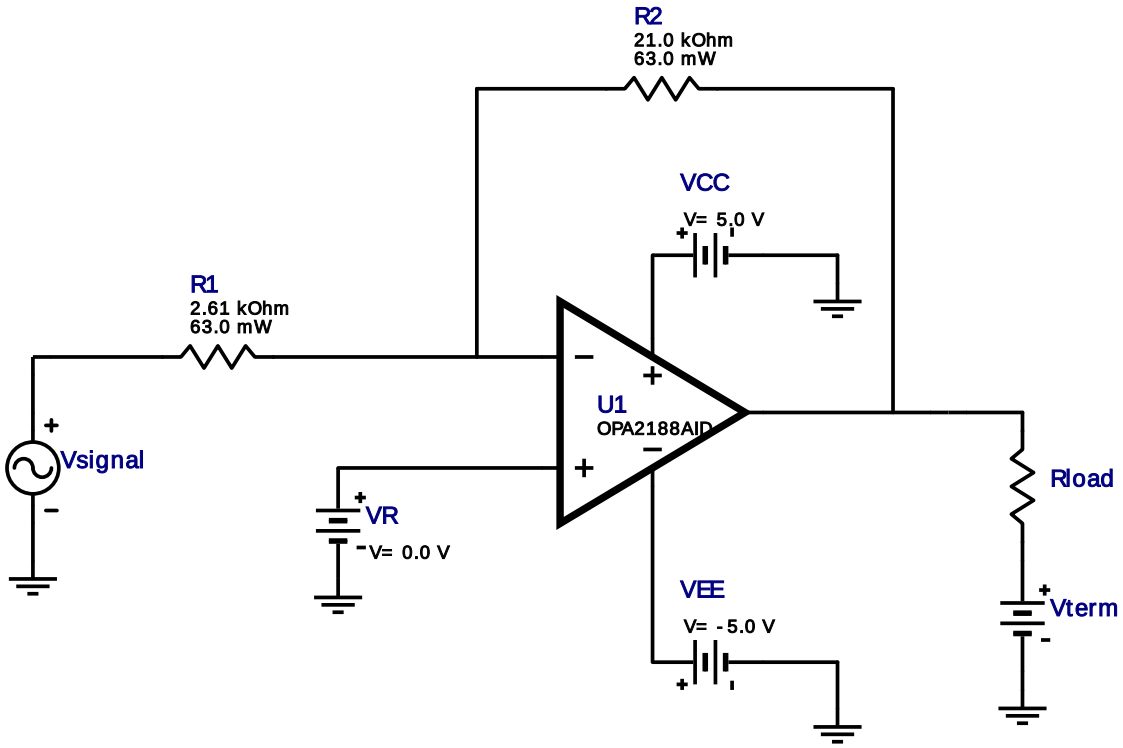
Device = OPA2188AID
Topology = Inverting
Created = Jul 21 2016 5:14AM
BOM Cost = $1.72
Footprint = 62.6 mm^2
BOM Count = 3

WEBENCH® Amplifier Design Report

Design : 4077713/67 OPA2188AID
Your OPA2188AID Inverting Amp Design



My Comments

No comments

Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	R1	Vishay-Dale	CRCW04022K61FKED Series= CRCW..e3	Res= 2.61 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
2.	R2	Vishay-Dale	CRCW040221K0FKED Series= CRCW..e3	Res= 21.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
3.	U1	Texas Instruments, Inc.	OPA2188AID	GbwTyp= 2.0 MHz VccMin= 4.0 V VccMax= 36.0 V	1	$1.70	D0008A 57 mm^2

Design Inputs

#	Name	Value	Description
1.	Topology	Inverting	
2.	ClosedLoopGain	-8.0 V/V	System Gain
3.	SmallSignalClosedLoopBandwidth	10000.0 Hz	Circuit Bandwidth
4.	DualSupply	true	Power supply(s) to active chips
5.	PositiveSupplyVoltage	5.0 V	
6.	PositiveSupplyTolerance	5.0 %	

