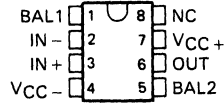


LF351 WIDE-BANDWIDTH JFET-INPUT OPERATIONAL AMPLIFIER

D2997, MARCH 1987

- Low Input Bias Current
Typically 50 pA
- Low Input Noise Voltage
Typically 18 nV/√Hz
- Low Input Noise Current
Typically 0.01 pA/√Hz
- Low Supply Current . . . Typically 1.8 mA
- High Input Impedance
Typically 10¹² Ω
- Low Total Harmonic Distortion
- Internally Trimmed Offset Voltage
Typically 10 mV
- High Slew Rate . . . Typically 13 V/μs
- Wide Gain Bandwidth . . . Typically 3 MHz
- Pin Compatible with Standard 741

P, D, OR JG PACKAGE
(TOP VIEW)



NC—No internal connection

2

Operational Amplifiers

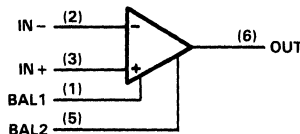
description

This device is a low-cost, high-speed, JFET-input operational amplifier with an internally trimmed input offset voltage. 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. It uses the same offset voltage adjustment circuits as the 741.

The LF351 can be used in applications such as high-speed integrators, digital-to-analog converters, sample-and-hold circuits, and many other circuits.

The LF351 is characterized for operation from 0°C to 70°C.

symbol (each amplifier)



AVAILABLE OPTIONS

SYMBOLIZATION		OPERATING TEMPERATURE RANGE	V _{IO} MAX at 25°C
DEVICE	PACKAGE SUFFIX		
LF351	D, JG, P	−0°C to 70°C	10 mV

The D packages are available taped and reeled. Add the suffix R to the device type when ordering. (ie., LF351DR)

LF351

WIDE-BANDWIDTH JFET-INPUT OPERATIONAL AMPLIFIER

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

Supply voltage, V_{CC+}	18 V
Supply voltage, V_{CC-}	-18 V
Differential input voltage, V_{ID}	± 30 V
Input voltage (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 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

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

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{IO} Input offset voltage	$V_{IC} = 0$, $R_S = 10$ k Ω $T_A = 25^\circ\text{C}$		5	10	mV
	Full range			13	
α_{VIO} Average temperature coefficient of input offset voltage	$V_{IC} = 0$, $R_S = 10$ k Ω		10		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current [†]	$V_{IC} = 0$ $T_J = 25^\circ\text{C}$		25	100	pA
	$T_J = 70^\circ\text{C}$			4	nA
I_{IB} Input bias current [†]	$V_{IC} = 0$ $T_J = 25^\circ\text{C}$		50	200	pA
	$T_J = 70^\circ\text{C}$			8	nA
V_{ICR} Common-mode input voltage range		-12 ± 11	to 15		V
V_{OM} Maximum peak output voltage swing	$R_L = 10$ k Ω	± 12	± 13.5		V
A_{VD} Large-signal differential voltage	$V_O = \pm 10$ V, $R_L = 2$ k Ω $T_A = 25^\circ\text{C}$		25	200	V/mV
	Full range		15	200	
r_i Input resistance	$T_J = 25^\circ\text{C}$		10^{12}		Ω
CMRR Common-mode rejection ratio	$R_S \leq 10$ k Ω	70	100		dB
k_{SVR} Supply voltage rejection ratio	See Note 2	70	100		dB
I_{CC} Supply current		1.8	3.4		mA

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SR Slew rate		8	13		V/ μs
B_1 Unity-gain bandwidth			3		MHz
V_n Equivalent input noise voltage	$f = 1$ kHz, $R_S = 100$ Ω		18		nV/ $\sqrt{\text{Hz}}$
I_n Equivalent input noise current	$f = 1$ kHz		0.01		pA/ $\sqrt{\text{Hz}}$

[†] 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.

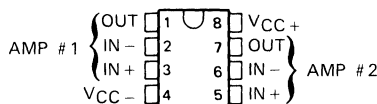
NOTE 2: Supply voltage rejection ratio is measured for both supply magnitudes increasing or decreasing simultaneously.

