1. DESCRIPTION

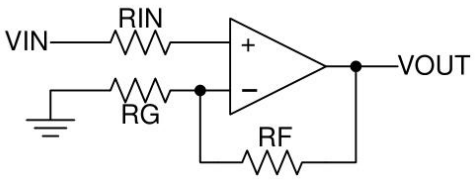
The XL5532 device is a high-performance operational amplifier combining excellent DC and AC characteristics. It features very low noise, high output-drive capability, high unity-gain and maximum-output-swing bandwidths, low distortion, high slew rate, input-protection diodes, and output short-circuit protection. This makes the device especially suitable for application in high quality and professional audio equipment, instrumentation, control circuits, and telephone channel amplifiers etc.

2. FEATURES

- Operating Voltage ±5V to ±22V
- Small Signal Bandwidth 10MHz typ.
- Slew Rate 8V/μs typ.
- Input Noise Voltage 5nV/$\sqrt{Hz}$ typ.
- Output Drive Capability 600Ω,10Vrms typ.
- Available Package: SOP8

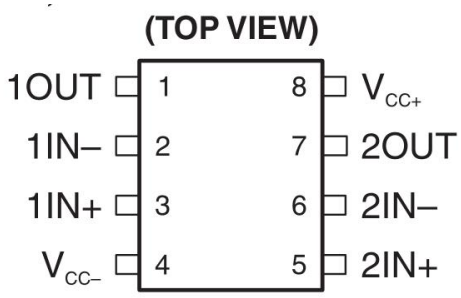
3. APPLICATION

- AV Receivers
- Embedded PCs
- Netbooks
- Video Broadcasting and Infrastructure: Scalable Platforms
- DVD Recorders and Players
- Multichannel Video Transcoders
- Pro Audio Mixers



Simplified Schematic (1/2 part)

4. PIN CONFIGURATIONS AND FUNCTIONS



PIN		TYPE	DESCRIPTION
NAME	NO.		
1OUT	1	O	Output
1IN-	2	I	Inverting Input
1IN+	3	I	Noninverting input
VCC-	4	—	Negative Supply
2IN+	5	I	Noninverting input
2IN-	6	I	Inverting Input
2OUT	7	O	Output
VCC+	8	—	Positive Supply

5. SPECIFICATIONS

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

			MIN	MAX	UNIT
V_{CC}	Supply voltage(2)	V_{CC+}	0	22	V
		V_{CC-}	–22	0	V
	Input voltage, either input(2)(3)		V_{CC-}	V_{CC+}	V
	Input current(4)		–10	10	mA
	Duration of output short circuit(5)		Unlimited		
T_J	Operating virtual-junction temperature			150	°C
T_{stg}	Storage temperature range		–50	150	°C

(1) All voltage values, except differential voltages, are with respect to the midpoint between V_{CC+} and V_{CC-}.
(2) The magnitude of the input voltage must never exceed the magnitude of the supply voltage.
(3) Excessive input current will flow if a differential input voltage in excess of approximately 0.6 V is applied between the inputs, unless some limiting resistance is used.
(4) The output may be shorted to ground or either power supply. Temperature and/or supply voltages must be limited to ensure the maximum dissipation rating is not exceeded.

5.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), all pins	2000	V
		Charged device model (CDM), all pins	200	

5.3 Recommended Operating Conditions

			MIN	MAX	UNIT
V_{CC+}	Supply voltage		5	15	V
V_{CC-}	Supply voltage		–5	–15	V
T_A	Operating free-air temperature	XL5532	–40	85	°C

5.4 Thermal Information

THERMAL METRIC(1)		XL5532 SOP 8 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance (2)(3)	105	°C/W

(1) The package thermal impedance is calculated in accordance with JESD 51-7.
(2) Maximum power dissipation is a function of $T_J(max)$, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) – T_A) / \theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.

5.5 Electrical Characteristics

$V_{CC\pm}$ = ±15 V, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS[1]		MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	V_O = 0	T_A = 25°C		0.7	6	mV
			T_A = Full range[2]			9	
I_{IO}	Input offset current	T_A = 25°C			25	200	nA
		T_A = Full range[2]				270	
I_{IB}	Input bias current	T_A = 25°C			200	1000	nA
		T_A = Full range[2]				1200	
V_{ICR}	Common-mode input-voltage range			±12	±13		V
V_{OPP}	Maximum peak-to-peak output-voltage swing	R_L ≥ 600 Ω, $V_{CC\pm}$ = ±15 V		22	24		V
A_{VD}	Large-signal differential-voltage amplification	R_L ≥ 600 Ω, V_O = ±10 V	T_A = 25°C	15	50		V/mV
			T_A = Full range[2]	10			
		R_L ≥ 2 kΩ, V_O±10 V	T_A = 25°C	25	100		
			T_A = Full range[2]	15			
A_{vd}	Small-signal differential-voltage amplification	f = 10 kHz			2.2		V/mV
B_{OM}	Maximum output-swing bandwidth	R_L = 600 Ω, V_O = ±10 V			140		kHz
B_1	Unity-gain bandwidth	R_L = 600 Ω, C_L = 100 pF			10		MHz
r_i	Input resistance			30	300		kΩ
z_o	Output impedance	A_{VD} = 30 dB, R_L = 600 Ω, f = 10 kHz			0.3		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR} min		70	100		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±9 V to ±15 V, V_O = 0		80	100		dB
I_{OS}	Output short-circuit current			10	35		mA
I_{CC}	Total supply current	V_O = 0, No load			8	20	mA
	Crosstalk attenuation (V_{O1}/V_{O2})	V_{01} = 10 V peak, f = 1 kHz			110		dB

