FET Input
350MHz Buffer

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CLM4133 / CLM4333

FEATURES

- Slew Rate 6000V/µs
- Wide Range Single or Dual Supply Operation
- Wide Bandwidth..................... DC to 350MHz
- Low Phase Non-Linearity .... 2^o
- Fast Rise Times 1.0ns
- High Input Resistance...................... $10^{10}\Omega$

APPLICATIONS

- High Speed ATE
- Coaxial Cable Driver
- Isolation Buffer
- High Speed S/H Amplifier
- High Frequency Filter
- Flash A/D Buffer

GENERAL DESCRIPTION

The CLM4133 is a high speed, FET input, voltage follower/buffer designed to provide frequencies from DC to over 350MHz and slew rates of 6000V/µs.

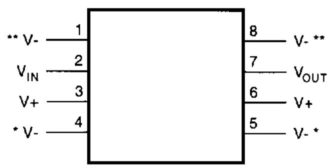
The family is intended to fulfill a wide range of buffer applications such as high speed line drivers, video impedance transformation, nuclear instrumentation amplifiers, op amp isolation buffer for driving reactive loads and high impedance input buffers for high speed ADCs and comparators.

ORDERING INFORMATION

Part	Package	Temperature Range
CLM4133N	NO8A (Plastic PDip 8 Lead)	-40°C to +85°C
CLM4333N	NO8A (Plastic PDip 8 Lead)	-40°C to +85°C
CLM4133M	M16A (SOIC 16 Lead)	-40°C to +85°C
CLM4333M	M16A (SOIC 16 Lead)	-40°C to +85°C

CONNECTION DIAGRAMS

PLASTIC DIP

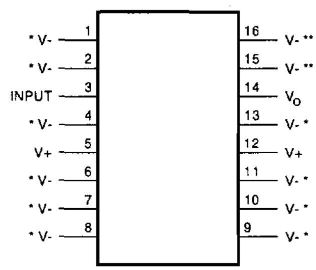


* HEAT SINK PINS
** PIN 8 MUST BE CONNECTED TO NEGATIVE SUPPLY

PACKAGE N08A

1A-40

SOIC



* HEAT SINK PINS
** PIN 15 AND PIN 16 MUST BE CONNECTED TO NEGATIVE SUPPLY

PACKAGE M16A

1A-41

ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage . . . . ±20
Input Voltage . . . . ±Vsupply
Storage Temperature Range . . . . -65°C to +150°C
Lead Temperature
(Soldering 10 seconds) . . . . 260°C
Power Dissipation . . . . (Note 4)

ESD Tolerance (Note 3) . . . . ±2000V
Thermal Resistance (θ_{JA}) (Note 6)
N Package . . . . 50°C/W
M Package . . . . 60°C/W
Maximum Junction Temperature . . . . 150°C

DC ELECTRICAL CHARACTERISTICS

The following specifications apply for Supply Voltage = ±15V, V_{CM} = 0, $R_L \geq$ 100KΩ and R_S = 50Ω unless otherwise noted.
Boldface limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J$ = 25°C.

SYMBOL	CHARACTERISTICS	TYP	CLM4133	CLM4333	UNITS	CONDITIONS
			Limit (Note 5)	**Limit (Note 5)**		
A_{V1}	Voltage Gain 1	0.980	0.960 **0.950**	0.950 **0.950**	V/V Min	R_L = 1KΩ, V_{IN} = ±10V
A_{V2}	Voltage Gain 2	0.900	0.800 **0.800**	0.800 **0.800**		R_L = 50Ω, V_{IN} = ±6V
V_{OS}	Offset Voltage	15	25	45	mV Max	R_L = 1KΩ (T_A = 25°C, Note 7)
I_B	Input Bias Current	1	350	750	pA Max	R_L = 1KΩ, R_S = 10kΩ
R_{IN}	Input Resistance	10^{10}	10^{10}	10^{10}	Ω	R_L = 50Ω
C_{IN}	Input Capacitance	3.0			pF	
R_O	Output Resistance	3	10	10	Ω Max	I_{OUT} = ±10mA
I_{S1}	Supply Current 1	14	18	20	mA Max	$R_L = \infty$
V_{O1}	Output Swing 1	13.5	12 **11**	12 **11**	±V Min	R_L = 1K
V_{O2}	Output Swing 2	12.5	10 **9**	10 **9**		R_L = 100Ω
I_{OUT}	Output Current	200	100	100	mA	V_{IN} = ±13V
PSSR	Power Supply Rejection Ratio	70	60 **60**	60 **60**	dB Min	$V^{\pm}$ = ±5V to ±15V

