

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.

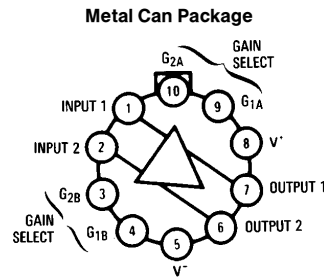
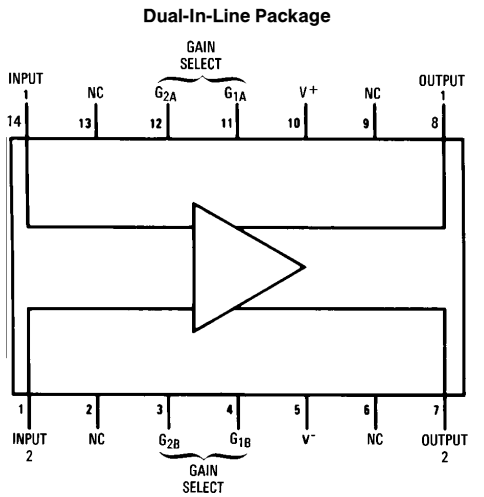
Features

- 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



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 Vp-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 Vp-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 Vp-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 | | μVrms |
| 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 | | | | | | | | | |
| 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 | |
| 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 $90^{\circ}\text{C}/\text{W}$.

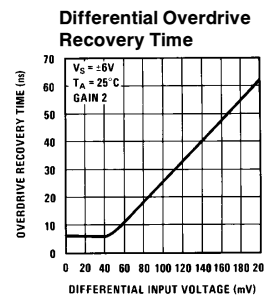
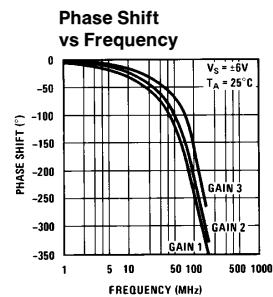
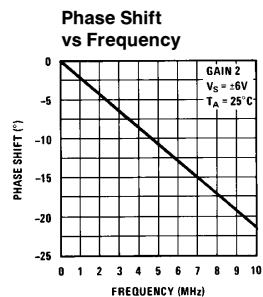
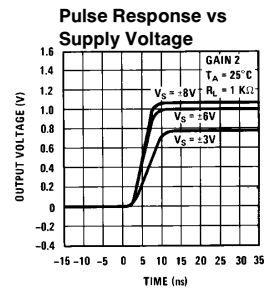
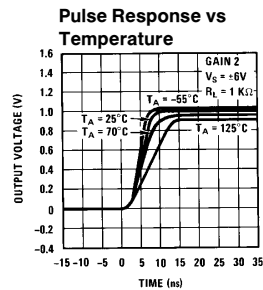
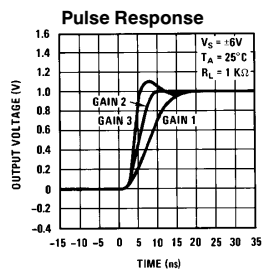
Note 2: Pins G1A and G1B connected together.

Note 3: Pins G2A and G2B connected together.

Note 4: Gain select pins open.

