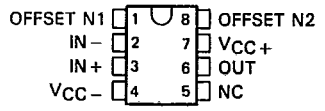
OP-07C, OP-07D, OP-07E
ULTRA-LOW-OFFSET-VOLTAGE OPERATIONAL AMPLIFIERS

T-79-06-10

D2757, OCTOBER 1983—REVISED JUNE 1988

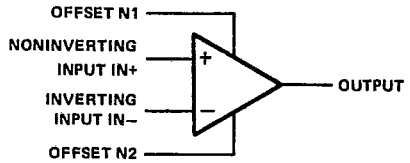
- Ultra-Low Offset Voltage . . .30 μV Typ (OP-07E)
- Ultra-Low Offset Voltage Temperature Coefficient . . . 0.3 μV/°C Typ (OP-07E)
- Ultra-Low Noise
- No External Components Required
- Replaces Chopper Amplifiers at a Lower Cost
- Single-Chip Monolithic Fabrication
- Wide Input Voltage Range 0 to ±14 V Typ
- Wide Supply Voltage Range ±3 V to ±18 V
- Essentially Equivalent to Fairchild μA714 Operational Amplifiers
- Direct Replacement for PMI OP-07C, OP-07D, OP-07E

D, JG, OR P PACKAGE
(TOP VIEW)



NC—No internal connection

symbol



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Operational Amplifiers

description

These devices represent a breakthrough in operational amplifier performance. Low offset and long-term stability are achieved by means of a low-noise, chopperless, bipolar-input-transistor amplifier circuit. For most applications, external components are required for offset nulling and frequency compensation. The true differential input, with a wide input voltage range and outstanding common-mode rejection, provides maximum flexibility and performance in high-noise environments and in noninverting applications. Low bias currents and extremely high input impedances are maintained over the entire temperature range. The OP-07 is unsurpassed for low-noise, high-accuracy amplification of very-low-level signals.

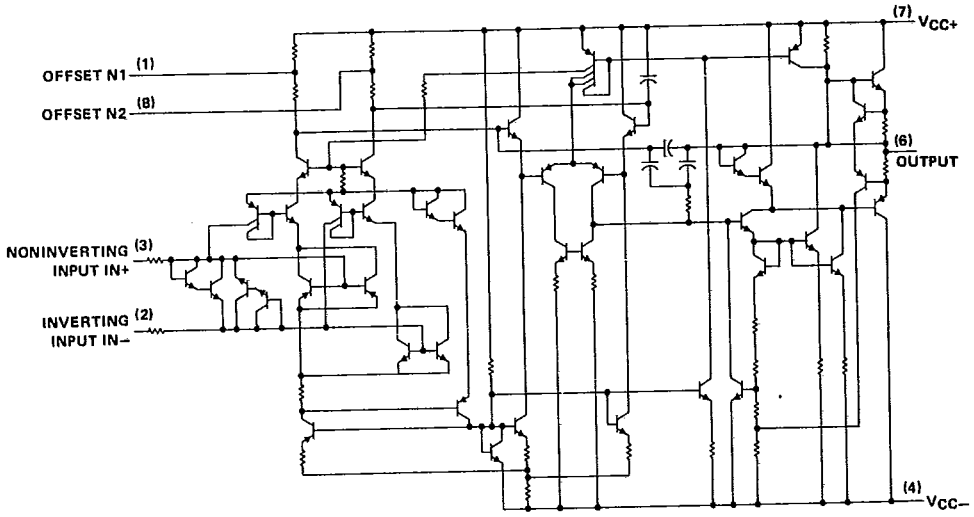
These devices are characterized for operation from 0°C to 70°C.

AVAILABLE OPTIONS

T_A	V_{IO} MAX at 25°C	PACKAGE		
		SMALL OUTLINE (D)	CERAMIC DIP (JG)	PLASTIC DIP (P)
0°C to 70°C	150 μV	OP-07CD OP-07DD	OP-07CJG OP-07DJG	OP-07CP OP-07DP
	75 μV	OP-07ED	OP-07EJG	OP-07EP

The D package is available taped and reeled. Add the suffix R to the device type when ordering. (e.g., OP-07CDR)

schematic



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage V_{CC+} (see Note 1)	22 V
Supply voltage V_{CC-}	−22 V
Differential input voltage (see Note 2)	±30 V
Input voltage (either input, see Note 3)	±22 V
Duration of output short circuit (see Note 4)	unlimited
Continuous total dissipation at (or below) 25°C free-air temperature (see Note 5)	500 mW
Operating free-air temperature range	0°C to 70°C
Storage temperature range	−65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: JG package	300°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or P package	260°C

NOTES: 1. All voltage values, unless otherwise noted, are with respect to the midpoint between V_{CC+} and V_{CC-}.
2. Differential voltages are at the noninverting input terminal with respect to the inverting input terminal.
3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
4. The output may be shorted to ground or either power supply.
5. For operation above 64°C free-air temperature, derate the D package to 464 mW at 70°C at the rate of 5.8 mW/°C.

