UMW LM321MF

1.Description

The LM321 brings performance and economy to low power systems. With a high unity gain frequency and a guaranteed 0.4V/μs slew rate, the quiescent current is only 430μA/amplifier (5V). The input co-mmon mode range includes ground and therefore the device is able to operate in single supply appli-cation s as well as in dual supply applications. It is also capable of comfortably driving large capacitive loads.The LM321 is available in the SOT-23-5L pack age. Overall the LM321 is a low power, wide supply range per formance opamp that can be designed into a wide range of applications at an economical price without sacrificing valuable board space.

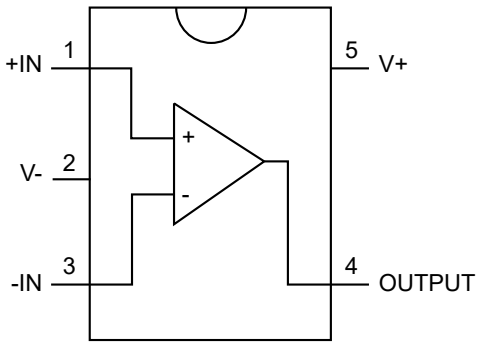
2.Features

- Gain - Bandwidth product: 1MHz
- Low supply current: 430μA
- Low input bias current: 45nA
- Wide supply voltage range: +3V to +32V

3.Applications

- Chargers
- Power supplies
- Industrial: controls, instruments
- Desktops
- Communications infrastructure

4.Pinning Information



SOT23-5

5.Absolute Maximum Ratings (Note 1)

Parameter	Value	Units
Supply Voltage, (V^+ - V^-)	32	V
Input Voltage	-0.3 ~ 32	V
Output Short Circuit to GND $V^+ \leq 15V$ and T_A=25°C (Note2)	Continuous	
Junction Temperature (Note3)	150	°C
Thermal Resistance to Ambient (θ_{JA})	265	°C
Operating Temperature Range	-40 ~ 85	°C
Storage Temperature Range	-65 ~ 150	°C

6.Electrical Characteristics (Unless otherwise specified: V^+=5.0V)

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Input Offset Voltage	V_{OS}	T_A=25°C (Note 4)			2	5	mV
Input Bias Current	I_B	T_A=25°C,$I_{IN(+)}$ or $I_{IN(-)}$,V_{CM}=0V(Note5)			45	250	nA
Input Offset Current	I_{OS}	T_A=25°C, $I_{IN(+)}$ - $I_{IN(-)}$, V_{CM}=0V			3	50	nA
Input Common Mode Voltage Range	V_{CM}	T_A=25°C, V^+=30V (Note 6)		0		V^+-1.5	V
Supply Current	I_S	Over the entire temperature range, R_L=∞ on all operational amplifiers	V^+=30V		0.66	2	mA
			V^+=5V		0.43	1.2	mA
Large Signal Voltage Gain	A_V	V^+=15V, T_A=25°C, R_L≥2kΩ (for V_O=1~11V)		50	100		V/mV
Common-Mode Rejection Ratio	CMRR	DC, T_A=25°C, V_{CM}=0~V^+-1.5V		70	90		dB
Power Supply Rejection Ratio	PSRR	DC, T_A=25°C, V^+=5~30V		75	100		dB
Output Current Sourcing	I_{SOURCE}	V_{ID}=+1V, V^+=15V, V_O=2V		20	40		mA
Output Current Sinking	I_{SINK}	V_{ID}=-1V, V^+=15V, V_O=2V		10	20		mA
		V_{ID}=-1V, V^+=15V, V_O=0.2V		12	100		μA

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Output Voltage Swing	V_{OH}	V^+=30V	R_L=2KΩ	26			V
			R_L=10KΩ	27	28		V
	V_{OL}	V^+=5V, R_L=10KΩ			5	20	mV
Output Short Circuit to Ground	I_O	V^+=15V			40	85	mA
Slew Rate	SR	V^+=15V, R_L=2kΩ, V_{IN}=0.5 to 3V C_L=100pF, Unity Gain			0.4		V/μs
Gain Bandwidth Product	GBW	V^+=30V, f=100kHz, V_{IN}=10mV R_L=2kΩ, C_L=100pF			1		MHz
Phase Margin	φm				60		degrees
Total Harmonic Distortion	THD	f=1kHz, A_V=20dB, R_L=2kΩ V_O=2V_{PP}, C_L=100pF, V^+=30V			0.015%		
Equivalent Input Noise Voltage	e_n	f=1kHz, R_S=100Ω, V^+=30V			40		nV/√Hz

Note 1 Absolute Maximum Ratings indicate limits beyond which damage to the device mayoccur. Operating Ratings indicate condition s for which the device is intended to be functional, but specific performance is not guaranteed. For guaranteed specifications and the test conditions, see the Electrical Characte ristics.

