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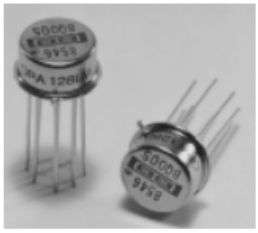


OPA128

Difet® Electrometer-Grade OPERATIONAL AMPLIFIER

FEATURES

- ULTRA-LOW BIAS CURRENT: 75fA max
- LOW OFFSET: 500µV max
- LOW DRIFT: 5µV/°C max
- HIGH OPEN-LOOP GAIN: 110dB min
- HIGH COMMON-MODE REJECTION: 90dB min
- IMPROVED REPLACEMENT FOR AD515 AND AD549

APPLICATIONS

- ELECTROMETER
- MASS SPECTROMETER
- CHROMATOGRAPH
- ION GAUGE
- PHOTODETECTOR
- RADIATION-HARD EQUIPMENT

DESCRIPTION

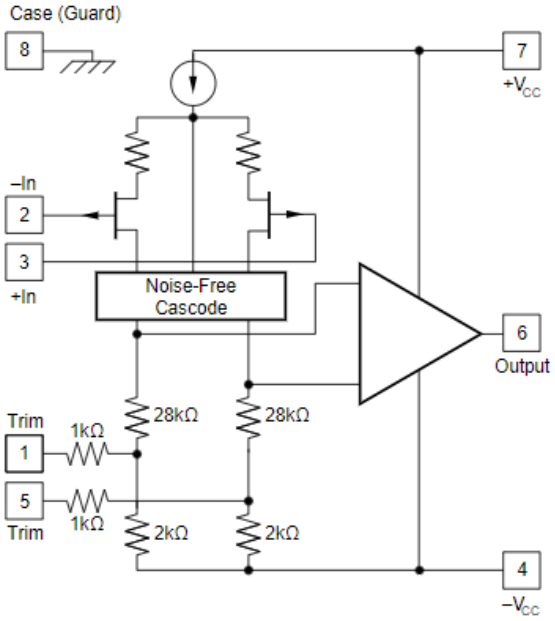
The OPA128 is an ultra-low bias current monolithic operational amplifier. Using advanced geometry dielectrically-isolated FET (***Difet***®) inputs, this monolithic amplifier achieves a performance level exceeding even the best hybrid electrometer amplifiers.

Laser-trimmed thin-film resistors give outstanding voltage offset and drift performance.

A noise-free cascode and low-noise processing give the OPA128 excellent low-level signal handling capabilities. Flicker noise is very low.

The OPA128 is an improved pin-for-pin replacement for the AD515.

Difet® Burr-Brown Corp.



OPA128 Simplified Circuit

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Internet: http://www.burr-brown.com/ • FAXLine: (800) 548-6133 (US/Canada Only) • Cable: BBRCORP • Telex: 066-6491 • FAX: (520) 889-1510 • Immediate Product Info: (800) 548-6132

PDS-653E

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SBOS148

SPECIFICATIONS

ELECTRICAL

At V_{CC} = ±15VDC and T_A = +25°C, unless otherwise noted. Pin 8 connected to ground.

