High Temperature 200°C Dual 100MHz, Rail-to-Rail Input and Output, Ultralow 1.9nV/√Hz Noise, Low Power Op Amp

FEATURES

- **Extreme High Temperature Operation: –40°C to 200°C**
- **Low Noise Voltage: 1.9nV/√Hz (100kHz)**
- **Low Supply Current: 3mA/Amp Max**
- **Gain Bandwidth Product: 100MHz**
- Low Distortion: –80dB at 1MHz
- Low Offset Voltage: 500µV Max
- Wide Supply Range: 2.5V to 12.6V
- Inputs and Outputs Swing Rail-to-Rail
- Common Mode Rejection Ratio 90dB Typ
- Low Noise Current: 1.1pA/√Hz
- Output Current: 30mA Min

APPLICATIONS

- Down Hole Drilling and Instrumentation
- Heavy Industrial
- Avionics
- High Temperature Environments
- Low Noise, Low Power Signal Processing
- Active Filters
- Rail-to-Rail Buffer Amplifiers
- Driving A/D Converters
- Battery Powered/Battery Backed Equipment

DESCRIPTION

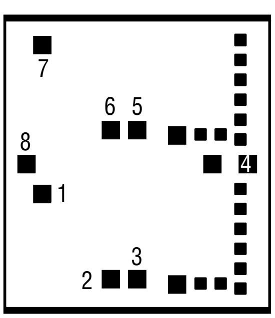
The LT®6203X is a dual low noise, rail-to-rail input and output unity gain stable op amp that features 1.9nV/√Hz noise voltage and draws only 2.5mA of supply current per amplifier. These amplifiers combine very low noise and supply current with a 100MHz gain bandwidth product, a 25V/µs slew rate, and are optimized for low supply signal conditioning systems.

These amplifiers maintain their performance for supplies from 2.5V to 12.6V and are specified at 3V, 5V and ±5V supplies. Harmonic distortion is less than –80dBc at 1MHz making these amplifiers suitable in low power data acquisition systems.

These devices can be used as replacements for many op amps to improve input/output range and noise performance.

The LT6203X is a member or a growing series of high temperature qualified products offered by Linear Technology®. For a complete selection of high temperature products, please consult our website, www.linear.com.

DICE PINOUT



50mils x 56mils
Backside potential: V⁻

DIE CROSS REFERENCE

LTC® Finished Part Number	Order Part Number
LT6203X	**LT6203X DICE**
LT6203X	**LT6203X DWF***

Please refer to LT6203X standard product data sheet for other applicable product information.

***DWF = DICE in wafer form.**

PAD FUNCTION

1. **OUT A:** Amplifier A Output. The output swings rail-to-rail and can source/sink a minimum of 15mA over temperature.
2. **–IN A:** Inverting Input of Amplifier A. Valid input range is from V^- to V^+.
3. **+IN A:** Noninverting Input of Amplifier A. Valid input range is from V^- to V^+.
4. **V^-:** Negative Supply Voltage. V^+ and V^- must be chosen so that $3V \le (V^+ - V^-) < 12.6V$.
5. **+IN B:** Noninverting Input of Amplifier B. Valid input range from V^- to V^+.
6. **–IN B:** Inverting Input of Amplifier B. Valid input range from V^- to V^+.
7. **OUT B:** Amplifier B Output. The output swings rail-to-rail and can source/sink a minimum of 15mA over temperature.
8. **V^+:** Positive Supply Voltage. V^+ and V^- must be chosen so that $3V \le (V^+ - V^-) < 12.6V$.

ABSOLUTE MAXIMUM RATINGS

(Note 1)

Total Supply Voltage (V^+ to V^-) 12.6V
Input Current (Note 2).. ±40mA
Output Short-Circuit Duration
(Note 3) ....Thermally Limited

Operating Junction Temperature Range
LT6203X ....–40°C to 200°C
Storage Temperature Range ....–65°C to 200°C

