LM6172 Dual High Speed, Low Power, Low Distortion, Voltage Feedback Amplifiers

Check for Samples: LM6172

FEATURES

- (Typical Unless Otherwise Noted)
- Easy to Use Voltage Feedback Topology
- High Slew Rate 3000V/μs
- Wide Unity-Gain Bandwidth 100MHz
- Low Supply Current 2.3mA/Channel
- High Output Current 50mA/channel
- Specified for ±15V and ±5V Operation

APPLICATIONS

- Scanner I-to-V Converters
- ADSL/HDSL Drivers
- Multimedia Broadcast Systems
- Video Amplifiers
- NTSC, PAL and SECAM Systems
- ADC/DAC Buffers
- Pulse Amplifiers and Peak Detectors

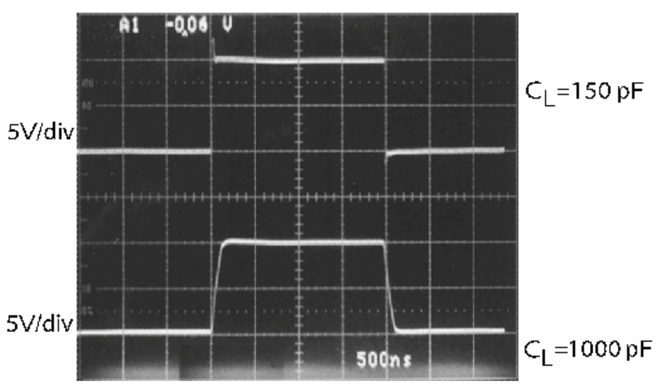
DESCRIPTION

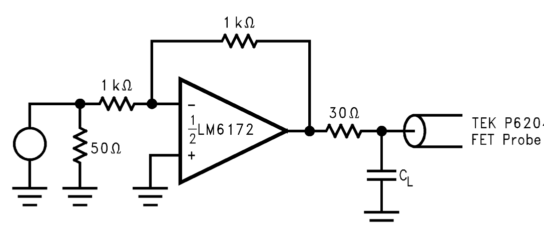
The LM6172 is a dual high speed voltage feedback amplifier. It is unity-gain stable and provides excellent DC and AC performance. With 100MHz unity-gain bandwidth, 3000V/μs slew rate and 50mA of output current per channel, the LM6172 offers high performance in dual amplifiers; yet it only consumes 2.3mA of supply current each channel.

The LM6172 operates on ±15V power supply for systems requiring large voltage swings, such as ADSL, scanners and ultrasound equipment. It is also specified at ±5V power supply for low voltage applications such as portable video systems.

The LM6172 is built with National's advanced VIP III (Vertically Integrated PNP) complementary bipolar process. See the LM6171 datasheet for a single amplifier with these same features.

LM6172 Driving Capacitive Load





Connection Diagram

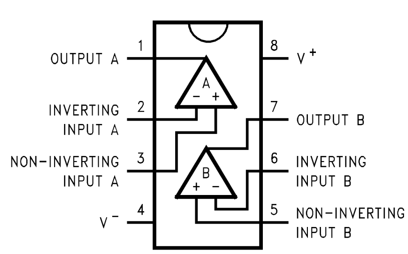


Figure 1. Top View 8-Pin
See Package Numbers P (PDIP) and D (SOIC)

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings (1) (2)

ESD Tolerance (3)	Human Body Model	3kV
	Machine Model	300V
Supply Voltage ($V^+ - V^-$)		36V
Differential Input Voltage		±10V
Common Mode Voltage Range		V^+ +0.3V to V^- −0.3V
Input Current		±10mA
Output Short Circuit to Ground (4)		Continuous
Storage Temp. Range		−65°C to +150°C
Maximum Junction Temperature (5)		150°C
Soldering Information	Infrared or Convection Reflow (20 sec.)	235°C
	Wave Soldering Lead Temp (10 sec.)	260°C

(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.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.
(3) Human body model, 1.5kΩ in series with 100pF. Machine Model, 200Ω in series with 100pF.
(4) Continuous short circuit operation can result in exceeding the maximum allowed junction temperature of 150°C.
(5) 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.

Operating Ratings (1)

Supply Voltage		$5.5V \le V_S \le 36V$
Operating Temperature Range	LM6172I	−40°C to +85°C
Thermal Resistance (θ_{JA})	P Package, 8-Pin PDIP	95°C/W
	D Package, 8-Pin SOIC	160°C/W

(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.

±15V DC Electrical Characteristics

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

Symbol	Parameter	Conditions	Typ (1)	LM6172I Limit (2)	Units
V_{OS}	Input Offset Voltage		0.4	3	mV
				4	max
TC V_{OS}	Input Offset Voltage Average Drift		6		μV/°C
I_B	Input Bias Current		1.2	3	μA
				4	max
I_{OS}	Input Offset Current		0.02	2	μA
				3	max
R_{IN}	Input Resistance	Common Mode	40		MΩ
		Differential Mode	4.9		
R_O	Open Loop Output Resistance		14		Ω

(1) Typical Values represent the most likely parametric normal.
(2) All limits are guaranteed by testing or statistical analysis.

±15V DC Electrical Characteristics (continued)

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

Symbol	Parameter	Conditions	Typ (1)	LM6172I Limit (2)	Units
CMRR	Common Mode Rejection Ratio	V_{CM} = ±10V	110	70	dB
				65	min
PSRR	Power Supply Rejection Ratio	V_S = ±15V to ±5V	95	75	dB
				70	min
V_{CM}	Input Common Mode Voltage Range	CMRR ≥ 60dB	±13.5		V
A_V	Large Signal Voltage Gain (3)	R_L = 1kΩ	86	80	dB
				75	min
		R_L = 100Ω	78	65	dB
				60	min
V_O	Output Swing	R_L = 1kΩ	13.2	12.5	V
				12	min
			−13.1	−12.5	V
				−12	max
		R_L = 100Ω	9	6	V
				5	min
			−8.5	−6	V
				−5	max
	Continuous Output Current	Sourcing, R_L = 100Ω	90	60	mA
				50	min
	(Open Loop) (4)	Sinking, R_L = 100Ω	−85	−60	mA
				−50	max
I_{SC}	Current Output Short Circuit	Sourcing	107		mA
		Sinking	−105		mA
I_S	Supply Current	Both Amplifiers	4.6	8	mA
				9	max

(3) Large signal voltage gain is the total output swing divided by the input signal required to produce that swing. For V_S = ±15V, V_{OUT} = ±5V. For V_S = ±5V, V_{OUT} = ±1V.
(4) The open loop output current is the output swing with the 100Ω load resistor divided by that resistor.