PARAMETER	CONDITIONS	OPA128JM			OPA128KM			OPA128LM			OPA128SM			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
INPUT														
BIAS CURRENT[1]														
Input Bias Current	V_{CM} = 0VDC, $R_L \geq 10k\Omega$		±150	±300		±75	±150		±40	±75		±75	±150	fA
OFFSET CURRENT[1]														
Input Offset Current	V_{CM} = 0VDC, $R_L \geq 10k\Omega$		65			30			30			30		fA
OFFSET VOLTAGE[1]														
Input Offset Voltage	V_{CM} = 0VDC		±260	±1000		±140	±500		±140	±500		±140	±500	∝V
Average Drift	$T_A = T_{MIN}$ to T_{MAX}			±20			±10			±5			±10	∝V/°C
Supply Rejection		80	120		90	120		90	120		90	120		dB
			±1	±100		±1	±32		±1	±32		±1	±32	∝V/V
NOISE														
Voltage: f_O = 10Hz			92			92			92			92		nV/√Hz
f_O = 100Hz			78			78			78			78		nV/√Hz
f_O = 1kHz			27			27			27			27		nV/√Hz
f_O = 10kHz			15			15			15			15		nV/√Hz
f_B = 10Hz to 10kHz			2.4			2.4			2.4			2.4		∝Vrms
f_B = 0.1Hz to 10Hz			4			4			4			4		∝Vp-p
Current: f_B = 0.1Hz to 10Hz			4.2			3			2.3			3		fA, p-p
f_O = 0.1Hz to 20kHz			0.22			0.16			0.12			0.16		fA/√Hz
IMPEDANCE														
Differential			10^{13} || 1			10^{13} || 1			10^{13} || 1			10^{13} || 1		Ω || pF
Common-Mode			10^{15} || 2			10^{15} || 2			10^{15} || 2			10^{15} || 2		Ω || pF
VOLTAGE RANGE[4]														
Common-Mode Input Range		±10	±12		±10	±12		±10	±12		±10	±12		V
Common-Mode Rejection	V_{IN} = ±10VDC	80	118		90	118		90	118		90	118		dB
OPEN-LOOP GAIN, DC														
Open-Loop Voltage Gain	$R_L \geq 2k\Omega$	94	128		110	128		110	128		110	128		dB
FREQUENCY RESPONSE														
Unity Gain, Small Signal	[2]	0.5	1		0.5	1		0.5	1		0.5	1		MHz
Full Power Response	20Vp-p, R_L = 2kΩ		47			47			47			47		kHz
Slew Rate	V_O = ±10V, R_L = 2kΩ	0.5	3		1	3		1	3		1	3		V/∝s
Settling Time, 0.1%	Gain = –1, R_L = 2kΩ		5			5			5			5		∝s
0.01%	10V Step		10			10			10			10		∝s
Overload Recovery, 50% Overdrive[3]	Gain = –1		5			5			5			5		∝s
RATED OUTPUT														
Voltage Output	R_L = 2kΩ	±10	±13		±10	±13		±10	±13		±10	±13		V
Current Output	V_O = ±10VDC	±5	±10		±5	±10		±5	±10		±5	±10		mA
Output Resistance	DC, Open Loop		100			100			100			100		Ω
Load Capacitance Stability	Gain = +1		1000			1000			1000			1000		pF
Short Circuit Current		10	34	55	10	34	55	10	34	55	10	34	55	mA
POWER SUPPLY														
Rated Voltage			±15			±15			±15			±15		VDC
Voltage Range, Derated Performance		±5		±18	±5		±18	±5		±18	±5		±18	VDC
Current, Quiescent	I_O = 0mADC		0.9	1.5		0.9	1.5		0.9	1.5		0.9	1.5	mA
TEMPERATURE RANGE														
Specification	Ambient Temp.	0		+70	0		+70	0		+70	–55		+125	°C
Operating	Ambient Temp.	–55		+125	–55		+125	–55		+125	–55		+125	°C
Storage	Ambient Temp.	–65		+150	–65		+150	–65		+150	–65		+150	°C
θ Junction-Ambient			200			200			200			200		°C/W

NOTES: (1) Offset voltage, offset current, and bias current are measured with the units fully warmed up. Bias current doubles approximately every 11°C. (2) Sample tested. (3) Overload recovery is defined as the time required for the output to return from saturation to linear operation following the removal of a 50% input overdrive. (4) If it is possible for the input voltage to exceed the supply voltage, a series protection resistor should be added to limit input current to 0.5mA. The input devices can withstand overload currents of 0.3mA indefinitely without damage.