ELECTRICAL CHARACTERISTICS

T_A = 25°C, V_S = 5V, 0V; V_S = 3V, 0V; V_{CM} = V_{OUT} = half supply, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	V_S = 5V, 0V, V_{CM} = Half Supply		0.1	0.5	mV
		V_S = 3V, 0V, V_{CM} = Half Supply		0.6	1.5	mV
		V_S = 5V, 0V, V_{CM} = V^+ to V^-		0.25	2.0	mV
		V_S = 3V, 0V, V_{CM} = V^+ to V^-		1.0	3.5	mV
	Input Offset Voltage Match (Channel-to-Channel) (Note 4)	V_{CM} = Half Supply V_{CM} = V^- to V^+		0.15 0.3	0.8 1.8	mV mV
I_B	Input Bias Current	V_{CM} = Half Supply V_{CM} = V^+ V_{CM} = V^-	–7.0 –8.8	–1.3 1.3 –3.3	 2.5 	µA µA µA
ΔI_B	I_B Shift	V_{CM} = V^- to V^+		4.7	11.3	µA
	I_B Match (Channel-to-Channel) (Note 4)			0.1	0.6	µA
I_{OS}	Input Offset Current	V_{CM} = Half Supply V_{CM} = V^+ V_{CM} = V^-		0.12 0.07 0.12	1 1 1.1	µA µA µA
	Input Noise Voltage	0.1Hz to 10Hz		800		nV_{P-P}
e_n	Input Noise Voltage Density	f = 100kHz, V_S = 5V f = 10kHz, V_S = 5V		2 2.9		$nV/\sqrt{Hz}$ $nV/\sqrt{Hz}$
i_n	Input Noise Current Density, Balanced Input Noise Current Density, Unbalanced	f = 10kHz, V_S = 5V		0.75 1.1		$pA/\sqrt{Hz}$ $pA/\sqrt{Hz}$
	Input Resistance	Common Mode Differential Mode		4 12		MΩ kΩ
C_{IN}	Input Capacitance	Common Mode Differential Mode		1.8 1.5		pF pF
A_{VOL}	Large Signal Gain	V_S = 5V, V_O = 0.5V to 4.5V, R_L = 1k to V_S/2 V_S = 5V, V_O = 1V to 4V, R_L = 100 to V_S/2 V_S = 3V, V_O = 0.5V to 2.5V, R_L = 1k to V_S/2	40 8.0 17	70 14 40		V/mV V/mV V/mV
CMRR	Common Mode Rejection Ratio	V_S = 5V, V_{CM} = V^- to V^+ V_S = 5V, V_{CM} = 1.5V to 3.5V V_S = 3V, V_{CM} = V^- to V^+	60 80 56	83 100 80		dB dB dB
	CMRR Match (Channel-to-Channel) (Note 4)	V_S = 5V, V_{CM} = 1.5V to 3.5V	85	120		dB
PSRR	Power Supply Rejection Ratio	V_S = 2.5V to 10V, V_{CM} = 0V	60	74		dB
	PSRR Match (Channel-to-Channel) (Note 4)	V_S = 2.5V to 10V, V_{CM} = 0V	70	100		dB
	Minimum Supply Voltage (Note 5)		2.5			V
V_{OL}	Output Voltage Swing LOW Saturation (Note 6)	No Load I_{SINK} = 5mA V_S = 5V, I_{SINK} = 20mA V_S = 3V, I_{SINK} = 15mA		5 85 240 185	50 	mV mV mV mV

ELECTRICAL CHARACTERISTICS

T_A = 25°C, V_S = 5V, 0V; V_S = 3V, 0V; V_{CM} = V_{OUT} = half supply, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{OH}	Output Voltage Swing HIGH Saturation (Note 6)	No Load I_{SOURCE} = 5mA V_S = 5V, I_{SOURCE} = 20mA V_S = 3V, I_{SOURCE} = 15mA		25 90 325 225	75	mV mV mV mV
I_{SC}	Short-Circuit Current	V_S = 5V V_S = 3V	±30 ±25	±45 ±40		mA mA
I_S	Supply Current per Amp	V_S = 5V V_S = 3V		2.5 2.3	3.0 2.85	mA mA
GBW	Gain Bandwidth Product	Frequency = 1MHz, V_S = 5V		90		MHz
SR	Slew Rate	V_S = 5V, A_V = –1, R_L = 1k, V_O = 4V		24		V/µs
FPBW	Full Power Bandwidth (Note 7)	V_S = 5V, V_{OUT} = $3V_{P-P}$		2.5		MHz
t_S	Settling Time	0.1%, V_S = 5V, V_{STEP} = 2V, A_V = –1, R_L = 1k		85		ns

