National Semiconductor

LH4106/LH4106C ±5V High Speed Operational Amplifier

General Description

The LH4106 is a wideband op amp designed to operate with ±5V power supplies. It features a 30 MHz bandwidth and can drive 50 or 75Ω loads directly at slew rates in excess of 170 V/μs.

It is intended to fulfill a wide range of applications; such as, precision cable drivers, buffers in high speed data acquisition systems, and high speed peak detectors.

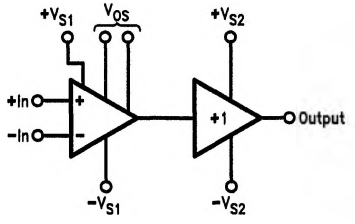
Features

- Operates from V_S of ±5V
- Unity gain stable
- Very high slew rate—170 V/μs
- Wide small signal bandwidth—32 MHz
- Low supply current—16 mA
- Drives 50 or 75Ω directly

Applications

- Flash A/D input buffers
- Video amplifier
- High speed summing amplifiers
- Pulse amplifiers
- Precision cable drivers

Block Diagram



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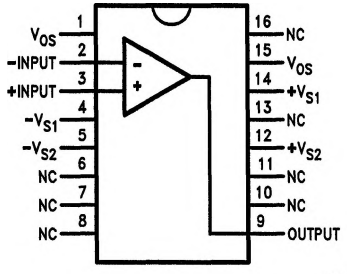
Connection Diagrams

LH4106CN



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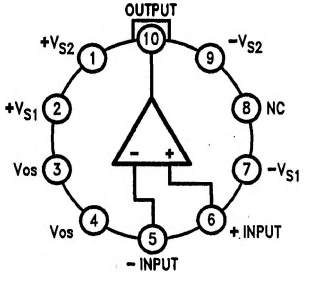
Order Number LH4106CN
See NS Package Number N16A



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Top View

TO-5 Metal Can Package (H)
Order Number LH4106CH or LH4106H
See NS Package Number H10F

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage, V_S	±7.5V
Steady State Output Current, I_O	40 mA
Power Dissipation, P_D (See Curve)	600 mW
Differential Input Voltage, V_{IN}	$\pm V_S$
Input Voltage Range, V_{CM}	(V+ − 0.7V) to (V− − 7V)
Operating Temperature Range, T_A	
LH4106	−55°C to +125°C
LH4106C	−25°C to +85°C
Storage Temperature Range, T_{STG}	−65°C to +150°C
Maximum Junction Temperature, T_j	150°C
Lead Temperature (Soldering <10 sec.)	300°C
ESD Rating (100 pF in series with 1500 ohms)	±700V

DC Electrical Characteristics

V_S = ±5V, T_A = 25°C, R_S = 50Ω, R_L = 100Ω unless otherwise noted (Note 1)

Symbol	Parameter	Conditions		LH4106C Typ	LH4106C Tested Limit (Note 2)	LH4106C Design Limit (Note 3)	Units (Max Unless Otherwise Stated)
V_{OS}	Input Offset Voltage	V_{IN} = 0V		5	15		mV
$V_{OS/AT}$	Offset Voltage Drift			10			µV/°C
I_B	Input Bias Current	(Note 4)		2	6		µA
I_{OS}	Input Offset Current	(Note 4)		150	1200		nA
C_{IN}	Input Capacitance	A_V = +1 @ 10 MHz		1.5			pF
R_{IN}	Input Resistance			325			kΩ
A_{VOL}	Large Signal Voltage Gain	R_L = 1 kΩ, $V_{OUT} \cong \pm 2V$		65	60		dB (Min)
V_O	Output Voltage Swing	R_L = 100Ω	$+V_o$	+3	+2		V (Min)
			$-V_o$	−2.6	−2		
V_{CM}	Input Common Mode Range	See CMRR			$+V_S - 1.5$ $-V_S + 2.0$		V (Min)
CMRR	Common Mode Rejection Ratio	$V_{IN} = -3V \le V_{CM} \le +3.5V$ R_L = 1 kΩ		90	70		db (Min)
PSRR	Power Supply Rejection Ratio	$V_{OC} = \pm 3V$ to ±6V, R_L = 1 kΩ		80	70		dB (Min)
I_S	Supply Current	No Load		16	20		mA

DC Electrical Characteristics

V_S = ±5V, T_A = 25°C, R_S = 50Ω, R_L = 100Ω unless otherwise noted (Note 1)

