National Semiconductor

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LM7121
235 MHz Tiny Low Power Voltage Feedback Amplifier

General Description

The LM7121 is a high performance operational amplifier which addresses the increasing AC performance needs of video and imaging applications, and the size and power constraints of portable applications.

The LM7121 can operate over a wide dynamic range of supply voltages, from 5V (single supply) up to ±15V (see the Application Information section for more details). It offers an excellent speed-power product delivering 1300V/μs and 235 MHz Bandwidth (−3 dB, $A_V = +1$). Another key feature of this operational amplifier is stability while driving unlimited capacitive loads.

Due to its Tiny SOT23-5 package, the LM7121 is ideal for designs where space and weight are the critical parameters. The benefits of the Tiny package are evident in small portable electronic devices, such as cameras, and PC video cards. Tiny amplifiers are so small that they can be placed anywhere on a board close to the signal source or near the input to an A/D converter.

Features

(Typical unless otherwise noted) $V_S = \pm 15V$

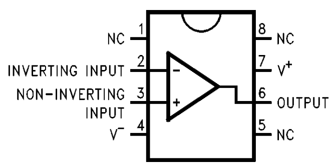
- Easy to use voltage feedback topology
- Stable with unlimited capacitive loads
- Tiny SOT23-5 package—typical circuit layout takes half the space of SO-8 designs
- Unity gain frequency 175 MHz
- Bandwidth (−3 dB, $A_V = +1$, $R_L = 100\Omega$) 235 MHz
- Slew rate 1300V/μs
- Supply Voltages DIP/SO-8 5V to ±15V; SOT23-5 5V to ±5V
- Characterized for +5V, ±5V, ±15V
- Low supply current 5.3 mA

Applications

- Scanners, color fax, digital copiers
- PC video cards
- Cable drivers
- Digital cameras
- ADC/DAC buffers
- Set-top boxes

Connection Diagram

8-Pin DIP/SO-8



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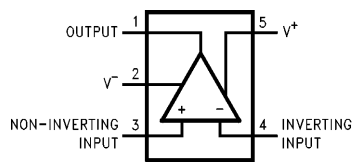
Top View

5-Pin SOT23



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Top View

Ordering Information

Package	Ordering Information	NSC Drawing Number	Package Marking	Supplied As
8-Pin Molded DIP	LM7121IN	N08E	LM7121IN	Rails
8-Pin SO-8	LM7121IM	M08A	LM7121IM	Rails
	LM7121IMX	M08A	LM7121IM	2.5k Tape and Reel
5-Pin SOT23-5	LM7121IM5X	MA05A	A03A	3k Tape and Reel

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Absolute Maximum Ratings (Note 1)

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

ESD Tolerance (Note 2)	2000V
Differential Input Voltage (Note 7)	±2V
Voltage at Input/Output Pin	$(V^+)-1.4V$, $(V^-)+1.4V$
Supply Voltage ($V^+ - V^-$)	36V
Output Short Circuit to Ground (Note 3)	Continuous
Lead Temperature (soldering, 10 sec)	260°C
Storage Temperature Range	−65°C to +150°C
Junction Temperature (Note 4)	150°C

Operating Ratings (Note 1)

Supply Voltage: DIP/SO-8	$4.5V \leq V_S \leq 33V$
SOT23-5	$4.5V \leq V_S \leq 11V$
Junction Temperature Range	$-40°C \leq T_J \leq +85°C$
Thermal Resistance (θ_{JA})	
N Package, 8-pin Molded DIP	115°C/W
M Package, 8-pin Surface Mount	165°C/W
SOT23-5 Package	325°C/W

±15V DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25°C$, $V^+ = +15V$, $V^- = -15V$, $V_{CM} = V_O = 0V$ and $R_L > 1\ M\Omega$. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Typ (Note 5)	LM7121I Limit (Note 6)	Units
V_{OS}	Input Offset Voltage		0.9	8 **15**	mV max
I_B	Input Bias Current		5.2	9.5 **12**	μA max
I_{OS}	Input Offset Current		0.04	4.3 **7**	μA max
R_{IN}	Input Resistance	Common Mode	10		MΩ
		Differential Mode	3.4		MΩ
C_{IN}	Input Capacitance	Common Mode	2.3		pF
CMRR	Common Mode Rejection Ratio	$-10V \leq V_{CM} \leq 10V$	93	73 **70**	dB min
+PSRR	Positive Power Supply Rejection Ratio	$10V \leq V^+ \leq 15V$	86	70 **68**	dB min
−PSRR	Negative Power Supply Rejection Ratio	$-15V \leq V^- \leq -10V$	81	68 **65**	dB min
V_{CM}	Input Common-Mode Voltage Range	CMRR ≥ 70 dB	13	11	V min
			−13	−11	V max
A_V	Large Signal Voltage Gain	$R_L = 2\ k\Omega$, $V_O = 20\ V_{PP}$	72	65 **57**	dB min
V_O	Output Swing	$R_L = 2\ k\Omega$	13.4	11.1 **10.8**	V min
			−13.4	−11.2 **−11.0**	V max
		$R_L = 150\Omega$	10.2	7.75 **7.0**	V min
			−7.0	−5.0 **−4.8**	V max

±15V DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for T_J = 25°C, V^+ = +15V, V^- = −15V, V_{CM} = V_O = 0V and R_L > 1 MΩ. **Boldface** limits apply at the temperature extremes. (Continued)

Symbol	Parameter	Conditions	Typ (Note 5)	LM7121I Limit (Note 6)	Units
I_{SC}	Output Short Circuit Current	Sourcing	71	54 **44**	mA min
		Sinking	52	39 **34**	mA min
I_S	Supply Current		5.3	6.6 **7.5**	mA max

±15V AC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for T_J = 25°C, V^+ = 15V, V^- = −15V, V_{CM} = V_O = 0V and R_L > 1 MΩ. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Typ (Note 5)	LM7121I Limit (Note 6)	Units
SR	Slew Rate (Note 8)	A_V = +2, R_L = 1 kΩ, V_O = 20 V_{PP}	1300		V/µs
GBW	Unity Gain-Bandwidth	R_L = 1 kΩ	175		MHz
ϕ_m	Phase Margin		63		Deg
f (−3 dB)	Bandwidth (Notes 9, 10)	R_L = 100Ω, A_V = +1	235		MHz
		R_L = 100Ω, A_V = +2	50		
t_s	Settling Time	10 V_{PP} Step, to 0.1%, R_L = 500Ω	74		ns
t_r, t_f	Rise and Fall Time (Note 10)	A_V = +2, R_L = 100Ω, V_O = 0.4 V_{PP}	5.3		ns
A_D	Differential Gain	A_V = +2, R_L = 150Ω	0.3		%
ϕ_D	Differential Phase	A_V = +2, R_L = 150Ω	0.65		Deg
e_n	Input-Referred Voltage Noise	f = 10 kHz	17		$\frac{nV}{\sqrt{Hz}}$
i_n	Input-Referred Current Noise	f = 10 kHz	1.9		$\frac{pA}{\sqrt{Hz}}$
T.H.D.	Total Harmonic Distortion	2 V_{PP} Output, R_L = 150Ω, A_V = +2, f = 1 MHz	0.065		%
		2 V_{PP} Output, R_L = 150Ω, A_V = +2, f = 5 MHz	0.52		