T_A = 25°C, V_S = ±5V, V_{CM} = V_{OUT} = 0V, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	V_{CM} = 0V V_{CM} = V^+ V_{CM} = V^-		1.0 2.6 2.3	2.5 5.5 5.0	mV mV mV
	Input Offset Voltage Match (Channel-to-Channel) (Note 4)	V_{CM} = 0V V_{CM} = V^- to V^+		0.2 0.4	1.0 2.0	mV mV
I_B	Input Bias Current	V_{CM} = Half Supply V_{CM} = V^+ V_{CM} = V^-	–7.0 –9.5	–1.3 1.3 –3.8	 3.0 	µA µA µA
ΔI_B	I_B Shift	V_{CM} = V^- to V^+		5.3	12.5	µA
	I_B Match (Channel-to-Channel) (Note 4)			0.1	0.6	µA
I_{OS}	Input Offset Current	V_{CM} = Half Supply V_{CM} = V^+ V_{CM} = V^-		0.15 0.2 0.35	1 1.2 1.3	µA µA µA
	Input Noise Voltage	0.1Hz to 10Hz		800		nV_{P-P}
e_n	Input Noise Voltage Density	f = 100kHz f = 10kHz		1.9 2.8		$nV/\sqrt{Hz}$ $nV/\sqrt{Hz}$
i_n	Input Noise Current Density, Balanced Input Noise Current Density, Unbalanced	f = 10kHz		0.75 1.1		$pA/\sqrt{Hz}$ $pA/\sqrt{Hz}$
	Input Resistance	Common Mode Differential Mode		4 12		MΩ kΩ
C_{IN}	Input Capacitance	Common Mode Differential Mode		1.8 1.5		pF pF
A_{VOL}	Large Signal Gain	V_O = ±4.5V, R_L = 1k V_O = ±2.5V, R_L = 100	75 11	130 19		V/mV V/mV
CMRR	Common Mode Rejection Ratio	V_{CM} = V^- to V^+ V_{CM} = –2V to 2V	65 85	85 98		dB dB
	CMRR Match (Channel-to-Channel) (Note 4)	V_{CM} = –2V to 2V	85	120		dB
PSRR	Power Supply Rejection Ratio	V_S = ±1.25V to ±5V	60	74		dB
	PSRR Match (Channel-to-Channel) (Note 4)	V_S = ±1.25V to ±5V	70	100		dB
V_{OL}	Output Voltage Swing LOW Saturation (Note 6)	No Load I_{SINK} = 5mA I_{SINK} = 20mA		5 87 245	50	mV mV mV

ELECTRICAL CHARACTERISTICS T_A = 25°C, V_S = ±5V; V_{CM} = V_{OUT} = 0V unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{OH}	Output Voltage Swing HIGH Saturation (Note 6)	No Load I_{SOURCE} = 5mA I_{SOURCE} = 20mA		40 95 320	95	mV mV mV
I_{SC}	Short-Circuit Current		±30	±40		mA
I_S	Supply Current per Amp			2.8	3.5	mA
GBW	Gain Bandwidth Product	Frequency = 1MHz		100		MHz
SR	Slew Rate	A_V = –1, R_L = 1k, V_O = 4V		25		V/µs
FPBW	Full Power Bandwidth (Note 7)	V_{OUT} = 3V_{P-P}		2.6		MHz
t_S	Settling Time	0.1%, V_{STEP} = 2V, A_V = –1, R_L = 1k		78		ns
dG	Differential Gain (Note 8)	A_V = 2, R_F = R_G = 499Ω, R_L = 2k		0.05		%
dP	Differential Phase (Note 8)	A_V = 2, R_F = R_G = 499Ω, R_L = 2k		0.03		DEG

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Note 2: Inputs are protected by back-to-back diodes and diodes to each supply. If the inputs are taken beyond the supplies or the differential input voltage exceeds 0.7V, the input current must be limited to less than 40mA.

Note 3: Junction temperatures must be kept below the absolute maximum rating when the output is shorted indefinitely.

Note 4: Matching parameters are the difference between the two amplifiers of the LT6203X. CMRR and PSRR match are defined as follows: CMRR and PSRR are measured in µV/V on the identical amplifiers. The difference is calculated between the matching sides in µV/V. The result is converted to dB.

Note 5: Minimum supply voltage is guaranteed by power supply rejection ratio test.

Note 6: Output voltage swings are measured between the output and power supply rails.

Note 7: Full-power bandwidth is calculated from the slew rate: FPBW = SR/2πV_P

Note 8: Differential gain and phase are measured using a Tektronix TSG120YC/NTSC signal generator and a Tektronix 1780R Video Measurement Set. The resolution of this equipment is 0.1% and 0.1°. Ten identical amplifier stages were cascaded giving an effective resolution of 0.01% and 0.01°.

NOW PART OF ANALOG DEVICES
LT 0617 • PRINTED IN USA
www.linear.com/LT6203X