±15V AC Electrical Characteristics

Unless otherwise specified, T_J = 25°C, V^+ = +15V, V^- = −15V, V_{CM} = 0V, and R_L = 1kΩ

Symbol	Parameter	Conditions	LM6172I Typ (1)	Units
SR	Slew Rate	A_V = +2, V_{IN} = 13 V_{PP}	3000	V/μs
		A_V = +2, V_{IN} = 10 V_{PP}	2500	V/μs
	Unity-Gain Bandwidth		100	MHz
	−3 dB Frequency	A_V = +1	160	MHz
		A_V = +2	62	MHz
	Bandwidth Matching between Channels		2	MHz
φ_m	Phase Margin		40	Deg
t_s	Settling Time (0.1%)	A_V = −1, V_{OUT} = ±5V, R_L = 500Ω	65	ns
A_D	Differential Gain (2)		0.28	%
φ_D	Differential Phase (2)		0.6	Deg
e_n	Input-Referred Voltage Noise	f = 1kHz	12	nV/√Hz
i_n	Input-Referred Current Noise	f = 1kHz	1	pA/√Hz
	Second Harmonic	f = 10kHz	−110	dB
	Distortion (3)	f = 5MHz	−50	dB
	Third Harmonic	f = 10kHz	−105	dB
	Distortion (3)	f = 5MHz	−50	dB

(1) Typical Values represent the most likely parametric normal.
(2) Differential gain and phase are measured with A_V = +2, V_{IN} = 1 V_{PP} at 3.58MHz and both input and output 75Ω terminated.
(3) Harmonics are measured with A_V = +2, V_{IN} = 1 V_{PP} and R_L = 100Ω.

±5V DC Electrical Characteristics

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

Symbol	Parameter	Conditions	Typ (1)	LM6172I Limit (2)	Units
V_{OS}	Input Offset Voltage		0.1	3	mV
				4	max
TC V_{OS}	Input Offset Voltage Average Drift		4		μV/°C
I_B	Input Bias Current		1.4	2.5	μA
				3.5	max
I_{OS}	Input Offset Current		0.02	1.5	μA
				2.2	max
R_{IN}	Input Resistance	Common Mode	40		MΩ
		Differential Mode	4.9		
R_O	Output Resistance		14		Ω
CMRR	Common Mode Rejection Ratio	V_{CM} = ±2.5V	105	70	dB
				65	min
PSRR	Power Supply Rejection Ratio	V_S = ±15V to ±5V	95	75	dB
				70	min
V_{CM}	Input Common Mode Voltage Range	CMRR ≥ 60dB	±3.7		V
A_V	Large Signal Voltage Gain (3)	R_L = 1kΩ	82	70	dB
				65	min
		R_L = 100Ω	78	65	dB
				60	min
V_O	Output Swing	R_L = 1kΩ	3.4	3.1	V
				3	min
			−3.3	−3.1	V
				−3	max
		R_L = 100Ω	2.9	2.5	V
				2.4	min
			−2.7	−2.4	V
				−2.3	max
	Continuous Output Current (Open Loop) (4)	Sourcing, R_L = 100Ω	29	25	mA
				24	min
		Sinking, R_L = 100Ω	−27	−24	mA
				−23	max
I_{SC}	Output Short Circuit Current	Sourcing	93		mA
		Sinking	−72		mA
I_S	Supply Current	Both Amplifiers	4.4	6	mA
				7	max

(1) Typical Values represent the most likely parametric normal.
(2) All limits are guaranteed by testing or statistical analysis.
(3) Large signal voltage gain is the total output swing divided by the input signal required to produce that swing. For V_S = ±15V, V_{OUT} = ±5V. For V_S = ±5V, V_{OUT} = ±1V.
(4) The open loop output current is the output swing with the 100Ω load resistor divided by that resistor.

±5V AC Electrical Characteristics

Unless otherwise specified, T_J = 25°C, V^+ = +5V, V^- = −5V, V_{CM} = 0V, and R_L = 1 kΩ.

Symbol	Parameter	Conditions	LM61722 Typ (1)	Units
SR	Slew Rate	A_V = +2, V_{IN} = 3.5 V_{PP}	750	V/μs
	Unity-Gain Bandwidth		70	MHz
	−3 dB Frequency	A_V = +1	130	MHz
		A_V = +2	45	MHz
φ_m	Phase Margin		57	Deg
t_s	Settling Time (0.1%)	A_V = −1, V_{OUT} = ±1V, R_L = 500Ω	72	ns
A_D	Differential Gain (2)		0.4	%
φ_D	Differential Phase (2)		0.7	Deg
e_n	Input-Referred Voltage Noise	f = 1kHz	11	nV/√Hz
i_n	Input-Referred Current Noise	f = 1kHz	1	pA/√Hz
	Second Harmonic Distortion (3)	f = 10kHz	−110	dB
		f = 5MHz	−48	dB
	Third Harmonic Distortion (3)	f = 10kHz	−105	dB
		f = 5MHz	−50	dB

(1) Typical Values represent the most likely parametric normal.
(2) Differential gain and phase are measured with A_V = +2, V_{IN} = 1 V_{PP} at 3.58MHz and both input and output 75Ω terminated.
(3) Harmonics are measured with A_V = +2, V_{IN} = 1 V_{PP} and R_L = 100Ω.

Typical Performance Characteristics

unless otherwise noted, T_A = 25°C

Supply Voltage vs. Supply Current

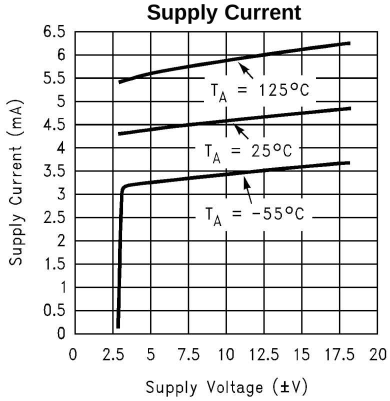


Figure 2.

Supply Current vs. Temperature

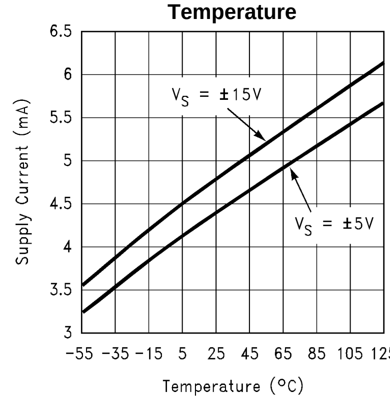


Figure 3.

Input Offset Voltage vs. Temperature

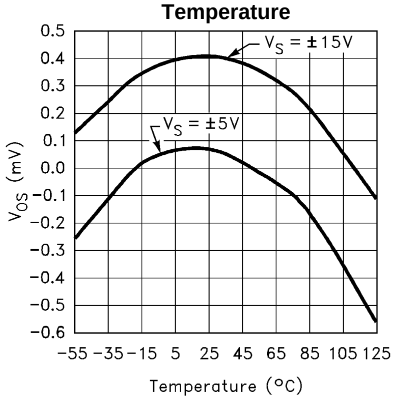


Figure 4.

Input Bias Current vs. Temperature

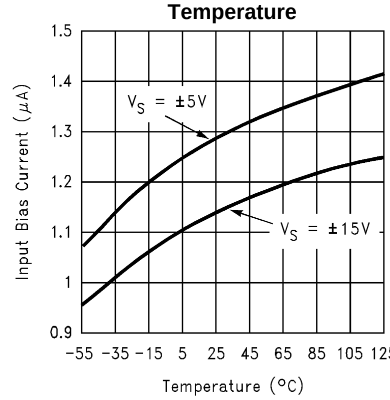


Figure 5.

Short Circuit Current vs. Temperature (Sourcing)

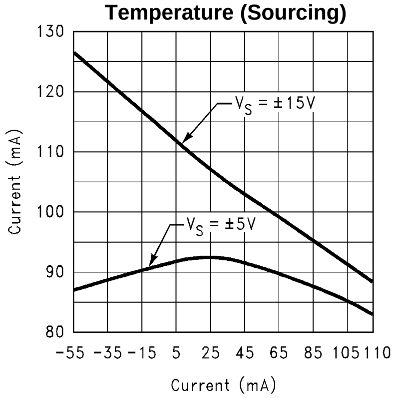


Figure 6.

