 | 200  |                   | mA        |
| $A_{VOL}$ | Voltage Gain                                  | sourcing                                                                    |     | 500  |                   | V/mV      |
|           |                                               | sinking                                                                     |     | 500  |                   | V/mV      |
| $I_S$     | Supply Current                                | $V_{V+} = 10V$ , $V_{OUT} = V_{V+}/2$                                       |     | 25   | 65                | $\mu A$   |

## AC Electrical Characteristics (10V)

$V_+ = +10V$ ,  $V_- = 0V$ ,  $V_{CM} = V_{OUT} = V_{V+}/2$ ;  $R_L = 1M$ ;  $T_J = 25^\circ C$ , **bold** values indicate  $-40^\circ C \leq T_J \leq +85^\circ C$ ; unless noted

| Symbol   | Parameter                    | Condition                                                             | Min | Typ  | Max | Units          |
|----------|------------------------------|-----------------------------------------------------------------------|-----|------|-----|----------------|
| SR       | Slew Rate                    | voltage follower, 1V step, $R_L = 100k@1.35V$<br>$V_{OUT} = 1V_{P-P}$ |     | 0.02 |     | V/ $\mu s$     |
| GBW      | Gain Bandwidth Product       |                                                                       |     | 25   |     | kHz            |
| $\phi_M$ | Phase Margin                 |                                                                       |     | 50   |     | $^\circ$       |
| $G_M$    | Gain Margin                  |                                                                       |     | 15   |     | dB             |
| $e_N$    | Input Referred Voltage Noise | $f = 1kHz$ , $V_{CM} = 1.0V$                                          |     | 110  |     | $nV/\sqrt{Hz}$ |
| $i_N$    | Input Referred Current Noise | $f = 1kHz$                                                            |     | 0.03 |     | $pA/\sqrt{Hz}$ |

**General Notes:** Devices are ESD protected; however, handling precautions are recommended. All limits guaranteed by testing on statistical analysis.

**Note 1:** Absolute maximum ratings indicate limits beyond which damage to the component may occur. Electrical specifications do not apply when operating the device outside its recommended operating ratings.

**Note 2:** I/O Pin Voltage is any external voltage to which an input or output is referenced.

**Note 3:** The maximum allowable power dissipation is a function of the maximum junction temperature,  $T_{J(max)}$ ; the junction-to-ambient thermal resistance,  $\theta_{JA}$ ; and the ambient temperature,  $T_A$ . The maximum allowable power dissipation at any ambient temperature is calculated using:  $P_D = (T_{J(max)} - T_A) \div \theta_{JA}$ . Exceeding the maximum allowable power dissipation will result in excessive die temperature.

**Note 4:** Thermal resistance,  $\theta_{JA}$ , applies to a part soldered on a printed-circuit board.

**Note 5:** Human body model, 1.5k in series with 100pF.

**Note 6:** Short circuit may cause the device to exceed maximum allowable power dissipation. See **Note 3**.

## Application Information

### Input Common-Mode Voltage

The MIC7111 tolerates input overdrive by at least 300mV beyond either rail without producing phase inversion.

If the absolute maximum input voltage is exceeded, the input current should be limited to  $\pm 5\text{mA}$  maximum to prevent reducing reliability. A  $10\text{k}\Omega$  series input resistor, used as a current limiter, will protect the input structure from voltages as large as 50V above the supply or below ground. See Figure 1.

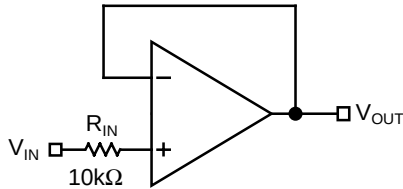


Figure 1. Input Current-Limit Protection

### Output Voltage Swing

Sink and source output resistances of the MIC7111 are equal. Maximum output voltage swing is determined by the load and the approximate output resistance. The output resistance is:

$$R_{OUT} = \frac{V_{DROP}}{I_{LOAD}}$$

$V_{DROP}$  is the voltage dropped within the amplifier output stage.  $V_{DROP}$  and  $I_{LOAD}$  can be determined from the  $V_O$  (output swing) portion of the appropriate Electrical Characteristics table.  $I_{LOAD}$  is equal to the typical output high voltage minus  $V+/2$  and divided by  $R_{LOAD}$ . For example, using the Electrical Characteristics DC (5V) table, the typical output voltage drop using a  $2\text{k}\Omega$  load (connected to  $V+/2$ ) is 0.015V, which produces an  $I_{LOAD}$  of:

