Dual High Output Current, High Speed Amplifier

AD8017

FEATURES

High Output Drive Capability
- 20 V p-p Differential Output Voltage, R_L = 50 Ω
- 10 V p-p Single-Ended Output Voltage While Delivering 200 mA to a 25 Ω Load

Low Power Operation
- 5 V to 12 V Voltage Supply @ 7 mA/Amplifier

Low Distortion
- –78 dBc @ 500 kHz SFDR, R_L = 100 Ω, V_O = 2 V p-p
- –58 dBc Highest Harmonic @ 1 MHz, I_O = 270 mA (R_L = 10 Ω)

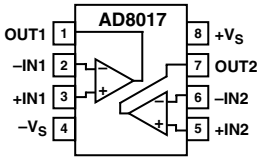
High Speed
- 160 MHz, –3 dB Bandwidth (G = +2)
- 1600 V/μs Slew Rate

APPLICATIONS

- xDSL PCI Cards
- Consumer DSL Modems
- Line Driver
- Video Distribution

PIN CONFIGURATION

8-Lead Thermal Coastline SOIC (SO-8)



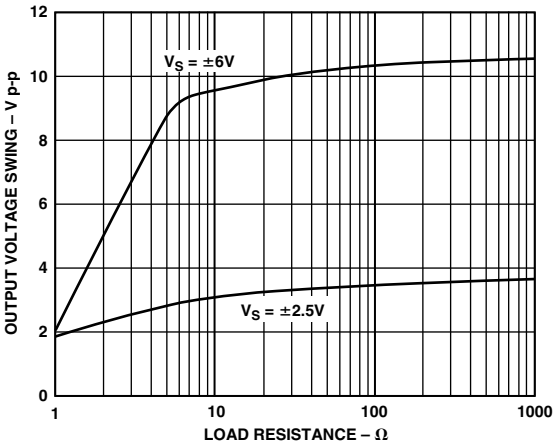


Figure 1. Output Swing vs. Load Resistance

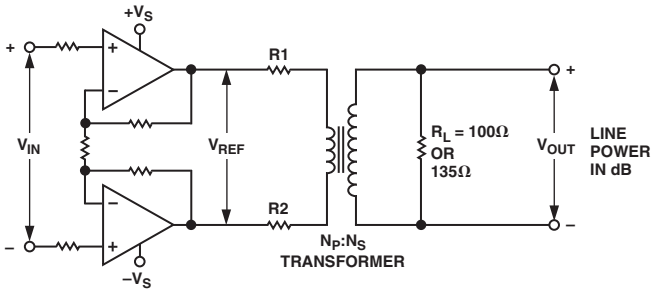


Figure 2. Differential Drive Circuit for xDSL Applications

PRODUCT DESCRIPTION

The AD8017 is a low cost, dual high speed amplifier capable of driving low distortion signals to within 1.0 V of the supply rail. It is intended for use in single supply xDSL systems where low distortion and low cost are essential. The amplifiers will be able to drive a minimum of 200 mA of output current per amplifier. The AD8017 will deliver –78 dBc of SFDR at 500 kHz, required for many xDSL applications.

Fabricated in ADI's high speed XFCB process, the high bandwidth and fast slew rate of the AD8017 keep distortion to a minimum, while dissipating a minimum amount of power. The quiescent current of the AD8017 is 7 mA/amplifier.

Low distortion, high output voltage drive, and high output current drive make the AD8017 ideal for use in low cost Customer Premise End (CPE) equipment for ADSL, SDSL, VDSL and proprietary xDSL systems.

The AD8017 drive capability comes in a very compact form. Utilizing ADI's proprietary Thermal Coastline SOIC package, the AD8017's total (static and dynamic) power on 12 V supplies is easily dissipated without external heat sink, other than to place the AD8017 on a 4-layer PCB.

The AD8017 will operate over the commercial temperature range –40°C to +85°C.

AD8017–SPECIFICATIONS (@ 25°C, V_S = ±6 V, R_L = 100 Ω, R_F = R_G = 619 Ω, unless otherwise noted.)