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AC ELECTRICAL CHARACTERISTICS

The following specifications apply for Supply Voltage = ±15V, V_{CM} = 0, $R_L \geq$ 100KΩ and R_S = 50Ω unless otherwise noted. **Boldface** limits apply for $T_A = T_J = T_{MIN}$ to T_{MAX}; all other limits $T_A = T_J$ = 25°C.

SYMBOL	CHARACTERISTICS	TYP	CLM4133	CLM4333	UNITS	CONDITIONS
			Limit (Note 5)	Limit (Note 5)		
SR_1	Slew Rate 1	6000	4000	3000	V/µs	V_{IN} = ±11V, R_L = 1KΩ (Note 2)
SR_2	Slew Rate 2	3000	2000	1000	V/µs	V_{IN} = ±7V, R_L = 50Ω (Note 2)
SS_{BW}	Small Signal Bandwidth	350	240	180	MHz	V_{IN} = ±100mV_{PP}, R_L = 50Ω $C_L \leq$ 10pF
LS_{BW}	Large Signal Bandwidth	95	60	40	MHz	V_{IN} = ±11V, R_L = 1K $C_L \leq$ 10pF
P_{BW}	Power Bandwidth	70	45	20	MHz	V_{IN} = ±8V, R_L = 50Ω $C_L \leq$ 10pF
t_r, t_f	Rise Time Fall Time	1.0	1.5	4.0	ns	R_L = 50Ω, $C_L \leq$ 10pF V_O = 100mV_{PP}
t_{pd}	Propagation Delay Time	1.5			ns	R_L = 50Ω, $C_L \leq$ 10pF V_O = 100mV_{PP}

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. DC and AC electrical specifications do not apply when operating the device beyond its rated operating conditions.

Note 2: Slew rate is measured with 50Ω source impedance at 25°C. For accurate measurements, the input slew rate should be at least 8000V/µs.

Note 3: The test circuit consists of the human body model of 120pF in series with 1500Ω.

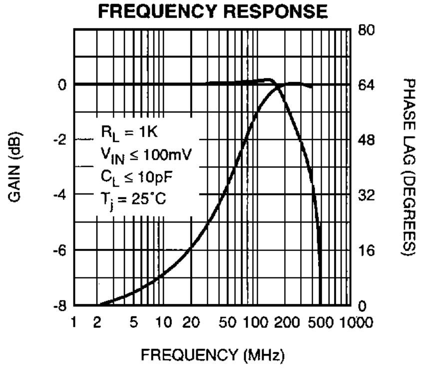
Note 4: The maximum power dissipation is a function of $T_{J(max)}$, θ_{JA} and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(max)} - T_A)/\theta_{JA}$.

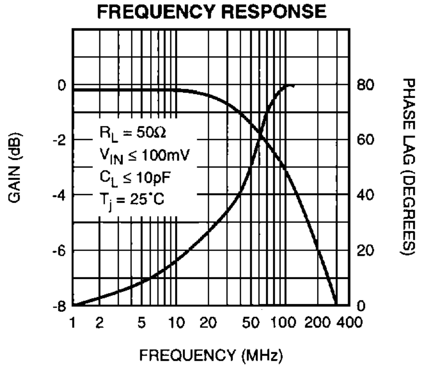
Note 5: Limits are guaranteed by testing, correlation or periodic characterization.

