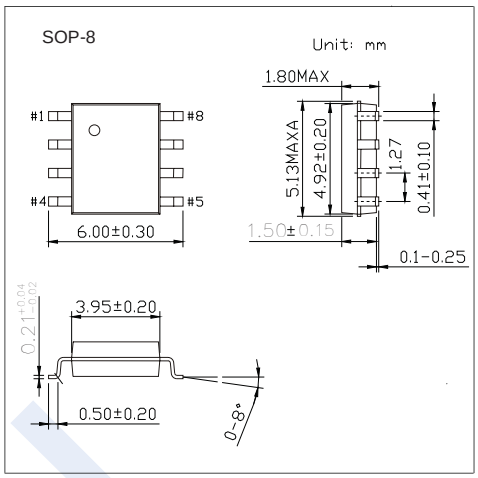
Operational Amplifier

KM5532

■ General Description

The 5532 is a dual high-performance low noise operational amplifier. Compared to most of the standard operational amplifiers, such as the 1458, it shows better noise performance, improved output drive capability and considerably higher small-signal and power bandwidths.

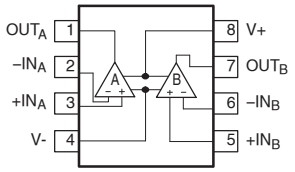
This makes the device especially suitable for application in high-quality and professional audio equipment, instrumentation and control circuits, and telephone channel amplifiers. The op amp is internally compensated for gains equal to one.



■ Features

- Small-Signal Bandwidth: 10 MHz
- Output Drive Capability: 600Ω, 10 V_{RMS}
- Input Noise Voltage: 5.0 $nV/\sqrt{Hz}$ (Typical)
- DC Voltage Gain: 50000
- AC Voltage Gain: 2200 at 10 kHz
- Power Bandwidth: 140 kHz
- Slew Rate: 9.0 V/μs
- Large Supply Voltage Range: ±3.0 to ±20 V
- Compensated for Unity Gain
- Pb–Free Packages are Available

PIN CONFIGURATION



Top View

KM5532

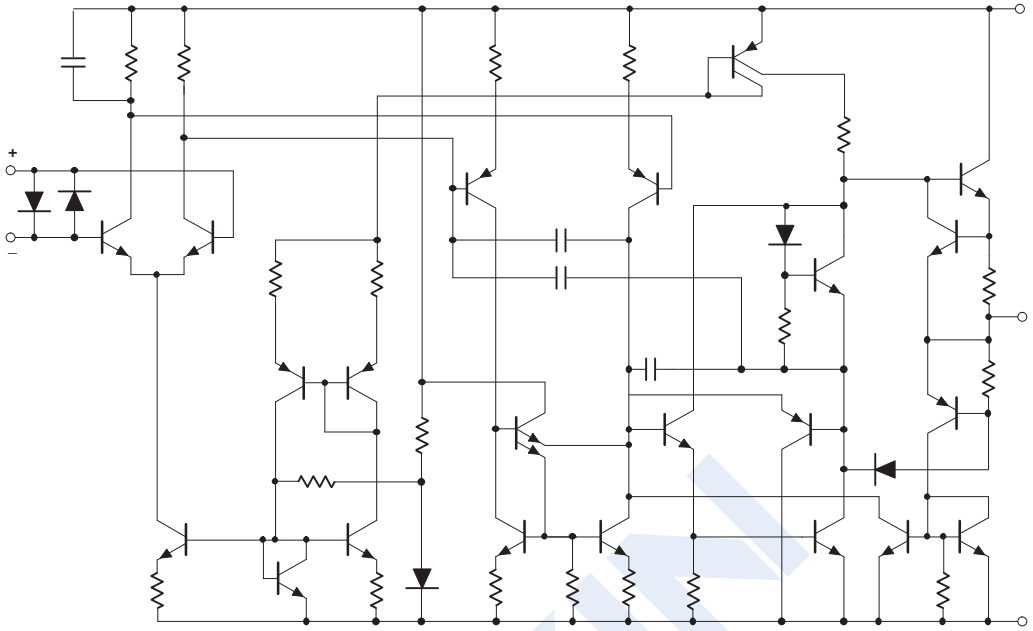


Figure 1. Equivalent Schematic (Each Amplifier)

■ MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage	V_S	±22	V
Input Voltage	V_{IN}	$\pm V_{SUPPLY}$	V
Differential Input Voltage (Note 1)	V_{DIFF}	±0.5	V
Operating Temperature Range	T_{amb}	0 to 70	°C
Storage Temperature	T_{stg}	–65 to +150	°C
Junction Temperature	T_j	150	°C
Maximum Power Dissipation, T_{amb} = 25°C (Still-Air)	P_D	780	mW
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	182	°C/W
Lead Soldering Temperature (10 sec max)	T_{sld}	230	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Diodes protect the inputs against overvoltage. Therefore, unless current-limiting resistors are used, large currents will flow if the differential input voltage exceeds 0.6 V. Maximum current should be limited to ±10 mA.