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
–3 dB Bandwidth	G = +2, V_{OUT} < 0.4 V p-p	100	160		MHz
0.1 dB Bandwidth	V_{OUT} < 0.4 V p-p		70		MHz
Large Signal Bandwidth	V_{OUT} = 4 V p-p		105		MHz
Slew Rate	Noninverting, V_{OUT} = 4 V p-p, G = +2		1600		V/µs
Rise and Fall Time	Noninverting, V_{OUT} = 2 V p-p		2.0		ns
Settling Time	0.1%, V_{OUT} = 4 V Step		35		ns
Overload Recovery	V_{IN} = 5 V p-p		74		ns
NOISE/HARMONIC PERFORMANCE					
Distortion	V_{OUT} = 2 V p-p				
Second Harmonic	500 kHz, R_L = 100 Ω/25 Ω		–78/–71		dBc
	1 MHz, R_L = 100 Ω/25 Ω		–76/–69		dBc
Third Harmonic	500 kHz, R_L = 100 Ω/25 Ω		–105/–91		dBc
	1 MHz, R_L = 100 Ω/25 Ω		–81/–72		dBc
IP3	500 kHz, R_L = 100 Ω/25 Ω		40/35		dBm
IMD	500 kHz, R_L = 100 Ω/25 Ω		–76/–66		dBc
MTPR	26 kHz to 1.1 MHz		–66		dBc
Input Noise Voltage	f = 10 kHz		1.9		nV/√Hz
Input Noise Current	f = 10 kHz (+ Inputs)		23		pA/√Hz
	f = 10 kHz (– Inputs)		21		pA/√Hz
Crosstalk	f = 5 MHz, G = +2		–66		dB
DC PERFORMANCE					
Input Offset Voltage			1.8	3.0	mV
	T_{MIN} to T_{MAX}			4.0	mV
Open Loop Transimpedance	V_{OUT} = 2 V p-p	185	700		kΩ
	T_{MIN} to T_{MAX}	143			kΩ
INPUT CHARACTERISTICS					
Input Resistance	+Input		50		kΩ
Input Capacitance	+Input		2.4		pF
Input Bias Current (+)			16	±45	µA
	T_{MIN} to T_{MAX}			±67	µA
Input Bias Current (–)			1.0	±25	µA
	T_{MIN} to T_{MAX}			±32	µA
CMRR	V_{CM} = ±2.5 V	59	63		dB
Input CM Voltage Range			±5.1		V
OUTPUT CHARACTERISTICS					
Output Resistance			0.2		Ω
Output Voltage Swing	R_L = 25 Ω	±4.6	±5.0		V
Output Current[1]	Highest Harmonic < –58 dBc, f = 1 MHz, R_L = 10 Ω	200	270		mA
	T_{MIN} to T_{MAX}, Highest Harmonic < –52 dBc	100			mA
Short-Circuit Current			1500		mA
POWER SUPPLY					
Supply Current/Amp			7.0	7.7	mA
	T_{MIN} to T_{MAX}			7.8	mA
Operating Range	Dual Supply	±2.2		±6.0	V
Power Supply Rejection Ratio		58	61		dB
Operating Temperature Range		–40		+85	°C

NOTE

[1]Output current is defined here as the highest current load delivered by the output of each amplifier into a specified resistive load (R_L = 10 Ω), while maintaining an acceptable distortion level (i.e., less than –60 dBc highest harmonic) at a given frequency (f = 1 MHz).

Specifications subject to change without notice.

SPECIFICATIONS (@ 25°C, V_S = ±2.5 V, R_L = 100 Ω, R_F = R_G = 619 Ω, unless otherwise noted.)

