



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

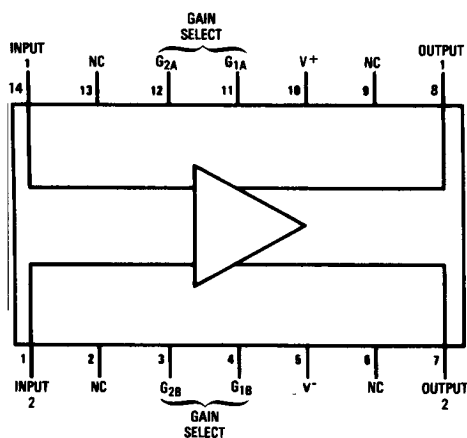
- 120 MHz bandwidth
- 250 k Ω input resistance
- Selectable gains of 10, 100, 400
- No frequency compensation
- High common mode rejection ratio at high frequencies

Applications

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

Connection Diagrams

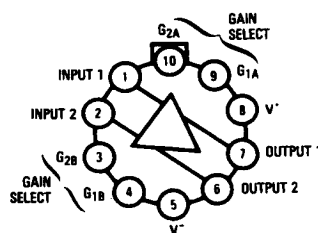
Dual-In-Line Package



TL/H/7866-1

Top View
Order Number LM733CN
See NS Package Number N14A

Metal Can Package



TL/H/7866-2

Note: Pin 5 connected to case.

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

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									
Gain 1 (Note 2)	1	R _L = 2 kΩ V _{OUT} = 3 V _{p-p}	300	400	500	250	400	600	
Gain 2 (Note 3)			90	100	110	80	100	120	
Gain 3 (Note 4)			9.0	10	11	8.0	10	12	
Bandwidth									
Gain 1	2			40			40		MHz
Gain 2				90			90		MHz
Gain 3				120			120		MHz
Rise Time									
Gain 1	2	V _{OUT} = 1 V _{p-p}		10.5			10.5		ns
Gain 2				4.5	10		4.5	12	ns
Gain 3				2.5			2.5		ns
Propagation Delay									
Gain 1	2	V _{OUT} = 1 V _{p-p}		7.5			7.5		ns
Gain 2				6.0	10		6.0	10	ns
Gain 3				3.6			3.6		ns
Input Resistance									
Gain 1				4.0			4.0		kΩ
Gain 2			20	30		10	30		kΩ
Gain 3				250			250		kΩ
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		μV _{rms}
Input Voltage Range	1		± 1.0			± 1.0			V
Common Mode Rejection Ratio									
Gain 2	1	V _{CM} = ± 1V f ≤ 100 kHz	60	86		60	86		dB
Gain 2		V _{CM} = ± 1V f = 5 MHz		60			60		dB
Supply Voltage Rejection Ratio									
Gain 2	1	ΔV _S = ± 0.5V	50	70		50	70		dB
Output Offset Voltage									
Gain 1	1	R _L = ∞		0.6	1.5		0.6	1.5	V
Gain 2 and 3				0.35	1.0		0.35	1.5	V
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	1	$R_L = 2\text{ k}\Omega$, $V_{OUT} = 3\text{ V}_{p-p}$	200		600	250		600	
Gain 1			80		120	80		120	
Gain 2			8.0		12.0	8.0		12.0	
Gain 3									
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	1	$R_L = \infty$			1.5			1.5	V
Gain 1					1.2			1.5	V
Gain 2 and 3									V
Output Voltage Swing	1	$R_L = 2\text{k}$	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 $90^{\circ}\text{C}/\text{W}$.

