

LM6132/LM6134

Dual and Quad Low Power 10 MHz Rail-to-Rail I/O Operational Amplifiers

General Description

The LM6132/34 provides new levels of speed vs. power performance in applications where low voltage supplies or power limitations previously made compromise necessary. With only 360 μ A/amp supply current, the 10 MHz gain-bandwidth of this device supports new portable applications where higher power devices unacceptably drain battery life.

The LM6132/34 can be driven by voltages that exceed both power supply rails, thus eliminating concerns over exceeding the common-mode voltage range. The rail-to-rail output swing capability provides the maximum possible dynamic range at the output. This is particularly important when operating on low supply voltages. The LM6132/34 can also drive large capacitive loads without oscillating.

Operating on supplies from 2.7V to over 24V, the LM6132/34 is excellent for a very wide range of applications, from battery operated systems with large bandwidth requirements to high speed instrumentation.

Features

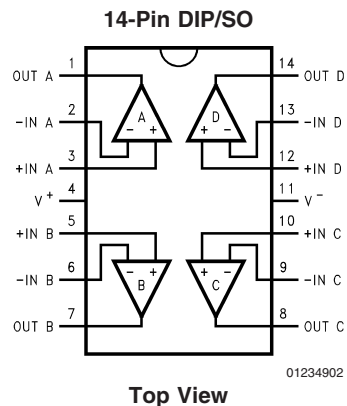
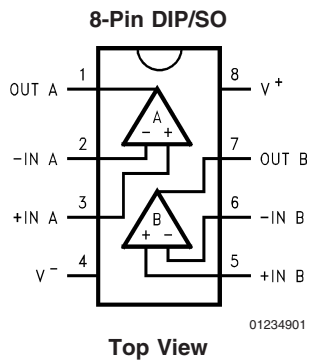
(For 5V Supply, Typ Unless Noted)

- Rail-to-Rail input CMVR $-0.25V$ to $5.25V$
- Rail-to-Rail output swing $0.01V$ to $4.99V$
- High gain-bandwidth, 10 MHz at 20 kHz
- Slew rate 12 V/ μ s
- Low supply current 360 μ A/Amp
- Wide supply range 2.7V to over 24V
- CMRR 100 dB
- Gain 100 dB with $R_L = 10k$
- PSRR 82 dB

Applications

- Battery operated instrumentation
- Instrumentation Amplifiers
- Portable scanners
- Wireless communications
- Flat panel display driver

Connection Diagrams



Ordering Information

Package	Temperature Range Industrial, $-40^{\circ}C$ to $+85^{\circ}C$	Transport Media	NSC Drawing
8-Pin Molded DIP	LM6132AIN, LM6132BIN	Rails	N08E
8-Pin Small Outline	LM6132AIM, LM6132BIM	Rails	M08A
	LM6132AIMX, LM6132BIMX	Tape and Reel	M08A
14-Pin Molded DIP	LM6134AIN, LM6134BIN	Rails	N14A
14-Pin Small Outline	LM6134AIM, LM6134BIM	Rails	M14A
	LM6134AIMX, LM6134BIMX	Tape and Reel	M14A

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

ESD Tolerance (Note 2)	2500V
Differential Input Voltage	15V
Voltage at Input/Output Pin	(V ⁺)+0.3V, (V ⁻)-0.3V
Supply Voltage (V ⁺ -V ⁻)	35V
Current at Input Pin	±10 mA
Current at Output Pin (Note 3)	±25 mA
Current at Power Supply Pin	50 mA
Lead Temp. (soldering, 10 sec.)	260°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature (Note 4)	150°C

Operating Ratings(Note 1)

Supply Voltage	1.8V ≤ V ⁺ ≤ 24V
Junction Temperature Range	-40°C ≤ T _J ≤ +85°C
LM6132, LM6134	
Thermal resistance (θ _{JA})	
N Package, 8-pin Molded DIP	115°C/W
M Package, 8-pin Surface	
Mount	193°C/W
N Package, 14-pin Molded DIP	81°C/W
M Package, 14-pin Surface	
Mount	126°C/W