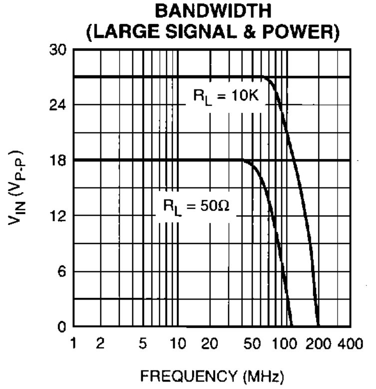
Note 6: For M & N package, θ_{JA} is measured by soldering the unit directly on a printed circuit board and V^- pins are connected to 2 square inches of 2 oz copper.

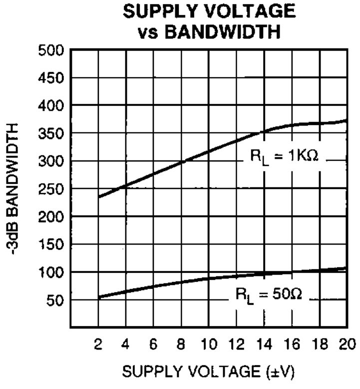
Note 7: T_A = 25°C, after 2 minutes of power in still air.

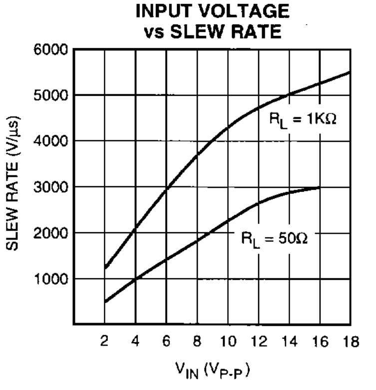
TYPICAL PERFORMANCE CHARACTERISTICS

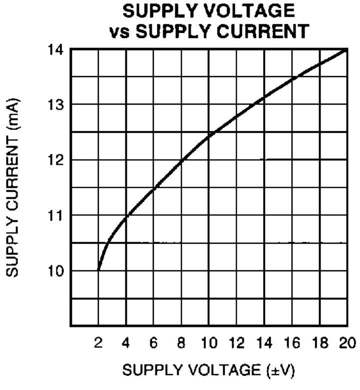




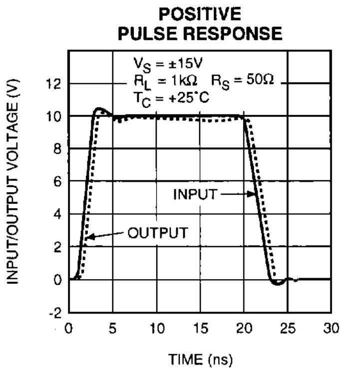


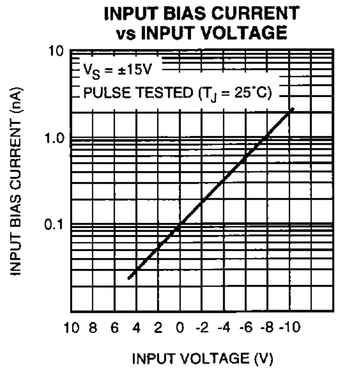


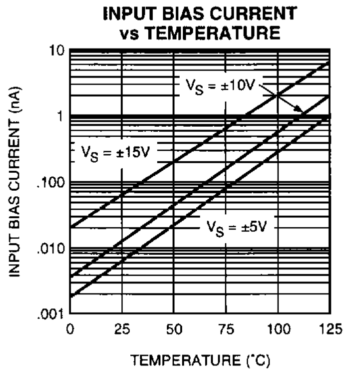




TYPICAL PERFORMANCE CHARACTERISTICS (Continued)







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APPLICATION HINTS

Recommended Layout Precautions

RF/video printed circuit board layout rules should be followed when using the CLM4133 since the product will provide power gain to frequencies over 200MHz. Ground planes are recommended and power supplies should be decoupled at each device with low inductance capacitors.

Operation from Single or Asymmetrical Power Supplies

The CLM4133 may be readily used in applications where symmetrical supplies are unavailable or not desirable. A typical application might be an interface to a MOS shift register where $V^+ = +5V$ and $V^- = -12V$. In this case, an apparent output offset occurs due to the device's voltage gain of less than unity. This additional output offset error may be predicted by:

$$\Delta V_O \cong (1 - A_V)\frac{(V^+ - V^-)}{2} = 0.005\,(V^+ - V^-)$$

where:

A_V = No load voltage gain, typically 0.99
V^+ = Positive supply voltage
V^- = Negative supply voltage

For the above example, ΔV_O would be -35mV. This may be adjusted to zero by offset voltage adjustment described earlier. For AC coupled applications, no additional offset occurs if the DC input is properly biased as illustrated in the "typical applications" section.