$$\frac{2.5\text{V} - 0.015\text{V}}{2\text{k}\Omega} = 1.243\text{mA}$$

then:

$$R_{OUT} = \frac{15\text{mV}}{1.243\text{mA}} = 12.1 \approx 12\Omega$$

### Driving Capacitive Loads

Driving a capacitive load introduces phase-lag into the output signal, and this in turn reduces op-amp system phase margin. The application that is least forgiving of reduced phase margin is a unity gain amplifier. The MIC7111 can typically drive a  $500\text{pF}$  capacitive load connected directly to the output when configured as a unity-gain amplifier.

### Using Large-Value Feedback Resistors

A large-value feedback resistor ( $> 500\text{k}\Omega$ ) can reduce the phase margin of a system. This occurs when the feedback resistor acts in conjunction with input capacitance to create phase lag in the feedback signal. Input capacitance is usually a combination of input circuit components and other parasitic capacitance, such as amplifier input capacitance and stray printed circuit board capacitance.

Figure 2 illustrates a method of compensating phase lag caused by using a large-value feedback resistor. Feedback capacitor  $C_{FB}$  introduces sufficient phase lead to overcome the phase lag caused by feedback resistor  $R_{FB}$  and input capacitance  $C_{IN}$ . The value of  $C_{FB}$  is determined by first estimating  $C_{IN}$  and then applying the following formula:

$$R_{IN} \times C_{IN} \leq R_{FB} \times C_{FB}$$

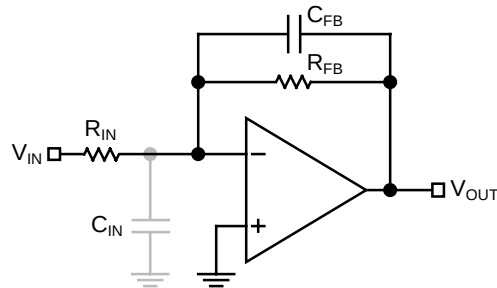


Figure 2. Cancelling Feedback Phase Lag

Since a significant percentage of  $C_{IN}$  may be caused by board layout, it is important to note that the correct value of  $C_{FB}$  may

change when changing from a breadboard to the final circuit layout.

### Typical Circuits

Some single-supply, rail-to-rail applications for which the MIC7111 is well suited are shown in the circuit diagrams of Figures 3 through 7.

