

LM733/LM733C Differential Amplifier

General Description

The LM733/LM733C is a two-stage, differential input, differential output, wide-band video amplifier. The use of internal series-shunt feedback gives wide bandwidth with low phase distortion and high gain stability. Emitter-follower outputs provide a high current drive, low impedance capability. Its 120 MHz bandwidth and selectable gains of 10, 100 and 400, without need for frequency compensation, make it a very useful circuit for memory element drivers, pulse amplifiers, and wide band linear gain stages.

The LM733 is specified for operation over the -55°C to $+125^{\circ}\text{C}$ military temperature range. The LM733C is specified for operation over the 0°C to $+70^{\circ}\text{C}$ temperature range.

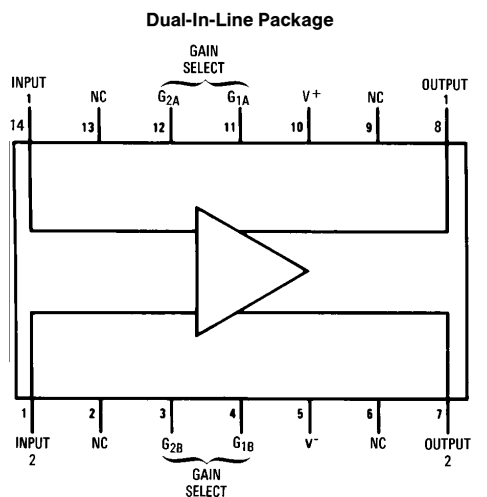
Features

- 120 MHz bandwidth
- 250 k Ω input resistance
- Selectable gains of 10, 100, 400
- No frequency compensation
- High common mode rejection ratio at high frequencies

Applications

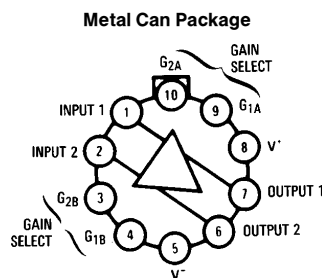
- Magnetic tape systems
- Disk file memories
- Thin and thick film memories
- Woven and plated wire memories
- Wide band video amplifiers

Connection Diagrams



Top View
Order Number LM733CN
See NS Package Number N14A

TL/H/7866-1



Note: Pin 5 connected to case.

Top View
Order Number LM733H or LM733CH
See NS Package Number H10D

TL/H/7866-2

Absolute Maximum Ratings

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

Differential Input Voltage	±5V
Common Mode Input Voltage	±6V
V _{CC}	±8V
Output Current	10 mA

Power Dissipation (Note 1)	500 mW
Junction Temperature	+150°C
Storage Temperature Range	–65°C to +150°C
Operating Temperature Range	
LM733	–55°C to +125°C
LM733C	0°C to +70°C
Lead Temperature (Soldering, 10 sec.)	260°C

Electrical Characteristics (T_A = 25°C, unless otherwise specified, see test circuits, V_S = ±6.0V)

Characteristics	Test Circuit	Test Conditions	LM733			LM733C			Units
			Min	Typ	Max	Min	Typ	Max	
Differential Voltage Gain	1	R _L = 2 kΩ V _{OUT} = 3 V _{p-p}	300	400	500	250	400	600	
Gain 1 (Note 2)			90	100	110	80	100	120	
Gain 2 (Note 3)			9.0	10	11	8.0	10	12	
Gain 3 (Note 4)									
Bandwidth	2			40			40		MHz
Gain 1				90			90		MHz
Gain 2				120			120		MHz
Gain 3									
Rise Time	2	V _{OUT} = 1 V _{p-p}		10.5			10.5		ns
Gain 1				4.5	10		4.5	12	ns
Gain 2				2.5			2.5		ns
Gain 3									
Propagation Delay	2	V _{OUT} = 1 V _{p-p}		7.5			7.5		ns
Gain 1				6.0	10		6.0	10	ns
Gain 2				3.6			3.6		ns
Gain 3									
Input Resistance			20	4.0		10	4.0		kΩ
Gain 1				30			30		kΩ
Gain 2				250			250		kΩ
Gain 3									
Input Capacitance		Gain 2		2.0			2.0		pF
Input Offset Current				0.4	3.0		0.4	5.0	μA
Input Bias Current				9.0	20		9.0	30	μA
Input Noise Voltage		BW = 1 kHz to 10 MHz		12			12		μVrms
Input Voltage Range	1		±1.0			±1.0			V
Common Mode Rejection Ratio	1	V _{CM} = ±1V f ≤ 100 kHz V _{CM} = ±1V f = 5 MHz	60	86		60	86		dB
Gain 2				60			60		dB
Gain 2									
Gain 2									
Supply Voltage Rejection Ratio	1	ΔV _S = ±0.5V	50	70		50	70		dB
Output Offset Voltage	1	R _L = ∞		0.6	1.5		0.6	1.5	V
Gain 1				0.35	1.0		0.35	1.5	V
Gain 2 and 3									
Gain 2 and 3									
Output Common Mode Voltage	1	R _L = ∞	2.4	2.9	3.4	2.4	2.9	3.4	V
Output Voltage Swing	1	R _L = 2k	3.0	4.0		3.0	4.0		
Output Sink Current			2.5	3.6		2.5	3.6		mA
Output Resistance				20			20		Ω
Power Supply Current	1	R _L = ∞		18	24		18	24	mA