Short Circuit Current vs. Temperature (Sinking)

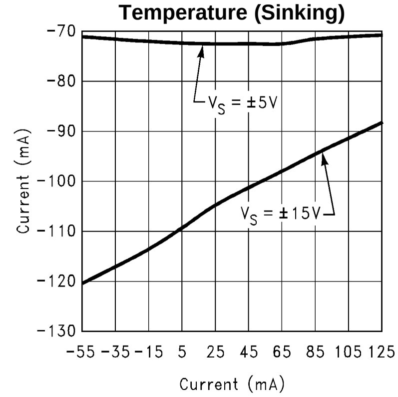


Figure 7.

Typical Performance Characteristics (continued)

unless otherwise noted, T_A = 25°C

Output Voltage vs. Output Current (V_S = ±15V)

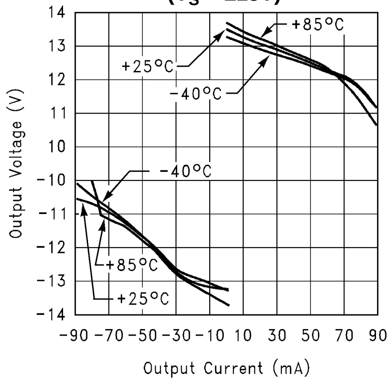


Figure 8.

Output Voltage vs. Output Current (V_S = ±5V)

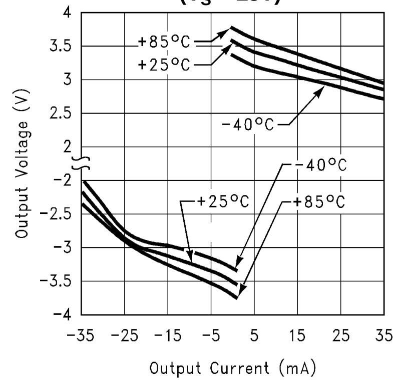


Figure 9.

CMRR vs. Frequency

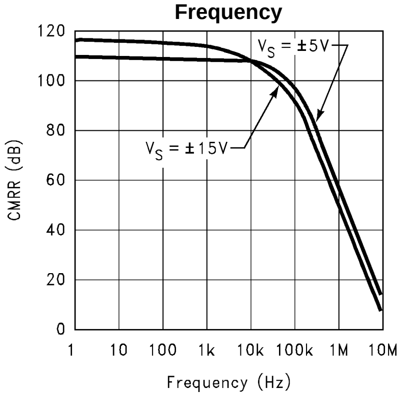


Figure 10.

PSRR vs. Frequency

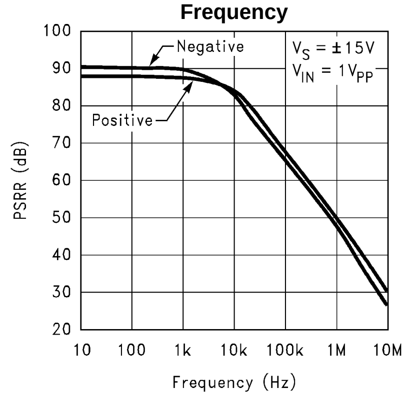


Figure 11.

PSRR vs. Frequency

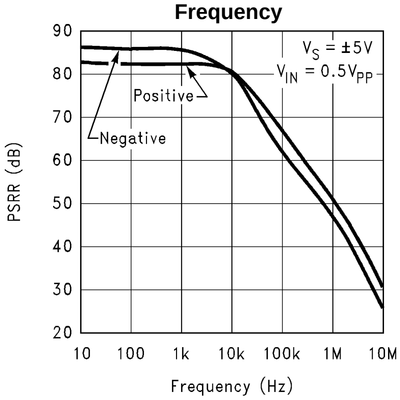


Figure 12.

Open-Loop Frequency Response

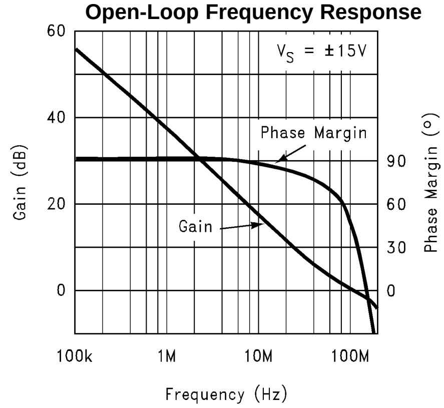


Figure 13.

Typical Performance Characteristics (continued)

unless otherwise noted, T_A = 25°C

Open-Loop Frequency Response

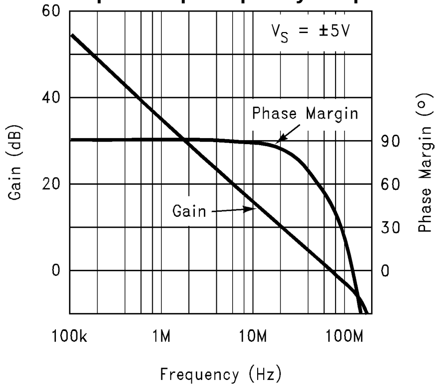


Figure 14.

Gain-Bandwidth Product vs. Supply Voltage at Different Temperature

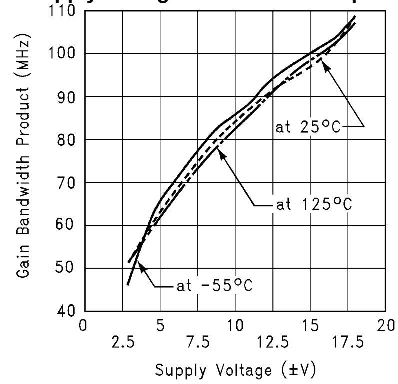


Figure 15.

Large Signal Voltage Gain vs. Load

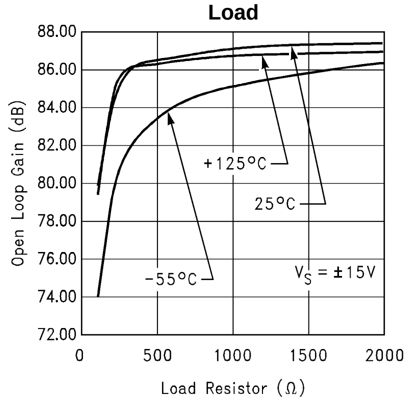


Figure 16.

Large Signal Voltage Gain vs. Load

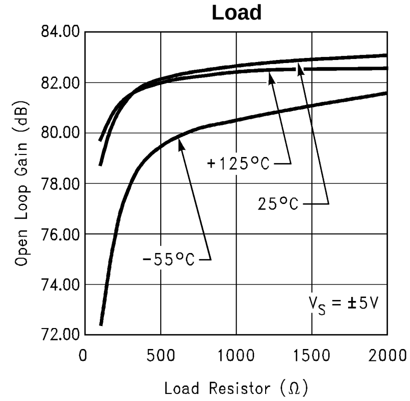


Figure 17.

Input Voltage Noise vs. Frequency

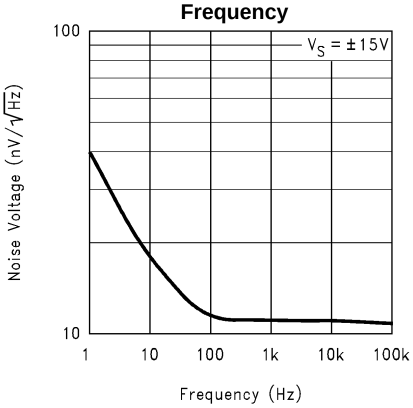


Figure 18.

