

## BiMOS Microprocessor Operational Amplifiers with MOSFET Input/CMOS Output

March 1993

### Features

- **MOSFET Input Stage provides**
  - Very High  $Z_i = 1.5T\Omega$  ( $1.5 \times 10^{12}\Omega$ ) Typ.
  - Very Low  $I_i = 5pA$  Typ. at 15V Operation  
= 2pA Typ. at 5V Operation
- **Ideal for Single Supply Applications**
- **Common Mode Input Voltage Range Includes Negative Supply Rail; Input Terminals Can be Swung 0.5V Below Negative Supply Rail**
- **CMOS Output Stage Permits Signal Swing to Either (or Both) Supply Rails**
- **CA5260A, CA5260 Have Full Military Temperature Range Guaranteed Specifications for  $V_+ = 5V$**
- **CA5260A, CA5260 are Guaranteed to Operate Down to 4.5V for  $A_{OL}$**
- **Fully guaranteed to operate from  $-55^\circ C$  to  $+125^\circ C$  at  $V_+ = 5V$ ,  $V_- = Gnd$**

### Applications

- **Ground Referenced Single Supply Amplifiers**
- **Fast Sample-Hold Amplifiers**
- **Long Duration Timers/Monostables**
- **Ideal Interface with Digital CMOS**
- **High Input Impedance Wideband Amplifiers**
- **Voltage Followers (e.g. Follower for Single Supply D/A Converter)**
- **Voltage Regulators (Permits Control of Output Voltage Down to Zero Volts)**
- **Wien Bridge Oscillators**
- **Voltage Controlled Oscillators**
- **Photo Diode Sensor Amplifiers**
- **5V Logic Systems**
- **Microprocessor Interface**

### Description

The CA5260A and CA5260 are integrated-circuit operational amplifiers that combine the advantage of both CMOS and bipolar transistors on a monolithic chip. The CA5260 series circuits are dual versions of the popular CA5160 series. They are designed and guaranteed to operate in microprocessor or logic systems that use +5V supplies.

Gate-protected p-channel MOSFET (PMOS) transistors are used in the input circuit to provide very-high-input impedance, very-low-input current, and exceptional speed performance. The use of PMOS field-effect transistors in the input stage results in common-mode input-voltage capability down to 0.5V below the negative-supply terminal, an important attribute in single-supply applications.

A complementary-symmetry MOS (CMOS) transistor-pair, capable of swinging the output voltage to within 10mV of either supply-voltage terminal (at very high values of load impedance), is employed as the output circuit.

The CA5260 Series circuits operate at supply voltages ranging from 4.5V to 16V, or  $\pm 2.25V$  to  $\pm 8V$  when using split supplies.

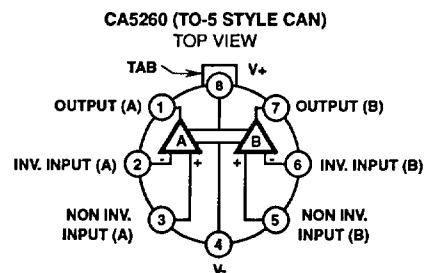
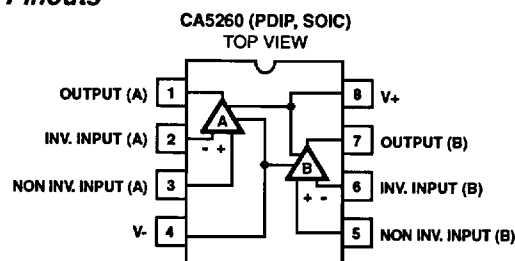
The CA5260A, CA5260 have guaranteed specifications for 5V operation over the full military temperature range of  $-55^\circ C$  to  $+125^\circ C$ .