Electrical Characteristics (Continued)

(The following specifications apply for $-55^{\circ}\text{C} < T_A < 125^{\circ}\text{C}$ for the LM733 and $0^{\circ}\text{C} < T_A < 70^{\circ}\text{C}$ for the LM733C, $V_S = \pm 6.0\text{V}$)

Characteristics	Test Circuit	Test Conditions	LM733			LM733C			Units
			Min	Typ	Max	Min	Typ	Max	
Differential Voltage Gain									
Gain 1	1	$R_L = 2\text{ k}\Omega$, $V_{OUT} = 3\text{ V}_{p-p}$	200		600	250		600	
Gain 2			80		120	80		120	
Gain 3			8.0		12.0	8.0		12.0	
Input Resistance Gain 2			8			8			$\text{k}\Omega$
Input Offset Current					5			6	μA
Input Bias Current					40			40	μA
Input Voltage Range	1		± 1			± 1			V
Common Mode Rejection Ratio									
Gain 2	1	$V_{CM} = \pm 1\text{ V}$, $f \leq 100\text{ kHz}$	50			50			dB
Supply Voltage Rejection Ratio									
Gain 2	1	$\Delta V_S = \pm 0.5\text{ V}$	50			50			dB
Output Offset Voltage									
Gain 1	1	$R_L = \infty$			1.5			1.5	V
Gain 2 and 3					1.2			1.5	V
Output Voltage Swing	1	$R_L = 2\text{ k}\Omega$	2.5			2.8			V_{pp}
Output Sink Current			2.2			2.5			mA
Power Supply Current	1	$R_L = \infty$			27			27	mA

Note 1: The maximum junction temperature of the LM733 is 150°C , while that of the LM733C is 100°C . For operation at elevated temperatures devices in the TO-100 package must be derated based on a thermal resistance of $150^{\circ}\text{C}/\text{W}$ junction to ambient or $45^{\circ}\text{C}/\text{W}$ junction to case. Thermal resistance of the dual-in-line package is $90^{\circ}\text{C}/\text{W}$.

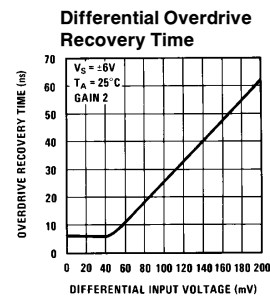
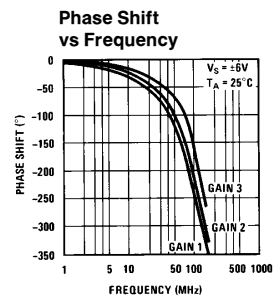
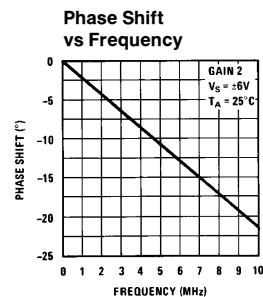
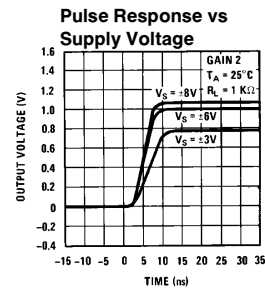
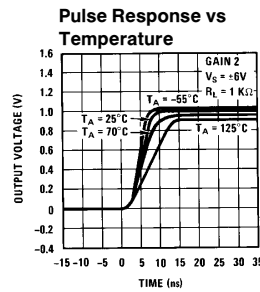
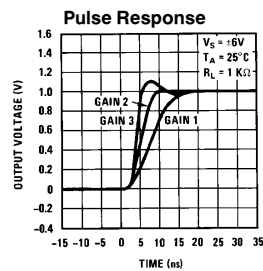
Note 2: Pins G1A and G1B connected together.

Note 3: Pins G2A and G2B connected together.

Note 4: Gain select pins open.

Note 5: Refer to RETS733X drawing for specifications of LM733H version.

