

## 3MHz, BiMOS Microprocessor Operational Amplifiers with MOSFET Input/CMOS Output

November 1996

### 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 0V)
- 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.

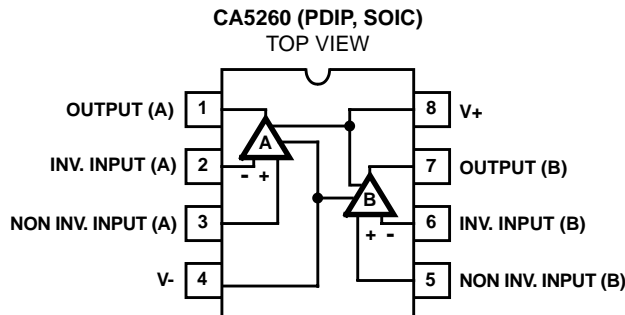
The CA5260 Series circuits operate at supply voltages ranging from 4.5V to 16V, or  $\pm 2.25V$  to  $\pm 8V$  when using split supplies.

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

### Ordering Information

PART NUMBER (BRAND)	TEMP. RANGE ( $^\circ C$ )	PACKAGE	PKG. NO.
CA5260AE	-55 to 125	8 Ld PDIP	E8.3
CA5260AM (5260A)	-55 to 125	8 Ld SOIC	M8.15
CA5260AM96 (5260A)	-55 to 125	8 Ld SOIC Tape and Reel	M8.15
CA5260E	-55 to 125	8 Ld PDIP	E8.3
CA5260M (5260)	-55 to 125	8 Ld SOIC	M8.15
CA5260M96 (5260)	-55 to 125	8 Ld SOIC Tape and Reel	M8.15

### Pinout



# CA5260, CA5260A

## Absolute Maximum Ratings

Supply Voltage (Between V+ and V- Terminals) . . . . . 16V  
 Differential Input Voltage . . . . . 8V  
 Input Voltage . . . . . (V+ +8V) to (V- -0.5V)  
 Input Current . . . . . 1mA  
 Output Short Circuit Duration (Note 1) . . . . . Indefinite

## Operating Conditions

Temperature Range . . . . . -55°C to 125°C

## Thermal Information

Thermal Resistance (Typical, Note 2)  $\theta_{JA}$  (°C/W)  
 PDIP Package . . . . . 96  
 SOIC Package . . . . . 157  
 Maximum Junction Temperature (Die) . . . . . 175°C  
 Maximum Junction Temperature (Plastic Package) . . . . . 150°C  
 Maximum Storage Temperature Range . . . . . -65°C to 150°C  
 Maximum Lead Temperature (Soldering 10s) . . . . . 300°C  
 (SOIC - Lead Tips Only)

*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.*

### NOTES:

- Short circuit may be applied to ground or to either supply.
- $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

## Electrical Specifications

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

PARAMETER	SYMBOL	TEST CONDITIONS	TYPICAL VALUES		UNITS
			CA5260	CA5260A	
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	Rise Time	C <sub>L</sub> = 25pF, R <sub>L</sub> = 2kΩ (Voltage Follower)	0.09	0.09	μs
Settling Time (To <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

PARAMETER	SYMBOL	TEST CONDITIONS	CA5260			CA5260A			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	V <sub>IO</sub>	V <sub>O</sub> = 2.5V	-	2	15	-	1.5	4	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	70	85	-	80	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	70	84	-	75	84	-	dB
Large Signal Voltage Gain (Note 3)	A <sub>OL</sub>	R <sub>L</sub> = ∞, V <sub>O</sub> = 0.5 to 4V	105	111	-	107	113	-	dB
		R <sub>L</sub> = 10kΩ, V <sub>O</sub> = 0.5 to 3.6V	80	86	-	83	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
Output Voltage	V <sub>OM+</sub>	R <sub>L</sub> = ∞	4.99	5	-	4.99	5	-	V
	V <sub>OM-</sub>		-	0	0.01	-	0	0.01	V
	V <sub>OM+</sub>	R <sub>L</sub> = 10kΩ	4.4	4.7	-	4.4	4.7	-	V
	V <sub>OM-</sub>		-	0	0.01	-	0	0.01	V
	V <sub>OM+</sub>	R <sub>L</sub> = 2kΩ	3	3.4	-	3	3.4	-	V
	V <sub>OM-</sub>		-	0	0.01	-	0	0.01	V