±5V DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25°C$, $V^+ = 5V$, $V^- = -5V$, $V_{CM} = V_O = 0V$ and $R_L > 1\ M\Omega$. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Typ (Note 5)	LM7121I Limit (Note 6)	Units
V_{OS}	Input Offset Voltage		1.6	8 **15**	mV max
I_B	Input Bias Current		5.5	9.5 **12**	μA max
I_{OS}	Input Offset Current		0.07	4.3 **7.0**	μA max
R_{IN}	Input Resistance	Common Mode	6.8		MΩ
		Differential Mode	3.4		MΩ
C_{IN}	Input Capacitance	Common Mode	2.3		pF
CMRR	Common Mode Rejection Ratio	$-2V \leq V_{CM} \leq 2V$	75	65 **60**	dB min
+PSRR	Positive Power Supply Rejection Ratio	$3V \leq V^+ \leq 5V$	89	65 **60**	dB min
−PSRR	Negative Power Supply Rejection Ratio	$-5V \leq V^- \leq -3V$	78	65 **60**	dB min
V_{CM}	Input Common Mode Voltage Range	CMRR ≥ 60 dB	3	2.5	V min
			−3	−2.5	V max
A_V	Large Signal Voltage Gain	$R_L = 2\ k\Omega$, $V_O = 3\ V_{PP}$	66	60 **58**	dB min
V_O	Output Swing	$R_L = 2\ k\Omega$	3.62	3.0 **2.75**	V min
			−3.62	−3.0 **−2.70**	V max
		$R_L = 150\Omega$	3.1	2.5 **2.3**	V min
			−2.8	−2.15 **−2.00**	V max
I_{SC}	Output Short Circuit Current	Sourcing	53	38 **33**	mA min
		Sinking	29	21 **19**	mA min
I_S	Supply Current		5.1	6.4 **7.2**	mA max

$\pm$5V AC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25°C$, $V^+ = 5V$, $V^- = -5V$, $V_{CM} = V_O = 0V$ and $R_L > 1\ M\Omega$. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Typ (Note 5)	LM7121I Limit (Note 6)	Units
SR	Slew Rate (Note 8)	$A_V = +2$, $R_L = 1\ k\Omega$, $V_O = 6\ V_{PP}$	520		V/μs
GBW	Unity Gain-Bandwidth	$R_L = 1\ k\Omega$	105		MHz
ϕ_m	Phase Margin	$R_L = 1\ k\Omega$	74		Deg
f (−3 dB)	Bandwidth (Notes 9, 10)	$R_L = 100\Omega$, $A_V = +1$	160		MHz
		$R_L = 100\Omega$, $A_V = +2$	50		
t_s	Settling Time	5 V_{PP} Step, to 0.1%, $R_L = 500\Omega$	65		ns
t_r, t_f	Rise and Fall Time (Note 10)	$A_V = +2$, $R_L = 100\Omega$, $V_O = 0.4\ V_{PP}$	5.8		ns
A_D	Differential Gain	$A_V = +2$, $R_L = 150\Omega$	0.3		%
ϕ_D	Differential Phase	$A_V = +2$, $R_L = 150\Omega$	0.65		Deg
e_n	Input-Referred Voltage Noise	f = 10 kHz	17		$\frac{nV}{\sqrt{Hz}}$
i_n	Input-Referred Current Noise	f = 10 kHz	2		$\frac{pA}{\sqrt{Hz}}$
T.H.D.	Total Harmonic Distortion	2 V_{PP} Output, $R_L = 150\Omega$, $A_V = +2$, f = 1 MHz	0.1		%
		2 V_{PP} Output, $R_L = 150\Omega$, $A_V = +2$, f = 5 MHz	0.6		

+5V DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25°C$, $V^+ = +5V$, $V^- = 0V$, $V_{CM} = V_O = V^+/2$ and $R_L > 1\ M\Omega$. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Typ (Note 5)	LM7121I Limit (Note 6)	Units
V_{OS}	Input Offset Voltage		2.4		mV
I_B	Input Bias Current		4		μA
I_{OS}	Input Offset Current		0.04		μA
R_{IN}	Input Resistance	Common Mode	2.6		MΩ
		Differential Mode	3.4		MΩ
C_{IN}	Input Capacitance	Common Mode	2.3		pF
CMRR	Common Mode Rejection Ratio	$2V \leq V_{CM} \leq 3V$	65		dB
+PSRR	Positive Power Supply Rejection Ratio	$4.6V \leq V^+ \leq 5V$	85		dB
−PSRR	Negative Power Supply Rejection Ratio	$0V \leq V^- \leq 0.4V$	61		dB
V_{CM}	Input Common-Mode Voltage Range	CMRR $\geq$ 45 dB	3.5		V min
			1.5		V max

$+$5V DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25°C$, $V^+ = +5V$, $V^- = 0V$, $V_{CM} = V_O = V^+/2$ and $R_L > 1\ M\Omega$. **Boldface** limits apply at the temperature extremes. (Continued)

Symbol	Parameter	Conditions	Typ (Note 5)	LM7121I Limit (Note 6)	Units
A_V	Large Signal Voltage Gain	$R_L = 2\ k\Omega$ to $V^+/2$	64		dB
V_O	Output Swing	$R_L = 2\ k\Omega$ to $V^+/2$, High	3.7		V
		$R_L = 2\ k\Omega$ to $V^+/2$, Low	1.3		
		$R_L = 150\Omega$ to $V^+/2$, High	3.48		
		$R_L = 150\Omega$ to $V^+/2$, Low	1.59		
I_{SC}	Output Short Circuit Current	Sourcing	33		mA
		Sinking	20		mA
I_S	Supply Current		4.8		mA

$+$5V AC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25°C$, $V^+ = +5V$, $V^- = 0V$, $V_{CM} = V_O = V^+/2$ and $R_L > 1\ M\Omega$. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Typ (Note 5)	LM7121I Limit (Note 6)	Units
SR	Slew Rate (Note 8)	$A_V = +2$, $R_L = 1\ k\Omega$ to $V^+/2$, $V_O = 1.8\ V_{PP}$	145		V/µs
GBW	Unity Gain-Bandwidth	$R_L = 1k$, to $V^+/2$	80		MHz
ϕ_m	Phase Margin	$R_L = 1k$ to $V^+/2$	70		Deg
f (−3 dB)	Bandwidth (Notes 9, 10)	$R_L = 100\Omega$ to $V^+/2$, $A_V = +1$	200		MHz
		$R_L = 100\Omega$ to $V^+/2$, $A_V = +2$	45		
t_r, t_f	Rise and Fall Time (Note 10)	$A_V = +2$, $R_L = 100\Omega$, $V_O = 0.2\ V_{PP}$	8		ns
T.H.D.	Total Harmonic Distortion	0.6 V_{PP} Output, $R_L = 150\Omega$, $A_V = +2$, f = 1 MHz	0.067		%
		0.6 V_{PP} Output, $R_L = 150\Omega$, $A_V = +2$, f = 5 MHz	0.33		

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not guaranteed. For guaranteed specifications and the test conditions, see the Electrical Characteristics.

Note 2: Human body model, 1.5 kΩ in series with 100 pF.

Note 3: Applies to both single-supply and split-supply operation. Continuous short circuit operation at elevated ambient temperature can result in exceeding the maximum allowed junction temperature of 150°C.

Note 4: The maximum power dissipation is a function of $T_{J(max)}$, θ_{JA}, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(max)} - T_A)/\theta_{JA}$. All numbers apply for packages soldered directly into a PC board.

Note 5: Typical Values represent the most likely parametric norm.

Note 6: All limits are guaranteed by testing or statistical analysis.

Note 7: Differential input voltage is measured at $V_S = \pm 15V$.

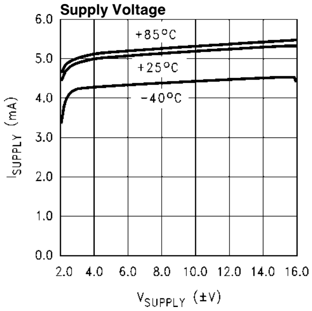
Note 8: Slew rate is the average of the rising and fallng slew rates.