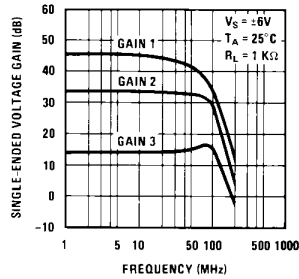
Typical Performance Characteristics



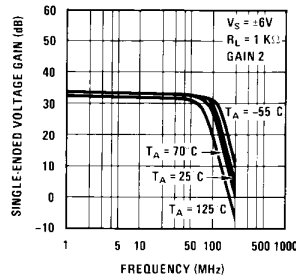
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Typical Performance Characteristics (Continued)

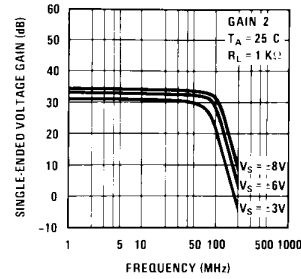
Voltage Gain vs Frequency



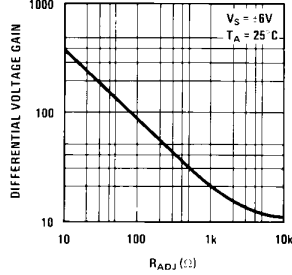
Gain vs Frequency Temperature



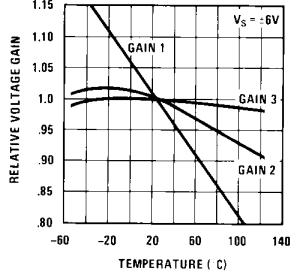
Gain vs Frequency vs Supply Voltage



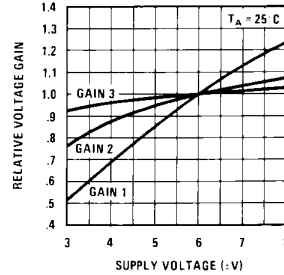
Voltage Gain vs R_{ADJ}



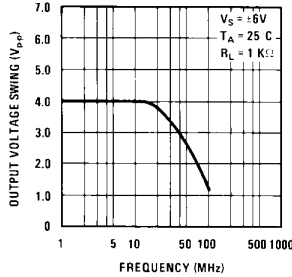
Voltage Gain vs Temperature



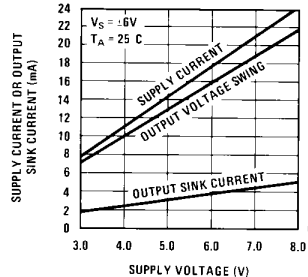
Voltage Gain vs Supply Voltage



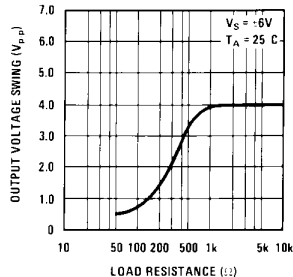
Output Voltage Swing vs Frequency



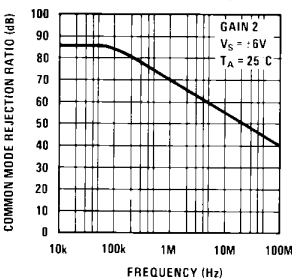
Supply Current, Output Voltage and Current Swing vs Supply Voltage



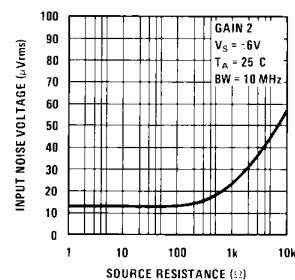
Output Voltage Swing vs Load Resistance



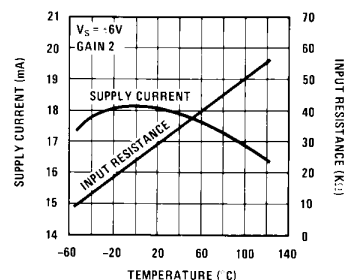
Common Mode Rejection Ratio vs Frequency



Input Noise Voltage vs Source Resistance



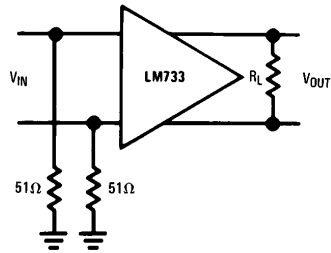
Supply Current and Input Resistance vs Temperature



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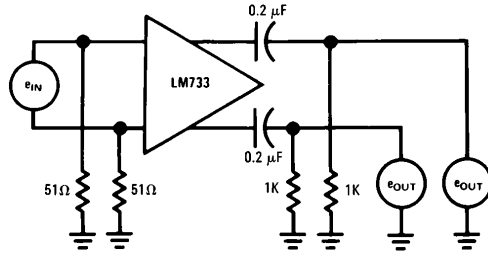
Test Circuits