## CA5260, CA5260A

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

PARAMETER	SYMBOL	TEST CONDITIONS	CA5260			CA5260A			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Supply Current	$I_{\text{SUPPLY}}$	$V_O = 0\text{V}$	-	1.60	2.0	-	1.60	2.0	mA
		$V_O = 2.5\text{V}$	-	1.80	2.25	-	1.80	2.25	mA

NOTE:

3. For  $V_+ = 4.5\text{V}$  and  $V_- = \text{GND}$ ;  $V_{\text{OUT}} = 0.5\text{V}$  to  $3.2\text{V}$  at  $R_L = 10\text{k}\Omega$ .

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

PARAMETER	SYMBOL	TEST CONDITIONS	CA5260			CA5260A			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	$V_{\text{IO}}$	$V_O = 2.5\text{V}$	-	3	20	-	2	15	mV
Input Offset Current	$I_{\text{IO}}$	$V_O = 2.5\text{V}$	-	1	10	-	1	10	nA
Input Current	$I_{\text{I}}$	$V_O = 2.5\text{V}$	-	2	15	-	2	15	nA
Common Mode Rejection Ratio	CMRR	$V_{\text{CM}} = 0$ to $1\text{V}$	60	78	-	65	78	-	dB
		$V_{\text{CM}} = 0$ to $2.5\text{V}$	50	60	-	50	60	-	dB
Common Mode Input Voltage Range	$V_{\text{ICR}+}$		2.5	3	-	2.5	3	-	V
	$V_{\text{ICR}-}$		-	-0.5	0	-	-0.5	0	V
Power Supply Rejection Ratio	PSRR	$\Delta V_+ = 1\text{V}$ ; $\Delta V_- = 1\text{V}$	60	65	-	62	65	-	dB
Large Signal Voltage Gain (Note 4)	$A_{\text{OL}}$	$R_L = \infty$ , $V_O = 0.5$ 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	$I_{\text{SOURCE}}$	$V_O = 0\text{V}$	1.3	1.6	-	1.3	1.6	-	mA
Sink Current	$I_{\text{SINK}}$	$V_O = 5\text{V}$	1.2	1.4	-	1.2	1.4	-	mA
Output Voltage	$V_{\text{OM}+}$	$R_L = \infty$	4.99	5	-	4.99	5	-	V
	$V_{\text{OM}-}$		-	0	0.01	-	0	0.01	V
	$V_{\text{OM}+}$	$R_L = 10\text{k}\Omega$	4.2	4.4	-	4.2	4.4	-	V
	$V_{\text{OM}-}$		-	0	0.01	-	0	0.01	V
	$V_{\text{OM}+}$	$R_L = 2\text{k}\Omega$	2.5	2.7	-	2.5	2.7	-	V
	$V_{\text{OM}-}$		-	0	0.01	-	0	0.01	V
Supply Current	$I_{\text{SUPPLY}}$	$V_O = 0\text{V}$	-	1.65	2.2	-	1.65	2.2	mA
		$V_O = 2.5\text{V}$	-	1.95	2.35	-	1.95	2.35	mA

NOTE:

4. For  $V_+ = 4.5\text{V}$  and  $V_- = \text{GND}$ ;  $V_{\text{OUT}} = 0.5\text{V}$  to  $3.2\text{V}$  at  $R_L = 10\text{k}\Omega$ .