Note 9: Unity gain operation for ±5V and ±15V supplies is with a feedback network of 510Ω and 3 pF in parallel (see the Application Information section). For +5V single supply operation, feedback is a direct short from the output to the inverting input.

Note 10: $A_V = +2$ operation with 2 kΩ resistors and 2 pF capacitor from summing node to ground.

Typical Performance Characteristics $T_A = 25°C$, $R_L = 1\ M\Omega$ unless otherwise specified

Supply Current vs Supply Voltage



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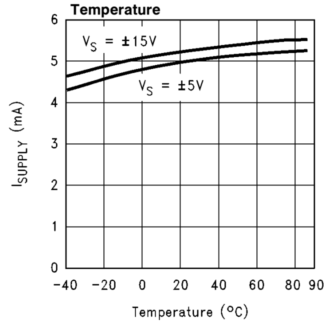
Supply Current vs Temperature



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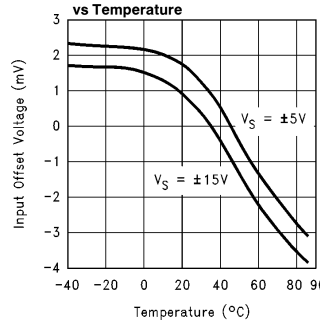
Input Offset Voltage vs Temperature



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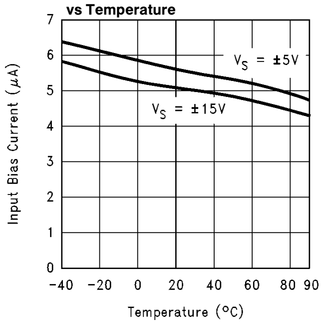
Input Bias Current vs Temperature



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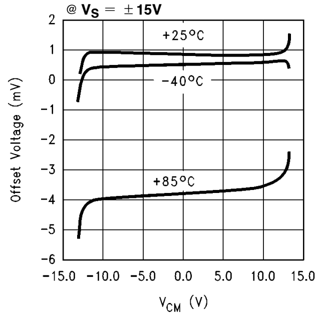
Input Offset Voltage vs Common Mode Voltage @ $V_S = \pm 15V$



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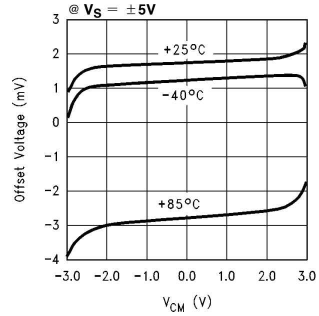
Input Offset Voltage vs Common Mode Voltage @ $V_S = \pm 5V$



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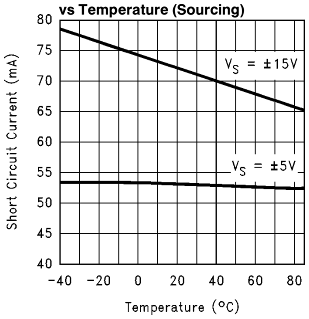
Short Circuit Current vs Temperature (Sourcing)



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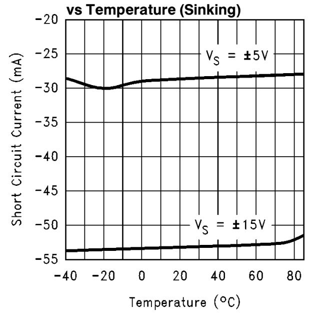
Short Circuit Current vs Temperature (Sinking)



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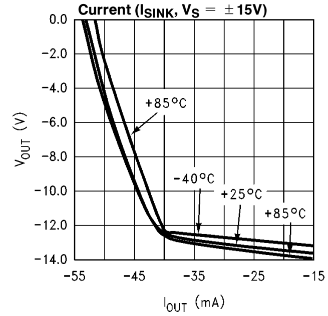
Output Voltage vs Output Current (I_{SINK}, $V_S = \pm 15V$)



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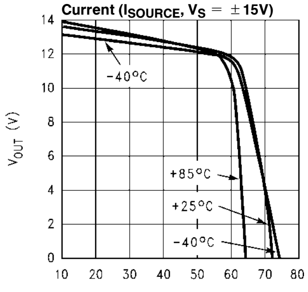
Output Voltage vs Output Current (I_{SOURCE}, $V_S = \pm 15V$)



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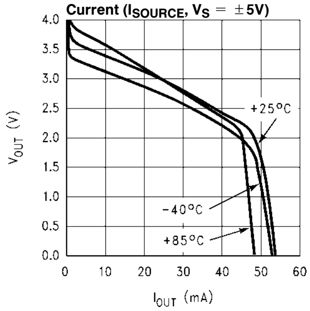
Output Voltage vs Output Current (I_{SOURCE}, $V_S = \pm 5V$)



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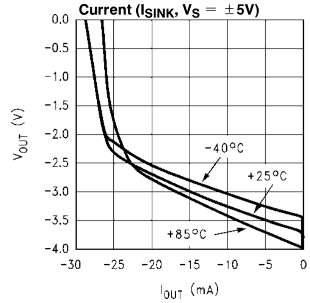
Output Voltage vs Output Current (I_{SINK}, $V_S = \pm 5V$)



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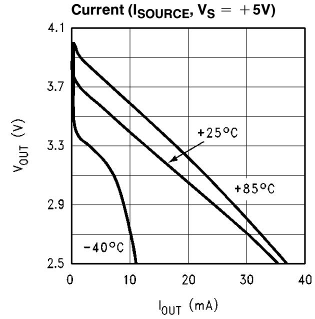
Typical Performance Characteristics $T_A = 25°C$, $R_L = 1\ M\Omega$ unless otherwise specified (Continued)

Output Voltage vs Output Current (I_{SOURCE}, $V_S = +5V$)



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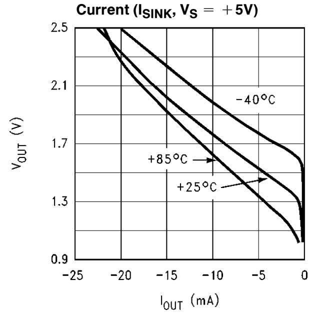
Output Voltage vs Output Current (I_{SINK}, $V_S = +5V$)



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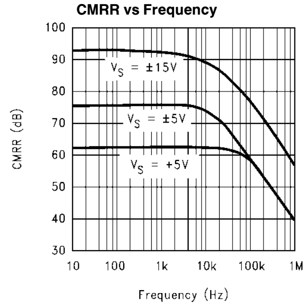
CMRR vs Frequency



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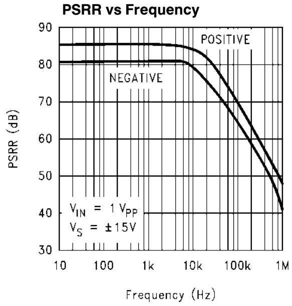
PSRR vs Frequency



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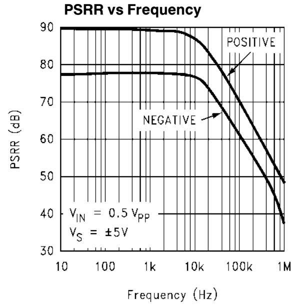
PSRR vs Frequency



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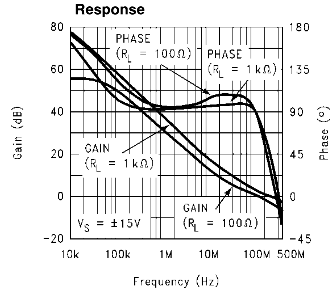
Open Loop Frequency Response



