MIC7111

2.4V IttyBitty™ Rail-to-Rail Input/Output Op Amp

Advance 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 2.4V to 10V 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 2.4V, 3.3V, 5V, and 10V
- 25µA typical supply current at 5V
- 50kHz gain-bandwidth at 5V
- Output swing to V_{SUPPLY} –20mV with 100kΩ load
- Suitable for driving capacitive loads

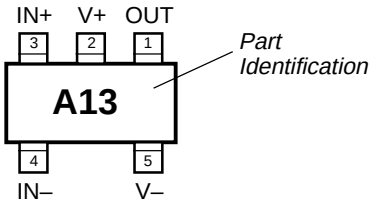
Applications

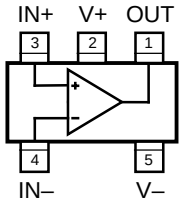
- Wireless and cellular communications
- GaAs RF amplifier bias amplifier
- Current sensing for battery chargers
- Reference voltage buffer
- Transducer linearization and interface
- Portable computing

Ordering Information

Part Number	Temperature Range	Package
MIC7111BM5	–40°C to +85°C	SOT-23-5

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 Suppy

Absolute Maximum Ratings (Note 1)

Supply Voltage ($V_{V+} – V_{V–}$) 12V
I/O Pin Voltage (V_{IN+}, $V_{IN–}$) ..... V_{V+} + 0.3V to $V_{V–}$ – 0.3V
Differential Input Voltage ($V_{IN+} – V_{IN–}$) ..... V_{V+} to $V_{V–}$
Input Current (I_{IN+}, $I_{IN–}$) ..... ±5mA
Output Current (I_{OUT}), **Note 1** ..... ±300mA
Junction Temperature (T_J) ..... +150°C
ESD, **Note 2** 2kV

Operating Ratings (Note 1)

Supply Voltage ($V_{V+} – V_{V–}$) ..... 2.2V to 11V
Ambient Temperature (T_J) ..... –40°C to +85°C
Package Thermal Resistance (θ_{JA}) ..... 325°C/W

DC Electrical Characteristics (2.4V)

V_{V+} = +2.4V, $V_{V–}$ = 0V, V_{CM} = V_{OUT} = V_{V+}/2; R_L = 1M; T_J = 25°C, **bold** values indicate –40°C ≤ T_J ≤ +85°C; unless noted

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{OS}	Input Offset Voltage			0.9	3 **5**	mV mV
TCV_{OS}	Input Offset Voltage Temperature Drift			2.0		µV/°C
I_B	Input Bias Current			0.1	1 **20**	pA pA
I_{OS}	Input Offset Current			0.01	0.5 **10**	pA pA
R_{IN}	Input Resistance			>10		TΩ
+PSRR	Positive Power Supply Rejection Ratio	2.4V ≤ V_{V+} ≤ 5V, $V_{V–}$ = 0V, V_{OUT} = 2.0V	55	60		dB
–PSRR	Negative Power Supply Rejection Ratio	–2.4V ≤ $V_{V–}$ ≤ –5V, V_{V+} = 0V, V_{OUT} = –2.0V	55	60		dB
V_{CM}	Input Common Mode Range	CMRR > 55dB	2.6	2.7		V
		CMRR > 55dB		–0.3	–0.2	V
C_{IN}	Common Mode Input Capacitance			3		pF
V_{OUT}	Output Voltage Swing	V_{V+} = 2.4V, R_L = 100k	**2.38**	2.39 0.01	 **0.02**	V V
		V_{V+} = 2.4V, R_L = 10k	**2.35**	2.3 0.05	 **0.1**	V V
I_{SC}	Output Short Circuit Current	sourcing, V_{OUT} = 0V	100	150		mA
		sinking, V_{OUT} = 2.4V	100	150		mA
A_{VOL}	Voltage Gain	sourcing		400		V/mV
		sinking		400		V/mV
I_s	Supply Current	V_{V+} = 2.4V, V_{OUT} = V_{V+}/2		20	45	µA

AC Electrical Characteristics (2.4V)

V+ = +2.4V, V– = 0V, V_{CM} = V_{OUT} = V_{V+}/2; R_L = 1M; T_J = 25°C, **bold** values indicate –40°C ≤ T_J ≤ +85°C; unless noted

SR	Slew Rate	voltage follower, 1V step, R_L = 100k@1.35V V_{OUT} = $1V_{P–P}$		0.015		V/µs
GBW	Gain Bandwidth Product			40		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°C, **bold** values indicate –40°C ≤ T_J ≤ +85°C; unless noted