Input Voltage Noise vs. Frequency

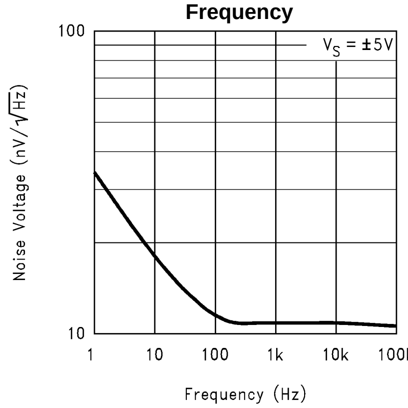


Figure 19.

Typical Performance Characteristics (continued)

unless otherwise noted, T_A = 25°C

Input Current Noise vs. Frequency

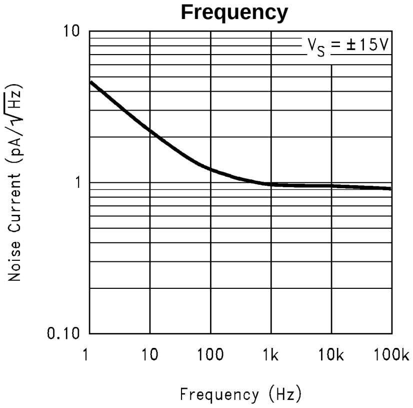


Figure 20.

Input Current Noise vs. Frequency

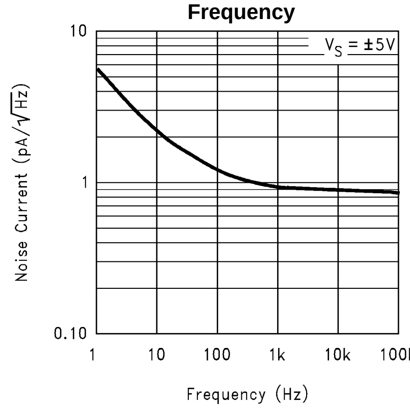


Figure 21.

Slew Rate vs. Supply Voltage

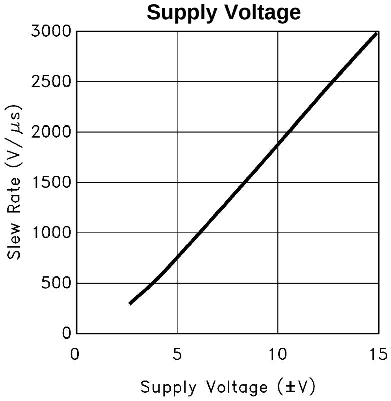


Figure 22.

Slew Rate vs. Input Voltage

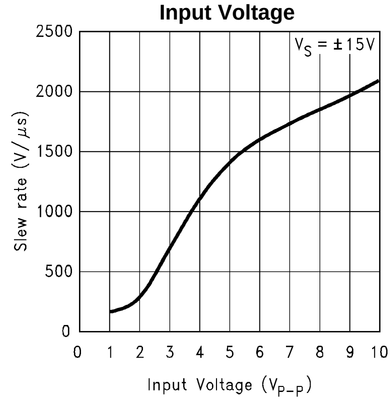


Figure 23.

Large Signal Pulse Response A_V = +1, V_S = ±15V

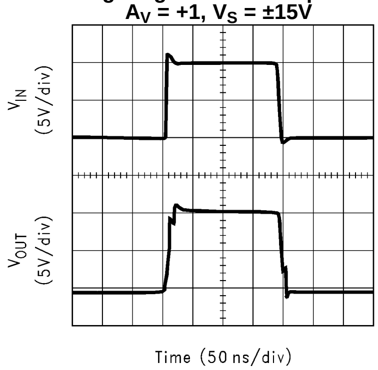


Figure 24.

Small Signal Pulse Response A_V = +1, V_S = ±15V

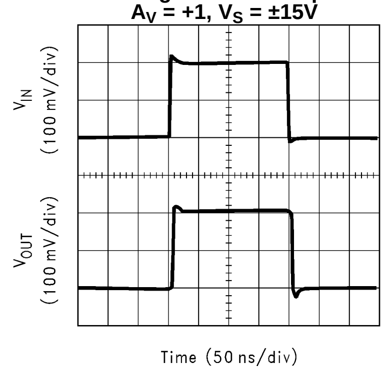


Figure 25.

Typical Performance Characteristics (continued)

unless otherwise noted, T_A = 25°C

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

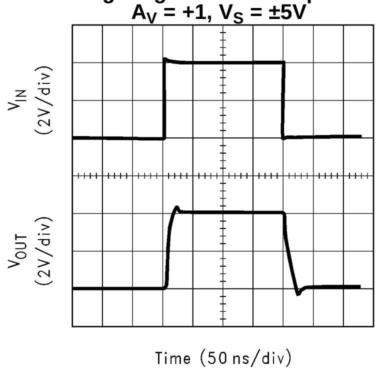


Figure 26.

Small Signal Pulse Response
A_V = +1, V_S = ±5V

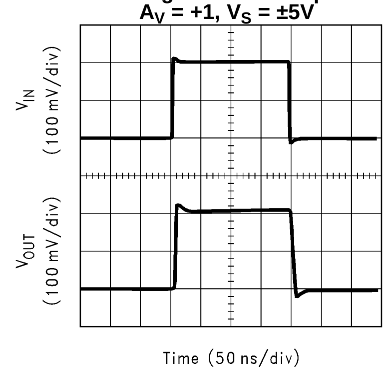


Figure 27.

Large Signal Pulse Response
A_V = +2, V_S = ±15V

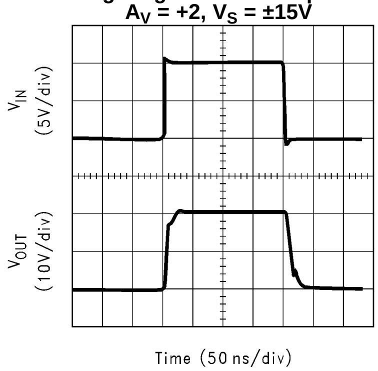


Figure 28.

Small Signal Pulse Response
A_V = +2, V_S = ±15V

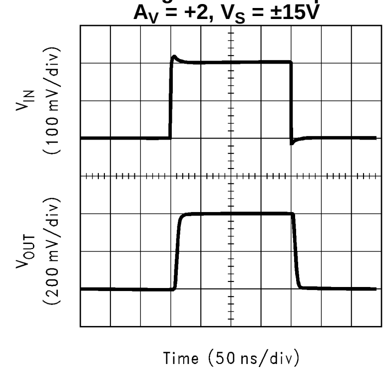


Figure 29.

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

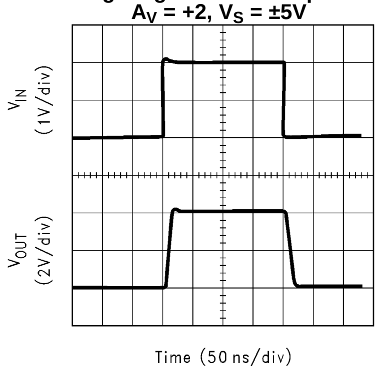


Figure 30.

