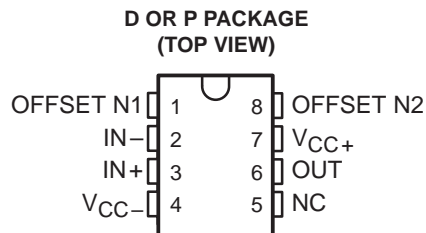


# OP07C, OP07D, OP07Y PRECISION OPERATIONAL AMPLIFIERS

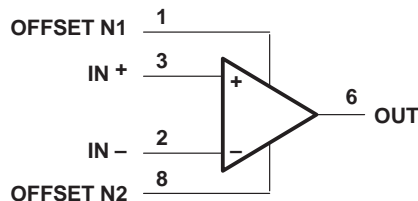
SLOS099B – OCTOBER 1983 – REVISED AUGUST 1996

- **Low Noise**
- **No External Components Required**
- **Replaces Chopper Amplifiers at a Lower Cost**
- **Single-Chip Monolithic Fabrication**
- **Wide Input Voltage Range**  
0 to  $\pm 14$  V Typ
- **Wide Supply Voltage Range**  
 $\pm 3$  V to  $\pm 18$  V
- **Essentially Equivalent to Fairchild  $\mu$ A714 Operational Amplifiers**
- **Direct Replacement for PMI OP07C and OP07D**



NC—No internal connection

## symbol



## 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 not 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 OP07 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 <sub>A</sub>	V <sub>I</sub> O <sub>max</sub> AT 25°C	PACKAGED DEVICES		CHIP FORM (Y)
		SMALL OUTLINE (D)	PLASTIC DIP (P)	
0°C to 70°C	150 $\mu$ V	OP07CD OP07DD	OP07CP OP07DP	OP07Y

The D package is available taped and reeled. Add the suffix R to the device type (e.g., OP07CDR). The chip form is tested at T<sub>A</sub> = 25°C.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

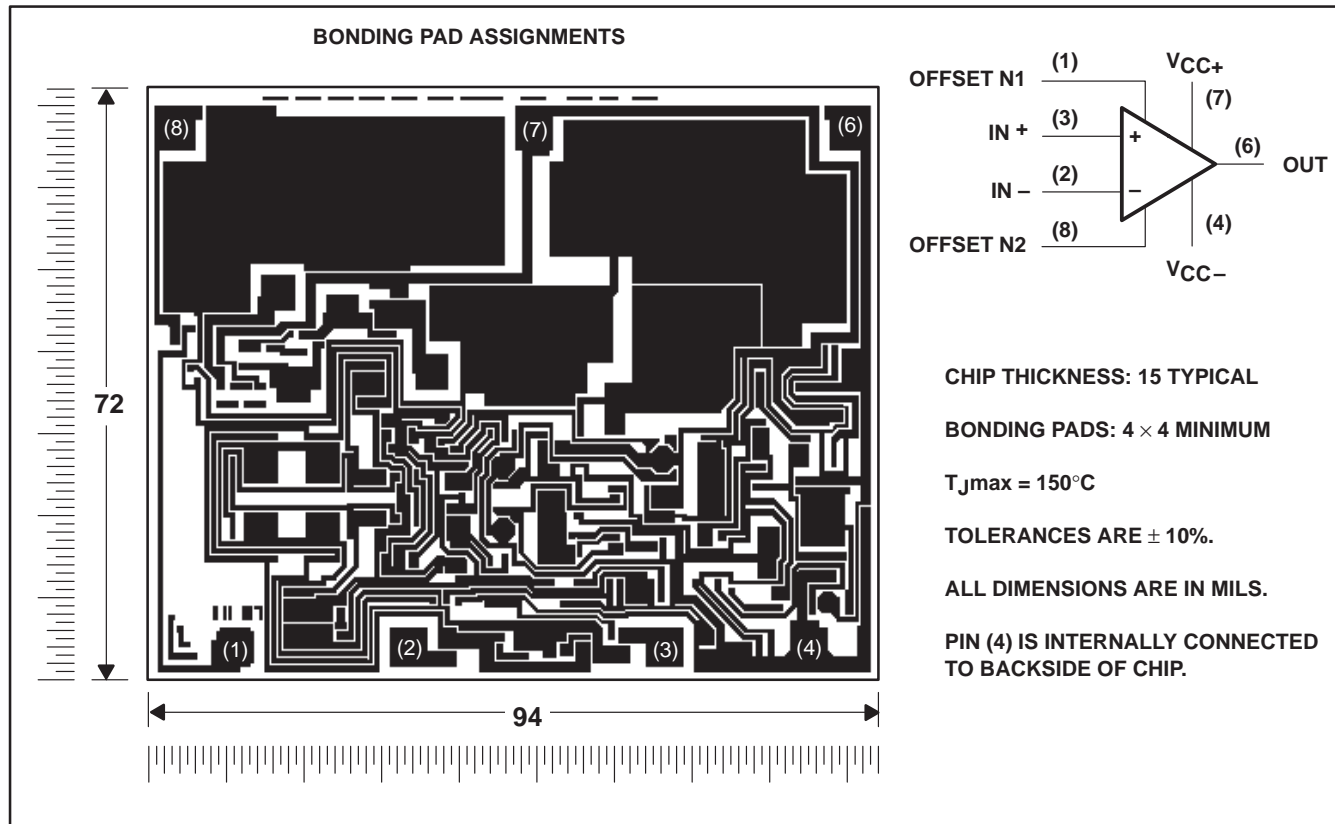
Copyright © 1996, Texas Instruments Incorporated

