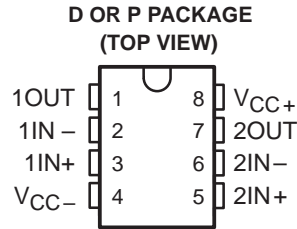


# LF412C DUAL JFET-INPUT OPERATIONAL AMPLIFIER

SLOS010B – MARCH 1987 – REVISED AUGUST 1994

- Low Input Bias Current . . . 50 pA Typ
- Low Input Noise Current  
0.01 pA/√Hz Typ
- Low Supply Current . . . 4.5 mA Typ
- High Input impedance . . . 10<sup>12</sup> Ω Typ
- Internally Trimmed Offset Voltage
- Wide Gain Bandwidth . . . 3 MHz Typ
- High Slew Rate . . . 13 V/μs Typ



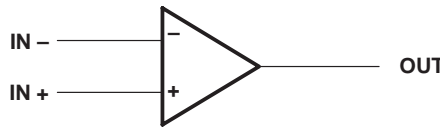
## description

This device is a low-cost, high-speed, JFET-input operational amplifier with very low input offset voltage and a specified maximum input offset voltage drift. It requires low supply current yet maintains a large gain bandwidth product and a fast slew rate. In addition, the matched high-voltage JFET input provides very low input bias and offset currents.

The LF412C can be used in applications such as high-speed integrators, digital-to-analog converters, sample-and-hold circuits, and many other circuits.

The LF412C is characterized for operation from 0°C to 70°C.

## symbol (each amplifier)



### AVAILABLE OPTIONS

T <sub>A</sub>	V <sub>IO</sub> max AT 25°C	PACKAGE	
		SMALL OUTLINE (D)	PLASTIC DIP (P)
0°C to 70°C	3 mV	LF412CD	LF412CP

The D packages are available taped and reeled. Add the suffix R to the device type (ie., LF412CDR).

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

Supply voltage, V <sub>CC+</sub>	18 V
Supply voltage, V <sub>CC-</sub>	-18 V
Differential input voltage, V <sub>ID</sub>	±30 V
Input voltage, V <sub>I</sub> (see Note 1)	±15 V
Duration of output short circuit	unlimited
Continuous total power dissipation	500 mW
Operating 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 10 seconds	260°C

NOTE 1: Unless otherwise specified, the absolute maximum negative input voltage is equal to the negative power supply voltage.

# LF412C

## DUAL JFET-INPUT OPERATIONAL AMPLIFIER

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### recommended operating conditions

	MIN	MAX	UNIT
Supply voltage, $V_{CC+}$	3.5	18	V
Supply voltage, $V_{CC-}$	-3.5	-18	V

### electrical characteristics over operating free-air temperature range, $V_{CC\pm} = \pm 15$ V (unless otherwise specified)

PARAMETER	TEST CONDITIONS	$T_A$ †	MIN	TYP	MAX	UNIT
$V_{IO}$ Input offset voltage	$V_{IC} = 0, R_S = 10 \text{ k}\Omega$	25°C		1	3	mV
$\alpha_{VIO}$ Average temperature coefficient of input offset voltage	$V_{IC} = 0, R_S = 10 \text{ k}\Omega$			10	20‡	$\mu\text{V}/^\circ\text{C}$
$I_{IO}$ Input offset current§	$V_{IC} = 0$	25°C		25	100	pA
		70°C			4	nA
$I_{IB}$ Input bias current§	$V_{IC} = 0$	25°C		50	200	pA
		70°C			8	nA
$V_{ICR}$ Common-mode input voltage range			$\pm 11$	-11.5 to 14.5		V
$V_{OM}$ Maximum peak output voltage swing	$R_L = 10 \text{ k}\Omega$		$\pm 12$	$\pm 13.5$		V
$A_{VD}$ Large-signal differential voltage	$V_O = \pm 10 \text{ V}, R_L = 2 \text{ k}\Omega$	25°C	25	200		V/mV
		Full range	15	200		
$r_i$ Input resistance	$T_A = 25^\circ\text{C}$			10 <sup>12</sup>		$\Omega$
CMRR Common-mode rejection ratio	$R_S \leq 10 \text{ k}\Omega$		70	100		dB
kSVR Supply-voltage rejection ratio	See Note 2		70	100		dB
$I_{CC}$ Supply current				4.5	6.8	mA

† Full range is 0°C to 70°C.