Small Signal Pulse Response
A_V = +2, V_S = ±5V

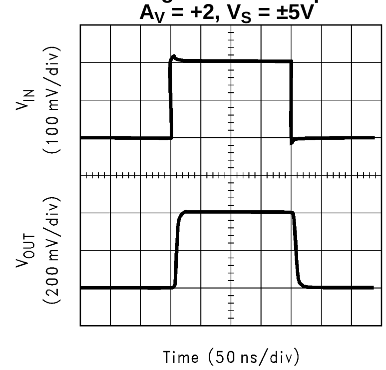


Figure 31.

Typical Performance Characteristics (continued)

unless otherwise noted, T_A = 25°C

Large Signal Pulse Response
A_V = −1, V_S = ±15V

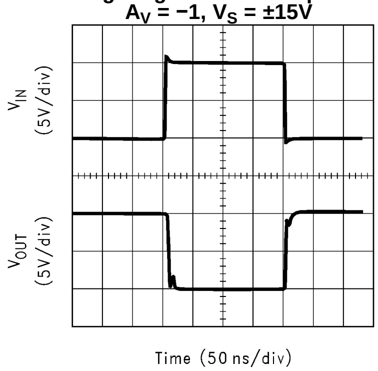


Figure 32.

Small Signal Pulse Response
A_V = −1, V_S = ±15V

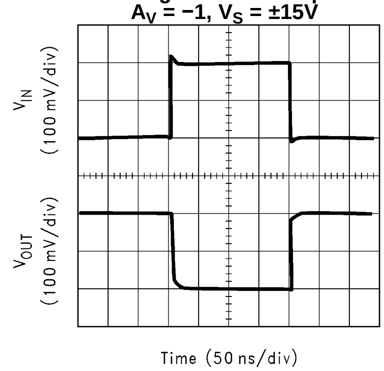


Figure 33.

Large Signal Pulse Response
A_V = −1, V_S = ±5V

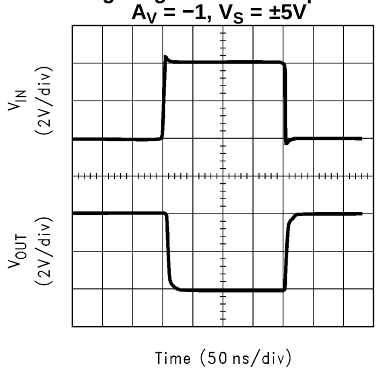


Figure 34.

Small Signal Pulse Response
A_V = −1, V_S = ±5V

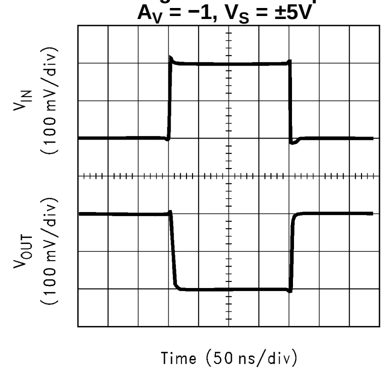


Figure 35.

Closed Loop Frequency Response
vs.
Supply Voltage
(A_V = +1)

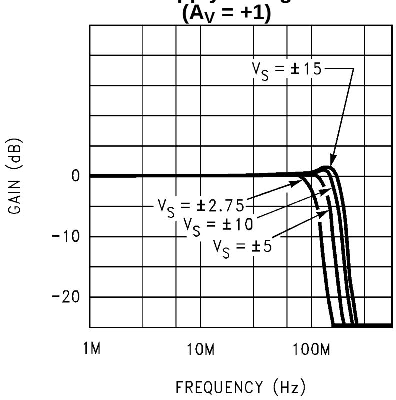


Figure 36.

Closed Loop Frequency Response
vs.
Supply Voltage
(A_V = +2)

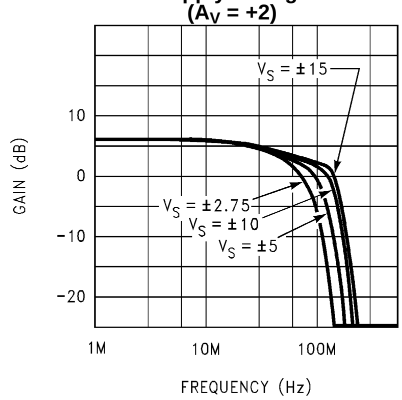


Figure 37.

Typical Performance Characteristics (continued)

unless otherwise noted, T_A = 25°C

Harmonic Distortion vs. Frequency (V_S = ±15V)

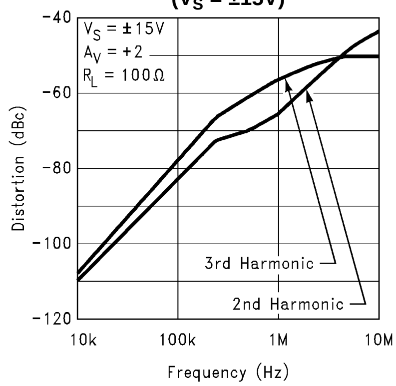


Figure 38.

Harmonic Distortion vs. Frequency (V_S = ±5V)

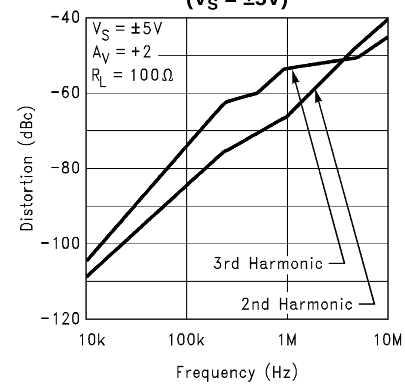


Figure 39.

Crosstalk Rejection vs. Frequency

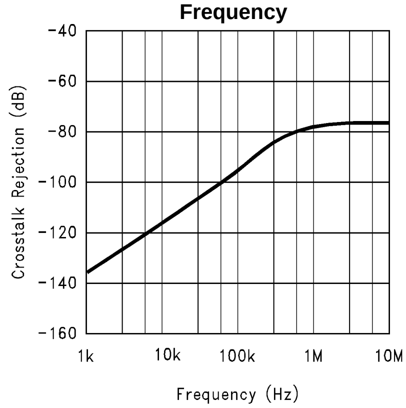


Figure 40.

Maximum Power Dissipation vs. Ambient Temperature

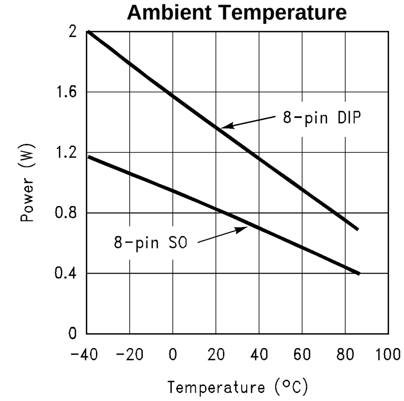
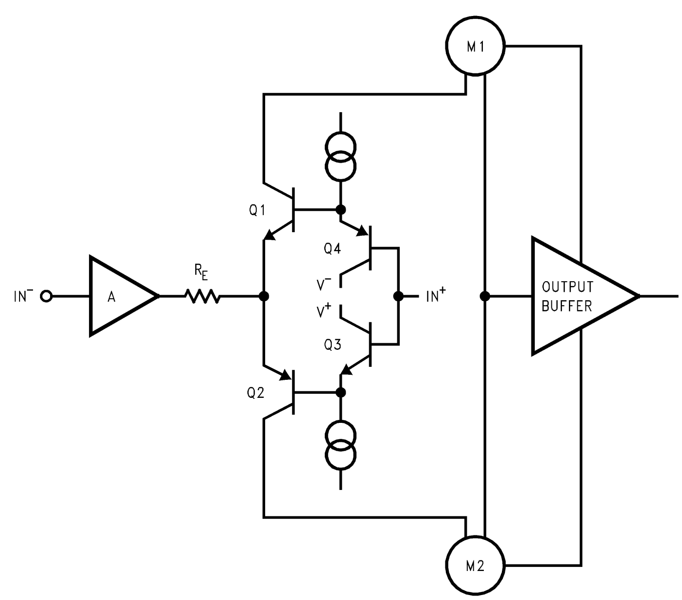


Figure 41.