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
–3 dB Bandwidth	G = +2, V_{OUT} < 0.4 V p-p	75	120		MHz
0.1 dB Bandwidth	V_{OUT} < 0.4 V p-p		40		MHz
Large Signal Bandwidth	V_{OUT} = 4 V p-p		100		MHz
Slew Rate	Noninverting, V_{OUT} = 2 V p-p, G = +2		800		V/µs
Rise and Fall Time	Noninverting, V_{OUT} = 2 V p-p		2.2		ns
Settling Time	0.1%, V_{OUT} = 2 V Step		35		ns
Overload Recovery	V_{IN} = 2.5 V p-p		74		ns
NOISE/HARMONIC PERFORMANCE					
Distortion	V_{OUT} = 2 V p-p				
Second Harmonic	500 kHz, R_L = 100 Ω/25 Ω		–75/–68		dBc
	1 MHz, R_L = 100 Ω/25 Ω		–73/–66		dBc
Third Harmonic	500 kHz, R_L = 100 Ω/25 Ω		–91/–88		dBc
	1 MHz, R_L = 100 Ω/25 Ω		–79/–74		dBc
IP3	500 kHz, R_L = 100 Ω/25 Ω		40/36		dBm
IMD	500 kHz, R_L = 100 Ω/25 Ω		–78/–64		dBc
MTPR	26 kHz to 1.1 MHz		–66		dBc
Input Noise Voltage	f = 10 kHz		1.8		nV/√Hz
Input Noise Current	f = 10 kHz (+ Inputs)		23		pA/√Hz
	f = 10 kHz (– Inputs)		21		pA/√Hz
Crosstalk	f = 5 MHz, G = +2		–66		dB
DC PERFORMANCE					
Input Offset Voltage			0.8	2.0	mV
	T_{MIN} to T_{MAX}			2.6	mV
Open Loop Transimpedance	V_{OUT} = 2 V p-p	40	166		kΩ
	T_{MIN} to T_{MAX}	45			kΩ
INPUT CHARACTERISTICS					
Input Resistance	+Input		50		kΩ
Input Capacitance	+Input		2.4		pF
Input Bias Current (+)			16	±40	µA
	T_{MIN} to T_{MAX}			±62	µA
Input Bias Current (–)			2	±25	µA
	T_{MIN} to T_{MAX}			±32	µA
CMRR	V_{CM} = ±1.0 (±1.0)	57	60		dB
Input CM Voltage Range			±1.6		V
OUTPUT CHARACTERISTICS					
Output Resistance			0.2		Ω
Output Voltage Swing	R_L = 25 Ω	±1.55	±1.65		V
Output Current[1]	Highest Harmonic < –55 dBc, f = 1 MHz, R_L = 10 Ω	100	120		mA
	T_{MIN} to T_{MAX} Highest Harmonic < 50 dBc	60			mA
Short-Circuit Current			1300		mA
POWER SUPPLY					
Supply Current/Amp			6.2	7	mA
	T_{MIN} to T_{MAX}			7.3	mA
Operating Range	Dual Supply	±2.2		±6.0	V
Power Supply Rejection Ratio		59	62		dB
Operating Temperature Range		–40		+85	°C

NOTE

[1]Output current is defined here as the highest current load delivered by the output of each amplifier into a specified resistive load (R_L = 10 Ω), while maintaining an acceptable distortion level (i.e., less than –60 dBc highest harmonic) at a given frequency (f = 1 MHz).

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS[1]

Supply Voltage . . . . . 13.2 V
Internal Power Dissipation[2]
Small Outline Package (R) . . . . . 1.3 W
Input Voltage (Common Mode) . . . . . $\pm V_S$
Differential Input Voltage . . . . . ±2.5 V
Output Short Circuit Duration
. . . . . Observe Power Derating Curves
Storage Temperature Range . . . . . –65°C to +125°C
Operating Temperature Range . . . . . –40°C to +85°C
Lead Temperature Range (Soldering 10 sec) . . . . . 300°C

NOTES

[1]Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

[2]Specification is for device on a two-layer board with 2500 mm^2 of 2 oz. copper at +25°C 8-lead SOIC package: θ_{JA} = 95.0°C/W.

MAXIMUM POWER DISSIPATION

The maximum power that can be safely dissipated by the AD8017 is limited by the associated rise in junction temperature. The maximum safe junction temperature for plastic encapsulated device is determined by the glass transition temperature of the plastic, approximately 150°C. Temporarily exceeding this limit may cause a shift in parametric performance due to a change in the stresses exerted on the die by the package. Exceeding a junction temperature of 175°C for an extended period can result in device failure.

