

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.

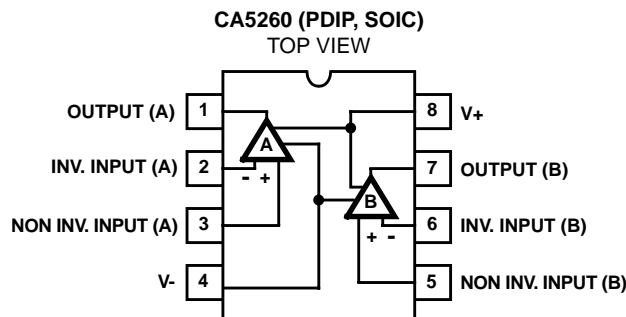
The CA5260 Series circuits operate at supply voltages ranging from 4.5V to 16V, or $\pm 2.25V$ to $\pm 8V$ when using split supplies.

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) θ_{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.
- θ_{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_A = 25°C, Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS	TYPICAL VALUES		UNITS
			CA5260	CA5260A	
Input Resistance	R _I		1.5	1.5	TΩ
Input Capacitance	C _I	f = 1MHz	4.3	4.3	pF
Unity Gain Crossover Frequency	f _T		3	3	MHz
Slew Rate	SR	V _{OUT} = 2.5V _{P-P}	5	5	V/μs
Transient Response	Rise Time	C _L = 25pF, R _L = 2kΩ (Voltage Follower)	0.09	0.09	μs
Settling Time (To <0.1%, V _{IN} = 4V _{P-P})	t _S	C _L = 25pF, R _L = 2kΩ (Voltage Follower)	1.8	1.8	μs

Electrical Specifications

T_A = 25°C, V+ = 5V, V- = 0V

PARAMETER	SYMBOL	TEST CONDITIONS	CA5260			CA5260A			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	V _{IO}	V _O = 2.5V	-	2	15	-	1.5	4	mV
Input Offset Current	I _{IO}	V _O = 2.5V	-	1	10	-	1	10	pA
Input Current	I _I	V _O = 2.5V	-	2	15	-	2	15	pA
Common Mode Rejection Ratio	CMRR	V _{CM} = 0 to 1V	70	85	-	80	85	-	dB
		V _{CM} = 0 to 2.5V	50	55	-	50	55	-	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	ΔV+ = 1V; ΔV- = 1V	70	84	-	75	84	-	dB
Large Signal Voltage Gain (Note 3)	A _{OL}	R _L = ∞, V _O = 0.5 to 4V	105	111	-	107	113	-	dB
		R _L = 10kΩ, V _O = 0.5 to 3.6V	80	86	-	83	86	-	dB
Source Current	I _{SOURCE}	V _O = 0V	1.75	2.2	-	1.75	2.2	-	mA
Sink Current	I _{SINK}	V _O = 5V	1.70	2	-	1.70	2	-	mA
Output Voltage	V _{OM+}	R _L = ∞	4.99	5	-	4.99	5	-	V
	V _{OM-}		-	0	0.01	-	0	0.01	V
	V _{OM+}	R _L = 10kΩ	4.4	4.7	-	4.4	4.7	-	V
	V _{OM-}		-	0	0.01	-	0	0.01	V
	V _{OM+}	R _L = 2kΩ	3	3.4	-	3	3.4	-	V
	V _{OM-}		-	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_{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 3.2V at $R_L = 10\text{k}\Omega$.