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■ **DC ELECTRICAL CHARACTERISTICS** (T_{amb} = 25°C; V_S = ±15 V, unless otherwise noted.) (Notes 2, 3 and 4)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Offset Voltage	V_{OS}	–	–	0.5	4.0	mV
	–	Overtemperature	–	–	5.0	mV
	$\Delta V_{OS}/\Delta T$	–	–	5.0	–	μV/°C
Offset Current	I_{OS}	–	–	10	150	nA
	–	Overtemperature	–	–	200	nA
	$\Delta I_{OS}/\Delta T$	–	–	200	–	pA/°C
Input Current	I_B	–	–	300	800	nA
	–	Overtemperature	–	–	1000	nA
	$\Delta I_B/\Delta T$	–	–	5.0	–	nA/°C
Supply Current	I_{CC}	–	–	8.0	16	mA
	–	Overtemperature	–	–	–	
Common-Mode Input Range	V_{CM}	–	±12	±13	–	V
Common-Mode Rejection Ratio	CMRR	–	70	100	–	dB
Power Supply Rejection Ratio	PSRR	–	–	10	100	μV/V
Large-Signal Voltage Gain	A_{VOL}	$R_L \geq 2.0$ kΩ; V_O = ±10 V	25	100	–	V/mV
		Overtemperature	15	–	–	
		$R_L \geq 600$ Ω; V_O = ±10 V	15	50	–	
		Overtemperature	10	–	–	
Output Swing	V_{OUT}	$R_L \geq 600$ Ω	±12	±13	–	V
		Overtemperature	±10	±12	–	
		$R_L \geq 600$ Ω; V_S = ±18 V	±15	±16	–	
		Overtemperature	±12	±14	–	
		$R_L \geq 2.0$ kΩ	±13	±13.5	–	
		Overtemperature	±10	±12.5	–	
Input Resistance	R_{IN}	–	30	300	–	kΩ
Output Short Circuit Current	I_{SC}	–	10	38	60	mA

2. Diodes protect the inputs against overvoltage. Therefore, unless current-limiting resistors are used, large currents will flow if thedifferential input voltage exceeds 0.6 V. Maximum current should be limited to ±10 mA.
3. For operation at elevated temperature, derate packages based on the package thermal resistance.
4. Output may be shorted to ground at V_S = ±15 V, T_{amb} = 25°C. Temperature and/or supply voltages must be limited to ensure dissipation rating is not exceeded.

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■ AC ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C; V_S = ±15 V, unless otherwise noted.)

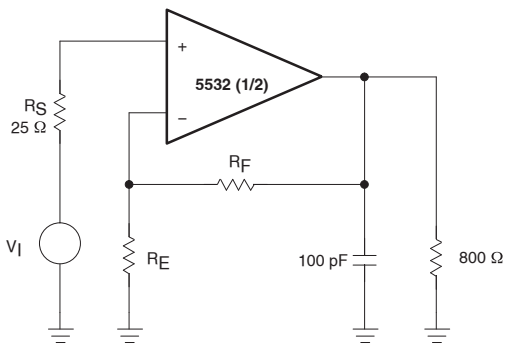
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Resistance	R_{OUT}	A_V = 30 dB Closed-loop f = 10 kHz, R_L = 600 Ω	–	0.3	–	Ω
Overshoot	–	Voltage-Follower V_{IN} = 100 mV_{P-P} C_L = 100 pF; R_L = 600 Ω	–	10	–	%
Gain	A_V	f = 10 kHz	–	2.2	–	V/mV
Gain Bandwidth Product	GBW	C_L = 100 pF; R_L = 600 Ω	–	10	–	MHz
Slew Rate	SR	–	–	9.0	–	V/μs
Power Bandwidth	–	V_{OUT} = ±10 V V_{OUT} = ±14 V; R_L = 600 Ω V_{CC} = ±18 V	– –	140 100	– –	kHz

■ ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C; V_S = ±15 V, unless otherwise noted.)

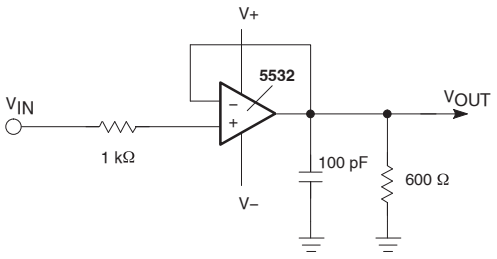
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Noise Voltage	V_{NOISE}	f_O = 30 Hz	–	8.0	–	nV/√Hz
		f_O = 1.0 kHz	–	5.0	–	
Input Noise Current	I_{NOISE}	f_O = 30 Hz	–	2.7	–	pA/√Hz
		f_O = 1.0 kHz	–	0.7	–	
Channel Separation	–	f = 1.0 kHz; R_S = 5.0 kΩ	–	110	–	dB