Capacitance Loading

The CLM4133/4233/4333 are designed to drive capacitive loads such as coaxial cables in excess of several thousand picofarads without susceptibility to oscillation. However, peak current resulting from (CdV/dt) should be limited below absolute maximum peak current ratings for the devices.

Thus for the CLM4133 family:

$$\left(\frac{\Delta V_{IN}}{\Delta t}\right) \times C_L \le I_{OUT} \le \pm 250\text{mA}$$

In addition, power dissipation resulting from driving capacitive loads plus standby power should be kept below total package rating:

$$P_{diss\,pkg} \ge P_{DC} + P_{AC}$$
$$\ge (V^+ - V^-) \times I_S + P_{AC}$$
$$P_{AC} \cong (V_{P\text{-}P})^2 \times f \times C_L$$

where:

$V_{P\text{-}P}$ = Peak-to-peak output voltage swing
f = Frequency
C_L = Load Capacitance

Operation Within an Op Amp Loop

The CLM4133 family may be used as a current booster or isolation buffer within a closed loop with op amps such as LH0032, CLM4132, or CLM4124. An isolation resistor of 47Ω should be used between the op amp output and the input of CLM4133. The wide bandwidths and high slew rates of the CLM4133 assures that the loop has the characteristics of the op amp and that additional rolloff is not required

Hardware

In order to utilize the full drive capabilities of the CLM4133, the device should be mounted with a heat sink particularly for extended temperature operation.

DESIGN PRECAUTION

Power supply bypassing is necessary to prevent oscillation in the CLM4133 in all circuits. Low inductance ceramic disc capacitors with the shortest practical lead lengths must be connected from each supply lead (within < ¼" to ½" of the device package) to a ground plane. Capacitors should be one or two 0.1µF in parallel for the CLM4133; adding a 4.7µF solid tantalum capacitor will help in troublesome instances.

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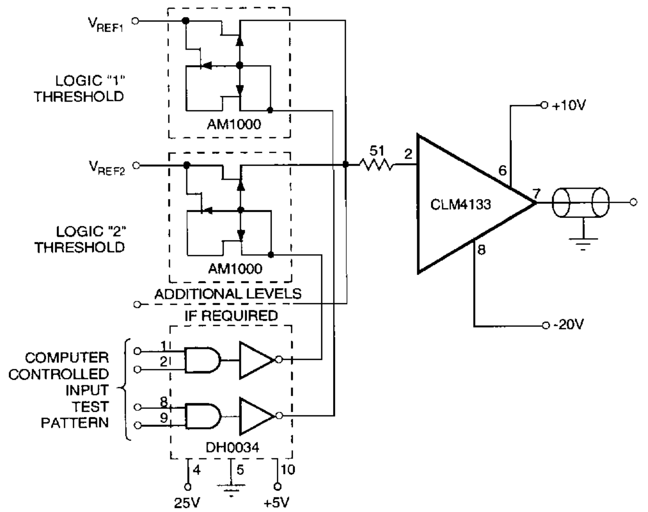
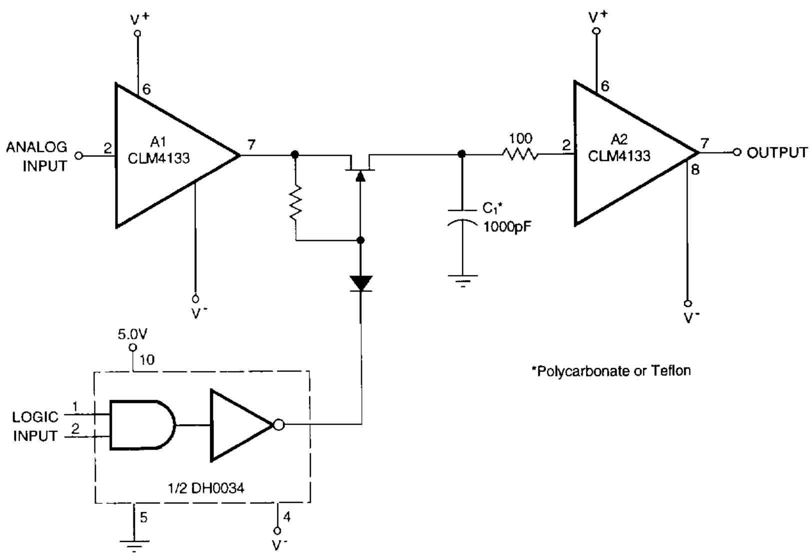
TYPICAL APPLICATIONS