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electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		OP-7C			OP-7D			OP-7E			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_O = 0, R_S = 50 Ω	25°C		60	150		60	150		30	75	μV
			0°C to 70°C		85	250		85	250		45	130	
α_{VIO}	Temperature coefficient of input offset voltage	V_O = 0, R_S = 50 Ω	0°C to 70°C		0.5	1.8		0.7	2.5		0.3	1.3	μV/°C
	Long-term drift of input offset voltage	See Note 6			0.4			0.5			0.3		μV/mo
	Offset adjustment range	R_S = 20 kΩ, See Figure 1	25°C		±4			±4			±4		mV
I_{IO}	Input offset current		25°C		0.8	6		0.8	6		0.5	3.8	nA
			0°C to 70°C		1.6	8		1.6	8		0.9	5.3	
α_{IIO}	Temperature coefficient of input offset current		0°C to 70°C		12	50		12	50		8	35	pA/°C
I_{IB}	Input bias current		25°C		±1.8	±7		±2	±12		±1.2	±4	nA
			0°C to 70°C		±2.2	±9		±3	±14		±1.5	±5.5	
α_{IIB}	Temperature coefficient of input bias current		0°C to 70°C		18	50		18	50		13	35	pA/°C
V_{ICR}	Common-mode input voltage range		25°C	±13	±14		±13	±14		±13	±14		V
			0°C to 70°C	±13	±13.5		±13	±13.5		±13	±13.5		
V_{OM}	Peak output voltage	R_L ≥ 10 kΩ	25°C	±12	±13		±12	±13		±12.5	±13		V
		R_L ≥ 2 kΩ		±11.5	±12.8		±11.5	±12.8		±12	±12.8		
		R_L ≥ 1 kΩ			±12			±12		±10.5	±12		
		R_L ≥ 2 kΩ	0°C to 70°C	±11	±12.6		±11	±12.6		±12	±12.6		
A_{VD}	Large-signal differential voltage amplification	$V_{CC\pm}$ = ±3 V, V_O = ±0.5 V, R_L ≥ 500 kΩ	25°C	100	400			400		150	400		V/mV
		V_O = ±10 V, R_L = 2 kΩ	25°C	120	400		120	400		200	500		
			0°C to 70°C	100	400		100	400		180	450		
B_1	Unity gain bandwidth		25°C	0.4	0.6		0.4	0.6		0.4	0.6		MHz
r_i	Input resistance		25°C	8	33		7	31		15	50		MΩ
CMRR	Common-mode rejection ratio	V_{IC} = ±13 V, R_S = 50 Ω	25°C	100	120		94	110		106	123		dB
			0°C to 70°C	97	120		94	106		103	123		
k_{SVS}	Supply voltage sensitivity ($\Delta V_{IO}/\Delta V_{CC}$)	$V_{CC\pm}$ = ±3 V to ±18 V, R_S = 50 Ω	25°C		7	32		7	32		5	20	μV/V
			0°C to 70°C		10	51		10	51		7	32	
P_D	Power dissipation	V_O = 0, No load	25°C		80	150		80	150		75	120	mW
		$V_{CC\pm}$ = ±3 V, V_O = 0, No load			4	8		4	8		4	6	

†All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise noted.

NOTE 6: Since long-term drift cannot be measured on the individual devices prior to shipment, this specification is not intended to be a guarantee or warranty. It is an engineering estimate of the averaged trend line of drift versus time over extended periods after the first thirty days of operation.

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operating characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		OP-7C MIN	OP-7C TYP	OP-7C MAX	OP-7D MIN	OP-7D TYP	OP-7D MAX	OP-7E MIN	OP-7E TYP	OP-7E MAX	UNIT
V_n	Equivalent input noise voltage	T_A = 25°C	f = 10 Hz		10.5			10.5			10.3		nV/√Hz
			f = 100 Hz		10.2			10.3			10.0		
			f = 1 kHz		9.8			9.8			9.6		
V_{NPP}	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 10 Hz, T_A = 25°C			0.38			0.38			0.35		μV
I_n	Equivalent input noise current	T_A = 25°C	f = 10 Hz		0.35			0.35			0.32		pA/√Hz
			f = 100 Hz		0.15			0.15			0.14		
			f = 1 kHz		0.13			0.13			0.12		
I_{NPP}	Peak-to-peak equivalent input noise current	f = 0.1 Hz to 10 Hz, T_A = 25°C			15			15			14		pA
SR	Slew rate	$R_L \geq 2$ kΩ, T_A = 25°C			0.3			0.3			0.3		V/μs

†All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified.

TYPICAL APPLICATION DATA

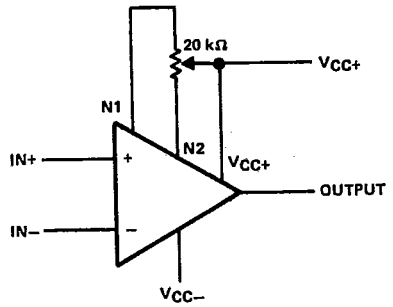

FIGURE 1. INPUT OFFSET VOLTAGE NULL CIRCUIT

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