5.0V DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for T_J = 25°C, V⁺ = 5.0V, V⁻ = 0V, V_{CM} = V_O = V⁺/2 and R_L > 1 MΩ to V⁺/2. **Boldface** limits apply at the temperature extremes

Symbol	Parameter	Conditions	Typ (Note 5)	LM6134AI LM6132AI Limit (Note 6)	LM6134BI LM6132BI Limit (Note 6)	Units
V _{OS}	Input Offset Voltage		0.25	2 4	6 8	mV max
TCV _{OS}	Input Offset Voltage Average Drift		5			μV/C
I _B	Input Bias Current	0V ≤ V _{CM} ≤ 5V	110	140 300	180 350	nA max
I _{OS}	Input Offset Current		3.4	30 50	30 50	nA max
R _{IN}	Input Resistance, CM		104			MΩ
CMRR	Common Mode Rejection Ratio	0V ≤ V _{CM} ≤ 4V	100	75 70	75 70	dB min
		0V ≤ V _{CM} ≤ 5V	80	60 55	60 55	
PSRR	Power Supply Rejection Ratio	±2.5V ≤ V ⁺ ≤ ±12V	82	78 75	78 75	dB min
V _{CM}	Input Common-Mode Voltage Range		-0.25	0	0	V
			5.25	5.0	5.0	
A _V	Large Signal Voltage Gain	R _L = 10k	100	25 8	15 6	V/mV min
V _O	Output Swing	100k Load	4.992	4.98 4.93	4.98 4.93	V min
			0.007	0.017 0.019	0.017 0.019	V max
		10k Load	4.952	4.94 4.85	4.94 4.85	V min
			0.032	0.07 0.09	0.07 0.09	V max
		5k Load	4.923	4.90 4.85	4.90 4.85	V min
			0.051	0.095 0.12	0.095 0.12	V max

5.0V DC Electrical Characteristics (Continued)

Unless otherwise specified, all limits guaranteed for $T_J = 25^\circ\text{C}$, $V^+ = 5.0\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{ M}\Omega$ to $V^+/2$.

Boldface limits apply at the temperature extremes

Symbol	Parameter	Conditions	Typ (Note 5)	LM6134AI LM6132AI Limit (Note 6)	LM6134BI LM6132BI Limit (Note 6)	Units
I_{SC}	Output Short Circuit Current LM6132	Sourcing	4	2 2	2 1	mA min
		Sinking	3.5	1.8 1.8	1.8 1	mA min
I_{SC}	Output Short Circuit Current LM6134	Sourcing	3	2 1.6	2 1	mA min
		Sinking	3.5	1.8 1.3	1.8 1	mA min
I_{S}	Supply Current	Per Amplifier	360	400 450	400 450	μA max

5.0V AC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25^\circ\text{C}$, $V^+ = 5.0\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{ M}\Omega$ to $V^+/2$.

Boldface limits apply at the temperature extremes

Symbol	Parameter	Conditions	Typ (Note 5)	LM6134AI LM6132AI Limit (Note 6)	LM6134BI LM6132BI Limit (Note 6)	Units
SR	Slew Rate	$\pm 4\text{V}$ @ $V_{\text{S}} = \pm 6\text{V}$ $R_{\text{S}} < 1\text{ k}\Omega$	14	8 7	8 7	$\text{V}/\mu\text{s}$ min
GBW	Gain-Bandwidth Product	$f = 20\text{ kHz}$	10	7.4 7	7.4 7	MHz min
θ_{m}	Phase Margin	$R_L = 10\text{k}$	33			deg
G_{m}	Gain Margin	$R_L = 10\text{k}$	10			dB
e_{n}	Input Referred Voltage Noise	$f = 1\text{ kHz}$	27			$\frac{\text{nV}}{\sqrt{\text{Hz}}}$
i_{n}	Input Referred Current Noise	$f = 1\text{ kHz}$	0.18			$\frac{\text{pA}}{\sqrt{\text{Hz}}}$

2.7V DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25^\circ\text{C}$, $V^+ = 2.7\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{ M}\Omega$ to $V^+/2$.