The output stage of the AD8017 is designed for maximum load current capability. As a result, shorting the output to common can cause the AD8017 to source or sink 500 mA. To ensure proper operation, it is necessary to observe the maximum power derating curves. Direct connection of the output to either power supply rail can destroy the device.

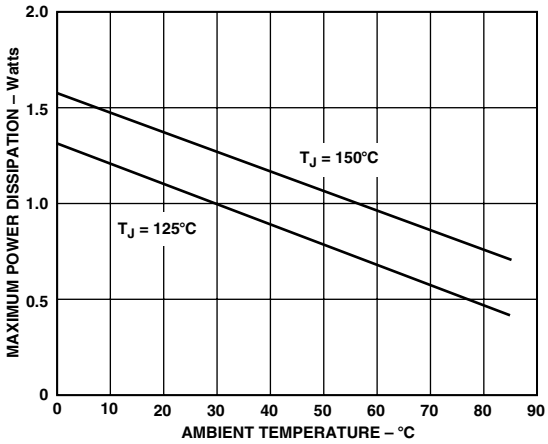


Figure 3. Plot of Maximum Power Dissipation vs. Temperature for AD8017

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
AD8017AR	–40°C to +85°C	8-Lead SOIC	SO-8
AD8017AR-REEL	–40°C to +85°C	Tape and Reel 13"	SO-8
AD8017AR-REEL7	–40°C to +85°C	Tape and Reel 7"	SO-8
AD8017AR-EVAL		Evaluation Board	

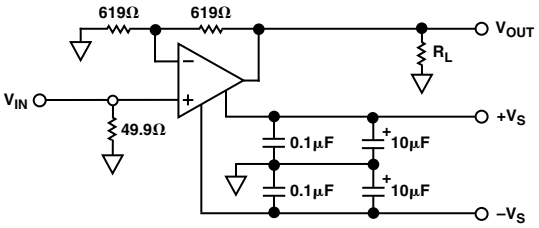


Figure 4. Test Circuit: Gain = +2

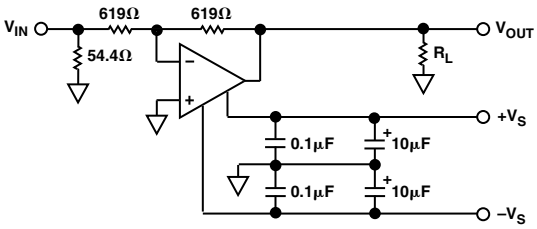


Figure 5. Test Circuit: Gain = –1

CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the AD8017 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high-energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

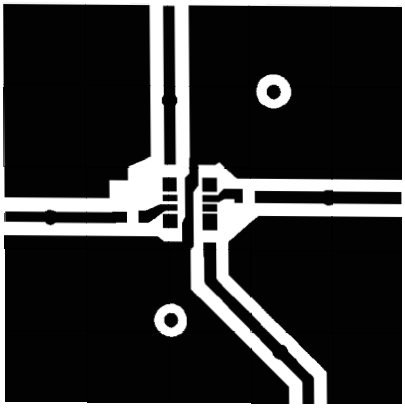


Figure 11. Universal SOIC Noninverter Top

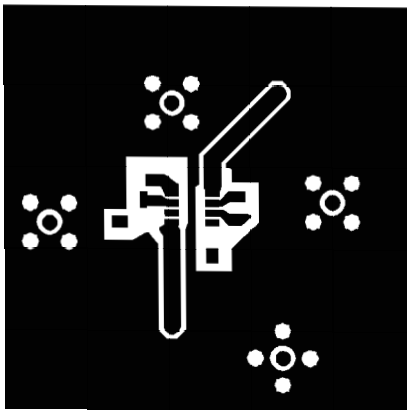


Figure 12. Universal SOIC Noninverter Bottom

OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).

8-Lead SOIC
(R-8)