‡ At least 90% of the devices meet this limit for  $\alpha_{VIO}$ .

§ Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive. Pulse techniques must be used that will maintain the junction temperatures as close to the ambient temperature as possible.

NOTE 2: Supply-voltage rejection ratio is measured for both supply magnitudes increasing or decreasing simultaneously.

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{O1}/V_{O2}$ Crosstalk attenuation	$f = 1 \text{ kHz}$		120		dB
SR Slew rate		8	13		V/ $\mu\text{s}$
$B_1$ Unity-gain bandwidth		2.7	3		MHz
$V_n$ Equivalent input noise voltage	$f = 1 \text{ kHz}, R_S = 20 \Omega$		18		$\text{nV}/\sqrt{\text{Hz}}$
$I_n$ Equivalent input noise current	$f = 1 \text{ kHz}$		0.01		$\text{pA}/\sqrt{\text{Hz}}$



**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
LF412CD	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
LF412CDE4	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
LF412CDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
LF412CDRE4	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
LF412CP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

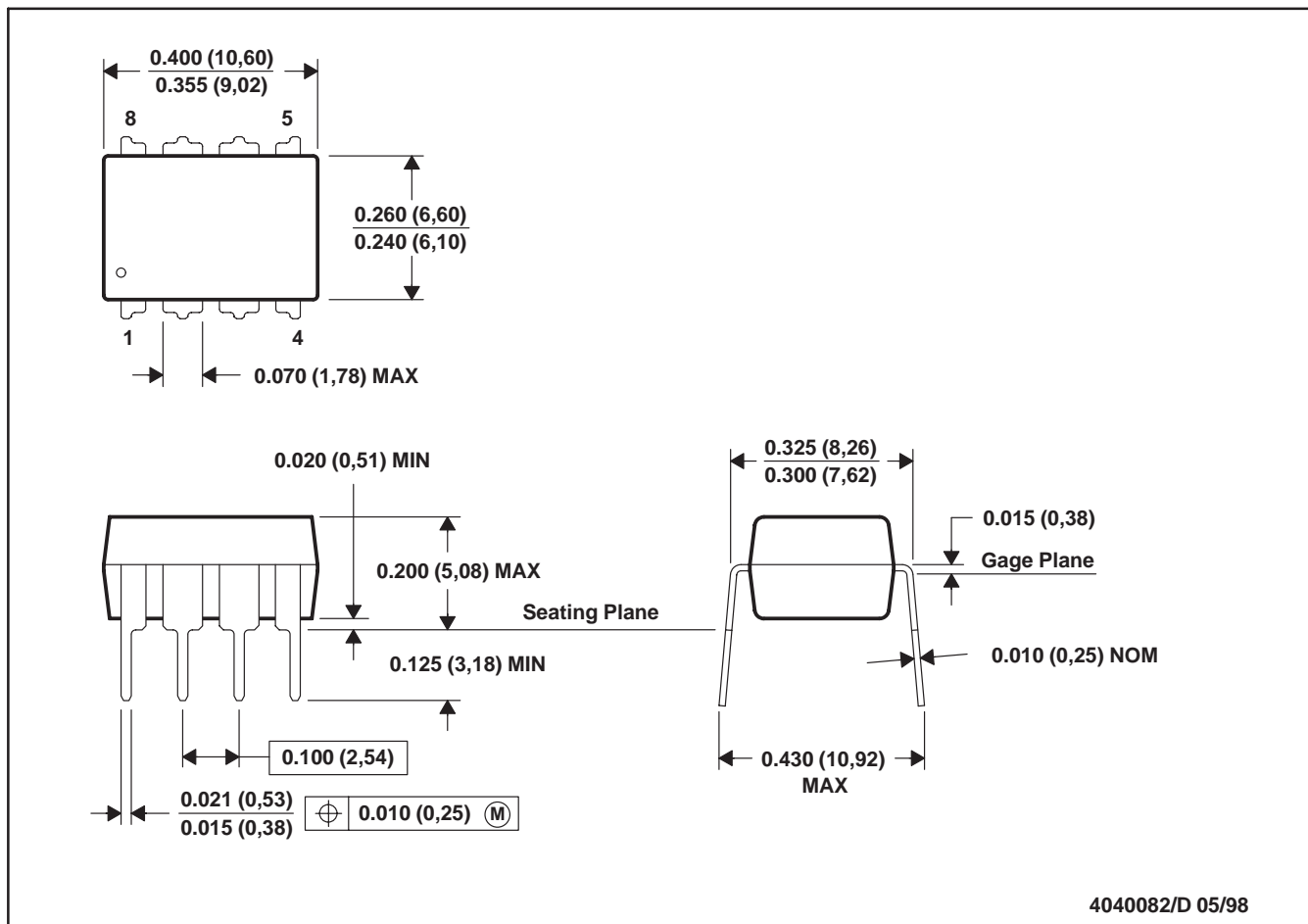
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE

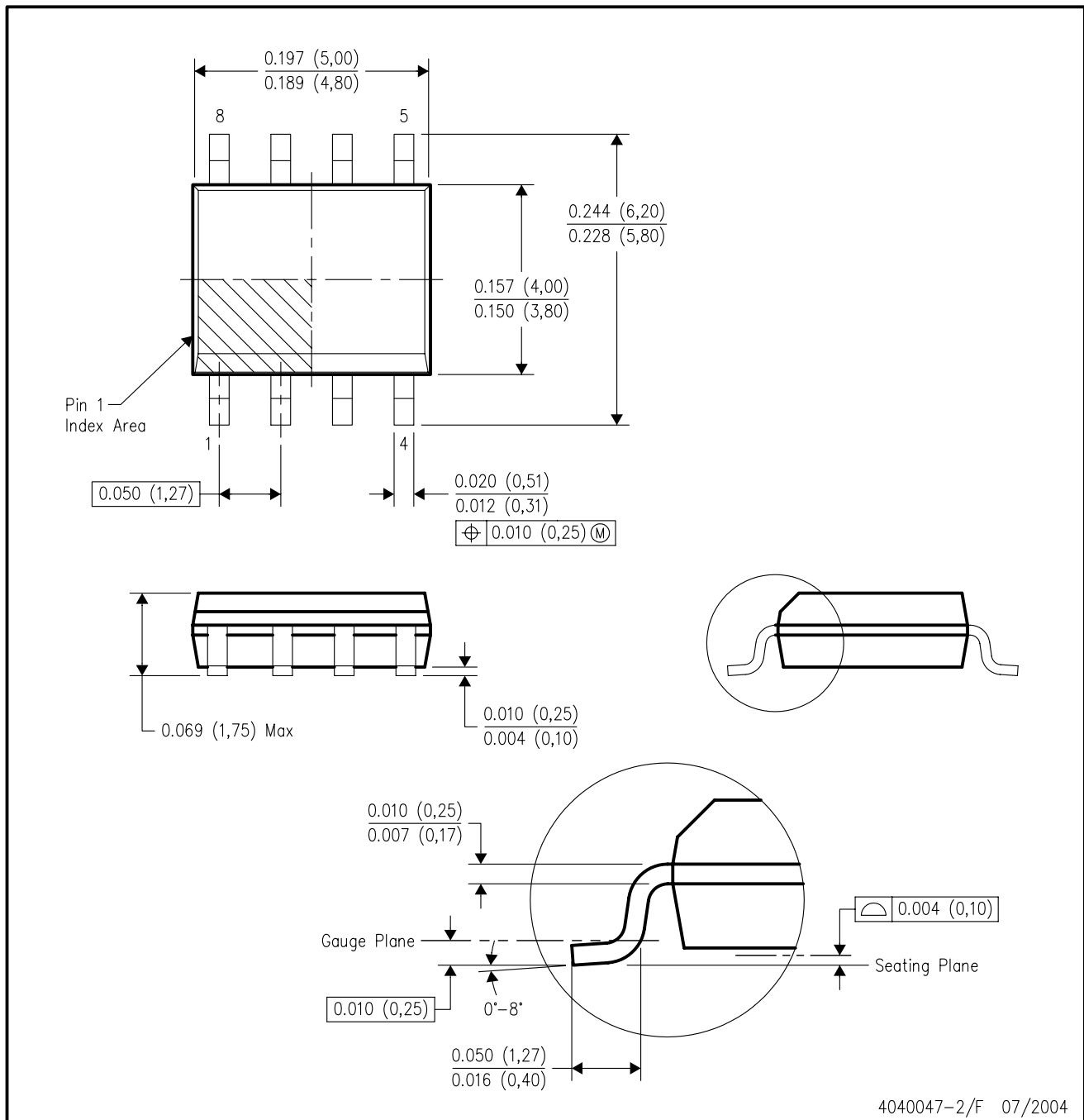


- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-001

For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)

D (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-012 variation AA.

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