Note 2 : Shortcircuits from the output to V^+ can cause excessive heating and eventual destruction. When considering short circuits to ground, the maximum output current is approximately 40mA independent of the magnitude of V^+ . At values of supply voltage in excess of +15V, continuous short -circuits can exceed the power dissipation ratings and cause eventualde struction. Destructive dissipation canresult from simultaneous shorts on all amplifiers.

Note 3: 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 $P_D=(T_{J(MAX)}- T_A)/\theta_{JA}$. All numbers apply for packages soldered directly onto a PC board.

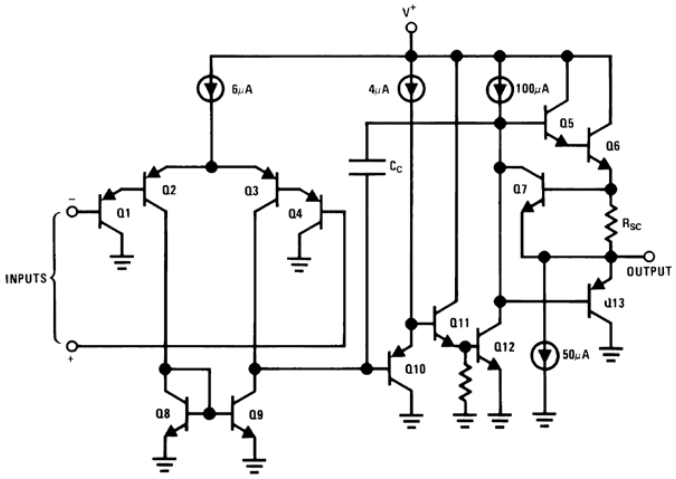
Note 4 : V_O=1.4V, R_S=0, with V^+ from 5V to 30V; and over the full input common -mode range (0V to V^+ -1.5V) at 25°C.

Note 5: The direction of the input current is out of the IC due to the PNP input stage. Thiscurrent is essentially constant, independent of the state of the output so no loading changeexists on the input lines.

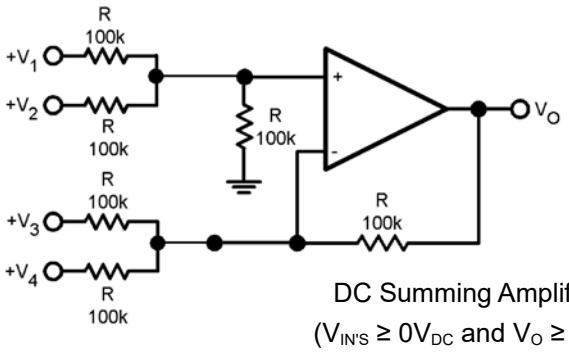
Note 6: The input common-mode voltage of either input signal voltage should not beallowed to go negative by more than 0.3V (at 25°C). The upper end of them common-modevoltage range is V^+-1.5V (at 25°C), but either or both inputs can go to +32V without damage, independent of the magnitude of V^+.

Note 7: Due to proximity of external components, insure that coupling is not originating viastray capacitance between these external parts. This typically can be detected as this type ofcapacitance increases at higher frequencies.

7.Simplified Schematic



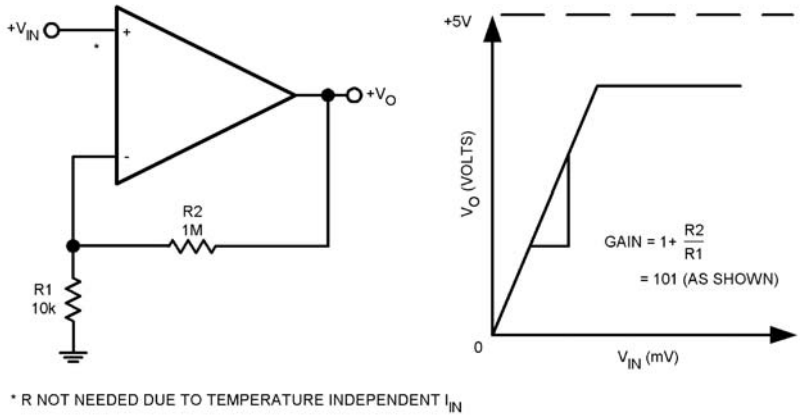
8.Application Circuit



DC Summing Amplifier
($V_{IN'S} \geq 0V_{DC}$ and $V_O \geq V_{DC}$)