# OP07C, OP07D, OP07Y PRECISION OPERATIONAL AMPLIFIERS

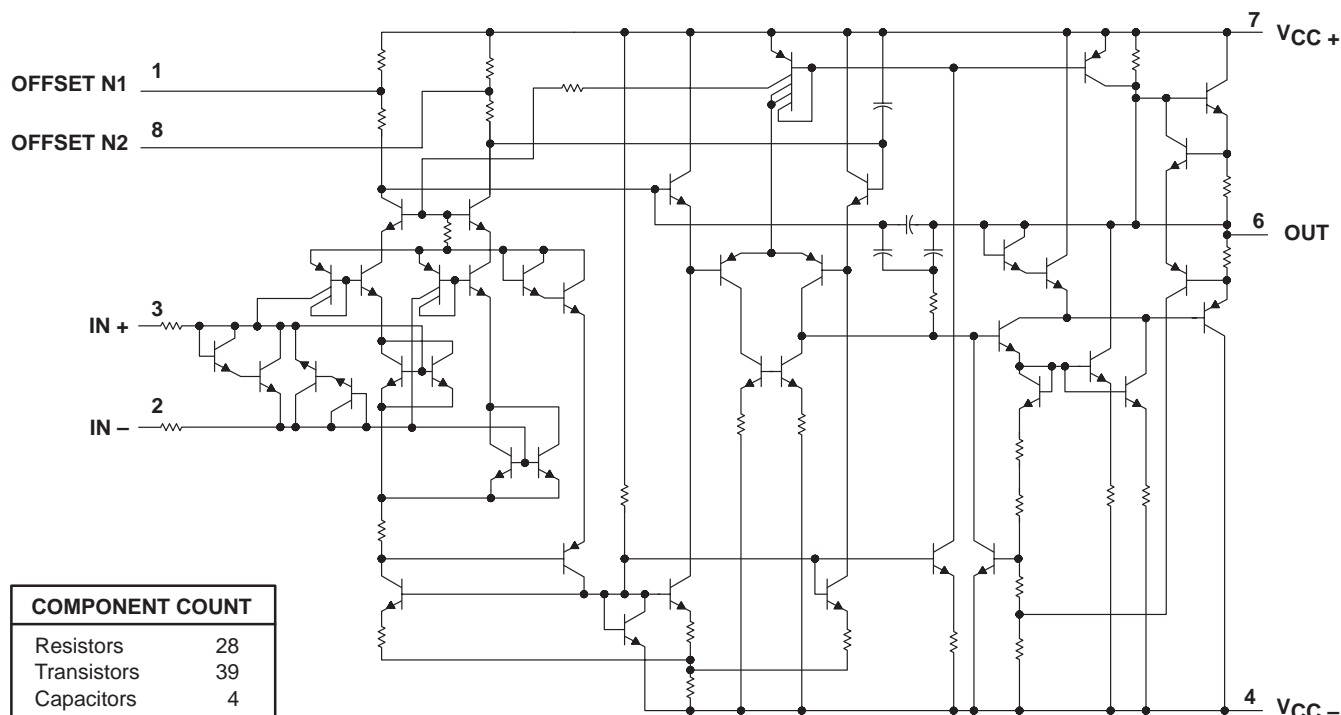
SLOS099B – OCTOBER 1983 – REVISED AUGUST 1996

## OP07Y chip information

These chips, properly assembled, display characteristics similar to the OP07. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.



