Quad 125MHz Video Current Feedback Amplifier with Disable

The HA5024 is a quad version of the popular Intersil HA5020. It features wide bandwidth and high slew rate, and is optimized for video applications and gains between 1 and 10. It is a current feedback amplifier and thus yields less bandwidth degradation at high closed loop gains than voltage feedback amplifiers.

The low differential gain and phase, 0.1dB gain flatness, and ability to drive two back terminated 75Ω cables, make this amplifier ideal for demanding video applications.

The HA5024 also features a disable function that significantly reduces supply current while forcing the output to a true high impedance state. This functionality allows 2:1 and 4:1 video multiplexers to be implemented with a single IC.

The current feedback design allows the user to take advantage of the amplifier's bandwidth dependency on the feedback resistor. By reducing R_F, the bandwidth can be increased to compensate for decreases at higher closed loop gains or heavy output loads.

Ordering Information

PART NUMBER	PART MARKING	TEMP. RANGE (°C)	PACKAGE	PKG. DWG. #
HA5024IP	HA5024IP	-40 to 85	20 Ld PDIP	E20.3
HA5024IPZ (Note)	HA5024IPZ	-40 to 85	20 Ld PDIP* (Pb-free)	E20.3
HA5024IB	HA5024IB	-40 to 85	20 Ld SOIC	M20.3
HA5024IBZ (Note)	HA5024IBZ	-40 to 85	20 Ld SOIC (Pb-free)	M20.3
HA5024IBZ96 (See Note)	HA5024IBZ	-40 to 85	20 Ld SOIC Tape and Reel (Pb-free)	M20.3
HA5024EVAL		High Speed Op Amp DIP Evaluation Board		

*Pb-free PDIPs can be used for through hole wave solder processing only. They are not intended for use in Reflow solder processing applications.

NOTE: Intersil Pb-free plus anneal products employ special Pb-free material sets; molding compounds/die attach materials and 100% matte tin plate termination finish, which are RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.

Features

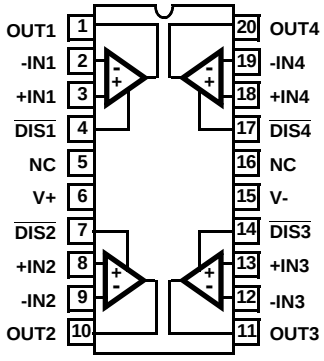
- Quad Version of HA-5020
- Individual Output Enable/Disable
- Input Offset Voltage 800μV
- Wide Unity Gain Bandwidth 125MHz
- Slew Rate 475V/μs
- Differential Gain 0.03%
- Differential Phase . . . . . 0.03 Degrees
- Supply Current (per Amplifier) 7.5mA
- ESD Protection 4000V
- Guaranteed Specifications at ±5V Supplies
- Pb-Free Plus Anneal Available (RoHS Compliant)

Applications

- Video Multiplexers; Video Switching and Routing
- Video Gain Block
- Video Distribution Amplifier/RGB Amplifier
- Flash A/D Driver
- Current to Voltage Converter
- Medical Imaging
- Radar and Imaging Systems

Pinout

HA5024
(PDIP, SOIC)
TOP VIEW



Absolute Maximum Ratings

Voltage Between V+ and V- Terminals 36V
DC Input Voltage (Note 3) . . . . . $\pm V_{SUPPLY}$
Differential Input Voltage 10V
Output Current (Note 4) . . . . . Short Circuit Protected
ESD Rating (Note 3)
Human Body Model (Per MIL-STD-883 Method 3015.7) . . .2000V

Operating Conditions

Temperature Range . . . . . -40°C to 85°C
Supply Voltage Range (Typical) . . . . . ±4.5V to ±15V

Thermal Information

Thermal Resistance (Typical, Note 2)	θ_{JA} (°C/W)
PDIP Package*	75
SOIC Package	90

Maximum Junction Temperature (Note 1) . . . . . 175°C
Maximum Junction Temperature (Plastic Package, Note 1) . . . 150°C
Maximum Storage Temperature Range . . . . . -65°C to 150°C
Maximum Lead Temperature (Soldering 10s) . . . . . 300°C
(SOIC - Lead Tips Only)

*Pb-free PDIPs can be used for through hole wave solder processing only. They are not intended for use in Reflow solder processing applications.

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:

1. Maximum power dissipation, including output load, must be designed to maintain junction temperature below 175°C for die, and below 150°C for plastic packages. See Application Information section for safe operating area information.
2. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.
3. The non-inverting input of unused amplifiers must be connected to GND.
4. Output is protected for short circuits to ground. Brief short circuits to ground will not degrade reliability, however, continuous (100% duty cycle) output current should not exceed 15mA for maximum reliability.