Where: $V_O=V_1 + V_2 - V_3 - V_4$, $(V_1 + V_2) \geq (V_3 + V_4)$ to keep $V_O > 0V_{DC}$

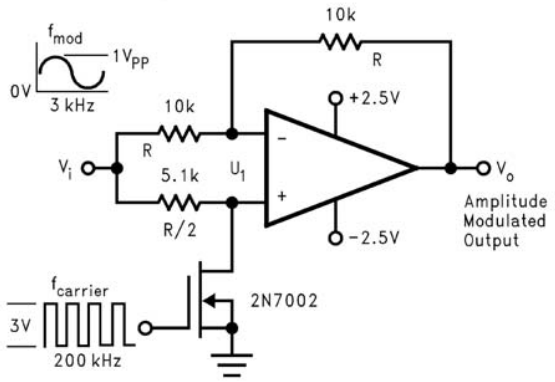
Non-Inverting DC Gain (0V Input = 0V Output)



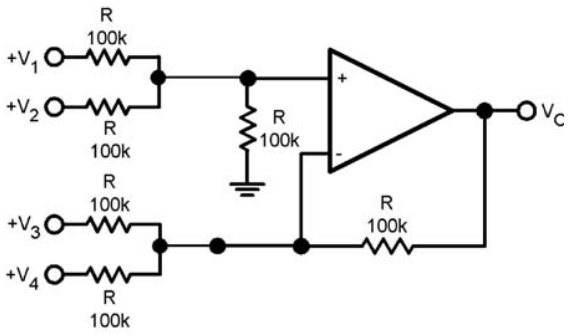
* R NOT NEEDED DUE TO TEMPERATURE INDEPENDENT I_{IN}

9.Typical Application

Amplitude Modulator Circuit

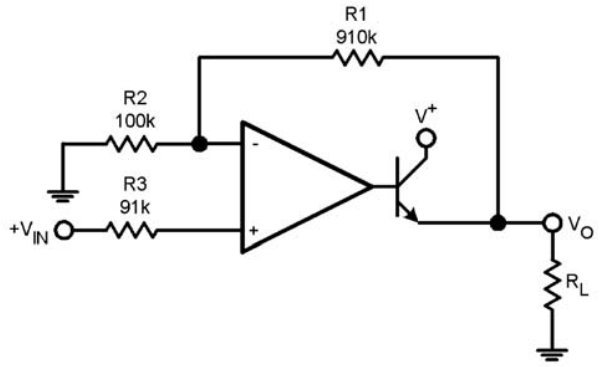


DC Summing Amplifier
($V_{IN's} \geq 0\ V_{DC}$ and $V_O \geq V_{DC}$)



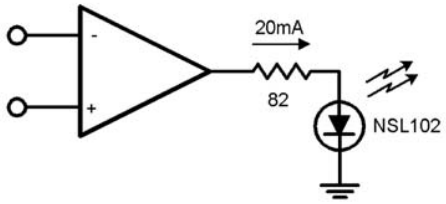
Where: $V_0 = V_1 + V_2 - V_3 - V_4$, $(V_1 + V_2) \geq (V_3 + V_4)$ to keep $V_O > 0\ V_{DC}$