WIDE-BANDWIDTH DUAL JFET-INPUT OPERATIONAL AMPLIFIER

D2997, MARCH 1987—REVISED MAY 1988

- Low Input Bias Current
Typically 50 pA
- Low Input Noise Current
Typically 0.01 pA/√Hz
- Low Input Noise Voltage
Typically 18 nV/√Hz
- Low Supply Current . . . Typically 3.6 mA
- High Input Impedance
Typically 10¹² Ω
- Internally Trimmed Offset Voltage
- Wide Gain Bandwidth . . . Typically 3 MHz
- High Slew Rate . . . Typically 13 V/μs

D, JG, OR P PACKAGE
(TOP VIEW)



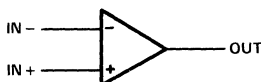
description

This device is a low-cost, high-speed, JFET-input operational amplifier with very low input offset voltage. 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 LF353 can be used in applications such as high-speed integrators, digital-to-analog converters, sample-and-hold circuits, and many other circuits.

The LF353 is characterized for operation from 0°C to 70°C.

symbol (each amplifier)



AVAILABLE OPTIONS

SYMBOLIZATION		OPERATING TEMPERATURE RANGE	V _{IO} MAX at 25°C
DEVICE	PACKAGE SUFFIX		
LF353	D,JG,P	0°C to 70°C	10 mV

The D packages are available taped and reeled. Add the suffix R to the device type when ordering. (i.e. LP353DR)

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

Supply voltage, V_{CC+}	18 V
Supply voltage, V_{CC-}	-18 V
Differential input voltage, V_{ID}	± 30 V
Input voltage (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 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

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

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{IO} Input offset voltage	$V_{IC} = 0$, $R_S = 10$ k Ω $T_A = 25^\circ\text{C}$ Full range		5	10 13	mV
α_{VIO} Average temperature coefficient of input offset voltage	$V_{IC} = 0$, $R_S = 10$ k Ω		10		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current†	$V_{IC} = 0$ $T_J = 25^\circ\text{C}$ $T_J = 70^\circ\text{C}$		25	100 4	pA nA
I_{IB} Input bias current†	$V_{IC} = 0$ $T_J = 25^\circ\text{C}$ $T_J = 70^\circ\text{C}$		50	200 8	pA nA
V_{ICR} Common-mode input voltage range		± 11	-12 to 15		V
V_{OM} Maximum peak output voltage swing	$R_L = 10$ k Ω	± 12	± 13.5		V
A_{VD} Large-signal differential voltage	$V_O = \pm 10$ V, $R_L = 2$ k Ω $T_A = 25^\circ\text{C}$ Full range		25	100 15	V/mV
r_i Input resistance	$T_J = 25^\circ\text{C}$		10^{12}		Ω
CMRR Common-mode rejection ratio	$R_S \leq 10$ k Ω	70	100		dB
k_{SVR} Supply voltage rejection ratio	See Note 2	70	100		dB
I_{CC} Supply current			3.6	6.5	mA

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{O1}/V_{O2} Crosstalk attenuation	$f = 1$ kHz		120		dB
SR Slew rate		8	13		V/ μs
B_1 Unity-gain bandwidth			3		MHz
V_n Equivalent input noise voltage	$f = 1$ kHz, $R_S = 100$ Ω		18		$\text{nV}/\sqrt{\text{Hz}}$
I_n Equivalent input noise current	$f = 1$ kHz		0.01		$\text{pA}/\sqrt{\text{Hz}}$

† 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.

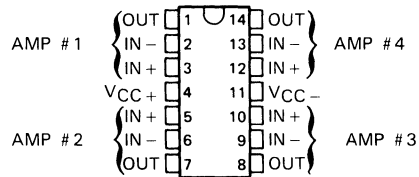
NOTE 2: Supply voltage rejection ratio is measured for both supply magnitudes increasing or decreasing simultaneously.