### Ordering Information

PART NUMBER	TEMPERATURE RANGE	PACKAGE
CA5260AE	$-55^\circ C$ to $+125^\circ C$	8 Lead Plastic DIP
CA5260AM	$-55^\circ C$ to $+125^\circ C$	8 Lead SOIC
CA5260AM96	$-55^\circ C$ to $+125^\circ C$	8 Lead SOIC*
CA5260AT	$-55^\circ C$ to $+125^\circ C$	8 Pin TO-5 Can
CA5260E	$-55^\circ C$ to $+125^\circ C$	8 Lead Plastic DIP
CA5260M	$-55^\circ C$ to $+125^\circ C$	8 Lead SOIC
CA5260M96	$-55^\circ C$ to $+125^\circ C$	8 Lead SOIC*
CA5260T	$-55^\circ C$ to $+125^\circ C$	8 Pin TO-5 Can

\* Denotes Tape and Reel

### Pinouts



CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper I.C. Handling Procedures.  
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## Specifications CA5260, CA5260A

### Absolute Maximum Ratings

Supply Voltage (Between V+ and V Terminals)	16V
Differential Input Voltage	8V
Input Voltage	(V+ +8 V) to (V- -0.5 V)
Input Current	1mA
Output Short Circuit Duration (Note 1)	Indefinite
Junction Temperature	+175°C
Junction Temperature (Plastic Package)	+150°C
Lead Temperature (Soldering 10 Sec.)	+300°C

### Operating Conditions

Operating Temperature Range (All Types)	-55°C to +125°C
Storage Temperature Range (All Types)	-65°C to +150°C

*CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.*

**Electrical Specifications** Typical Values Intended Only for Design Guidance, V+ = 5V, V- = 0V, T<sub>A</sub> = +25°C, Unless Otherwise Specified

PARAMETERS	SYMBOL	TEST CONDITIONS	TYPICAL VALUES		UNITS
			CA5260A	CA5260	
Input Resistance	R <sub>I</sub>		1.5	1.5	TΩ
Input Capacitance	C <sub>I</sub>	f = 1MHz	4.3	4.3	pF
Unity Gain Crossover Frequency	f <sub>T</sub>		3	3	MHz
Slew Rate	SR	V <sub>OUT</sub> = 2.5V <sub>P-P</sub>	5	5	V/μs
Transient Response		C <sub>L</sub> = 25pF, R <sub>L</sub> = 2kΩ (Voltage Follower)			
Rise Time	t <sub>R</sub>		0.09	0.09	μs
Overshoot	OS		10	10	%
Settling Time (T <sub>0</sub> <0.1%, V <sub>IN</sub> = 4V <sub>P-P</sub> )	t <sub>S</sub>	C <sub>L</sub> = 25pF, R <sub>L</sub> = 2kΩ (Voltage Follower)	1.8	1.8	μs

**Electrical Specifications** T<sub>A</sub> = +25°C, V+ = 5V, V- = 0V

PARAMETERS	SYMBOL	TEST CONDITIONS	LIMITS						UNITS
			CA3260A			CA5260			
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	V <sub>IO</sub>	V <sub>O</sub> = 2.5V	-	1.5	4	-	2	15	mV
Input Offset Current	I <sub>IO</sub>	V <sub>O</sub> = 2.5V	-	1	10	-	1	10	pA
Input Current	I <sub>I</sub>	V <sub>O</sub> = 2.5V	-	2	15	-	2	15	pA
Common Mode Rejection Ratio	CMRR	V <sub>CM</sub> = 0 to 1V	80	85	-	70	85	-	dB
		V <sub>CM</sub> = 0 to 2.5V	50	55	-	50	55	-	dB
Common Mode Input Voltage Range	V <sub>ICR+</sub>		2.5	3	-	2.5	3	-	V
	V <sub>ICR-</sub>		-	-0.5	0	-	-0.5	0	V
Power Supply Rejection Ratio	PSRR	ΔV+ = 1V; ΔV- = 1V	75	84	-	70	84	-	dB
Large Signal Voltage Gain (Note 2)	A <sub>OL</sub>	R <sub>L</sub> = ∞, V <sub>O</sub> = 0.5 to 4V	107	113	-	105	111	-	dB
		R <sub>L</sub> = 10kΩ, V <sub>O</sub> = 0.5 to 3.6V	83	86	-	80	86	-	dB
Source Current	I <sub>SOURCE</sub>	V <sub>O</sub> = 0V	1.75	2.2	-	1.75	2.2	-	mA
Sink Current	I <sub>SINK</sub>	V <sub>O</sub> = 5V	1.70	2	-	1.70	2	-	mA