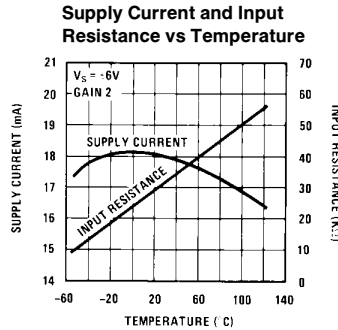
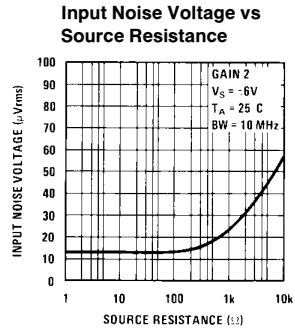
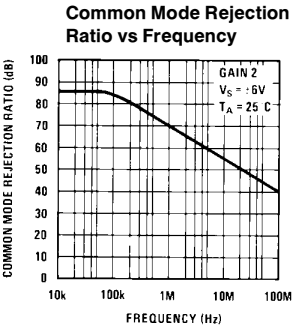
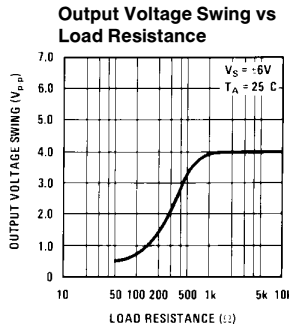
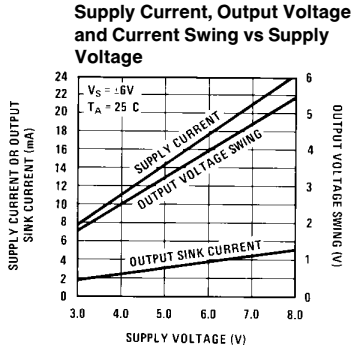
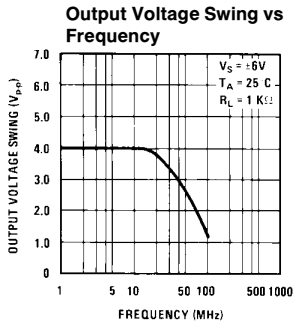
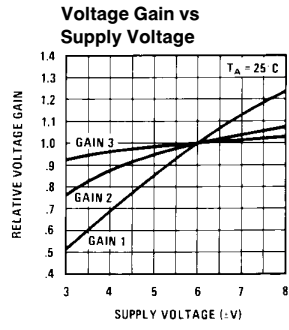
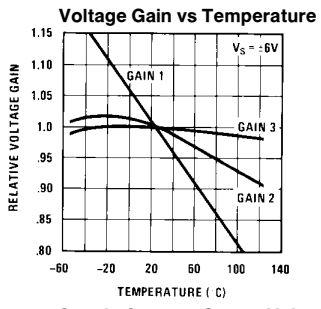
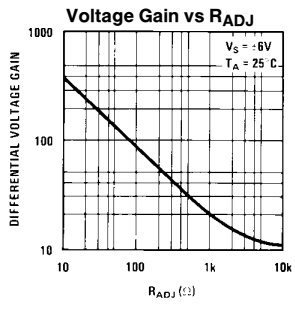
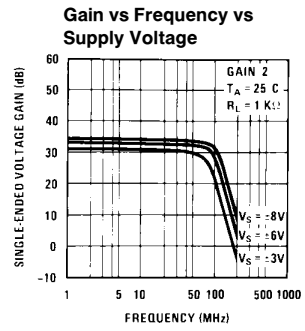
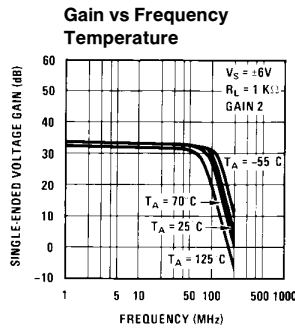
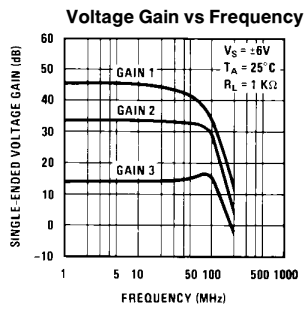
Note 5: Refer to RETS733X drawing for specifications of LM733H version.

Typical Performance Characteristics



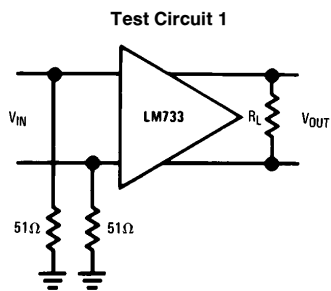
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Typical Performance Characteristics (Continued)