■ Marking

Marking	5532



Closed-Loop Frequency Response



Voltage-Follower

Figure 2. Test Circuits

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■ TYPICAL PERFORMANCE CHARACTERISTICS

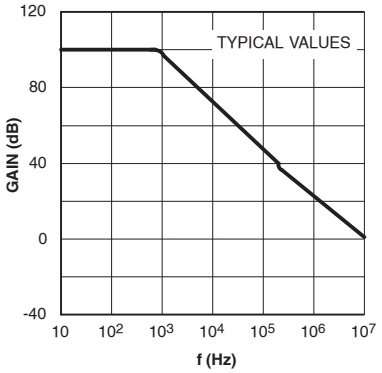

Figure 3. Open-Loop Frequency Response

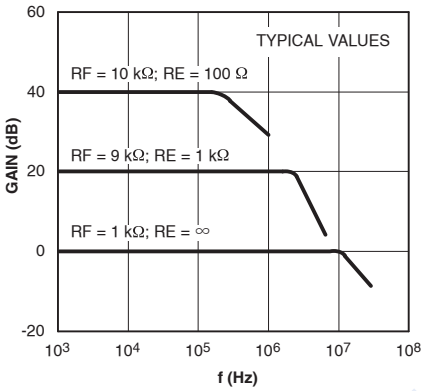

Figure 4. Closed-Loop Frequency Response

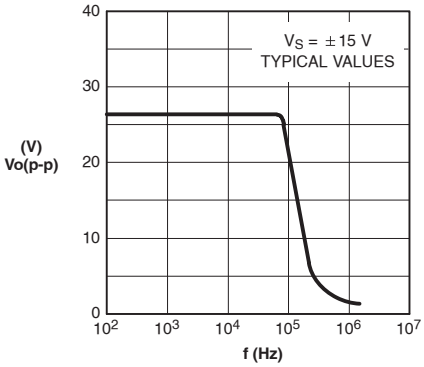

Figure 5. Large–Signal Frequency Response

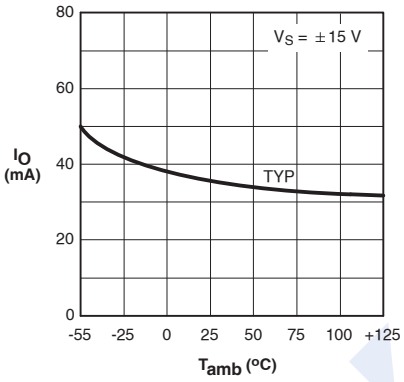

Figure 6. Output Short–Circuit Current

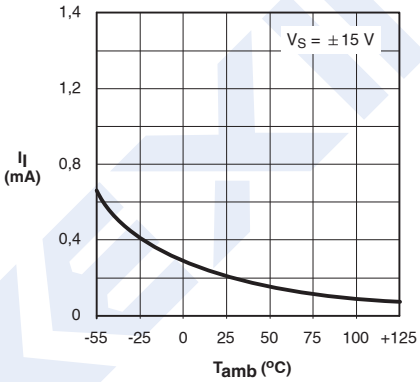

Figure 7. Input Bias Current

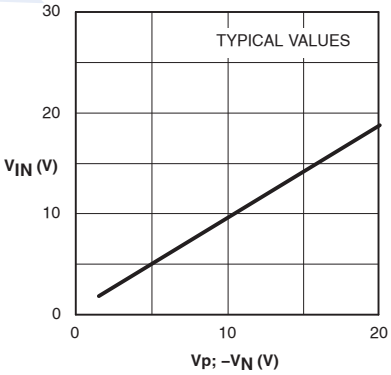

Figure 8. Input Common–Mode Voltage Range

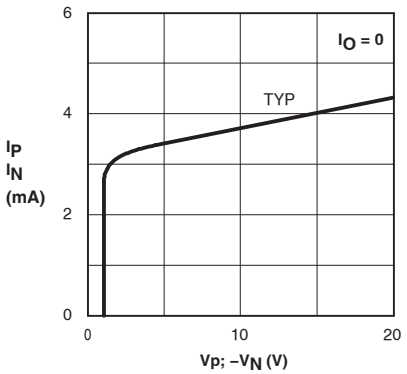

Figure 9. Supply Current

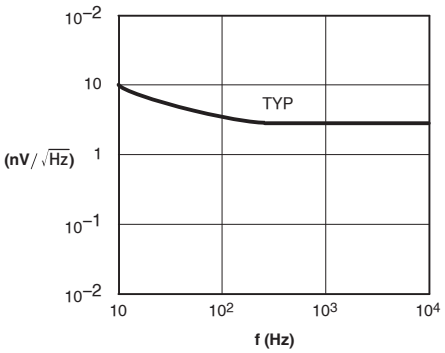

Figure 10. Input Noise Voltage Density