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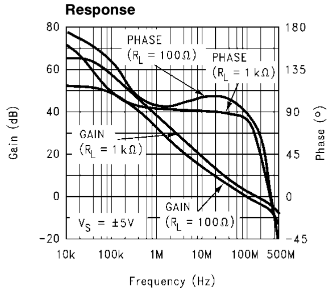
Open Loop Frequency Response



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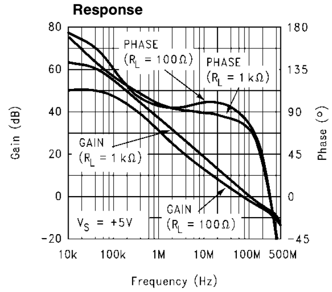
Open Loop Frequency Response



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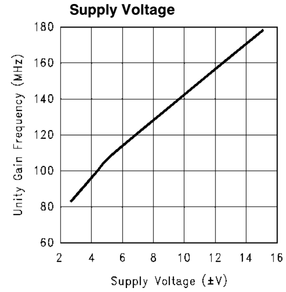
Unity Gain Frequency vs Supply Voltage



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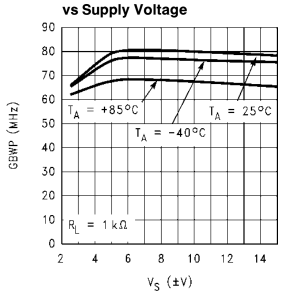
GBWP @ 10 MHz vs Supply Voltage



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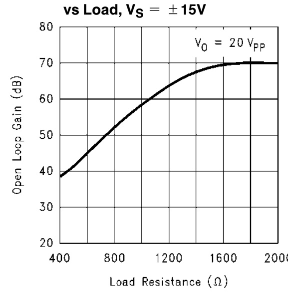
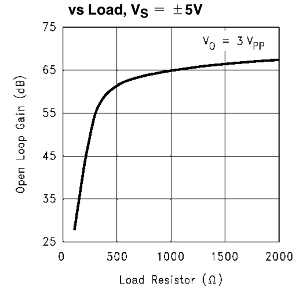
Large Signal Voltage Gain vs Load, $V_S = \pm 15V$



TL/H/12348–96

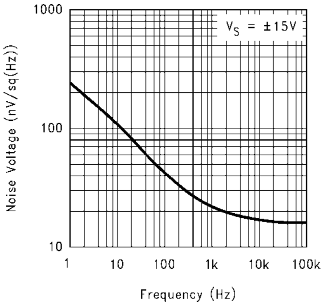
Large Signal Voltage Gain vs Load, $V_S = \pm 5V$



TL/H/12348–97

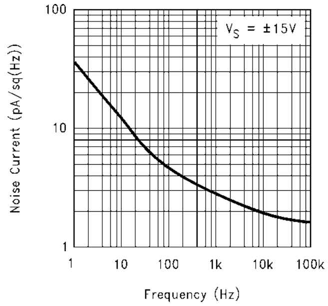
Typical Performance Characteristics $T_A = 25°C$, $R_L = 1\ M\Omega$ unless otherwise specified (Continued)

Input Voltage Noise vs Frequency



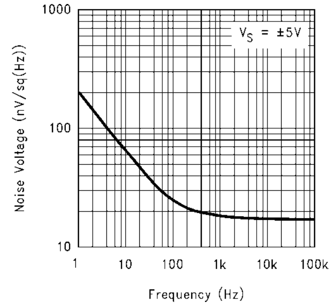
TL/H/12348–27

Input Current Noise vs Frequency



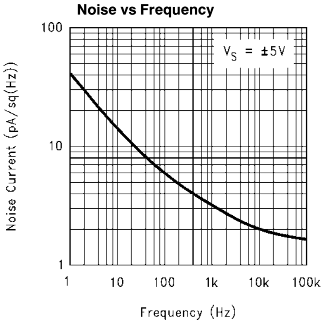
TL/H/12348–28

Input Voltage Noise vs Frequency



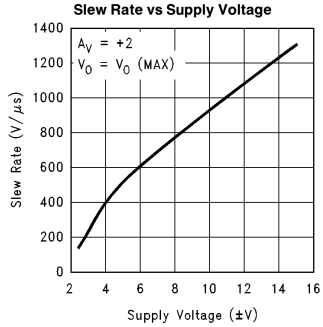
TL/H/12348–29

Input Current Noise vs Frequency



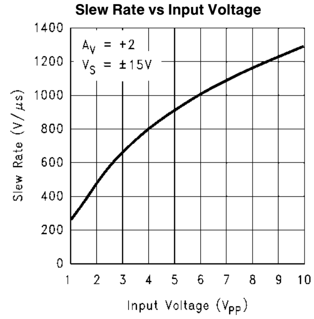
TL/H/12348–30

Slew Rate vs Supply Voltage



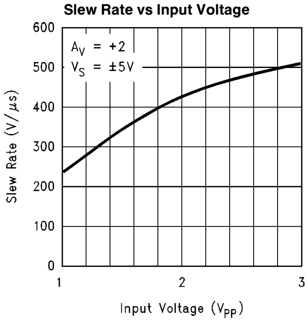
TL/H/12348–31

Slew Rate vs Input Voltage



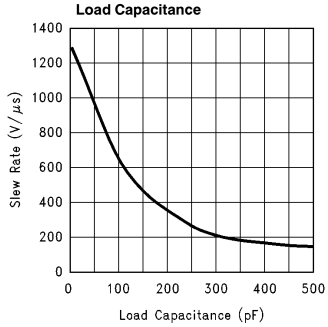
TL/H/12348–32

Slew Rate vs Input Voltage



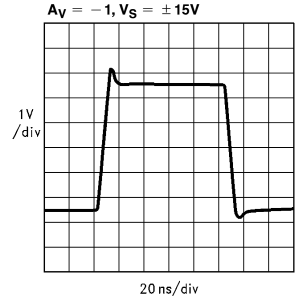
TL/H/12348–33

Slew Rate vs Load Capacitance



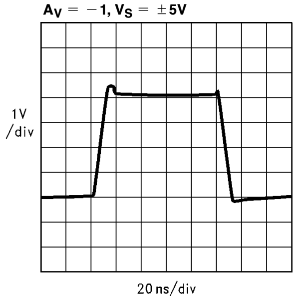
TL/H/12348–34

Large Signal Pulse Response, $A_V = -1$, $V_S = \pm 15V$



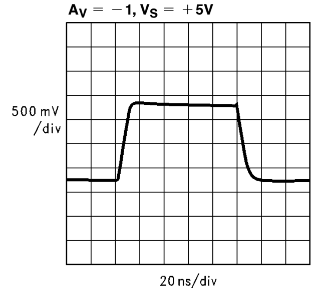
TL/H/12348–35

Large Signal Pulse Response, $A_V = -1$, $V_S = \pm 5V$



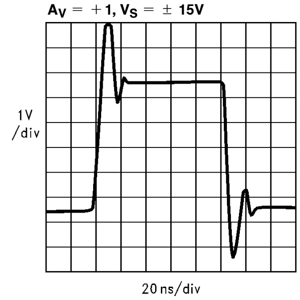
TL/H/12348–36

Large Signal Pulse Response, $A_V = -1$, $V_S = +5V$



TL/H/12348–37

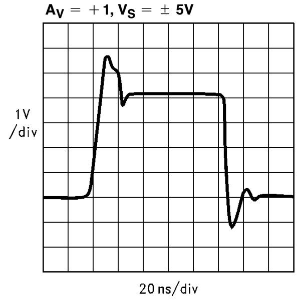
Large Signal Pulse Response, $A_V = +1$, $V_S = \pm 15V$