Symbol	Parameter	Conditions	LH4106 Typ	LH4106 Tested Limit (Note 2)	LH4106 Design Limit (Note 3)	Units (Max Unless Otherwise Stated)
V_{OS}	Input Offset Voltage	V_{IN} = 0V	5	**20**		mV
$V_{OS/AT}$	Offset Voltage Drift		10			µV/°C
I_B	Input Bias Current	(Note 4)	2	**6**		µA
I_{OS}	Input Offset Current	(Note 4)	150	**1500**		nA
C_{IN}	Input Capacitance	A_V = +1 @ 10 MHz	1.5			pF
R_{IN}	Input Resistance		325			kΩ
A_{VOL}	Large Signal Voltage Gain	R_L = 1 kΩ, $V_{OUT} \cong \pm 2V$	65	**60**		dB (Min)

DC Electrical Characteristics

$V_S = \pm 5V$, $T_A = 25°C$, $R_S = 50\Omega$, $R_L = 100\Omega$ unless otherwise noted (Note 1) (Continued)

Symbol	Parameter	Conditions		LH4106 Typ	LH4106 Tested Limit (Note 2)	LH4106 Design Limit (Note 3)	Units (Max Unless Otherwise Stated)
V_O	Output Voltage Swing	$R_L = 100\Omega$	$+V_O$	+3	**+2**		V (Min)
			$-V_O$	−2.6	**−2**		
V_{CM}	Input Common Mode Range	See CMRR			$+V_S - 1.5$ $-V_S + 2.0$		
CMRR	Common Mode Rejection Ratio	$V_{IN} = -3V \le V_{CM} \le +3.5V$ $R_L = 1\ k\Omega$		90	**70**		db (Min)
PSRR	Power Supply Rejection Ratio	$V_{OC} = \pm 3V$ to $\pm 6V$, $R_L = 1\ k\Omega$		80	**70**		
I_S	Supply Current	No Load		16	20		mA

AC Electrical Characteristics $V_S = \pm 5V$, $T_A = 25°C$, $R_S = R_L = 50\Omega$ unless otherwise noted (Note 1)

Symbol	Parameter	Conditions	LH4106/LH4106C Typ	LH4106/LH4106C Tested Limit (Note 2)	LH4106/LH4106C Design Limit (Note 3)	Units (Max Unless Otherwise Stated)
t_s	Settling Time to 0.1%		120			ns
SR	Slew Rate	$V_O = \pm 2V$	170	120		V/μs (Min)
t_r	Small Signal Rise Time	$A_V = 1$, $V_O = \pm 0.1V$	11			ns
	Power Bandwidth	(Note 6)	7			MHz
	Differential Gain	NTSC, $A_V = +4$	<0.1			%
	Differential Phase	NTSC, $A_V = +4$	0.1			degrees
	GBWP		34			MHz
	Phase Margin		60			degrees
	Input Noise Voltage	f = 10 kHz	15			$nV/\sqrt{Hz}$
	Input Noise Current	f = 10 kHz	1.5			$pa/\sqrt{Hz}$
SSBW	Small Signal Bandwidth	(Note 7)	32			MHz

Note 1: Boldface limits are guaranteed over full temperature range. Operating ambient temperature range of LH4106C is −25°C to +85°C, and LH4106 is −55°C to +125°C.

Note 2: Tested limits are guaranteed and 100% production tested.

Note 3: Design limits are guaranteed (but not production tested) over the indicated temperature or temperature range. These limits are not used to calculate outgoing quality level.

Note 4: Specification is at 25°C junction temperature due to requirements of high speed automatic testing. Actual values at operating temperature may exceed value at $T_J = 25°C$.

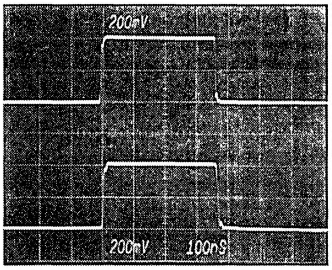
Note 5: When the LH4106 is operated at elevated temperature (such as 125°), some form of heatsinking or forced air cooling is required. The quiescent power with $V_S = \pm 5V$ is 160 mW, whereas, the package is only rated to 170 mW without a heatsink at 125°C.

Note 6: Power bandwidth is calculated from slew rate measurement using BW = Slew Rate/2πV Peak.

Note 7: Calculated from t_r using SSBW = $0.35/t_r$.