Power Amplifier

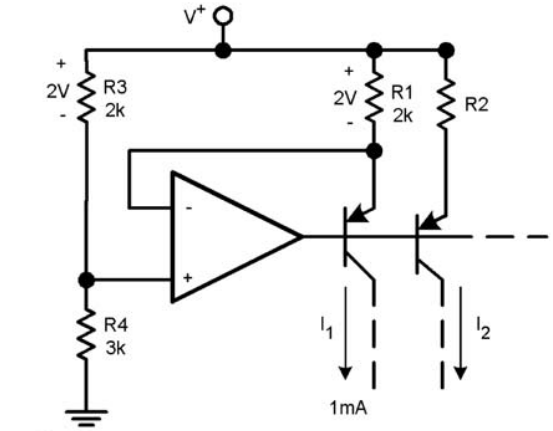


$V_0 = 0\ V_{DC}$ for $V_{IN} = 0\ V_{DC}$, $A_V = 10$

LED Driver

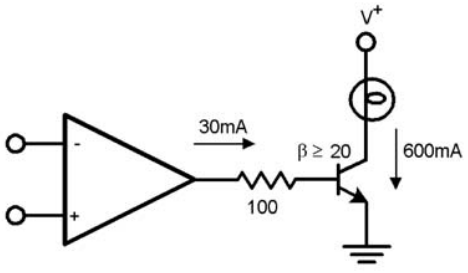


Fixed Current Sources



$$I_2 = \left[\frac{R1}{R2}\right] I_1$$

Lamp Driver



10.Typical Characterisitics

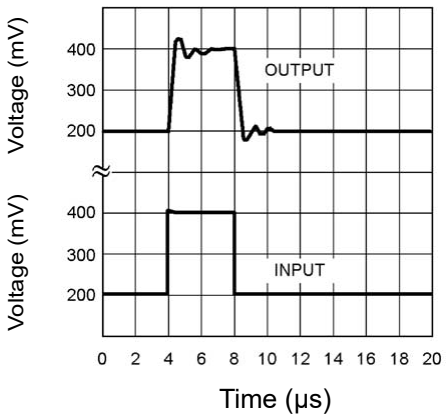


Figure 1: Small Signal Pulse Response

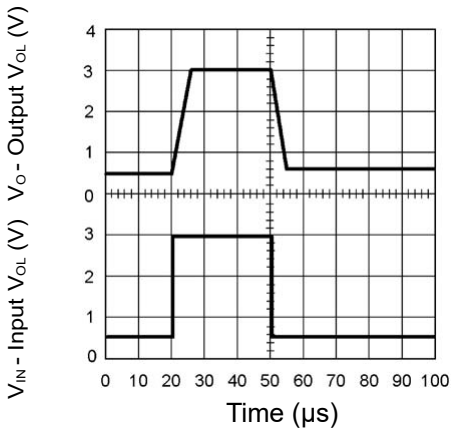


Figure 2: Large Signal Pulse Response

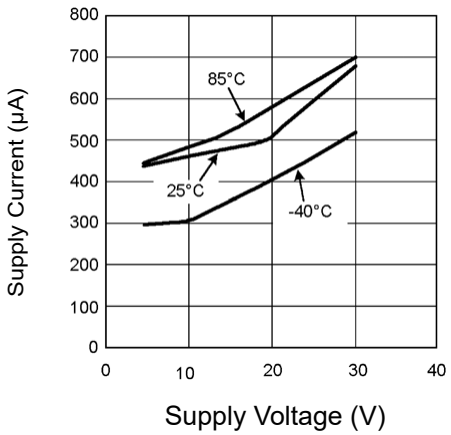


Figure 3: Supply Current vs. Supply Voltage

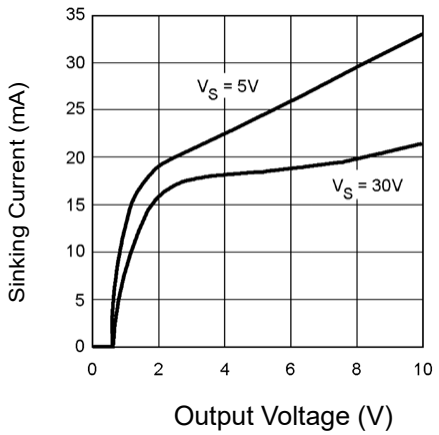


Figure 4: Sinking Current vs. Output Voltage

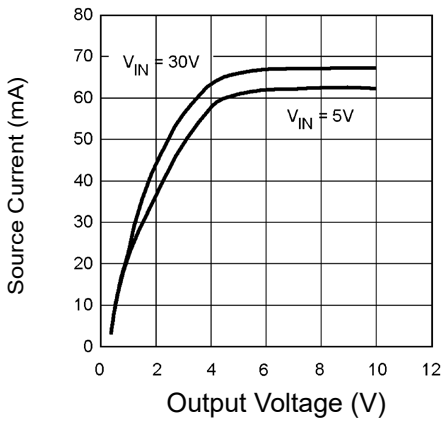