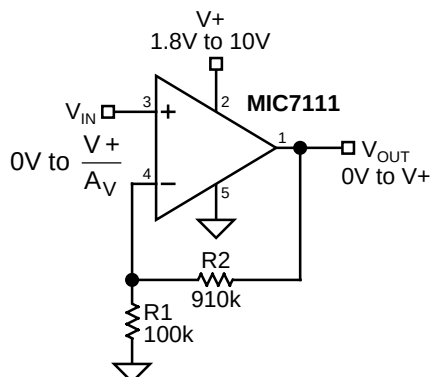


Figure 3a. Noninverting Amplifier

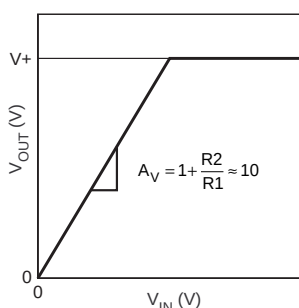


Figure 3b. Noninverting Amplifier Behavior

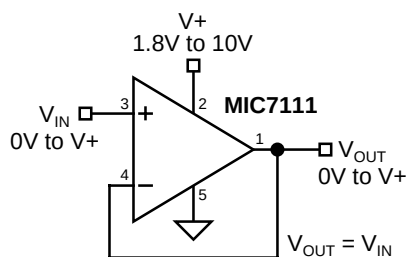


Figure 4. Voltage Follower/Buffer

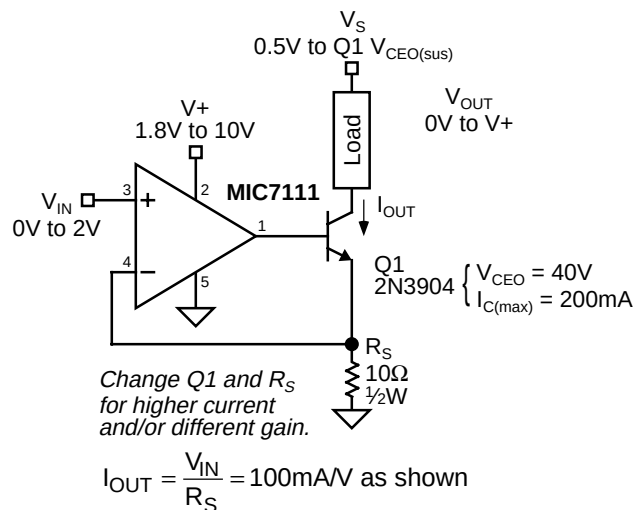


Figure 5. Voltage-Controlled Current Sink

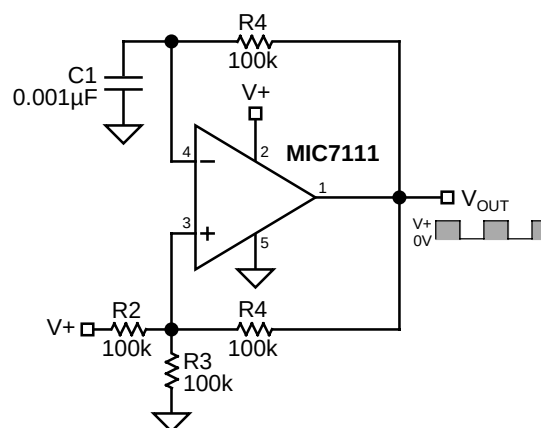


Figure 6. Square Wave Oscillator

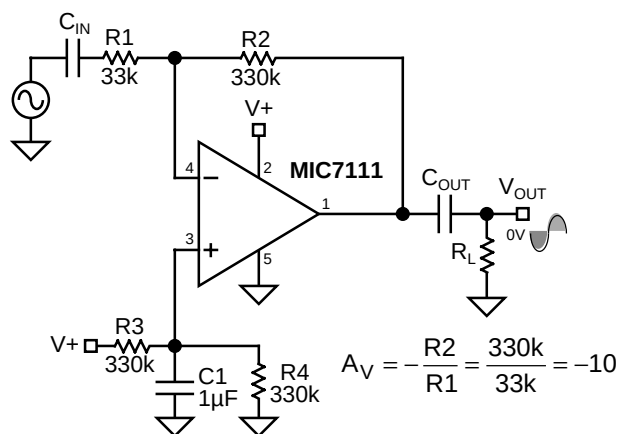
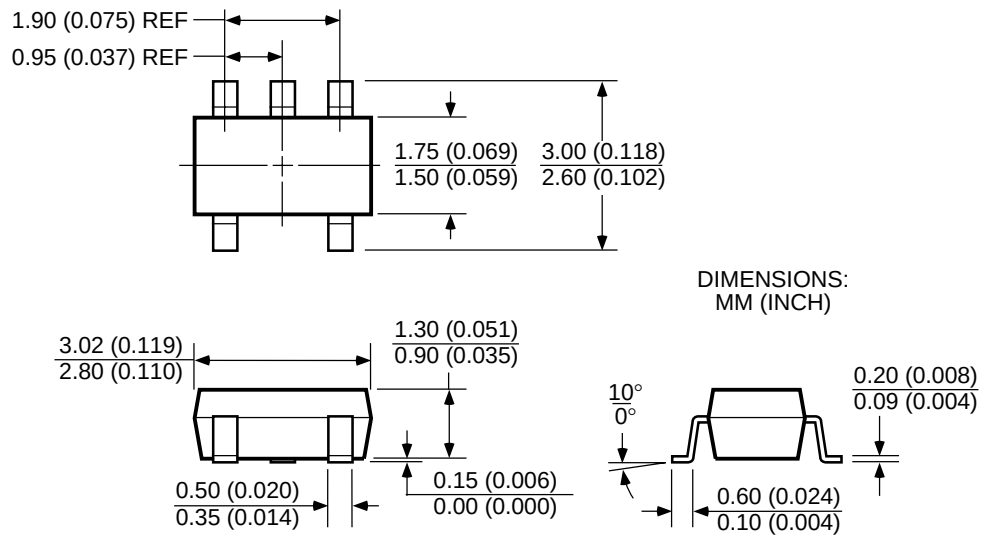


Figure 7. AC-Coupled Inverting Amplifier

## Package Information

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**SOT-23-5 (M5)**

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