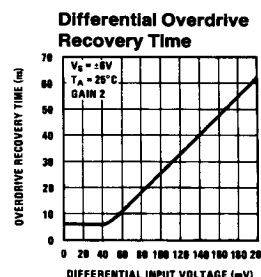
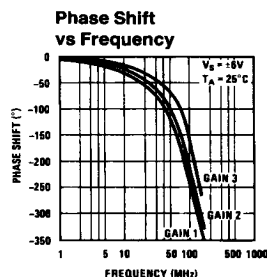
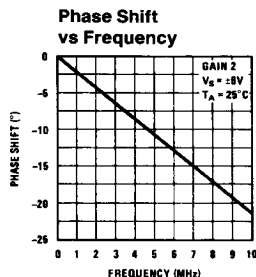
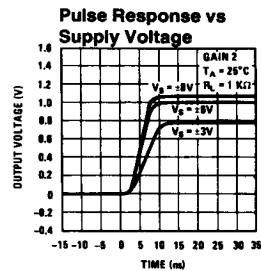
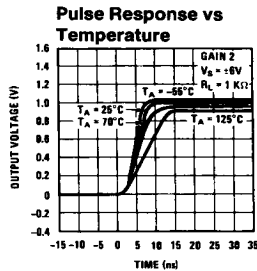
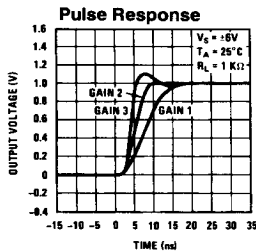
Note 2: Pins G1A and G1B connected together.

Note 3: Pins G2A and G2B connected together.

Note 4: Gain select pins open.

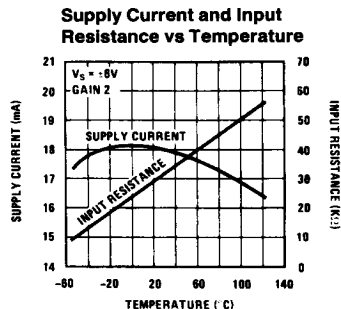
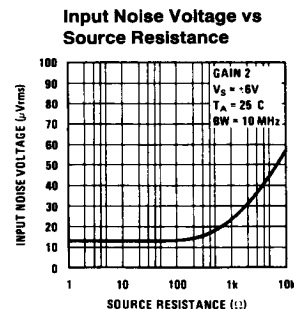
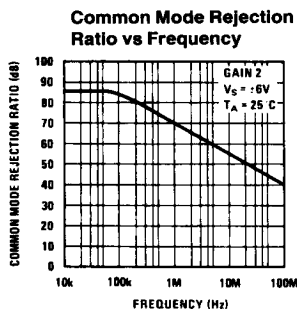
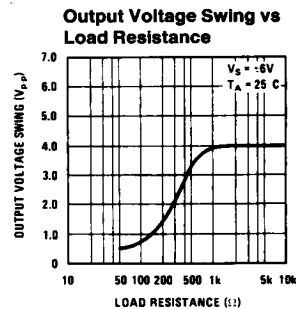
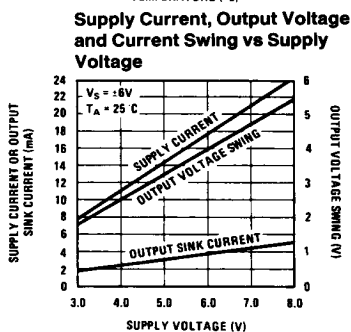
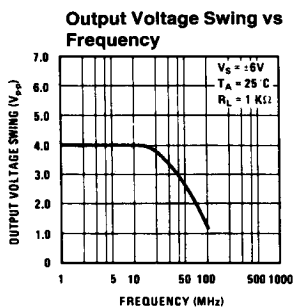
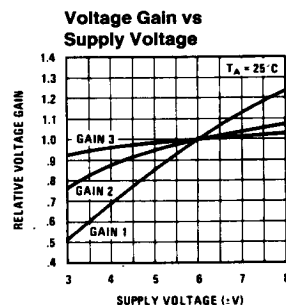
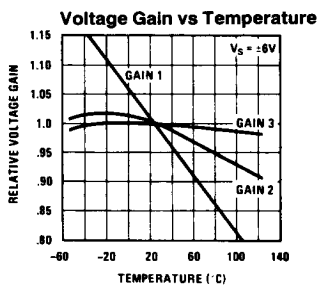
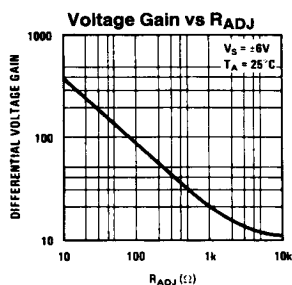
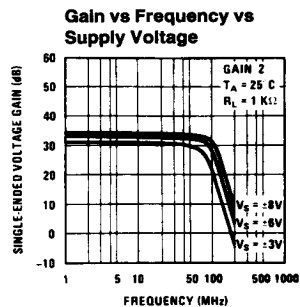
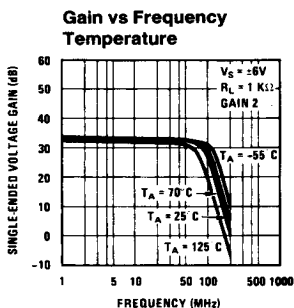
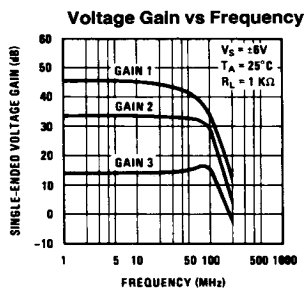
Note 5: Refer to RETS733X drawing for specifications of LM733H version.