Typical Performance Characteristics

Small Signal Pulse Response



TOP = INPUT

BOTTOM = OUTPUT
$R_S = R_L = 50\Omega$

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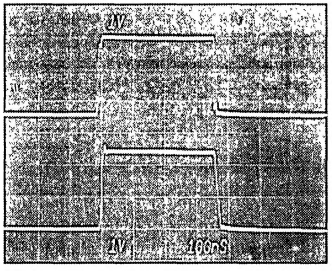
Large Signal Pulse Response



TOP = INPUT

BOTTOM = OUTPUT
$R_S = R_L = 50\Omega$

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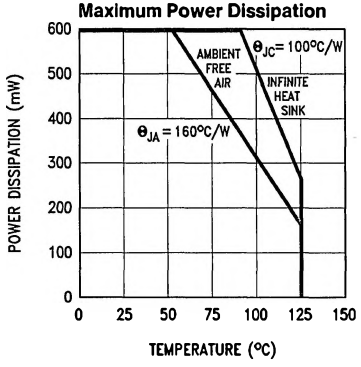
Typical Applications

Maximum Power Dissipation



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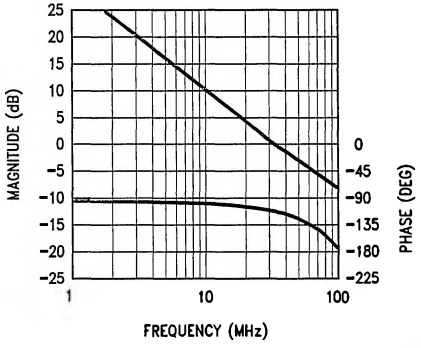
Bode Plot LH4106



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Typical Applications (Continued)

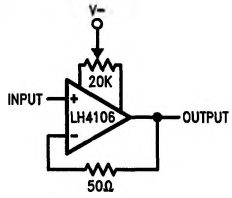

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FIGURE 1. Unity Gain Follower with Offset Adjust

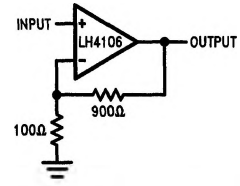

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FIGURE 2. 10X Buffer Amplifier

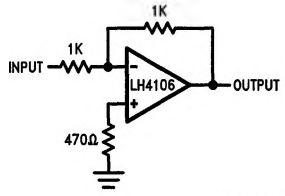

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FIGURE 3. Unity Gain Inverter

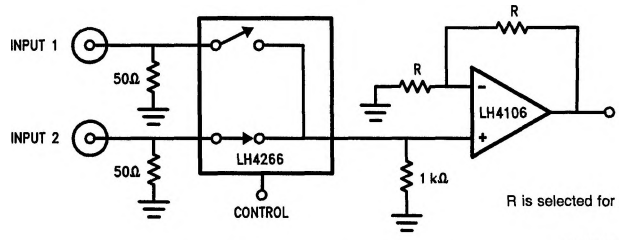

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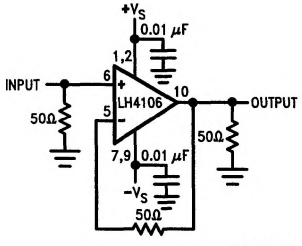
FIGURE 4. Switched Video Amplifier

AC Test Circuit



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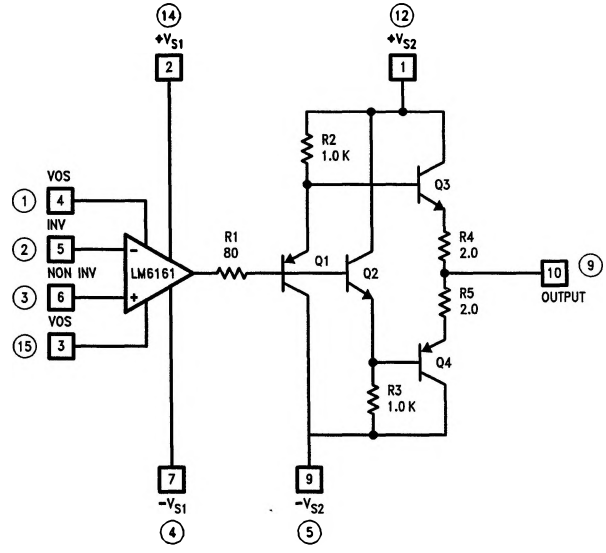
Circuit Schematic



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Pin numbers in circle denote pin connections for the dual-in-line package.