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**Specifications CA5260, CA5260A**

**Electrical Specifications**  $T_A = +25^\circ\text{C}$ ,  $V_+ = 5\text{V}$ ,  $V_- = 0\text{V}$  (Continued)

PARAMETERS	SYMBOL	TEST CONDITIONS	LIMITS						UNITS
			CA3260A			CA5260			
			MIN	TYP	MAX	MIN	TYP	MAX	
Output Voltage	$V_{OM+}$	$R_L = \infty$	4.99	5	-	4.99	5	-	V
	$V_{OM-}$		-	0	0.01	-	0	0.01	V
	$V_{OM+}$	$R_L = 10\text{k}\Omega$	4.4	4.7	-	4.4	4.7	-	V
	$V_{OM-}$		-	0	0.01	-	0	0.01	V
	$V_{OM+}$	$R_L = 2\text{k}\Omega$	3	3.4	-	3	3.4	-	V
	$V_{OM-}$		-	0	0.01	-	0	0.01	V
Supply Current	$I_{SUPPLY}$	$V_O = 0\text{V}$	-	1.60	2.0	-	1.60	2.0	mA
		$V_O = 2.5\text{V}$	-	1.80	2.25	-	1.80	2.25	mA

**NOTES:**

- Short circuit may be applied to ground or to either supply.
- For  $V_+ = 4.5\text{V}$  and  $V_- = \text{GND}$ ;  $V_{OUT} = 0.5\text{V}$  to  $3.2\text{V}$  at  $R_L = 10\text{k}\Omega$ .

**Electrical Specifications**  $T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$ ,  $V_+ = 5\text{V}$ ,  $V_- = 0\text{V}$

PARAMETERS	SYMBOL	TEST CONDITIONS	LIMITS						UNITS
			CA3260A			CA5260			
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	$V_{IO}$	$V_O = 2.5\text{V}$	-	2	15	-	3	20	mV
Input Offset Current	$I_{IO}$	$V_O = 2.5\text{V}$	-	1	10	-	1	10	nA
Input Current	$I_I$	$V_O = 2.5\text{V}$	-	2	15	-	2	15	nA
Common Mode Rejection Ratio	CMRR	$V_{CM} = 0$ to $1\text{V}$	65	78	-	60	78	-	dB
		$V_{CM} = 0$ to $2.5\text{V}$	50	60	-	50	60	-	dB
Common Mode Input Voltage Range	$V_{ICR+}$		2.5	3	-	2.5	3	-	V
	$V_{ICR-}$		-	-0.5	0	-	-0.5	0	V
Power Supply Rejection Ratio	PSRR	$\Delta V_+ = 1\text{V}$ ; $\Delta V_- = 1\text{V}$	62	65	-	60	65	-	dB
Large Signal Voltage Gain (Note 2)	$A_{OL}$	$R_L = \infty$ , $V_O = 0.5$ to $4\text{V}$	70	78	-	70	78	-	dB
		$R_L = 10\text{k}\Omega$ , $V_O = 0.5$ to $3.6\text{V}$	60	65	-	60	65	-	dB
Source Current	$I_{SOURCE}$	$V_O = 0\text{V}$	1.3	1.6	-	1.3	1.6	-	mA
Sink Current	$I_{SINK}$	$V_O = 5\text{V}$	1.2	1.4	-	1.2	1.4	-	mA
Output Voltage	$V_{OM+}$	$R_L = \infty$	4.99	5	-	4.99	5	-	V
	$V_{OM-}$		-	0	0.01	-	0	0.01	V
	$V_{OM+}$	$R_L = 10\text{k}\Omega$	4.2	4.4	-	4.2	4.4	-	V
	$V_{OM-}$		-	0	0.01	-	0	0.01	V
	$V_{OM+}$	$R_L = 2\text{k}\Omega$	2.5	2.7	-	2.5	2.7	-	V
	$V_{OM-}$		-	0	0.01	-	0	0.01	V
Supply Current	$I_{SUPPLY}$	$V_O = 0\text{V}$	-	1.65	2.2	-	1.65	2.2	mA
		$V_O = 2.5\text{V}$	-	1.95	2.35	-	1.95	2.35	mA