Typical Performance Characteristics



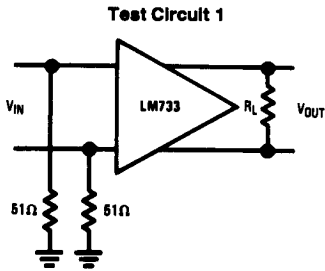
TL/H/7866-6

Typical Performance Characteristics (Continued)

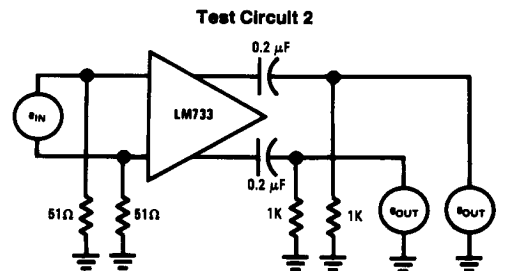


TL/H/7866-7

Test Circuits

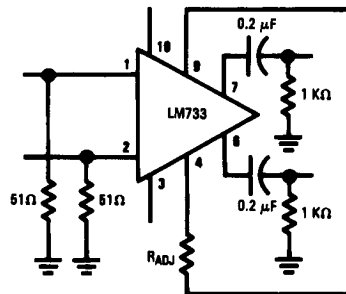


TL/H/7866-3



TL/H/7866-4

Voltage Gain Adjust Circuit

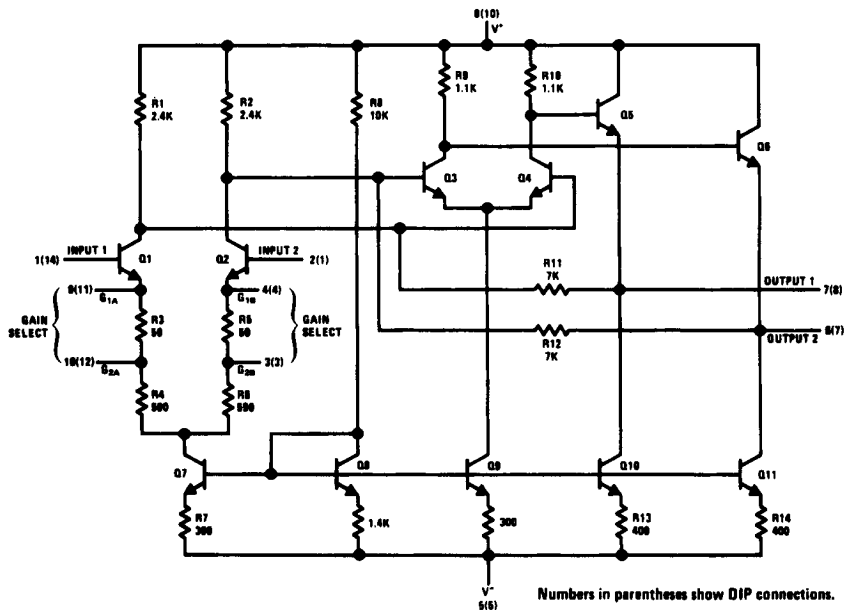


TL/H/7866-5

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

(Pin numbers apply to TO-5 package)

Schematic Diagram



TL/H/7866-8