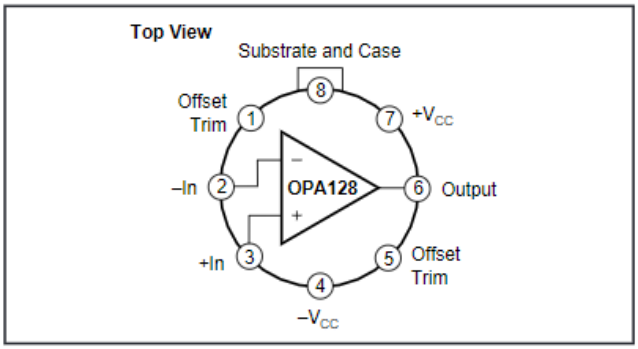
ELECTRICAL (FULL TEMPERATURE RANGE SPECIFICATIONS)

At V_{CC} = ±15VDC and $T_A = T_{MIN}$ and T_{MAX}, unless otherwise noted.

PARAMETER	CONDITIONS	OPA128JM			OPA128KM			OPA128LM			OPA128SM			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
TEMPERATURE RANGE														
Specification Range	Ambient Temp.	0		+70	0		+70	0		+70	–55		+125	°C
INPUT														
BIAS CURRENT[1] Input Bias Current	V_{CM} = 0VDC		±2.5	±8		±1.3	±4		±0.7	±2		±43	±170	pA
OFFSET CURRENT[1] Input Offset Current	V_{CM} = 0VDC		1.1			0.6			0.6			18		pA
OFFSET VOLTAGE[1] Input Offset Voltage Average Drift Supply Rejection	V_{CM} = 0VDC	 74	 114 ±2	±2.2mV ±20 ±200	 80	 114 ±2	±1mV ±10 ±100	 80	 114 ±2	±750 ±5 ±100	 80	 106 ±5	±1.5mV ±10 ±100	∝V ∝V/°C dB ∝V/V
VOLTAGE RANGE[2] Common-Mode Input Range Commmon-Mode Rejection	 V_{IN} = ±10VDC	±10 74	±11 112		±10 80	±11 112		±10 80	±11 112		±10 74	±11 104		V dB
OPEN-LOOP GAIN, DC														
Open-Loop Voltage Gain	R_L ≥ 2kΩ	90	125		104	125		104	125		90	122		dB
RATED OUTPUT														
Voltage Output Current Output Short Circuit Current	R_L = 2k□ V_O = ±10VDC V_O = 0VDC	±10 ±5 10	 22		±10 ±5 10	 22		±10 ±5 10	 22		±10 ±5 10	 18		V mA mA
POWER SUPPLY														
Current, Quiescent	I = 0mADC		0.9	1.8		0.9	1.8		0.9	1.8		0.9	2	mA

NOTES: (1) Offset voltage, offset current, and bias current are measured with the units fully warmed up. (2) If it is possible for the input voltage to exceed the supply voltage, a series protection resistor should be added to limit input current to 0.5mA. The input devices can withstand overload currents of 0.3mA indefinitely without damage.

CONNECTION DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Supply	±18VDC
Internal Power Dissipation[1]	500mW
Differential Input Voltage	±36VDC
Input Voltage Range	±18VDC
Storage Temperature Range	–65°C to +150°C
Operating Temperature Range	–55°C to +125°C
Lead Temperature (soldering, 10s)	+300°C
Output Short Circuit Duration[2]	Continuous
Junction Temperature	+175°C

NOTES: (1) Packages must be derated based on θ_{CA} = 150°C/W or θ_{JA} = 200°C/W. (2) Short circuit may be to power supply common only. Rating applies to +25°C ambient. Observe dissipation limit and T_J.

ORDERING INFORMATION

PRODUCT	PACKAGE	TEMPERATURE RANGE	BIAS CURRENT, max (fA)
OPA128JM	TO-99	0°C to +70°C	±300
OPA128KM	TO-99	0°C to +70°C	±150
OPA128LM	TO-99	0°C to +70°C	±75
OPA128SM	TO-99	–55°C to +125°C	±150

PACKAGE INFORMATION

PRODUCT	PACKAGE	PACKAGE DRAWING NUMBER[1]
OPA128JM	TO-99	001
OPA128KM	TO-99	001
OPA128LM	TO-99	001
OPA128SM	TO-99	001

NOTE: (1) For detailed drawing and dimension table, please see end of data sheet, or Appendix C of Burr-Brown IC Data Book.