**NOTES:**

- Short circuit may be applied to ground or to either supply.
- For  $V_+ = 4.5\text{V}$  and  $V_- = \text{GND}$ ;  $V_{OUT} = 0.5\text{V}$  to  $3.2\text{V}$  at  $R_L = 10\text{k}\Omega$ .

**Specifications CA5260, CA5260A**

**Electrical Specifications** Each Amplifier at  $T_A = 25^\circ\text{C}$ ,  $V_+ = 15\text{V}$ ,  $V_- = 0\text{V}$ , Unless Otherwise Specified.

PARAMETERS	SYMBOL	TEST CONDITIONS	LIMITS						UNITS
			CA3260A			CA5260			
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	$V_{IO}$	$V_{\pm} = \pm 7.5$	-	2	5	-	6	15	mV
Input Offset Current	$I_{IO}$	$V_{\pm} = \pm 7.5$	-	0.5	20	-	0.5	30	pA
Input Current	$I_I$	$V_{\pm} = \pm 7.5$	-	5	30	-	5	50	pA
Large Signal Voltage Gain	$A_{OL}$	$V_O = 10\text{V}_{\text{p-p}}$ , $R_L = 10\text{k}\Omega$	50	320	-	50	320	-	kV/V
			94	110	-	94	110	-	dB
Common Mode Rejection Ratio	CMRR		80	95	-	70	90	-	dB
Common Mode Input Voltage Range	$V_{ICR}$		10	-0.5 to 12	0	10	-0.5 to 12	0	V
Power Supply Rejection Ratio, $\Delta V_{IO}/\Delta V_{\pm}$	PSRR	$V_{\pm} = \pm 7.5$	-	32	150	-	32	320	$\mu\text{V/V}$
Maximum Output Voltage	$V_{OM+}$	$R_L = 10\text{k}\Omega$	11	13.3	-	11	13.3	-	V
	$V_{OM-}$		-	0.002	0.01	-	0.002	0.01	V
	$V_{OM+}$	$R_L = \infty$	14.99	15	-	14.99	15	-	V
	$V_{OM-}$		-	0	0.01	-	0	0.01	V
Maximum Output Current	$I_{OM+}$ (Source)	$V_O = 7.5\text{V}$	12	22	45	12	22	45	mA
	$I_{OM-}$ (Sink)		12	20	45	12	20	45	mA
Total Supply Current, $R_L = \infty$	I+	$V_O$ (Amp A) = 7.5V $V_O$ (Amp B) = 7.5V	-	9	16.5	-	9	16.5	mA
		$V_O$ (Amp A) = 0V $V_O$ (Amp B) = 0V	-	1.2	4	-	1.2	4	mA
		$V_O$ (Amp A) = 0V $V_O$ (Amp B) = 7.5V	-	5	9.5	-	5	9.5	mA
Input Offset Voltage Temp. Drift	$\Delta V_{IO}/\Delta T$		-	6	-	-	8	-	$\mu\text{V}/^\circ\text{C}$
Crosstalk		$f = 1\text{kHz}$	-	120	-	-	120	-	dB

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Schematic Diagram