Electrical Specifications $T_A = -55^\circ\text{C}$ to 125°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_{IO}	$V_O = 2.5\text{V}$	-	3	20	-	2	15	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	$V_{\text{CM}} = 0$ to 1V	60	78	-	65	78	-	dB
		$V_{\text{CM}} = 0$ to 2.5V	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_{OL}	$R_L = \infty$, $V_O = 0.5$ to 4V	70	78	-	70	78	-	dB
		$R_L = 10\text{k}\Omega$, $V_O = 0.5$ to 3.6V	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	$V_{\text{OM}+}$	$R_L = \infty$	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_{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 3.2V 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

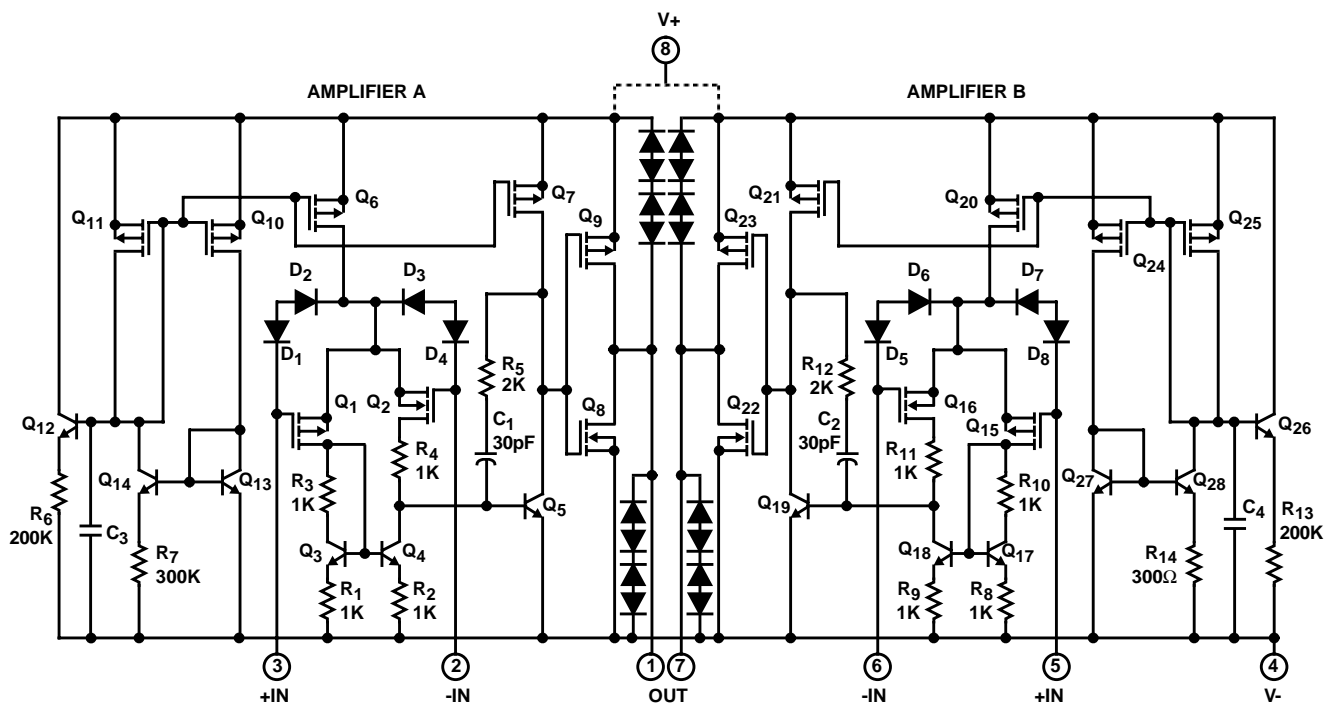
PARAMETER	SYMBOL	TEST CONDITIONS	CA5260			CA5260A			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	V_{IO}	$V_S = \pm 7.5$	-	6	15	-	2	5	mV
Input Offset Current	I_{IO}	$V_S = \pm 7.5$	-	0.5	30	-	0.5	20	pA
Input Current	I_{I}	$V_S = \pm 7.5$	-	5	50	-	5	30	pA
Large Signal Voltage Gain	A_{OL}	$V_O = 10V_{\text{P-P}}$, $R_L = 10\text{k}\Omega$	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



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