TL/H/12348–38

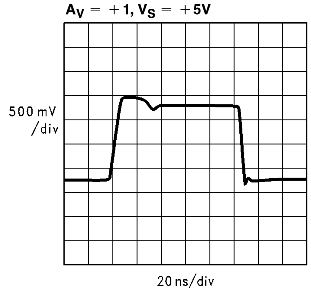
Typical Performance Characteristics $T_A = 25°C$, $R_L = 1\ M\Omega$ unless otherwise specified (Continued)

Large Signal Pulse Response, $A_V = +1$, $V_S = \pm 5V$



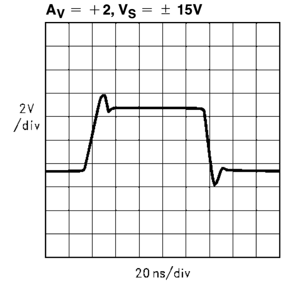
TL/H/12348–39

Large Signal Pulse Response, $A_V = +1$, $V_S = +5V$



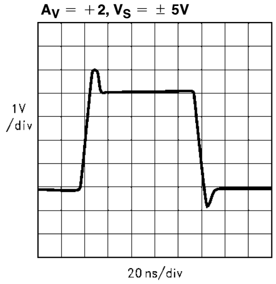
TL/H/12348–40

Large Signal Pulse Response, $A_V = +2$, $V_S = \pm 15V$



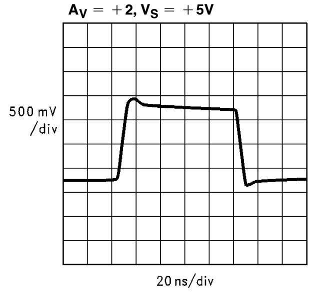
TL/H/12348–41

Large Signal Pulse Response, $A_V = +2$, $V_S = \pm 5V$



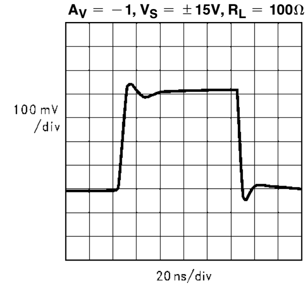
TL/H/12348–42

Large Signal Pulse Response, $A_V = +2$, $V_S = +5V$



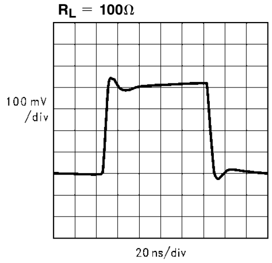
TL/H/12348–43

Small Signal Pulse Response, $A_V = -1$, $V_S = \pm 15V$, $R_L = 100\Omega$



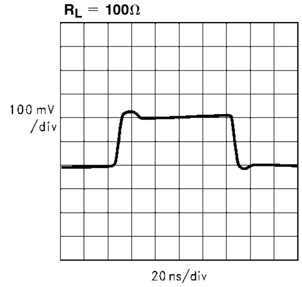
TL/H/12348–44

Small Signal Pulse Response, $A_V = -1$, $V_S = \pm 5V$, $R_L = 100\Omega$



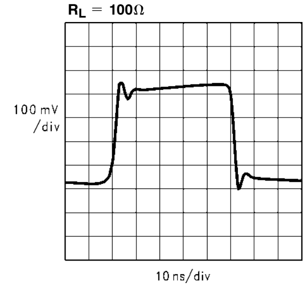
TL/H/12348–45

Small Signal Pulse Response, $A_V = -1$, $V_S = +5V$, $R_L = 100\Omega$



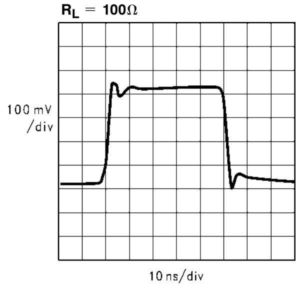
TL/H/12348–46

Small Signal Pulse Response, $A_V = +1$, $V_S = \pm 15V$, $R_L = 100\Omega$



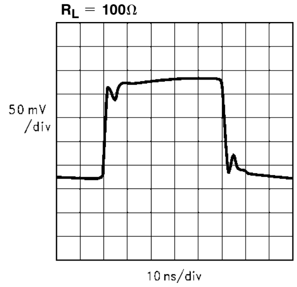
TL/H/12348–47

Small Signal Pulse Response, $A_V = +1$, $V_S = \pm 5V$, $R_L = 100\Omega$



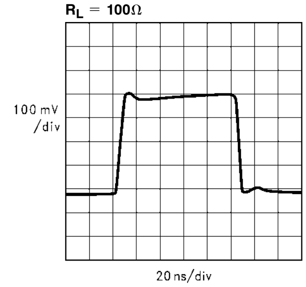
TL/H/12348–48

Small Signal Pulse Response, $A_V = +1$, $V_S = +5V$, $R_L = 100\Omega$



TL/H/12348–49

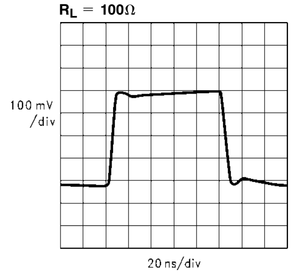
Small Signal Pulse Response, $A_V = +2$, $V_S = \pm 15V$, $R_L = 100\Omega$



TL/H/12348–50

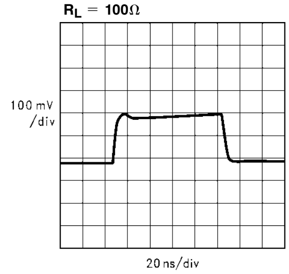
Typical Performance Characteristics $T_A = 25°C$, $R_L = 1\ M\Omega$ unless otherwise specified (Continued)

Small Signal Pulse Response, $A_V = +2$, $V_S = \pm 5V$, $R_L = 100\Omega$



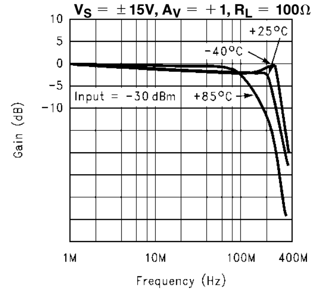
TL/H/12348–51

Small Signal Pulse Response, $A_V = +2$, $V_S = +5V$, $R_L = 100\Omega$



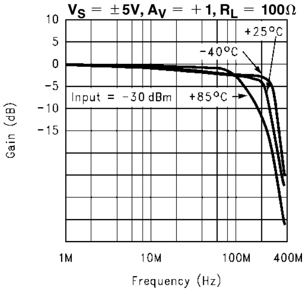
TL/H/12348–52

Closed Loop Frequency Response vs Temperature $V_S = \pm 15V$, $A_V = +1$, $R_L = 100\Omega$



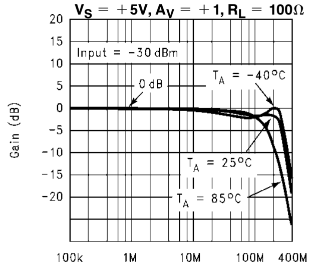
TL/H/12348–53

Closed Loop Frequency Response vs Temperature $V_S = \pm 5V$, $A_V = +1$, $R_L = 100\Omega$



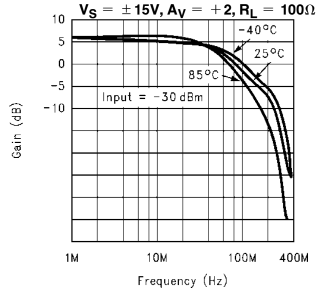
TL/H/12348–54

Closed Loop Frequency Response vs Temperature $V_S = +5V$, $A_V = +1$, $R_L = 100\Omega$