Boldface limits apply at the temperature extreme

Symbol	Parameter	Conditions	Typ (Note 5)	LM6134AI LM6132AI Limit (Note 6)	LM6134BI LM6132BI Limit (Note 6)	Units
V_{OS}	Input Offset Voltage		0.12	2 8	6 12	mV max
I_{B}	Input Bias Current	$0\text{V} \leq V_{\text{CM}} \leq 2.7\text{V}$	90			nA
I_{OS}	Input Offset Current		2.8			nA
R_{IN}	Input Resistance		134			$\text{M}\Omega$
CMRR	Common Mode Rejection Ratio	$0\text{V} \leq V_{\text{CM}} \leq 2.7\text{V}$	82			dB
PSRR	Power Supply	$\pm 1.35\text{V} \leq V^+ \leq \pm 12\text{V}$	80			dB

2.7V DC Electrical Characteristics (Continued)

Unless otherwise specified, all limits guaranteed for $T_J = 25^\circ\text{C}$, $V^+ = 2.7\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{ M}\Omega$ to $V^+/2$.

Boldface limits apply at the temperature extreme

Symbol	Parameter	Conditions	Typ (Note 5)	LM6134AI LM6132AI Limit (Note 6)	LM6134BI LM6132BI Limit (Note 6)	Units
	Rejection Ratio					
V_{CM}	Input Common-Mode Voltage Range			2.7	2.7	V
				0	0	
A_V	Large Signal Voltage Gain	$R_L = 10\text{k}$	100			V/mV
V_O	Output Swing	$R_L = 100\text{k}$	0.03	0.08	0.08	V
				0.112	0.112	max
			2.66	2.65	2.65	V
				2.25	2.25	min
I_S	Supply Current	Per Amplifier	330			μA

2.7V AC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25^\circ\text{C}$, $V^+ = 2.7\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{ M}\Omega$ to $V^+/2$.

Symbol	Parameter	Conditions	Typ (Note 5)	LM6134AI LM6132AI Limit (Note 6)	LM6134BI LM6132BI Limit (Note 6)	Units
GBW	Gain-Bandwidth Product	$R_L = 10\text{k}$, $f = 20\text{ kHz}$	7			MHz
θ_m	Phase Margin	$R_L = 10\text{k}$	23			deg
G_m	Gain Margin		12			dB

24V DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25^\circ\text{C}$, $V^+ = 24\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{ M}\Omega$ to $V^+/2$. **Boldface** limits apply at the temperature extreme

Symbol	Parameter	Conditions	Typ (Note 5)	LM6134AI LM6132AI Limit (Note 6)	LM6134BI LM6132BI Limit (Note 6)	Units
V_{OS}	Input Offset Voltage		1.7	3 5	7 9	mV max
I_{B}	Input Bias Current	$0\text{V} \leq V_{\text{CM}} \leq 24\text{V}$	125			nA
I_{OS}	Input Offset Current		4.8			nA
R_{IN}	Input Resistance		210			$\text{M}\Omega$
CMRR	Common Mode Rejection Ratio	$0\text{V} \leq V_{\text{CM}} \leq 24\text{V}$	80			dB
PSRR	Power Supply Rejection Ratio	$2.7\text{V} \leq V^+ \leq 24\text{V}$	82			dB
V_{CM}	Input Common-Mode Voltage Range		-0.25	0	0	V min
			24.25	24	24	V max
A_{V}	Large Signal Voltage Gain	$R_L = 10\text{k}$	102			V/mV
V_{O}	Output Swing	$R_L = 10\text{k}$	0.075	0.15	0.15	V max
			23.86	23.8	23.8	V min
I_{S}	Supply Current	Per Amplifier	390	450 490	450 490	μA max

24V AC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25^\circ\text{C}$, $V^+ = 24\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{ M}\Omega$ to $V^+/2$.

Symbol	Parameter	Conditions	Typ (Note 5)	LM6134AI LM6132AI Limit (Note 6)	LM6134BI LM6132BI Limit (Note 6)	Units
GBW	Gain-Bandwidth Product	$R_L = 10\text{k}$, $f = 20\text{ kHz}$	11			MHz
θ_m	Phase Margin	$R_L = 10\text{k}$	23			deg
G_m	Gain Margin	$R_L = 10\text{k}$	12			dB
THD + N	Total Harmonic Distortion and Noise	$A_{\text{V}} = +1$, $V_{\text{O}} = 20\text{V}_{\text{P-P}}$ $f = 10\text{ kHz}$	0.0015			%

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not guaranteed. For guaranteed specifications and the test conditions, see the Electrical characteristics.