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{OS}	Input Offset Voltage			0.9	3 **5**	mV mV
TCV_{OS}	Input Offset Voltage Temperature Drift			2.0		µV/°C
I_B	Input Bias Current			0.1	1 **20**	pA pA
I_{OS}	Input Offset Current			0.01	0.5 **10**	pA pA
R_{IN}	Input Resistance			>10		TΩ
+PSRR	Positive Power Supply Rejection Ratio	2.7V ≤ V_{V+} ≤ 5V, V_{V-} = 0V, V_{OUT} = 2.5V	55	60		dB
–PSRR	Negative Power Supply Rejection Ratio	–2.7V ≤ V_{V-} ≤ –5V, V_{V+} = 0V, V_{OUT} = –2.5V	55	60		dB
V_{CM}	Input Common Mode Range	CMRR > 55dB	2.9	3.0		V
		CMRR > 55dB		–0.3	–0.2	V
C_{IN}	Common Mode Input Capacitance			3		pF
V_{OUT}	Output Voltage Swing	V_{V+} = 2.7V, R_L = 100k	**2.68**	2.69 0.01	 **0.02**	V V
		V_{V+} = 2.7V, R_L = 10k	**2.65**	2.6 0.05	 **0.1**	V V
I_{SC}	Output Short Circuit Current	sourcing, V_{OUT} = 0V	100	150		mA
		sinking, V_{OUT} = 2.7V	100	150		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		20	45	µA

AC Electrical Characteristics (2.7V)

V+ = +2.7V, V– = 0V, V_{CM} = V_{OUT} = V_{V+}/2; R_L = 1M; T_J = 25°C, **bold** values indicate –40°C ≤ T_J ≤ +85°C; unless noted

Symbol	Parameter	Condition	Min	Typ	Max	Units
SR	Slew Rate	voltage follower, 1V step, R_L = 100k@1.35V V_{OUT} = $1V_{P-P}$		0.015		V/µs
GBW	Gain Bandwidth Product			40		kHz

DC Electrical Characteristics (3V)

V_{V+} = +3.0V, V_{V-} = 0V, V_{CM} = V_{OUT} = V_{V+}/2; R_L = 1M; T_J = 25°C, **bold** values indicate –40°C ≤ T_J ≤ +85°C; unless noted

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{CM}	Input Common Mode Range	CMRR ≥ 50dB	3.2	3.3		V
		CMRR ≥ 50dB		–0.3	–0.2	V

DC Electrical Characteristics (3.3V)

V_{V+} = +3.3V, V_{V-} = 0V, $V_{CM} = V_{OUT} = V_{V+}/2$; R_L = 1M; T_J = 25°C, **bold** values indicate –40°C ≤ T_J ≤ +85°C; unless noted

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{CM}	Input Common Mode Range	CMRR ≥ 50dB	3.5	3.6		V
		CMRR ≥ 50dB		–0.3	–0.2	V

DC Electrical Characteristics (5V)

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

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{OS}	Input Offset Voltage			0.9	3 **5**	mV mV
TCV_{OS}	Input Offset Voltage Temperature Drift			2.0		µV/°C
I_B	Input Bias Current			0.1	1 **20**	pA pA
I_{OS}	Input Offset Current			0.01	0.5 **10**	pA pA
R_{IN}	Input Resistance			>10		TΩ
+PSRR	Positive Power Supply Rejection Ratio	5V ≤ V_{V+} ≤ 10V, V_{V-} = 0V, V_{OUT} = 2.5V	70	85		dB
–PSRR	Negative Power Supply Rejection Ratio	–5V ≤ V_{V-} ≤ –10V, V_{V+} = 0V, V_{OUT} = –2.5V	70	85		dB
V_{CM}	Input Common Mode Range	CMRR > 55dB	5.2	5.3		V
		CMRR > 55dB		–0.3	–0.2	V
C_{IN}	Common Mode Input Capacitance			3		pF
V_{OUT}	Output Voltage Swing	V_{V+} = 5V, R_L = 100k	**4.98**	4.99 0.01	 **0.02**	V V
		V_{V+} = 5V, R_L = 10k	**4.9**	4.98 0.02	 **0.1**	V V
I_{SC}	Output Short Circuit Current	sourcing, V_{OUT} = 0V	100	150		mA
		sinking, V_{OUT} = 5V	100	150		mA
A_{VOL}	Voltage Gain	sourcing		500		V/mV
		sinking		500		V/mV
I_S	Supply Current	V_{V+} = 5V, $V_{OUT} = V_{V+}/2$			55	µA

AC Electrical Characteristics (5V)

V+ = +5V, V– = 0V, $V_{CM} = V_{OUT} = V_{V+}/2$; R_L = 1M; T_J = 25°C, **bold** values indicate –40°C ≤ T_J ≤ +85°C; unless noted