(1) All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified.
(2) Full temperature ranges are: –40°C to 85°C

5.6 Operating Characteristics

$V_{CC\pm}$ = ±15 V, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	XL5532			UNIT
			MIN	TYP	MAX	
SR	Slew rate at unity gain			8		V/μs
	Overshoot factor	VI = 100 mV, RL = 600 Ω, AVD = 1, CL = 100 pF		10		%
V_n	Equivalent input noise voltage	f = 30 Hz		8		nV/√Hz
		f = 1 kHz		5		
I_n	Equivalent input noise current	f = 30 Hz		2.7		pA/√Hz
		f = 1 kHz		0.7		

5.7 Typical Characteristics

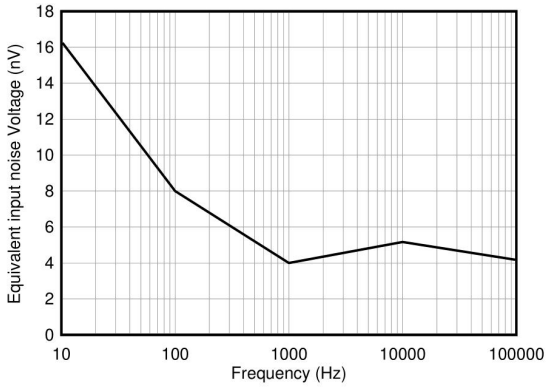


Figure 1. Equivalent Input Noise Voltage vs Frequency

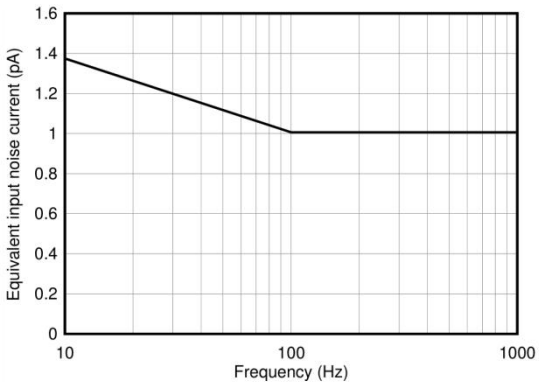


Figure 2. Equivalent Input Noise Current vs Frequency

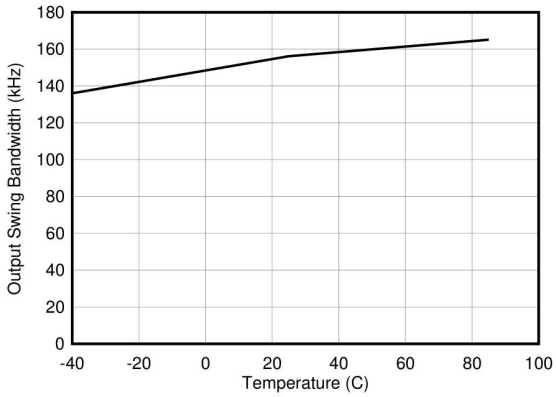


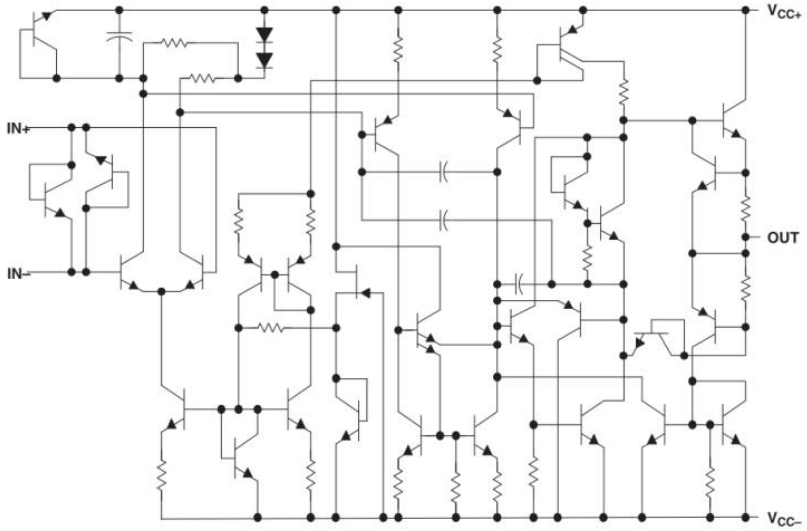
Figure 3. Output Swing Bandwidth vs Temperature at V_{CC} = ±10 V