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

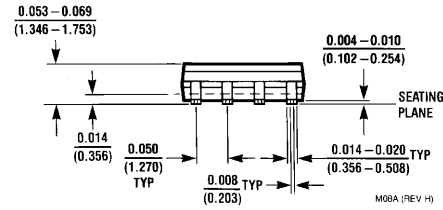
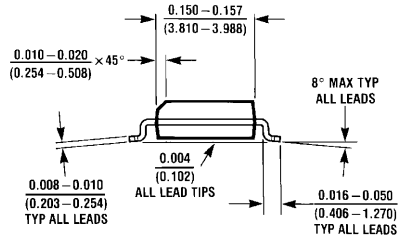
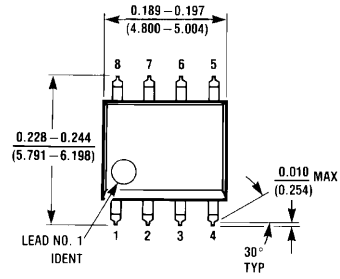
Note 3: Applies to both single-supply and split-supply operation. Continuous short circuit operation at elevated ambient temperature can result in exceeding the maximum allowed junction temperature of 150°C.

Note 4: The maximum power dissipation is a function of $T_{\text{J(MAX)}}$, θ_{JA} , and T_{A} . The maximum allowable power dissipation at any ambient temperature is $P_{\text{D}} = (T_{\text{J(MAX)}} - T_{\text{A}})/\theta_{\text{JA}}$. All numbers apply for packages soldered directly into a PC board.

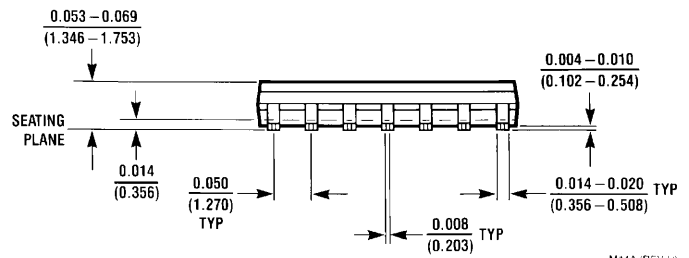
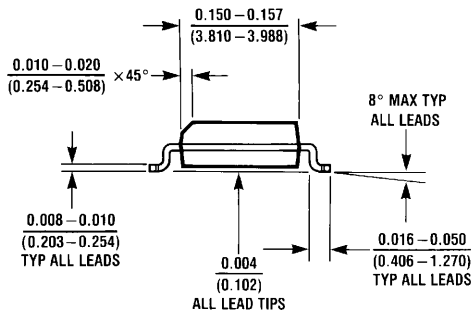
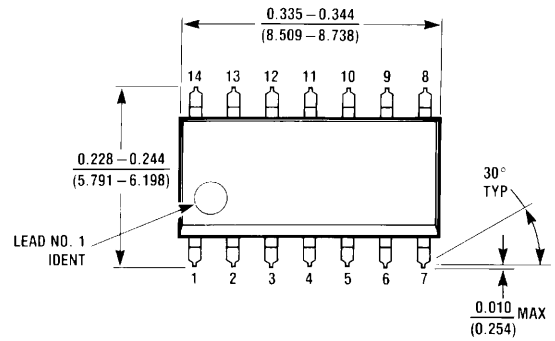
Note 5: Typical Values represent the most likely parametric norm.

Note 6: All limits are guaranteed by testing or statistical analysis.

Physical Dimensions inches (millimeters)
 unless otherwise noted



**8-Lead (0.150" Wide) Molded Small Outline Package, JEDEC
 NS Package Number M08A**



**14-Lead (0.300" Wide) Molded Small Outline Package, JEDEC
 NS Package Number M14A**