LM6172 Simplified Schematic (Each Amplifier)



APPLICATION NOTES

LM6172 PERFORMANCE DISCUSSION

The LM6172 is a dual high-speed, low power, voltage feedback amplifier. It is unity-gain stable and offers outstanding performance with only 2.3mA of supply current per channel. The combination of 100MHz unity-gain bandwidth, 3000V/μs slew rate, 50mA per channel output current and other attractive features makes it easy to implement the LM6172 in various applications. Quiescent power of the LM6172 is 138mW operating at ±15V supply and 46mW at ±5V supply.

LM6172 CIRCUIT OPERATION

The class AB input stage in LM6172 is fully symmetrical and has a similar slewing characteristic to the current feedback amplifiers. In the LM6172 Simplified Schematic, Q1 through Q4 form the equivalent of the current feedback input buffer, R_E the equivalent of the feedback resistor, and stage A buffers the inverting input. The triple-buffered output stage isolates the gain stage from the load to provide low output impedance.

LM6172 SLEW RATE CHARACTERISTIC

The slew rate of LM6172 is determined by the current available to charge and discharge an internal high impedance node capacitor. This current is the differential input voltage divided by the total degeneration resistor R_E. Therefore, the slew rate is proportional to the input voltage level, and the higher slew rates are achievable in the lower gain configurations.

When a very fast large signal pulse is applied to the input of an amplifier, some overshoot or undershoot occurs. By placing an external series resistor such as 1kΩ to the input of LM6172, the slew rate is reduced to help lower the overshoot, which reduces settling time.

REDUCING SETTLING TIME

The LM6172 has a very fast slew rate that causes overshoot and undershoot. To reduce settling time on LM6172, a 1kΩ resistor can be placed in series with the input signal to decrease slew rate. A feedback capacitor can also be used to reduce overshoot and undershoot. This feedback capacitor serves as a zero to increase the stability of the amplifier circuit. A 2pF feedback capacitor is recommended for initial evaluation. When the LM6172 is configured as a buffer, a feedback resistor of 1kΩ must be added in parallel to the feedback capacitor.

Another possible source of overshoot and undershoot comes from capacitive load at the output. Please see DRIVING CAPACITIVE LOADS for more detail.

DRIVING CAPACITIVE LOADS

Amplifiers driving capacitive loads can oscillate or have ringing at the output. To eliminate oscillation or reduce ringing, an isolation resistor can be placed as shown in Figure 42. The combination of the isolation resistor and the load capacitor forms a pole to increase stability by adding more phase margin to the overall system. The desired performance depends on the value of the isolation resistor; the bigger the isolation resistor, the more damped (slow) the pulse response becomes. For LM6172, a 50Ω isolation resistor is recommended for initial evaluation.