6. DETAILED DESCRIPTION

6.1 Absolute Maximum Ratings

The XL5532 devices are high-performance operational amplifiers combining excellent dc and ac characteristics. They feature very low noise, high output-drive capability, high unity-gain and maximum-output-swing bandwidths, low distortion, high slew rate, input-protection diodes, and output short-circuit protection. These operational amplifiers are compensated internally for unity-gain operation. These devices have specified maximum limits for equivalent input noise voltage.

6.2 Equivalent Circuit (1/2 part shown)



6.3 Feature Description

6.3.1 Unity-Gain Bandwidth

The unity-gain bandwidth is the frequency up to which an amplifier with a unity gain may be operated without greatly distorting the signal. The XL5532 device has a 10-MHz unity-gain bandwidth.

6.3.2 Common-Mode Rejection Ratio

The common-mode rejection ratio (CMRR) of an amplifier is a measure of how well the device rejects unwanted input signals common to both input leads. It is found by taking the ratio of the change in input offset voltage to the change in the input voltage and converting to decibels. Ideally the CMRR would be infinite, but in practice, amplifiers are designed to have it as high as possible. The CMRR of the XL5532 devices is 100 dB.

6.3.3 Common-Mode Rejection Ratio

The slew rate is the rate at which an operational amplifier can change its output when there is a change on the input. The XL5532 device has a 8V/μs slew rate.

6.3.3 Device Functional Modes

The XL5532 device is powered on when the supply is connected. Each of these devices can be operated as a single supply operational amplifier or dual supply amplifier depending on the application.

7. APPLICATION AND IMPLEMENTATION

7.1 Typical Application

Some applications require differential signals. Figure 4 shows a simple circuit to convert a single-ended input of 2 V to 10 V into differential output of ±8 V on a single 15-V supply. The output range is intentionally limited to maximize linearity. The circuit is composed of two amplifiers. One amplifier acts as a buffer and creates a voltage, V_{OUT+}. The second amplifier inverts the input and adds a reference voltage to generate $V_{OUT–}$. Both V_{OUT+} and $V_{OUT–}$ range from 2 V to 10 V. The difference, V_{DIFF}, is the difference between V_{OUT+} and $V_{OUT–}$.

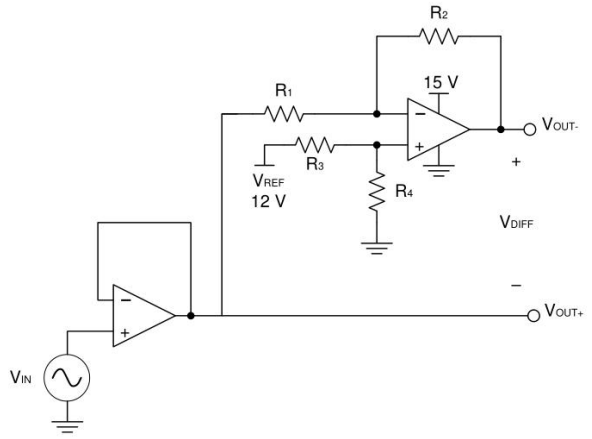


Figure 4. Schematic for Single-Ended Input to Differential Output Conversion

7.1.1 Design Requirements

The design requirements are as follows:

- Supply voltage: 15 V
- Reference voltage: 12V
- Input: 2 V to 10 V
- Output differential: ±8 V

Typical Application (continued)