High Speed Automatic Test Equipment Forcing Function Generator

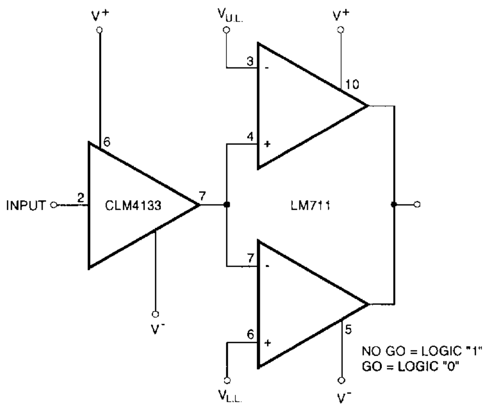


High Speed Sample & Hold

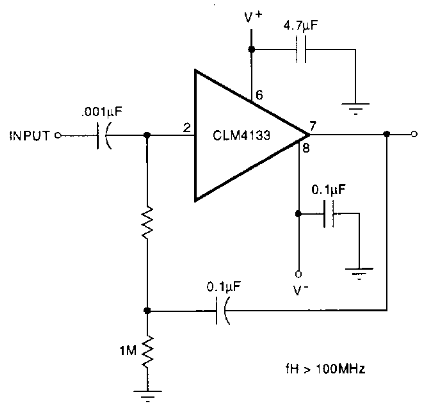


TYPICAL APPLICATIONS (Continued)

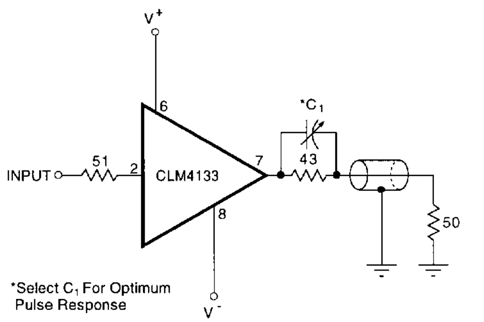
High Input Impedance Comparator



High Input Impedance AC Coupled Amplifier

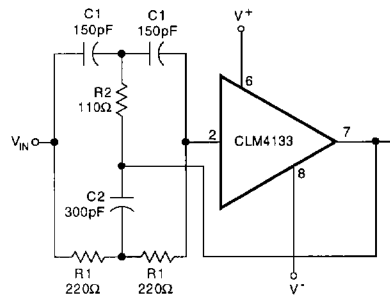


Coaxial Cable Driver



*Select C_1 For Optimum Pulse Response

4.5 MHz Notch Filter

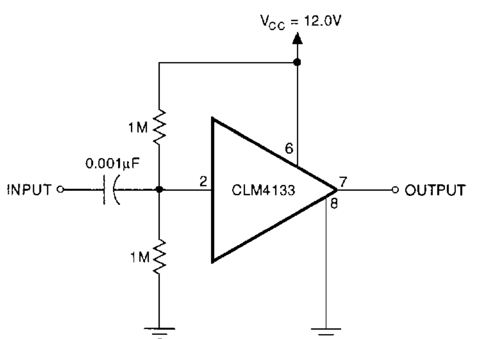


$f_O = \frac{1}{2\pi R1C1}$

$R1 = 2\ R2$

$C1 = \frac{C2}{2}$

Single Supply AC Amplifier



Instrumentation Shield/Line Driver