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)	$\pm 30$ V
Input voltage, $V_I$ (either input, see Note 3)	$\pm 22$ 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, $T_A$	0°C to 70°C
Storage temperature range	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	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 IN+ with respect to IN-.  
 3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, 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.

recommended operating conditions

		MIN	MAX	UNIT
Supply voltage, $V_{CC\pm}$		$\pm 3$	$\pm 18$	V
Common-mode input voltage, $V_{IC}$	$V_{CC\pm} = \pm 15$ V	-13	13	V
Operating free-air temperature, $T_A$		0	70	°C

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

PARAMETER	TEST CONDITIONS†	T <sub>A</sub>	OP07C			OP07D			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V <sub>IO</sub> Input offset voltage	V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω	25°C		60	150		60	150	μV
		0°C to 70°C		85	250		85	250	
α <sub>VIO</sub> Temperature coefficient of input offset voltage	V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω	0°C to 70°C		0.5	1.8		0.7	2.5	μV/°C
Long-term drift of input offset voltage	See Note 6			0.4			0.5		μV/mo
Offset adjustment range	R <sub>S</sub> = 20 kΩ, See Figure 1	25°C		±4			±4		mV
I <sub>IO</sub> Input offset current		25°C		0.8	6		0.8	6	nA
		0°C to 70°C		1.6	8		1.6	8	
α <sub>IIO</sub> Temperature coefficient of input offset current		0°C to 70°C		12	50		12	50	pA/°C
I <sub>IB</sub> Input bias current		25°C		±1.8	±7		±2	±12	nA
		0°C to 70°C		±2.2	±9		±3	±14	
α <sub>IIB</sub> Temperature coefficient of input bias current		0°C to 70°C		18	50		18	50	pA/°C
V <sub>ICR</sub> Common-mode input voltage range		25°C		±13	±14		±13	±14	V
		0°C to 70°C		±13	±13.5		±13	±13.5	
V <sub>OM</sub> Peak output voltage	R <sub>L</sub> ≥ 10 kΩ	25°C		±12	±13		±12	±13	V
	R <sub>L</sub> ≥ 2 kΩ			±11.5	±12.8		±11.5	±12.8	
	R <sub>L</sub> ≥ 1 kΩ			±12			±12		
	R <sub>L</sub> ≥ 2 kΩ	0°C to 70°C		±11	±12.6		±11	±12.6	
A <sub>VD</sub> Large-signal differential voltage amplification	V <sub>CC±</sub> = ±3 V, V <sub>O</sub> = ±0.5 V, R <sub>L</sub> ≥ 500 kΩ	25°C		100	400		400		V/mV
	V <sub>O</sub> = ±10 V, R <sub>L</sub> = 2 kΩ	25°C		120	400		120	400	
		0°C to 70°C		100	400		100	400	
B <sub>1</sub> Unity-gain bandwidth		25°C		0.4	0.6		0.4	0.6	MHz
r <sub>i</sub> Input resistance		25°C		8	33		7	31	MΩ
CMRR Common-mode rejection ratio	V <sub>IC</sub> = ±13 V, R <sub>S</sub> = 50 Ω	25°C		100	120		94	110	dB
		0°C to 70°C		97	120		94	106	
k <sub>SVS</sub> Supply voltage sensitivity (ΔV <sub>IO</sub> /ΔV <sub>CC</sub> )	V <sub>CC±</sub> = ±3 V to ±18 V, R <sub>S</sub> = 50 Ω	25°C		7	32		7	32	μV/V
		0°C to 70°C		10	51		10	51	
P <sub>D</sub> Power dissipation	V <sub>O</sub> = 0, No load	25°C		80	150		80	150	mW
	V <sub>CC±</sub> = ±3 V, V <sub>O</sub> = 0, No load			4	8		4	8	

† 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 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.

# OP07C, OP07D, OP07Y PRECISION OPERATIONAL AMPLIFIERS

SLOS099B – OCTOBER 1983 – REVISED AUGUST 1996

## operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITION <sup>†</sup>	OP07C			OP07D			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$V_n$ Equivalent input noise voltage	$f = 10\text{ Hz}$	10.5			10.5			$\text{nV}/\sqrt{\text{Hz}}$
	$f = 100\text{ Hz}$	10.2			10.3			
	$f = 1\text{ kHz}$	9.8			9.8			
$V_{N(PP)}$ Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }10\text{ Hz}$	0.38			0.38			$\mu\text{V}$
$I_n$ Equivalent input noise current	$f = 10\text{ Hz}$	0.35			0.35			$\text{pA}/\sqrt{\text{Hz}}$
	$f = 100\text{ Hz}$	0.15			0.15			
	$f = 1\text{ kHz}$	0.13			0.13			
$I_{N(PP)}$ Peak-to-peak equivalent input noise current	$f = 0.1\text{ Hz to }10\text{ Hz}$	15			15			$\text{pA}$
SR Slew rate	$R_L \geq 2\text{ k}\Omega$	0.3			0.3			$\text{V}/\mu\text{s}$