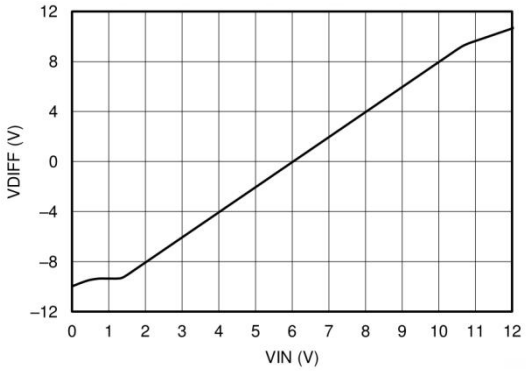


Figure 5. Differential Output Voltage vs Input Voltage

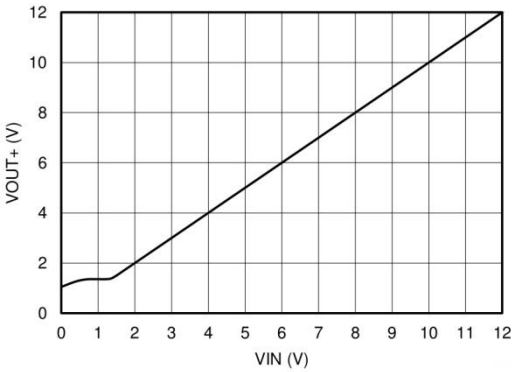


Figure 6. Positive Output Voltage Node vs Input Voltage

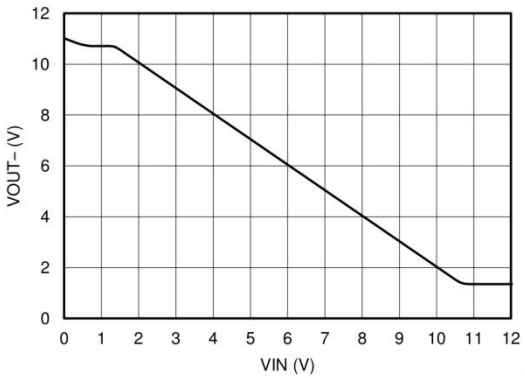


Figure 7. Positive Output Voltage Node vs Input Voltage

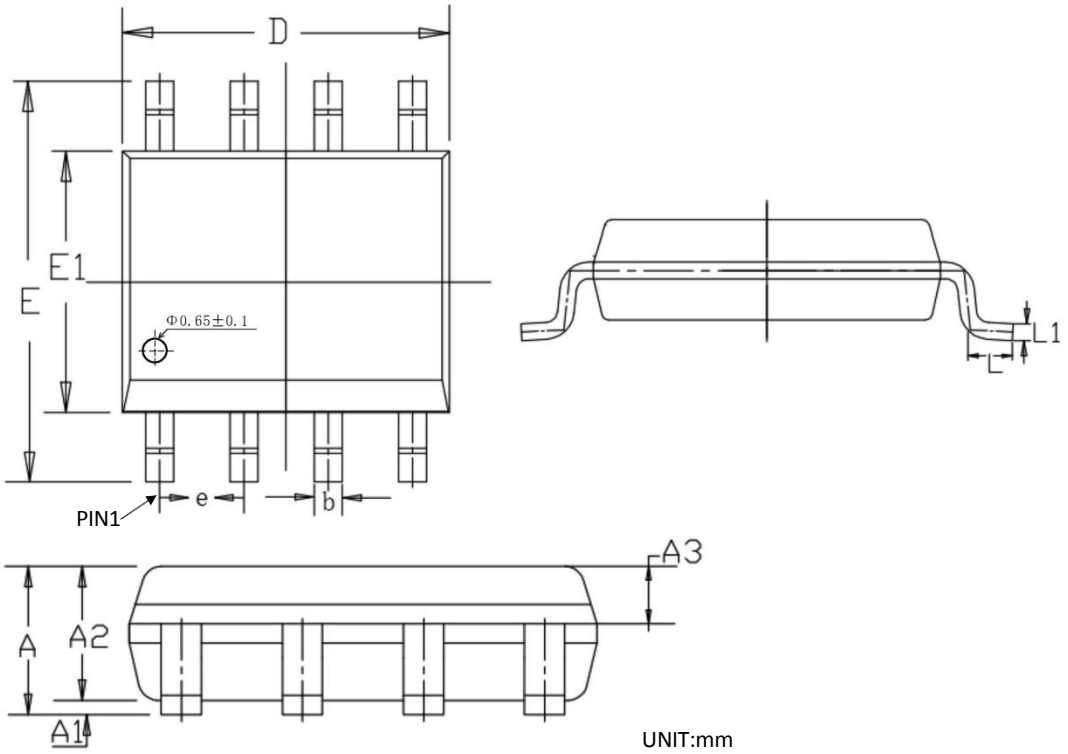
8. ORDERING INFORMATION

Ordering Information

Part Number	Device Marking	Package Type	Body size (mm)	Temperature (°C)	MSL	Transport Media	Package Quantity
XL5532	XL5532	SOP8	4.90 * 3.90	-40 to 85	MSL3	T&R	2500

9. DIMENSIONAL DRAWINGS

SOP8



UNIT:mm

	MIN	NOM	MAX
A	1.450	1.550	1.650
A1	0.100	0.150	0.200
A2	1.300	1.400	1.500
A3	0.600	0.650	0.700
b	0.380	–	0.510
e	1.240	1.270	1.300
D	4.800	4.900	5.000
E	5.800	6.000	6.200
E1	3.800	3.900	4.000
L	0.450	0.600	0.750
L1	—	0.25BSC	—