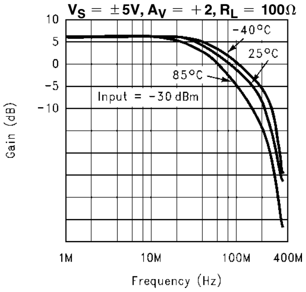
TL/H/12348–55

Closed Loop Frequency Response vs Temperature $V_S = \pm 15V$, $A_V = +2$, $R_L = 100\Omega$



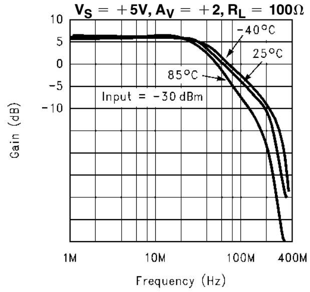
TL/H/12348–58

Closed Loop Frequency Response vs Temperature $V_S = \pm 5V$, $A_V = +2$, $R_L = 100\Omega$



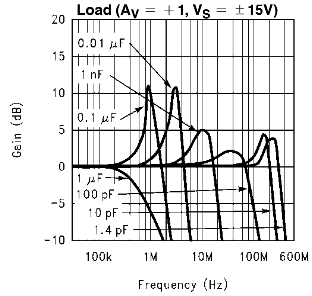
TL/H/12348–59

Closed Loop Frequency Response vs Temperature $V_S = +5V$, $A_V = +2$, $R_L = 100\Omega$



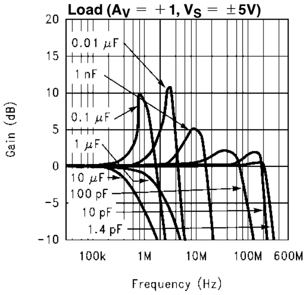
TL/H/12348–60

Closed Loop Frequency Response vs Capacitive Load ($A_V = +1$, $V_S = \pm 15V$)



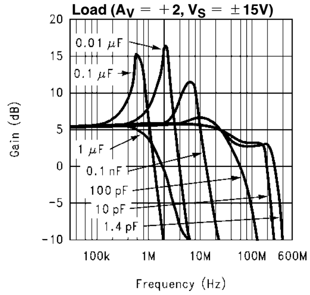
TL/H/12348–61

Closed Loop Frequency Response vs Capacitive Load ($A_V = +1$, $V_S = \pm 5V$)



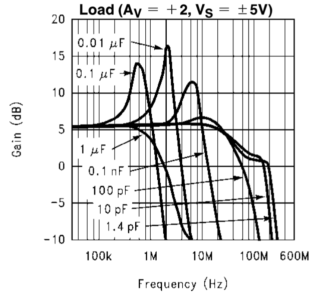
TL/H/12348–62

Closed Loop Frequency Response vs Capacitive Load ($A_V = +2$, $V_S = \pm 15V$)



TL/H/12348–63

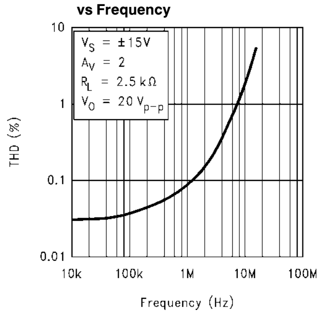
Closed Loop Frequency Response vs Capacitive Load ($A_V = +2$, $V_S = \pm 5V$)



TL/H/12348–64

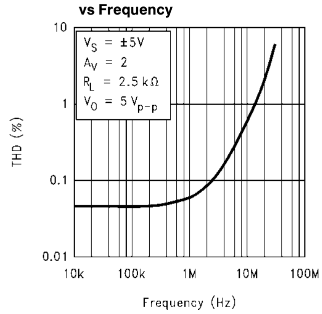
Typical Performance Characteristics $T_A = 25°C$, $R_L = 1\ M\Omega$ unless otherwise specified (Continued)

Total Harmonic Distortion vs Frequency



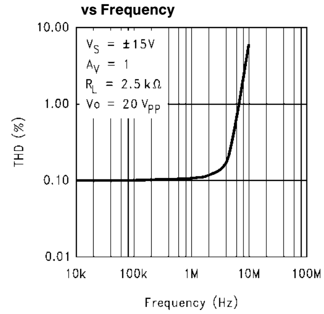
TL/H/12348–80

Total Harmonic Distortion vs Frequency



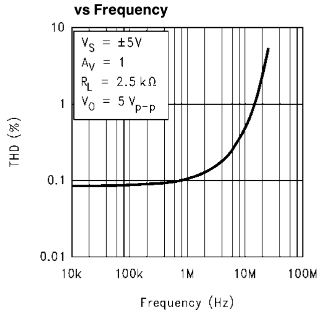
TL/H/12348–81

Total Harmonic Distortion vs Frequency



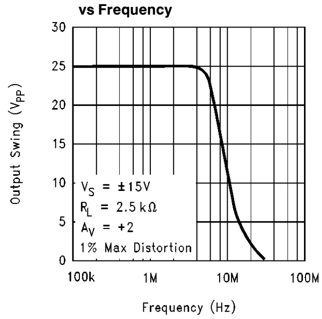
TL/H/12348–83

Total Harmonic Distortion vs Frequency



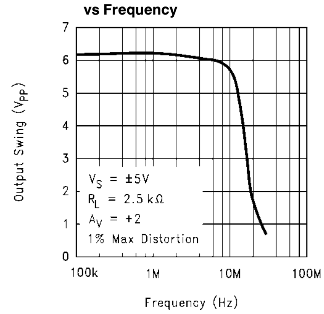
TL/H/12348–82

Undistorted Output Swing vs Frequency



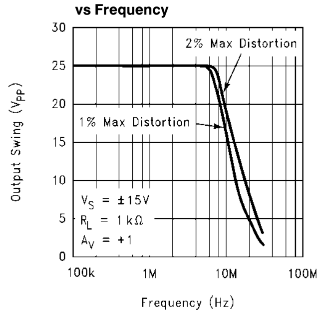
TL/H/12348–85

Undistorted Output Swing vs Frequency



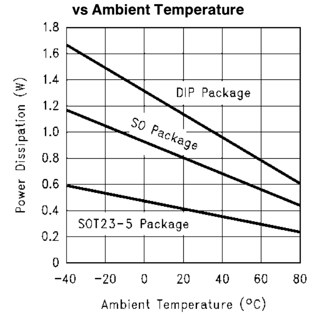
TL/H/12348–84

Undistorted Output Swing vs Frequency



TL/H/12348–86

Total Power Dissipation vs Ambient Temperature



TL/H/12348–65

Application Information

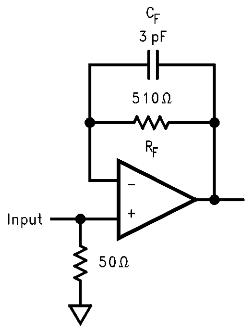
The table below, depicts the maximum operating supply voltage for each package type:

TABLE I. Maximum Supply Voltage Values

	SOT23-5	SO-8	DIP
Single Supply	10V	30V	30V
Dual Supplies	±5V	±15V	±15V

Stable unity gain operation is possible with supply voltage of 5V for all capacitive loads. This allows the possibility of using the device in portable applications with low supply voltages with minimum components around it.

Above a supply voltage of 6V (±3V Dual supplies), an additional resistor and capacitor (shown below) should be placed in the feedback path to achieve stability at unity gain over the full temperature range.



TL/H/12348–87

FIGURE 1. Typical Circuit for $A_V = +1$ Operation ($V_S \geq 6V$)

The package power dissipation should be taken into account when operating at high ambient temperatures and/or high power dissipative conditions. Refer to the power derating curves in the data sheet for each type of package.