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

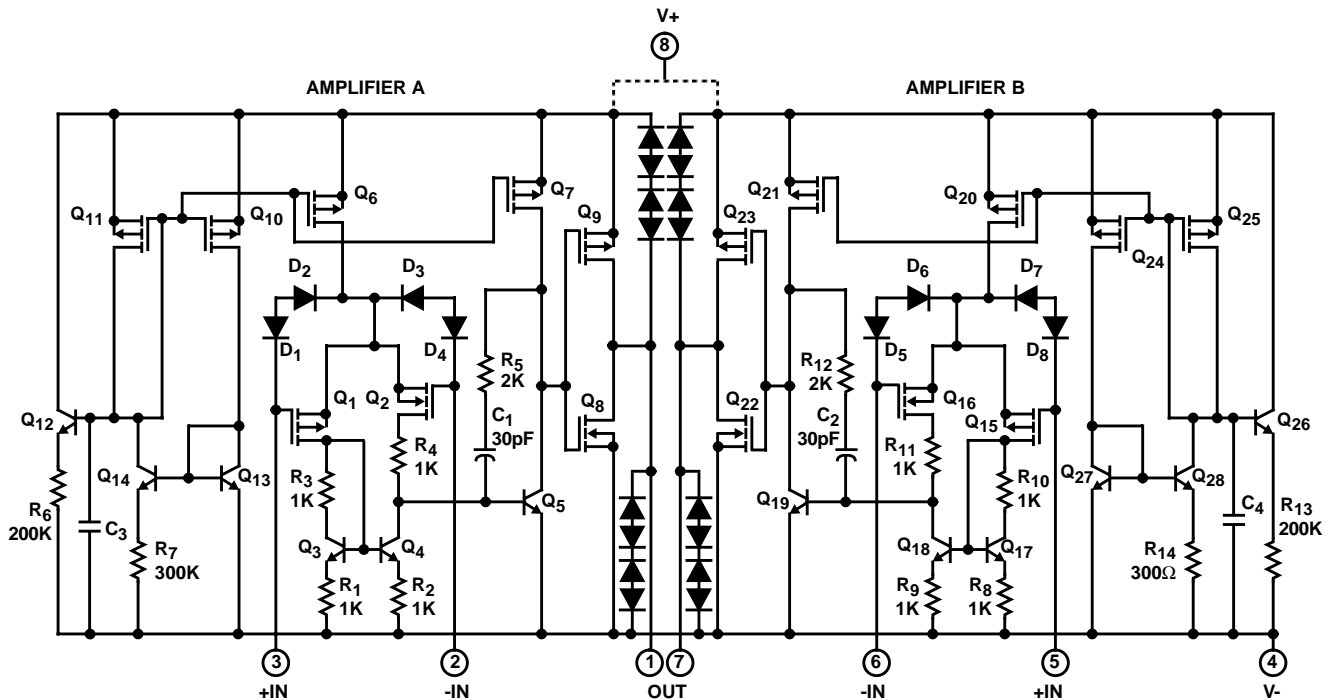
PARAMETER	SYMBOL	TEST CONDITIONS	CA5260			CA5260A			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	$V_{\text{IO}}$	$V_S = \pm 7.5$	-	6	15	-	2	5	mV
Input Offset Current	$I_{\text{IO}}$	$V_S = \pm 7.5$	-	0.5	30	-	0.5	20	pA
Input Current	$I_{\text{I}}$	$V_S = \pm 7.5$	-	5	50	-	5	30	pA
Large Signal Voltage Gain	$A_{\text{OL}}$	$V_O = 10V_{\text{P-P}}$ , $R_L = 10\text{k}\Omega$	50	320	-	50	320	-	kV/V
			94	110	-	94	110	-	dB
Common Mode Rejection Ratio	CMRR		70	90	-	80	95	-	dB

# CA5260, CA5260A

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

PARAMETER	SYMBOL	TEST CONDITIONS	CA5260			CA5260A			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
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	$V_S = \pm 7.5$	-	32	320	-	32	150	$\mu\text{V}/\text{V}$
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 Temperature Drift	$\Delta V_{IO} / \Delta T$		-	8	-	-	6	-	$\mu\text{V}/^\circ\text{C}$
Crosstalk		$f = 1\text{kHz}$	-	120	-	-	120	-	dB

### Schematic Diagram



All Intersil semiconductor products are manufactured, assembled and tested under **ISO9000** quality systems certification.

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### **Sales Office Headquarters**

#### **NORTH AMERICA**

Intersil Corporation  
P. O. Box 883, Mail Stop 53-204  
Melbourne, FL 32902  
TEL: (321) 724-7000  
FAX: (321) 724-7240

#### **EUROPE**

Intersil SA  
Mercure Center  
100, Rue de la Fusee  
1130 Brussels, Belgium  
TEL: (32) 2.724.2111  
FAX: (32) 2.724.22.05

#### **ASIA**

Intersil (Taiwan) Ltd.  
Taiwan Limited  
7F-6, No. 101 Fu Hsing North Road  
Taipei, Taiwan  
Republic of China  
TEL: (886) 2 2716 9310  
FAX: (886) 2 2715 3029