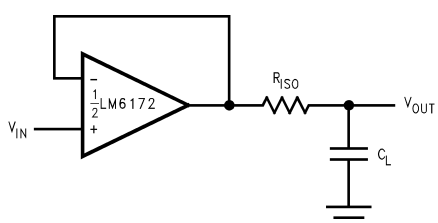


Figure 42. Isolation Resistor Used to Drive Capacitive Load

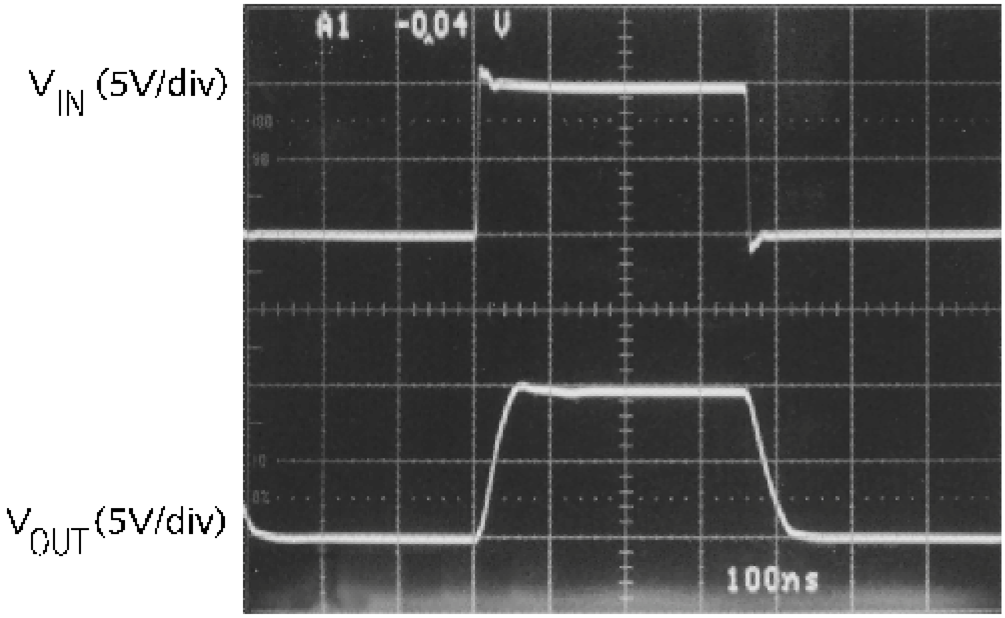


Figure 43. The LM6172 Driving a 510pF Load with a 30Ω Isolation Resistor

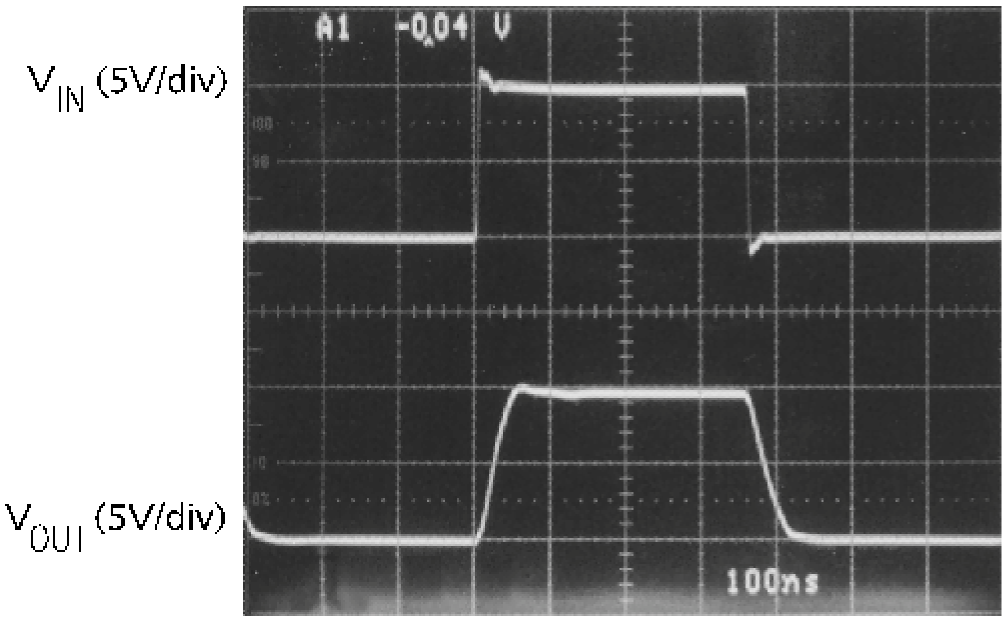


Figure 44. The LM6172 Driving a 220 pF Load with a 50Ω Isolation Resistor

LAYOUT CONSIDERATION

PRINTED CIRCUIT BOARDS AND HIGH SPEED OP AMPS

There are many things to consider when designing PC boards for high speed op amps. Without proper caution, it is very easy to have excessive ringing, oscillation and other degraded AC performance in high speed circuits. As a rule, the signal traces should be short and wide to provide low inductance and low impedance paths. Any unused board space needs to be grounded to reduce stray signal pickup. Critical components should also be grounded at a common point to eliminate voltage drop. Sockets add capacitance to the board and can affect frequency performance. It is better to solder the amplifier directly into the PC board without using any socket.

USING PROBES

Active (FET) probes are ideal for taking high frequency measurements because they have wide bandwidth, high input impedance and low input capacitance. However, the probe ground leads provide a long ground loop that will produce errors in measurement. Instead, the probes can be grounded directly by removing the ground leads and probe jackets and using scope probe jacks.

COMPONENTS SELECTION AND FEEDBACK RESISTOR

It is important in high speed applications to keep all component leads short because wires are inductive at high frequency. For discrete components, choose carbon composition-type resistors and mica-type capacitors. Surface mount components are preferred over discrete components for minimum inductive effect.

Large values of feedback resistors can couple with parasitic capacitance and cause undesirable effects such as ringing or oscillation in high speed amplifiers. For LM6172, a feedback resistor less than 1kΩ gives optimal performance.

COMPENSATION FOR INPUT CAPACITANCE

The combination of an amplifier's input capacitance with the gain setting resistors adds a pole that can cause peaking or oscillation. To solve this problem, a feedback capacitor with a value

$$C_F > (R_G \times C_{IN})/R_F \quad (1)$$

can be used to cancel that pole. For LM6172, a feedback capacitor of 2pF is recommended. Figure 45 illustrates the compensation circuit.

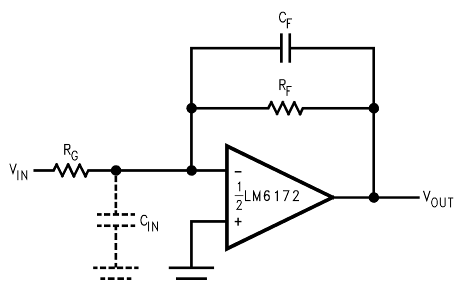


Figure 45. Compensating for Input Capacitance

POWER SUPPLY BYPASSING

Bypassing the power supply is necessary to maintain low power supply impedance across frequency. Both positive and negative power supplies should be bypassed individually by placing 0.01μF ceramic capacitors directly to power supply pins and 2.2μF tantalum capacitors close to the power supply pins.

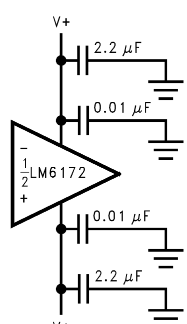


Figure 46. Power Supply Bypassing

TERMINATION

In high frequency applications, reflections occur if signals are not properly terminated. Figure 47 shows a properly terminated signal while Figure 48 shows an improperly terminated signal.

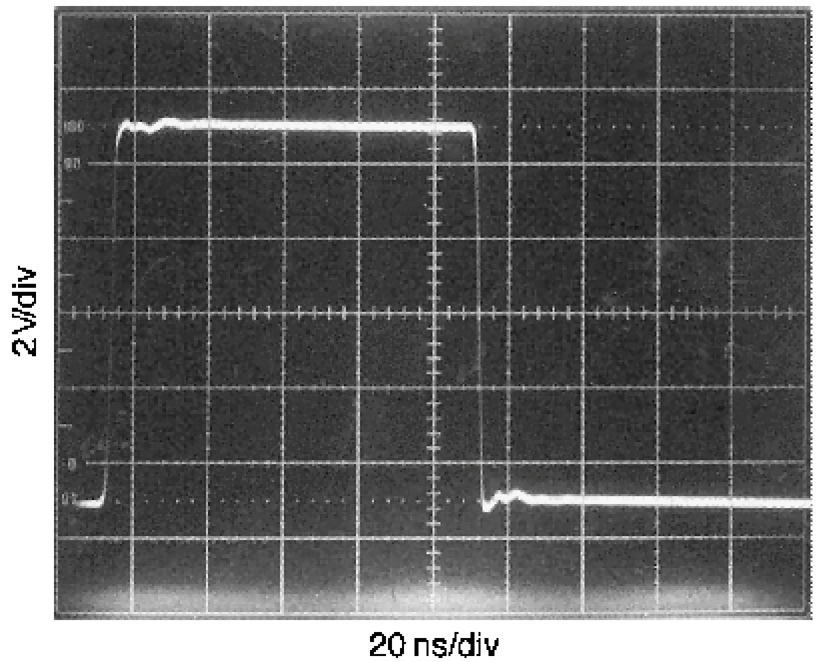


Figure 47. Properly Terminated Signal

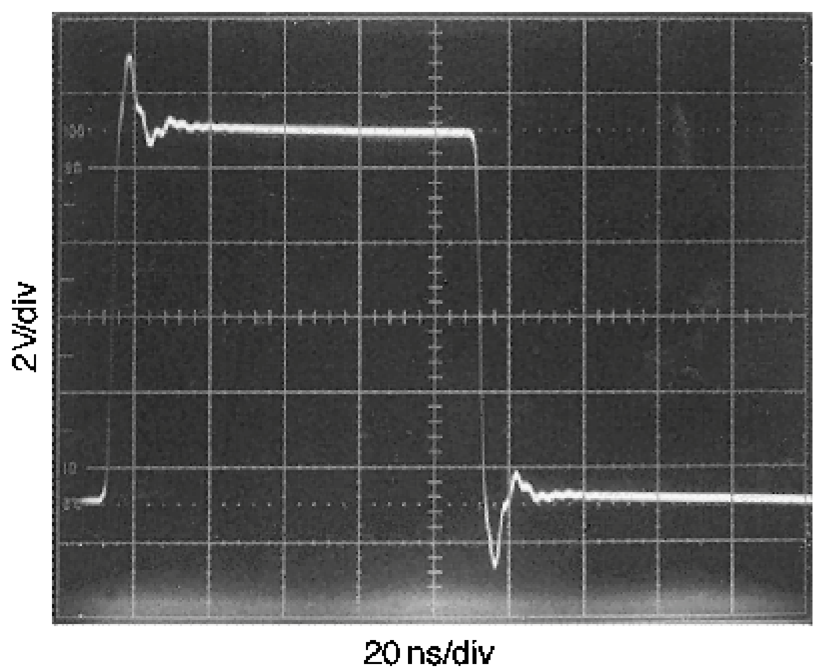


Figure 48. Improperly Terminated Signal

To minimize reflection, coaxial cable with matching characteristic impedance to the signal source should be used. The other end of the cable should be terminated with the same value terminator or resistor. For the commonly used cables, RG59 has 75Ω characteristic impedance, and RG58 has 50Ω characteristic impedance.