Symbol	Parameter	Condition	Min	Typ	Max	Units
SR	Slew Rate	voltage follower, 1V step, R_L = 100k@1.5V $V_{OUT} = 1V_{P-P}$	0.015	0.027		V/µs
GBW	Gain Bandwidth Product			50		kHz

DC Electrical Characteristics (10V)

V_{V+} = +10V, V_{V-} = 0V, V_{CM} = V_{OUT} = V_{V+}/2; R_L = 1M; T_J = 25°C, **bold** values indicate –40°C ≤ T_J ≤ +85°C; unless noted

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{OS}	Input Offset Voltage			0.9	3 **5**	mV mV
TCV_{OS}	Input Offset Voltage Temperature Drift			2.0		µV/°C
I_B	Input Bias Current			0.1	1 **20**	pA pA
I_{OS}	Input Offset Current			0.01	0.5 **10**	pA pA
R_{IN}	Input Resistance			>10		TΩ
+PSRR	Positive Power Supply Rejection Ratio	5V ≤ V_{V+} ≤ 10V, V_{V-} = 0V, V_{OUT} = 2.5V		80		dB
–PSRR	Negative Power Supply Rejection Ratio	–5V ≤ V_{V-} ≤ –10V, V_{V+} = 0V, V_{OUT} = –2.5V		80		dB
V_{CM}	Input Common Mode Range	CMRR > 55dB	10.15	10.2		V
		CMRR > 55dB		–0.2	–0.15	V
C_{IN}	Common Mode Input Capacitance			3		pF
V_{OUT}	Output Voltage Swing	V_{V+} =10V, R_L = 100k	**9.98**	9.99 0.01	 **0.02**	V V
		V_{V+} = 10V, R_L = 10k	**9.9**	9.95 0.05	 **0.1**	V V
I_{SC}	Output Short Circuit Current	sourcing, V_{OUT} = 0V	100	150		mA
		sinking, V_{OUT} = 10V	100	150		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	µA

AC Electrical Characteristics (10V)

V+ = +10V, V– = 0V, V_{CM} = V_{OUT} = V_{V+}/2; R_L = 1M; T_J = 25°C, **bold** values indicate –40°C ≤ T_J ≤ +85°C; unless noted

Symbol	Parameter	Condition	Min	Typ	Max	Units
SR	Slew Rate	voltage follower, 1V step, R_L = 100k@1.35V V_{OUT} = $1V_{P-P}$		0.03		V/µs
GBW	Gain Bandwidth Product			50		kHz
ϕ_M	Phase Margin			50		°
G_M	Gain Margin			15		dB
e_N	Input Referred Voltage Noise	f = 1kHz, V_{CM} = 1.0V		110		nV/√Hz
i_N	Input Referred Current Noise	f = 1kHz		0.03		pA/√Hz

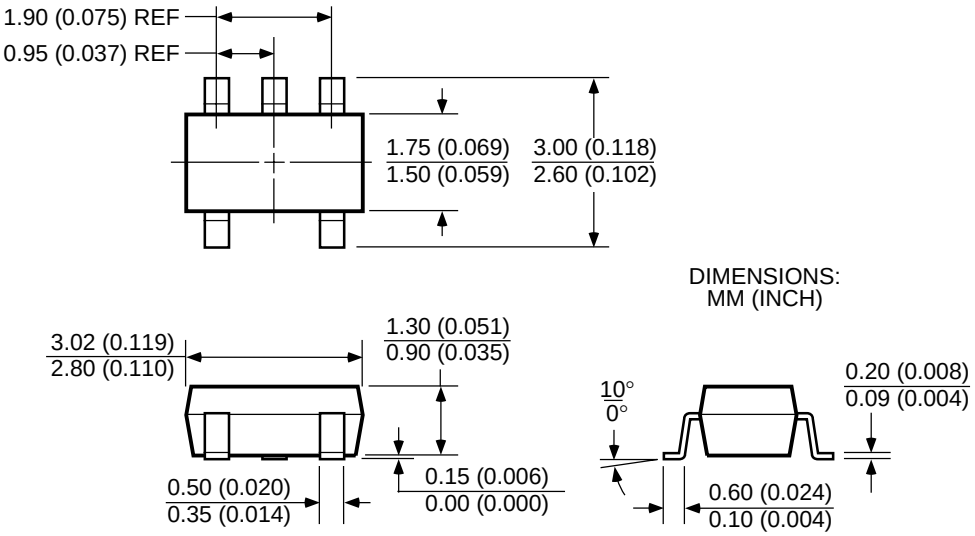
General Note: Devices are ESD protected; however, handling precautions are recommended.

General Note: All limits guarenteed by testing on statistical analysis.

Note 1: Single or split supply.

Note 2: Human body model, 1.5k in series with 100pF.

Package Information



SOT-23-5 (M5)

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