Electrical Specifications

$V_{SUPPLY} = \pm 5V$, $R_F = 1k\Omega$, $A_V = +1$, $R_L = 400\Omega$, $C_L \leq 10pF$, Unless Otherwise Specified

PARAMETER	TEST CONDITIONS	(NOTE 11) TEST LEVEL	TEMP. (°C)	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS							
Input Offset Voltage (V_{IO})		A	25	-	0.8	3	mV
		A	Full	-	-	5	mV
Delta V_{IO} Between Channels		A	Full	-	1.2	3.5	mV
Average Input Offset Voltage Drift		B	Full	-	5	-	µV/°C
V_{IO} Common Mode Rejection Ratio	Note 5	A	25	53	-	-	dB
		A	Full	50	-	-	dB
V_{IO} Power Supply Rejection Ratio	$\pm 3.5V \leq V_S \leq \pm 6.5V$	A	25	60	-	-	dB
		A	Full	55	-	-	dB
Input Common Mode Range	Note 5	A	Full	±2.5	-	-	V
Non-Inverting Input (+IN) Current		A	25	-	3	8	µA
		A	Full	-	-	20	µA
+IN Common Mode Rejection ($+I_{BCMR} = \frac{1}{R_{IN}}$)	Note 5	A	25	-	-	0.15	µA/V
		A	Full	-	-	0.5	µA/V
+IN Power Supply Rejection	$\pm 3.5V \leq V_S \leq \pm 6.5V$	A	25	-	-	0.1	µA/V
		A	Full	-	-	0.3	µA/V
Inverting Input (-IN) Current		A	25,85	-	4	12	µA
		A	-40	-	10	30	µA
Delta -IN BIAS Current Between Channels		A	25,85	-	6	15	µA
		A	-40	-	10	30	µA
-IN Common Mode Rejection	Note 5	A	25	-	-	0.4	µA/V
		A	Full	-	-	1.0	µA/V

Electrical Specifications $V_{SUPPLY} = \pm5V$, $R_F = 1k\Omega$, $A_V = +1$, $R_L = 400\Omega$, $C_L \leq 10pF$, Unless Otherwise Specified **(Continued)**

PARAMETER	TEST CONDITIONS	(NOTE 11) TEST LEVEL	TEMP. (°C)	MIN	TYP	MAX	UNITS
-IN Power Supply Rejection	$\pm3.5V \leq V_S \leq \pm6.5V$	A	25	-	-	0.2	µA/V
		A	Full	-	-	0.5	µA/V
Input Noise Voltage	f = 1kHz	B	25	-	4.5	-	nV/√Hz
+Input Noise Current	f = 1kHz	B	25	-	2.5	-	pA/√Hz
-Input Noise Current	f = 1kHz	B	25	-	25.0	-	pA/√Hz
TRANSFER CHARACTERISTICS							
Transimpedence	Note 16	A	25	1.0	-	-	MΩ
		A	Full	0.85	-	-	MΩ
Open Loop DC Voltage Gain	$R_L = 400\Omega$, $V_{OUT} = \pm2.5V$	25A	25	70	-	-	dB
		A	Full	65	-	-	dB
Open Loop DC Voltage Gain	$R_L = 100\Omega$, $V_{OUT} = \pm2.5V$	A	25	50	-	-	dB
		A	Full	45	-	-	dB
OUTPUT CHARACTERISTICS							
Output Voltage Swing	$R_L = 150\Omega$	A	25	±2.5	±3.0	-	V
		A	Full	±2.5	±3.0	-	V
Output Current	$R_L = 150\Omega$	B	Full	±16.6	±20.0	-	mA
Output Current, Short Circuit	$V_{IN} = \pm2.5V$, $V_{OUT} = 0V$	A	Full	±40	±60	-	mA
Output Current, Disabled (Note 5)	$\overline{DISABLE} = 0V$, $V_{OUT} = \pm2.5V$, $V_{IN} = 0V$	A	Full	-	-	2	µA
Output Disable Time	Note 12	B	25	-	40	-	µs
Output Enable Time	Note 13	B	25	-	40	-	ns
Output Capacitance Disabled	Note 14	B	25	-	15	-	pF
POWER SUPPLY CHARACTERISTICS							
Supply Voltage Range		A	25	5	-	15	V
Quiescent Supply Current		A	Full	-	7.5	10	mA/Op Amp
Supply Current, Disabled	$\overline{DISABLE} = 0V$	A	Full	-	5	7.5	mA/Op Amp
$\overline{Disable}$ Pin Input Current	$\overline{DISABLE} = 0V$	A	Full	-	1.0	1.5	mA
Minimum Pin 8 Current to Disable	Note 6	A	Full	350	-	-	µA
Maximum Pin 8 Current to Enable	Note 7	A	Full	-	-	20	µA
AC CHARACTERISTICS ($A_V = +1$)							
Slew Rate	Note 8	B	25	275	350	-	V/µs
Full Power Bandwidth	Note 9	B	25	22	28	-	MHz
Rise Time	Note 10	B	25	-	6	-	ns
Fall Time	Note 10	B	25	-	6	-	ns
Propagation Delay	Note 10	B	25	-	6	-	ns
Overshoot		B	25	-	4.5	-	%
-3dB Bandwidth	$V_{OUT} = 100mV$	B	25	-	125	-	MHz
Settling Time to 1%	2V Output Step	B	25	-	50	-	ns
Settling Time to 0.25%	2V Output Step	B	25	-	75	-	ns

