National Semiconductor

LM725 Operational Amplifier

General Description

The LM725/LM725A/LM725C are operational amplifiers featuring superior performance in applications where low noise, low drift, and accurate closed-loop gain are required. With high common mode rejection and offset null capability, it is especially suited for low level instrumentation applications over a wide supply voltage range.

The LM725A has tightened electrical performance with higher input accuracy and like the LM725, is guaranteed over a -55° C to $+125^{\circ}$ C temperature range. The LM725C has slightly relaxed specifications and has its performance guaranteed over a 0°C to 70°C temperature range.

Connection Diagrams

■ High open loop gain 3,000,000

- Low input voltage drift 0.6 µV/°C
- High common mode rejection 120 dB
- Low input noise current 0.15 pA/ \sqrt{Hz}
- Low input offset current 2 nA
- High input voltage range ±14V
- Wide power supply range ±3V to ±22V
- Offset null capability
- Output short circuit protection

Metal Can Package **Dual-In-Line Package** OFFSET NULL OFFSET NULL - OFFSET NULL INVERTING INPUT • v + NON-INVERTING INPUT - OUTPUT COMP v INVERTING OUTPUT 2 6 DS010474-2 INPUT Order Number LM725CN See NS Package Number N08E NON-INVERTING 3 5 COME INPUT v TOP VIEW DS010474-1 Order Number LM725H/883, LM725CH or LM725AH/883 See NS Package Number H08C

LM725 Operational Amplifier

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Absolute Maximum Ratings (Note 1)

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If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Supply voltage	±22V
Internal Power Dissipation (Note 2)	500 mW
Differential Input Voltage	±5V
Input Voltage (Note 3)	±22V
Storage Temperature Range	–65°C to +150°C

Lead Temperature (Soldering, 10 Sec.) Maximum Junction Temperature			260°C 150°C
Operating Temperature Range	T _{A(MIN)}	to	T _{A(MAX)}
LM725	-55°C		+125°C
LM725A	-55 C	to	+125 C
LM725C	0°C		+70°C

Electrical Characteristics (Note 4)

Parameter	Conditions	LI	LM725A LM725		LM725C		Units				
		Min	Тур	Max	Min	Тур	Max	Min	Тур	Max	
Input Offset Voltage	T _A = 25°C,			0.5		0.5	1.0		0.5	2.5	mV
(Without External Trim)	R _S ≤ 10 kΩ										
Input Offset Current	T _A = 25°C		2.0	5.0		2.0	20		2.0	35	nA
Input Bias Current	T _A = 25°C		42	80		42	100		42	125	nA
Input Noise Voltage	T _A = 25°C										
	f _o = 10 Hz		15			15			15		nV/√Hz
	f _o = 100 Hz		9.0			9.0			9.0		nV/√Hz
	f _o = 1 kHz		8.0			8.0			8.0		nV/√Hz
Input Noise Current	T _A = 25°C										
	f _o = 10 Hz		1.0			1.0			1.0		pA/√Hz
	f _o = 100 Hz		0.3			0.3			0.3		pA/√Hz
	f _o = 1 kHz		0.15			0.15			0.15		pA/√Hz
Input Resistance	T _A = 25°C		1.5			1.5			1.5		MΩ
Input Voltage Range	T _A = 25°C	±13.5	±14		±13.5	±14		±13.5	±14		V
Large Signal Voltage	T _A = 25°C,										
Gain	$R_L \ge 2 \ k\Omega$,	1000	3000		1000	3000		250	3000		V/mV
	$V_{OUT} = \pm 10V$										
Common-Mode	T _A = 25°C,	120			110	120		94	120		dB
Rejection Ratio	$R_{S} \le 10 \ k\Omega$										
Power Supply	T _A = 25°C,		2.0	5.0		2.0	10		2.0	35	μV/V
Rejection Ratio	$R_S \le 10 \ k\Omega$										
Output Voltage Swing	T _A = 25°C,										
	$R_L \ge 10 \ k\Omega$	±12.5	±13.5		±12	±13.5		±12	±13.5		V
	$R_L \ge 2 \ k\Omega$	±12.0	±13.5		±10	±13.5		±10	±13.5		V
Power Consumption	T _A = 25°C		80	105		80	105		80	150	mW
Input Offset Voltage	$R_S \le 10 \ k\Omega$			0.7			1.5			3.5	mV
(Without External Trim)											
Average Input Offset	R _S = 50Ω										
Voltage Drift				2.0		2.0	5.0		2.0		µV/°C
(Without External Trim)											
Average Input Offset	R _S = 50Ω										
Voltage Drift			0.6	1.0		0.6			0.6		µV/°C
(With External Trim)											
Input Offset Current	$T_A = T_{MAX}$		1.2	4.0		1.2	20		1.2	35	nA
	$T_A = T_{MIN}$		7.5	18.0		7.5	40		4.0	50	nA
Average Input Offset			35	90		35	150		10		pA/°C
Current Drift											
Input Bias Current	$T_A = T_{MAX}$		20	70		20	100			125	nA
	$T_A = T_{MIN}$		80	180		80	200			250	nA

Electrical Characteristics (Note 4) (Continued)											
Parameter	Conditions	LM	725A		LM725		LM725C			Units	
		Min	Тур Ма	ax	Min	Тур	Max	Min	Тур	Max	
Large Signal Voltage	$R_L \ge 2 \ k\Omega$										
Gain	$T_A = T_{MAX}$	1,000,000			1,000,000			125,000			V/V
	$R_L \ge 2 \ k\Omega$										
	$T_A = T_{MIN}$	500,000			250,000			125,000			V/V
Common-Mode	$R_{S} \le 10 \text{ k}\Omega$	110			100				115		dB
Rejection Ratio											
Power Supply	$R_{S} \le 10 \text{ k}\Omega$		8	3.0			20		20		μV/V
Rejection Ratio											
Output Voltage Swing	$R_L \ge 2 \ k\Omega$	±12			±10			±10			V

Note 1: "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits.

Note 2: Derate at 150°C/W for operation at ambient temperatures above 75°C.

Note 3: For supply voltages less than ±22V, the absolute maximum input voltage is equal to the supply voltage.

Note 4: These specifications apply for $V_S = \pm 15V$ unless otherwise specified.

Note 5: For Military electrical specifications RETS725AX are available for LM725AH and RETS725X are available for LM725H.

Schematic Diagram





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	(Ω)	(µF)	(Ω)	(µF)	
10,000	10k	50 pF			
1,000	470	0.001			
100	47	0.01			
10	27	0.05	270	0.0015	
1	10	0.05	39	0.02	
10 1	27 10	0.05 0.05	270 39	0.0015 0.02	

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Notes

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