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

## electrical characteristics, $V_{CC\pm} = \pm 15\text{ V}$ , $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITION <sup>†</sup>	OP07Y			UNIT
		MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$R_S = 50\ \Omega$	60		150	$\mu\text{V}$
Long-term drift of input offset voltage	See Note 6	0.5			$\mu\text{V}/\text{mo}$
Offset adjustment range	$R_S = 20\text{ k}\Omega$ , See Figure 1	$\pm 4$			$\text{mV}$
$I_{IO}$ Input offset current		0.8		6	$\text{nA}$
$I_{IB}$ Input bias current		$\pm 2$	$\pm 12$		$\text{nA}$
$V_{ICR}$ Common-mode input voltage range		$\pm 13$	$\pm 14$		$\text{V}$
$V_{OM}$ Peak output voltage	$R_L \leq 10\text{ k}\Omega$	$\pm 12$	$\pm 13$		$\text{V}$
	$R_L \leq 2\text{ k}\Omega$	$\pm 11.5$	$\pm 12.8$		
	$R_L \leq 1\text{ k}\Omega$	$\pm 12$			
$A_{VD}$ Large-signal differential voltage amplification	$V_{CC\pm} = \pm 3\text{ V}$ , $V_O = \pm 0.5\text{ V}$ , $R_L \leq 500\text{ k}\Omega$	400			
	$V_O = \pm 10\text{ V}$ , $R_L = 2\text{ k}\Omega$	120	400		
$B_1$ Unity-gain bandwidth		0.4	0.6		$\text{MHz}$
$r_i$ Input resistance		7	31		$\text{M}\Omega$
CMRR Common-mode input resistance	$V_{IC} = \pm 13\text{ V}$ , $R_S = 50\ \Omega$	94	110		$\text{dB}$
$k_{SVS}$ Supply-voltage rejection ratio ( $\Delta V_{CC}/\Delta V_{IO}$ )	$V_{CC\pm} = \pm 3\text{ V to } \pm 18\text{ V}$ , $R_S = 50\ \Omega$	7	32		$\mu\text{V}/\text{V}$
$P_D$ Power dissipation	$V_O = 0$ , No load	80	150		$\text{mW}$
	$V_{CC\pm} = \pm 3\text{ V}$ , $V_O = 0$ , No load	4	8		

NOTE 6: Since long-term drift cannot be measured on the individual devices prior to shipment, this specification is not intended to be a 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.

# OP07C, OP07D, OP07Y PRECISION OPERATIONAL AMPLIFIERS

SLOS099B – OCTOBER 1983 – REVISED AUGUST 1996

operating characteristics,  $V_{CC\pm} = \pm 15\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONST	OP07Y			UNIT
		MIN	TYP	MAX	
$V_n$ Equivalent input noise voltage	$f = 10\text{ Hz}$		10.5		$\text{nV}/\sqrt{\text{Hz}}$
	$f = 1\text{ kHz}$		10.3		
	$f = 0.1\text{ Hz to }10\text{ Hz}$		9.8		
$V_{N(PP)}$ Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }10\text{ Hz}$		0.38		$\mu\text{V}$
$I_n$ Equivalent input noise current	$f = 10\text{ Hz}$		0.35		$\text{pA}/\sqrt{\text{Hz}}$
	$f = 100\text{ Hz}$		0.15		
	$f = 1\text{ kHz}$		0.13		
$I_{N(PP)}$ Peak-to-peak equivalent input noise current	$f = 0.1\text{ Hz to }10\text{ Hz}$		15		$\text{pA}$
SR Slew rate	$R_L = 2\text{ k}\Omega$		0.3		$\text{V}/\mu\text{s}$

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

## APPLICATION INFORMATION

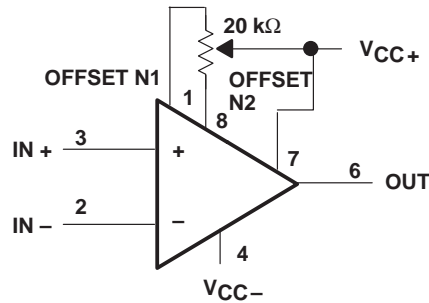


Figure 1. Input Offset Voltage Null Circuit

## IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.