Test Circuit 1



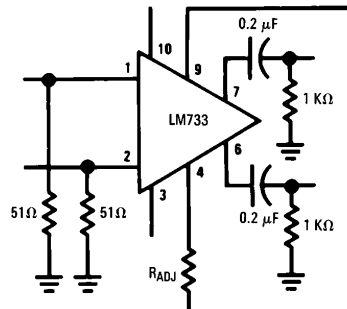
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Test Circuit 2



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Voltage Gain Adjust Circuit

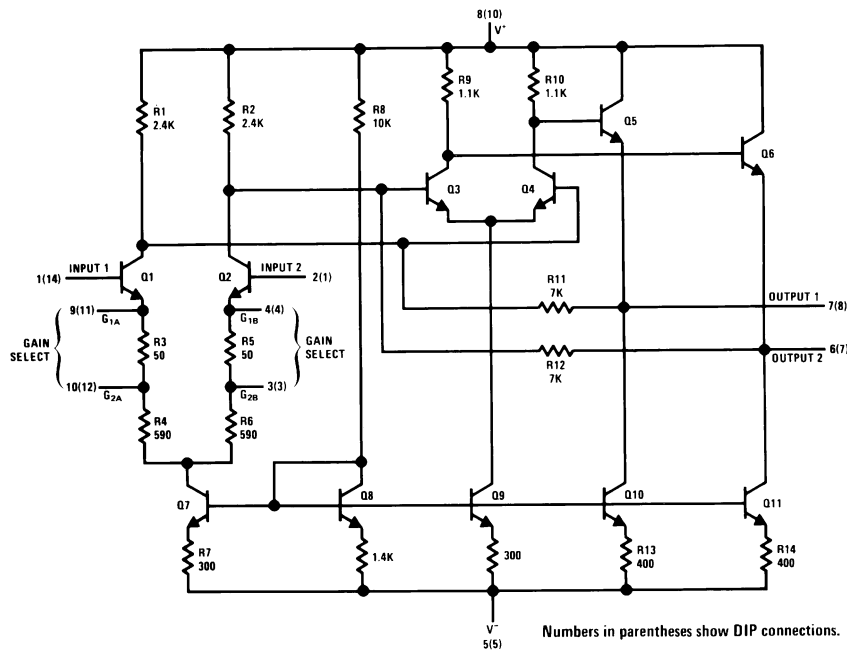


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$V_S = 6V$, $T_A = 25^\circ C$

(Pin numbers apply to TO-5 package)

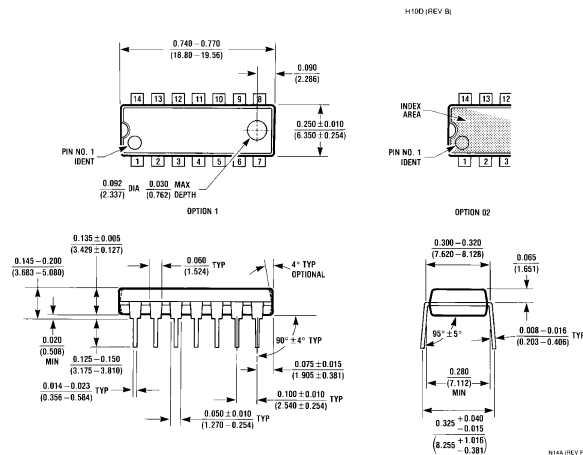
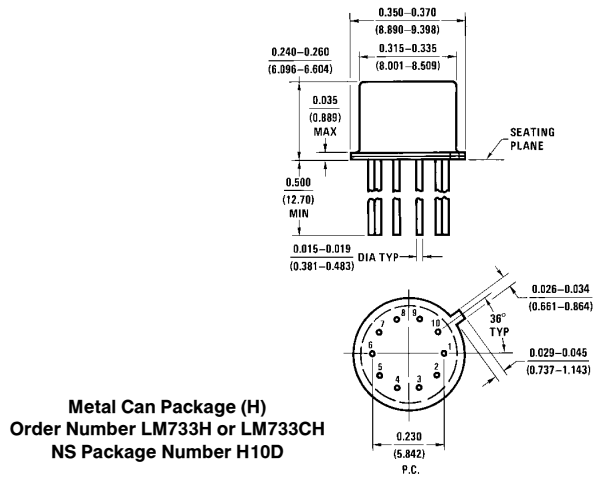
Schematic Diagram



Numbers in parentheses show DIP connections.

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Physical Dimensions inches (millimeters)



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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



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