LF347, LF347B WIDE-BANDWIDTH QUAD JFET-INPUT OPERATIONAL AMPLIFIERS

D2997, MARCH 1987

- Low Input Bias Current
Typically 50 pA
- Low Input Noise Current
Typically 0.01 pA/√Hz
- Low Total Harmonic Distortion
- Low Supply Current . . . Typically 8 mA
- Wide Gain Bandwidth . . . Typically 3 MHz
- High Slew Rate . . . Typically 13 V/μs
- Pin Compatible with the LM348

D, J, OR N PACKAGE
(TOP VIEW)



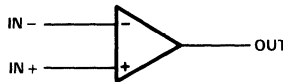
description

These devices are low-cost, high-speed, JFET-input operational amplifiers. They require low supply current yet maintain a large gain-bandwidth product and a fast slew rate. In addition, their matched high-voltage JFET inputs provide very low input bias and offset current.

The LF347 and LF347B can be used in applications such as high-speed integrators, digital-to-analog converters, sample-and-hold circuits, and many other circuits.

The LF347 and LF347B are characterized for operation from 0°C to 70°C.

symbol (each amplifier)



AVAILABLE OPTIONS

T _A	V _{IO} MAX AT 25°C	PACKAGE		
		SMALL-OUTLINE (D)	CERAMIC DIP (J)	PLASTIC DIP (N)
0°C	10 mV	LF347D	LF347J	LF347N
to 70°C	5 mV	LF347BD	LF347BJ	LF347BN

D packages are available taped and reeled. Add "R" suffix to the device type. (e.g. LF347DR)

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

Supply voltage, V _{CC} +	18 V
Supply voltage, V _{CC} -	-18 V
Differential input voltage, V _{ID}	±30 V
Input voltage (see Note 1)	±15 V
Duration of output short circuit	Unlimited
Continuous total power dissipation	See Dissipation Rating Table
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 60 seconds, J package	300°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds, D or N package	260°C

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

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Operational Amplifiers

LF347, LF347B

WIDE-BANDWIDTH QUAD JFET-INPUT OPERATIONAL AMPLIFIERS

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR	DERATE ABOVE T_A	$T_A = 70^\circ\text{C}$ POWER RATING
D	680 mW	7.6 mW/ $^\circ\text{C}$	61 $^\circ\text{C}$	608 mW
J	680 mW	8.2 mW/ $^\circ\text{C}$	67 $^\circ\text{C}$	656 mW
N	680 mW	N/A	N/A	680 mW

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

2

Operational Amplifiers

PARAMETER		TEST CONDITIONS		LF347			LF347B			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage	V _{IC} = 0, R _S = 10 kΩ	T _A = 25 °C Full range	5 10		3 5		mV		
αV _{IO}	Average temperature coefficient of input offset voltage	V _{IC} = 0, R _S = 10 kΩ		13		7				
				18		18		μV/°C		
I _{IO}	Input offset current †	V _{IC} = 0	T _J = 25 °C	25	100	25	100	pA		
			T _J = 70 °C	4		4		nA		
I _{IB}	Input bias current †	V _{IC} = 0	T _J = 25 °C	50	200	50	200	pA		
			T _J = 70 °C	8		8		nA		
V _{ICR}	Common-mode input voltage range			- 12 to 15		- 12 to 15		V		
V _{OM}	Maximum peak output voltage swing	R _L = 10 kΩ		± 12 ± 13.5		± 12 ± 13.5		V		
A _{VD}	Large-signal differential voltage	V _O = ± 10 V, R _L = 2 kΩ	T _A = 25 °C Full range	25	100	50	100	V/mV		
				15		25				
r _i	Input resistance	T _J = 25 °C		10 ¹²		10 ¹²		Ω		
CMRR	Common-mode rejection ratio	R _S ≤ 10 kΩ		70	100	80	100	dB		
k _{SVR}	Supply voltage rejection ratio	See Note 2		70	100	80	100	dB		
I _{CC}	Supply current			8	11	8	11	mA		

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

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/ μs
B_1 Unity-gain bandwidth			3		MHz
V_n Equivalent input noise voltage	$f = 1\text{ kHz}$, $R_S = 100\text{ }\Omega$		18		nV/ $\sqrt{\text{Hz}}$
I_n Equivalent input noise current	$f = 1\text{ kHz}$		0.01		pA/ $\sqrt{\text{Hz}}$

[†] 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.