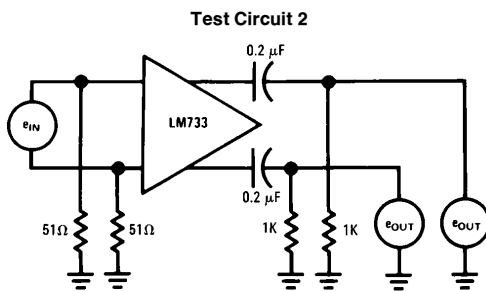


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Test Circuits

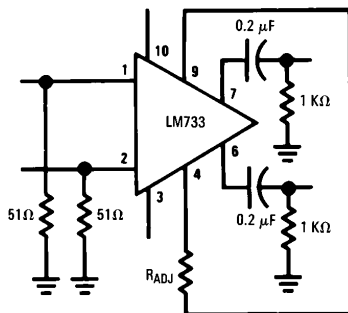


TL/H/7866-3



TL/H/7866-4

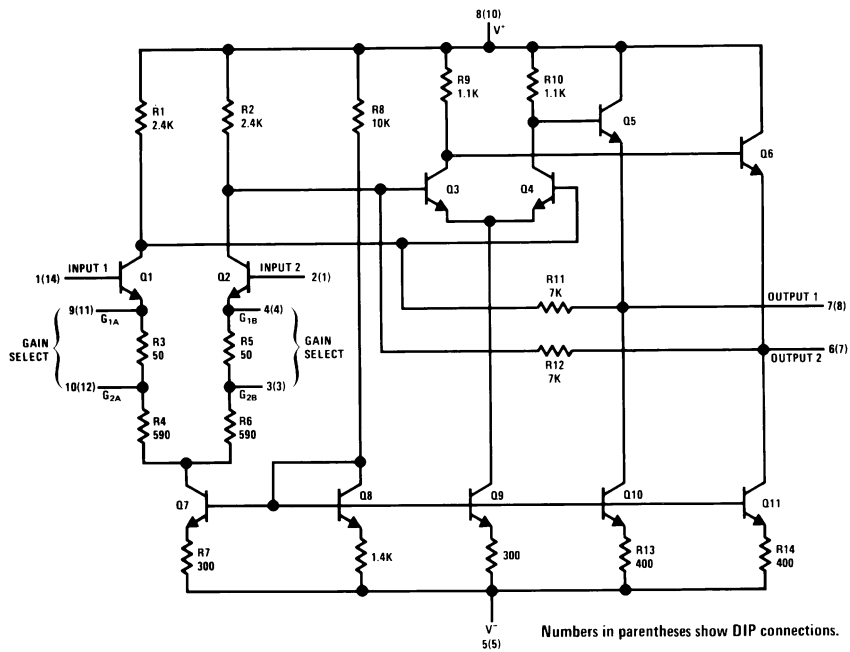
Voltage Gain Adjust Circuit



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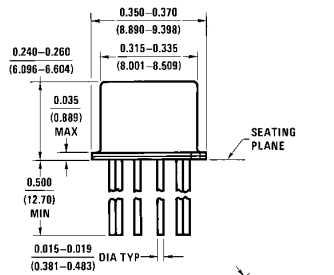
$V_S = 6V, T_A = 25^\circ C$
(Pin numbers apply to TO-5 package)

Schematic Diagram

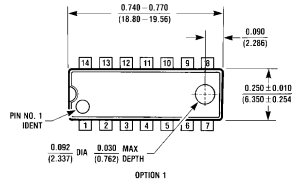
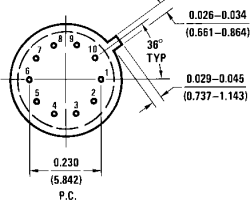


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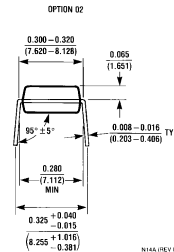
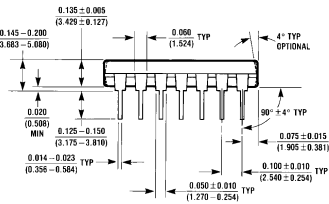
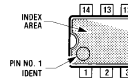
Physical Dimensions inches (millimeters)



Metal Can Package (H)
Order Number LM733H or LM733CH
NS Package Number H10D



H10D (REV B)



N14A (REV F)

Molded Dual-In-Line Package (N)
Order Number LM733CN
NS Package Number N14A

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