Figure 5: Source Current vs. Output Voltage

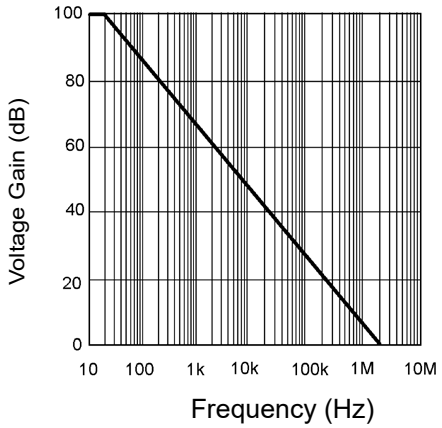
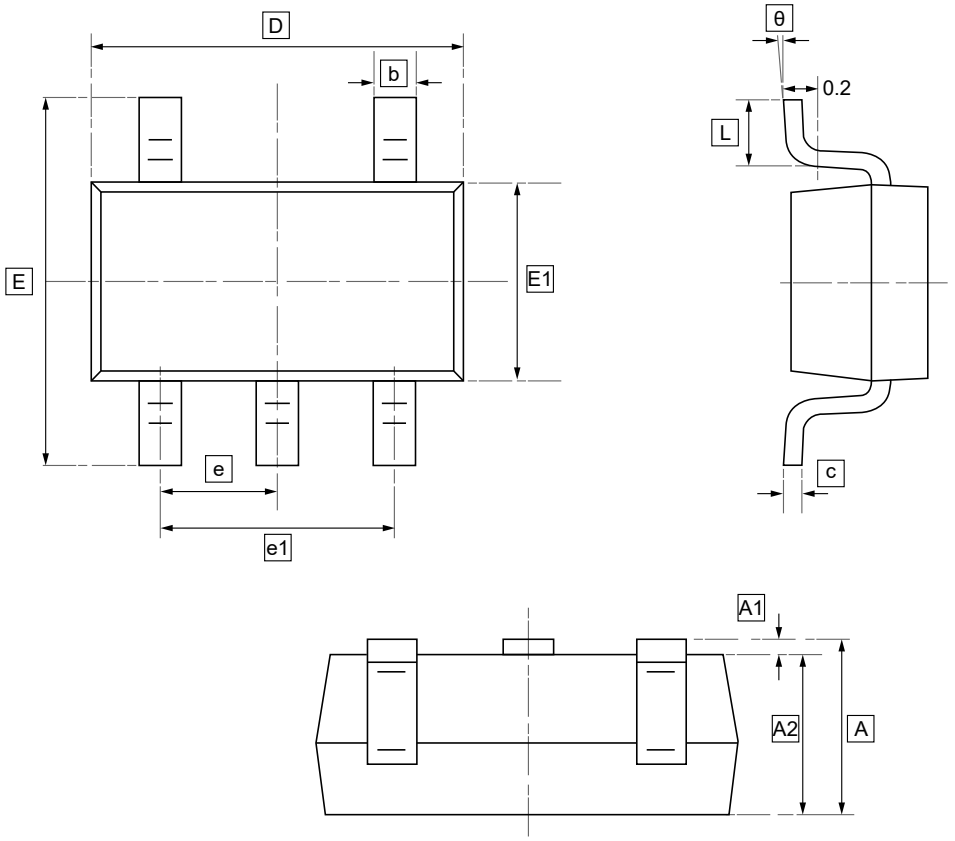


Figure 6: Open Loop Frequency Response

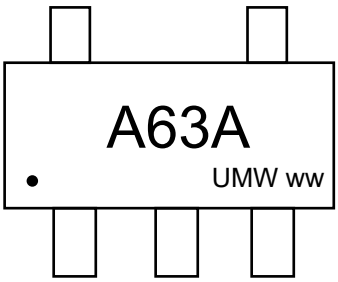
11.SOT-23-5 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E1	E	e	e1	L	θ
Min	1.050	0.000	1.050	0.300	0.100	2.820	1.500	2.650	0.950	1.800	0.300	0°
Max	1.250	0.100	1.150	0.500	0.200	3.020	1.700	2.950	BSC	2.000	0.600	8°

12.Ordering Information



ww: Batch Code

Order Code	Package	Base QTY	Delivery Mode
UMW LM321MF	SOT23-5	3000	Tape and reel

13.Disclaimer

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