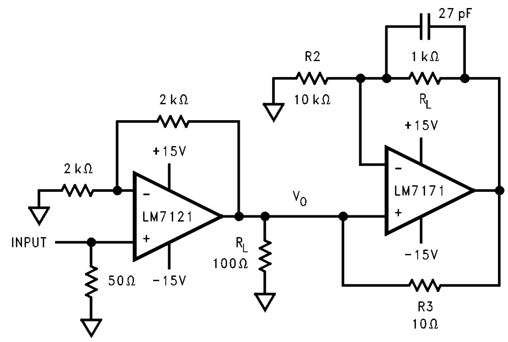
In determining maximum operable temperature of the device, make sure the total power dissipation of the device is considered; this includes the power dissipated in the device with a load connected to the output as well as the nominal dissipation of the op amp.

The device is capable of tolerating momentary short circits from its output to ground but prolonged operation in this mode will damage the device, if the maximum allowed junction temperation is exceeded.

APPLICATION CIRCUITS

Current Boost Circuit

The circuit in *Figure 2* can be used to achieve good linearity along with high output current capability.



TL/H/12348–92

FIGURE 2. Simple Circuit to Improve Linearity and Output Drive Current

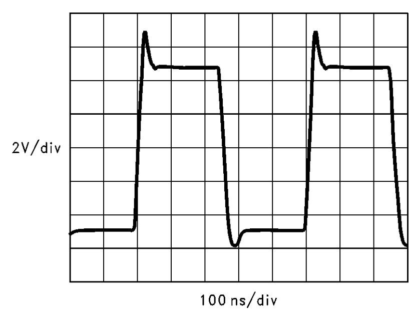
By proper choice of R_3, the LM7121 output can be set to supply a minimal amount of current, thereby improving its output linearity.

R_3 can be adjusted to allow for different loads:

$$R_3 = 0.1\ R_L$$

The circuit above has been set for a load of 100Ω.

Reasonable speeds (<30 ns rise and fall times) can be expected up to 120 mA_{PP} of load current (see *Figure 3* for step response across the load).



TL/H/12348–93

FIGURE 3. Waveform across a 100Ω Load

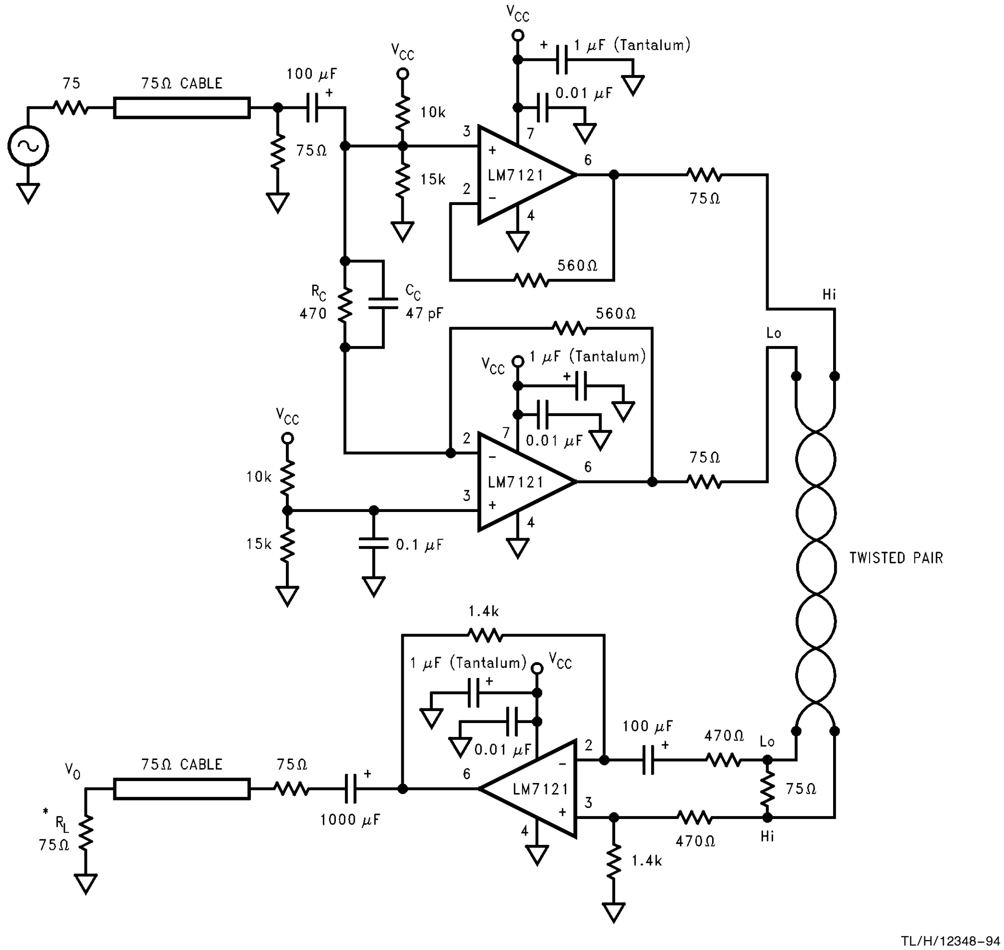
It is very important to keep the lead lengths to a minimum and to provide a low impedance current path by using a ground-plane on the board.

Caution: If R_L is removed, the current balance at the output of LM7121 would be disturbed and it would have to supply the full amount of load current. This might damage the part if power dissipation limit is exceeded.

Application Information (Continued)

Color Video on Twisted Pairs Using Single Supply

The circuit shown in *Figure 4* can be used to drive in excess of 25 meters length of twisted pair cable with no loss of resolution or picture definition when driving a NTSC monitor at the load end.



Note: Pin numbers shown are for DIP/SO-8 packages.

*Input termination of NTSC monitor.

FIGURE 4. Single Supply Differential Twister Pair Cable Transmitter/Receiver
8.5V ≤ V_{CC} ≤ 30V

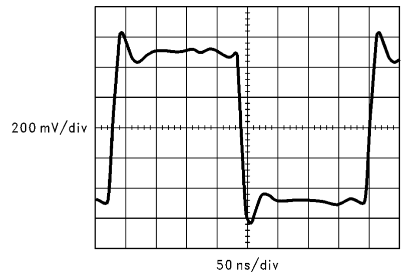
Application Information (Continued)

Differential Gain and Differential Phase errors measured at the load are less than 1% and 1° respectively.

R_G and C_C can be adjusted for various cable lengths to compensate for the line losses and for proper response at the output. Values shown correspond to a twisted pair cable length of 25 meters with about 3 turns/inch (see *Figure 5* for step response).

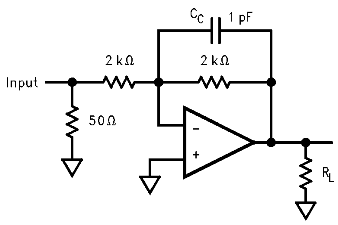
The supply voltage can vary from 8.5V up to 30V with the output rise and fall times under 12 ns. With the component values shown, the overall gain from the input to the output is about 1.

Even though the transmission line is not terminated in its nominal characteristic impedance of about 600Ω, the resulting reflection at the load is only about 5% of the total signal and in most cases can be neglected. Using 75Ω termination instead, has the advantage of operating at a low impedance and results in a higher realizable bandwidth and signal fidelity.