Electrical Specifications V_{SUPPLY} = ±5V, R_F = 1kΩ, A_V = +1, R_L = 400Ω, C_L ≤ 10pF,Unless Otherwise Specified **(Continued)**

PARAMETER	TEST CONDITIONS	(NOTE 11) TEST LEVEL	TEMP. (°C)	MIN	TYP	MAX	UNITS
AC CHARACTERISTICS (A_V = +2, R_F = 681Ω)							
Slew Rate	Note 8	B	25	-	475	-	V/µs
Full Power Bandwidth	Note 9	B	25	-	26	-	MHz
Rise Time	Note 10	B	25	-	6	-	ns
Fall Time	Note 10	B	25	-	6	-	ns
Propagation Delay	Note 10	B	25	-	6	-	ns
Overshoot		B	25	-	12	-	%
-3dB Bandwidth	V_{OUT} = 100mV	B	25	-	95	-	MHz
Settling Time to 1%	2V Output Step	B	25	-	50	-	ns
Settling Time to 0.25%	2V Output Step	B	25	-	100	-	ns
Gain Flatness	5MHz	B	25	-	0.02	-	dB
	20MHz	B	25	-	0.07	-	dB
AC CHARACTERISTICS (A_V = +10, R_F = 383Ω)							
Slew Rate	Note 8	B	25	350	475	-	V/µs
Full Power Bandwidth	Note 9	B	25	28	38	-	MHz
Rise Time	Note 10	B	25	-	8	-	ns
Fall Time	Note 10	B	25	-	9	-	ns
Propagation Delay	Note 10	B	25	-	9	-	ns
Overshoot		B	25	-	1.8	-	%
-3dB Bandwidth	V_{OUT} = 100mV	B	25	-	65	-	MHz
Settling Time to 1%	2V Output Step	B	25	-	75	-	ns
Settling Time to 0.1%	2V Output Step	B	25	-	130	-	ns
VIDEO CHARACTERISTICS							
Differential Gain (Note 15)	R_L = 150Ω	B	25	-	0.03	-	%
Differential Phase (Note 15)	R_L = 150Ω	B	25	-	0.03	-	Degrees

NOTES:

5. V_{CM} = ±2.5V. At -40°C Product is tested at V_{CM} = ±2.25V because short test duration does not allow self heating.
6. R_L = 100Ω, V_{IN} = 2.5V. This is the minimum current which must be pulled out of the $\overline{\text{Disable}}$ pin in order to disable the output. The output is considered disabled when -10mV ≤ V_{OUT} ≤ +10mV.
7. V_{IN} = 0V. This is the maximum current that can be pulled out of the $\overline{\text{Disable}}$ pin with the HA5024 remaining enabled. The HA5024 is considered disabled when the supply current has decreased by at least 0.5mA.
8. V_{OUT} switches from -2V to +2V, or from +2V to -2V. Specification is from the 25% to 75% points.
9. $\text{FPBW} = \frac{\text{Slew Rate}}{2\pi V_{PEAK}}$; $V_{PEAK} = 2V$.
10. R_L = 100Ω, V_{OUT} = 1V. Measured from 10% to 90% points for rise/fall times; from 50% points of input and output for propagation delay.
11. A. Production Tested; B. Typical or Guaranteed Limit based on characterization; C. Design Typical for information only.
12. V_{IN} = +2V, $\overline{\text{DISABLE}}$ = +5V to 0V. Measured from the 50% point of $\overline{\text{DISABLE}}$ to V_{OUT} = 0V.
13. V_{IN} = +2V, $\overline{\text{DISABLE}}$ = 0V to +5V. Measured from the 50% point of $\overline{\text{DISABLE}}$ to V_{OUT} = 2V.
14. V_{IN} = 0V, Force V_{OUT} from 0V to ±2.5V, $t_R = t_F$ = 50ns, $\overline{\text{DISABLE}}$ = 0V.
15. Measured with a VM700A video tester using an NTC-7 composite VITS.
16. V_{OUT} = ±2.5V. At -40°C Product is tested at V_{OUT} = ±2.25V because short test duration does not allow self heating.