POWER DISSIPATION

The maximum power allowed to dissipate in a device is defined as:

$P_D = (T_{J(max)} - T_A)/\theta_{JA}$

Where

- P_D is the power dissipation in a device
- $T_{J(max)}$ is the maximum junction temperature
- T_A is the ambient temperature
- θ_{JA} is the thermal resistance of a particular package
- For example, for the LM6172 in a SO-8 package, the maximum power dissipation at 25°C ambient temperature is 780mW.
- Thermal resistance, θ_{JA}, depends on parameters such as die size, package size and package material. The smaller the die size and package, the higher θ_{JA} becomes. The 8-pin DIP package has a lower thermal resistance (95°C/W) than that of 8-pin SO (160°C/W). Therefore, for higher dissipation capability, use an 8-pin DIP package.
- The total power dissipated in a device can be calculated as: $P_D = P_Q + P_L$ (2)

P_Q is the quiescent power dissipated in a device with no load connected at the output. P_L is the power dissipated in the device with a load connected at the output; it is not the power dissipated by the load.

Furthermore,

P_Q = supply current x total supply voltage with no load

P_L = output current x (voltage difference between supply voltage and output voltage of the same supply)

For example, the total power dissipated by the LM6172 with V_S = ±15V and both channels swinging output voltage of 10V into 1kΩ is

P_D = $P_Q + P_L$

= 2[(2.3mA)(30V)] + 2[(10mA)(15V − 10V)]

= 138mW + 100mW

= 238mW

Application Circuits

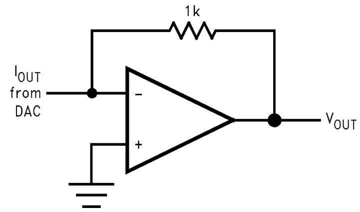


Figure 49. I-to-V Converters

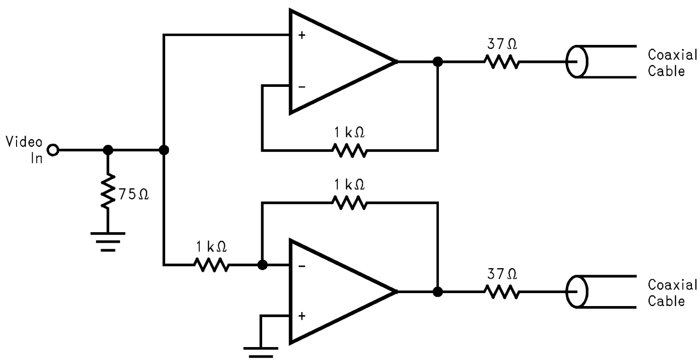


Figure 50. Differential Line Driver

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM6172IM	ACTIVE	SOIC	D	8	95	TBD	CU SNPB	Level-1-235C-UNLIM	-40 to 85	LM61 72IM	Samples
LM6172IM/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM61 72IM	Samples
LM6172IMX	ACTIVE	SOIC	D	8	2500	TBD	CU SNPB	Level-1-235C-UNLIM	-40 to 85	LM61 72IM	Samples
LM6172IMX/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM61 72IM	Samples
LM6172IN	ACTIVE	PDIP	P	8	40	TBD	CU SNPB	Level-1-NA-UNLIM	-40 to 85	LM6172IN	Samples
LM6172IN/NOPB	ACTIVE	PDIP	P	8	40	Green (RoHS & no Sb/Br)	SN	Level-1-NA-UNLIM	-40 to 85	LM6172IN	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Only one of markings shown within the brackets will appear on the physical device.

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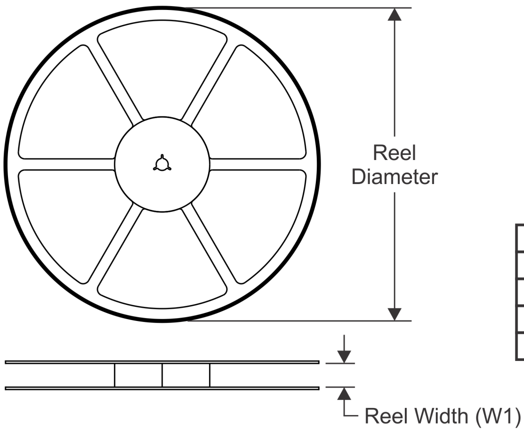
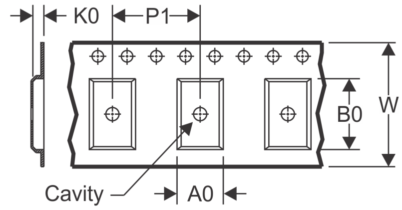
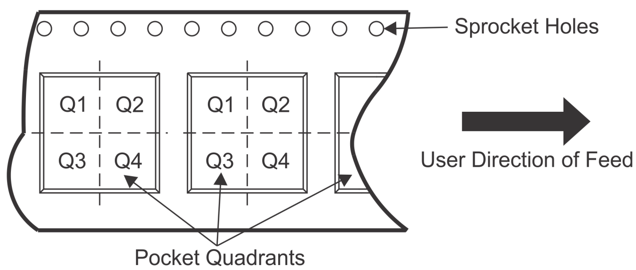


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

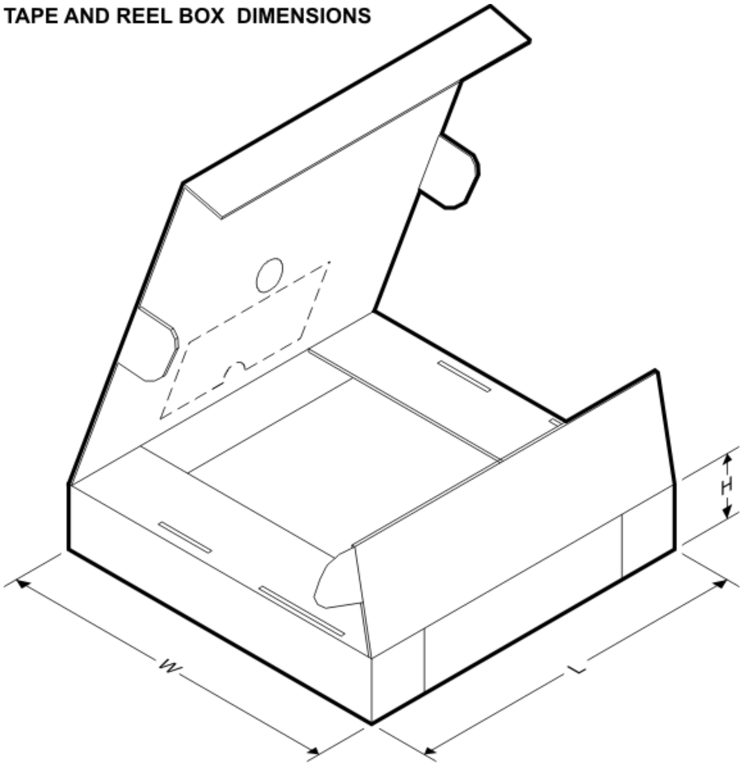
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM6172IMX	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM6172IMX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM6172IMX	SOIC	D	8	2500	349.0	337.0	45.0
LM6172IMX/NOPB	SOIC	D	8	2500	349.0	337.0	45.0

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