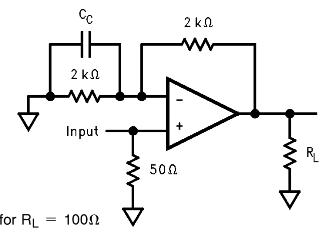
TL/H/12348–95

FIGURE 5. Step Response to a 1 V_{PP} Input Signal Measured across the 75Ω Load



TL/H/12348–98

(a) $A_V = -1$

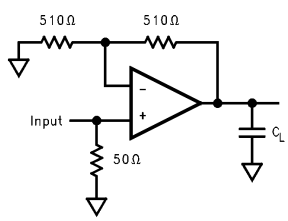


C_C = 2 pF for R_L = 100Ω

C_C = Open for R_L = Open

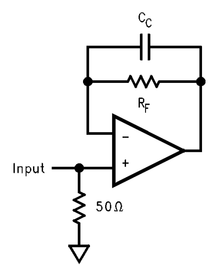
TL/H/12348–99

(b) $A_V = +2$



TL/H/12348–A0

(c) $A_V = +2$, Capacitive Load

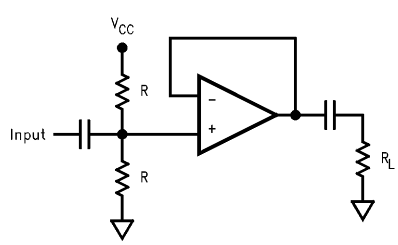


TL/H/12348–A1

R_F = 0Ω, C_C = Open for $V_S < 6V$

R_F = 510Ω, C_C = 3 pF for $V_S \geq 6V$

(d) $A_V = +1$

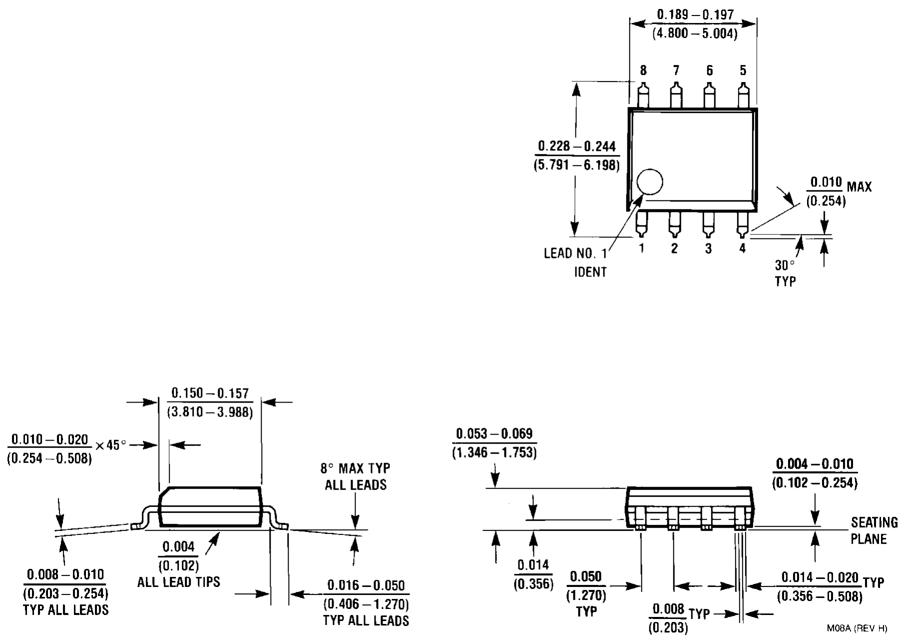


TL/H/12348–A2

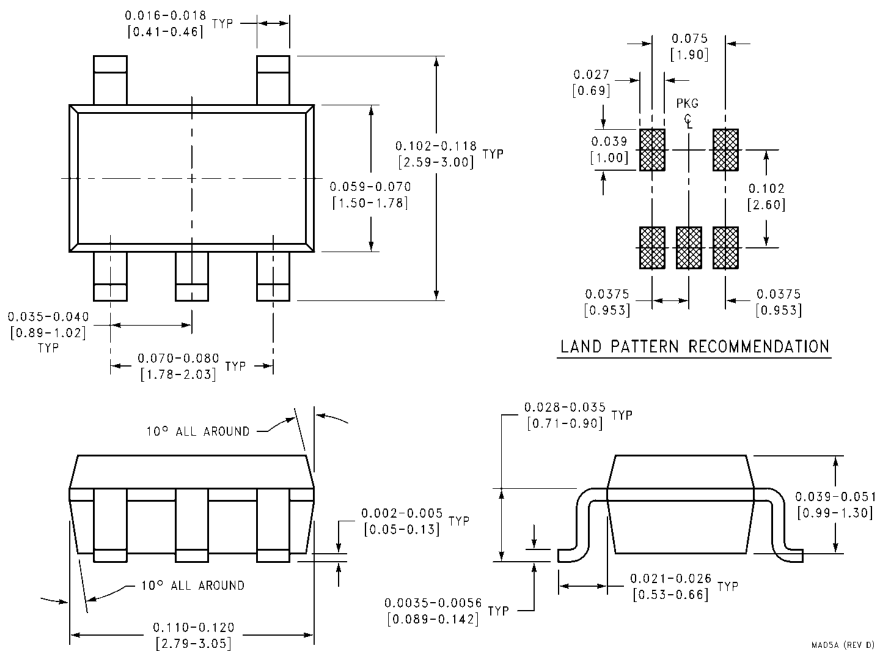
(e) $A_V = +1$, $V_S = +5V$, Single Supply Operation

FIGURE 6. Application Test Circuits

Physical Dimensions inches (millimeters) unless otherwise noted



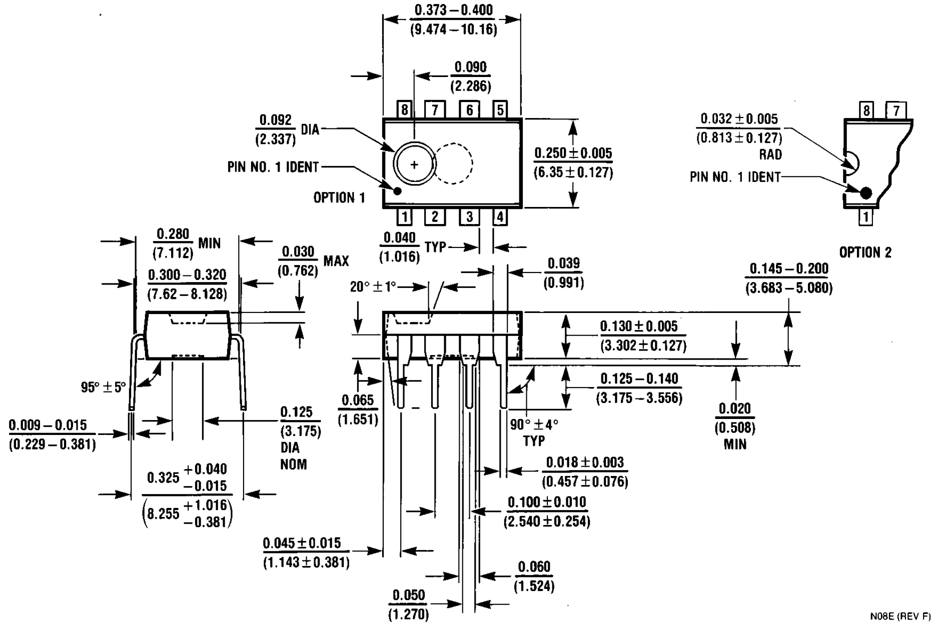
8-Lead (0.150″ Wide) Small Outline Package, JEDEC
Order Number LM7121IM or LM7121IMX
NS Package Number M08A



5-Lead Molded SOT23-5
Order Number LM7121IM5X
NS Package Number MA05A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

Lit. # 108303-001



8-Lead (0.300″ Wide) Molded Dual-In-Line Package
Order Number LM7121IN
NS Package Number N08E

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