#	Name	Value	Description
7.	NegativeSupplyVoltage	-5.0 V	
8.	NegativeSupplyTolerance	5.0 %	
9.	VinMin	-0.5 V	Minimum input voltage
10.	VinMax	0.5 V	Maximum input voltage
11.	VinPkPk	1.0 V	Peak to peak input voltage (VinMax – VinMin)
12.	VinMidpointVoltage	0.0 V	Midpoint of input voltage ((VinMax – VinMin)/2 + VinMin)
13.	VoutMin	-4.0 V	Minimum output voltage
14.	VoutMax	4.0 V	Maximum output voltage
15.	VoutPkPk	8.0 V	Peak to peak input voltage (VoutMax – VoutMin)
16.	VoutMidpointVoltage	0.0 V	Midpoint of input voltage ((VoutMax – VoutMin)/2 + VoutMin)
17.	VRefRecommended	0.0 V	Recommended WEBENCH Voltage Reference Value
18.	VRefUserSpec	0.0 V	User override of Voltage Reference Value
19.	TempMin	0.0 degC	Minimum Specified Temperature
20.	TempMax	70.0 degC	Maximum Specified Temperature

Performance Values - Design Criteria

#	Name	Value	Description
1.	Vcc	5.0 V	Positive Power Supply
2.	Vee	-5.0 V	Negative Power Supply
3.	Op Amp	OPA2188AID	Circuit's Operational Amplifier
4.	Gain	-8.0 V/V	Signal Gain
5.	Vin Min	-500.0 mV	Input minimum voltage
6.	Vin Max	500.0 mV	Input maximum voltage
7.	Vin pk-pk	1.0 V	Input peak-to-peak voltage
8.	Vin Midpoint	0.0 V	Input midpoint voltage
9.	Vout Min	-4.0 V	Output minimum voltage
10.	Vout Max	4.0 V	Output maximum voltage
11.	Vout pk-pk	8.0 V	Output peak-to-peak voltage
12.	Vout Midpoint	0.0 V	Output midpoint voltage
13.	Voltage Reference	0.0 V	Voltage reference
14.	R1	2.566 kOhms	Gain resistor
15.	R1 Tolerance		Gain resistor tolerance
16.	R2	20.531 kOhms	Feedback resistor
17.	R2 Tolerance		Feedback resistor tolerance
18.	SS Bandwidth	10.0 kHz	Small Signal Bandwidth
19.	Temp Minimum	0.0 degC	Minimum circuit temperature
20.	Temp Maximum	70.0 degC	Maximum circuit temperature
21.	R1	2.61 kOhms	Gain resistor
22.	R1 Tolerance	1.0 %	Gain resistor tolerance
23.	R2	21.0 kOhms	Feedback resistor
24.	R2 Tolerance	1.0 %	Feedback resistor tolerance
25.	SS Bandwidth	-248.571 kHz	Small Signal Bandwidth

Performance Values - Actual Design

#	Name	Value	Description
1.	Vcc	5.0 V	Positive Power Supply
2.	Vee	-5.0 V	Negative Power Supply
3.	Op Amp	OPA2188AID	Actual Circuit operational amplifier
4.	Gain_target	-8.046 V/V	Signal gain with actual resistors
5.	Vin Min	-500.0 mV	Input minimum voltage
6.	Vin Max	500.0 mV	Input maximum voltage
7.	Vin pk-pk	1.0 V	Input peak-to-peak voltage
8.	Vin Midpoint	0.0 V	Input midpoint voltage
9.	Vout Min	-4.023 V	Actual Output minimum voltage
10.	Vout Max	4.023 V	Actual Output maximum voltage
11.	Vout pk-pk	8.046 V	Actual Output peak-to-peak voltage
12.	Vout Midpoint	0.0 V	Actual Output midpoint voltage
13.	Voltage Reference	0.0 V	Actual Voltage reference
14.	Temp Minimum	0.0 degC	Minimum circuit temperature
15.	Temp Maximum	70.0 degC	Maximum circuit temperature

Performance Values - Operating Frequency Values

#	Name	Value	Description
1.	Amplifier GBWP	2.0 MHz	Amplifier Gain Bandwidth Product
2.	Amplifier Slew Rate	800.0 mV/usec	Amplifier Slew Rate
3.	Closed Loop Bandwidth	221.093 mMHz	System Bandwidth
4.	FPBW	12.732 mKHz	Circuit Full-power Bandwidth

Performance Values - Power Requirements

#	Name	Value	Description
1.	Vcc	5.0 V	Positive nominal power supply

#	Name	Value	Description
2.	Vee	-5.0 V	Negative nominal power supply
3.	Vsupply Max	36.0 V	Operational amplifier maximum power supply range
4.	Vsupply Min	4.0 V	Operational amplifier minumum power supply range
5.	Power IC	3.85 mW	Operational amplifier nominal power dissipation

Performance Values - Vos / Ib Vout error

#	Name	Value	Description
1.	Vout Vos(max) error	226.0 mmV	25 deg C maximimum offset voltage error at the output
2.	Vout Ib(max) error	0.0 mV	25 deg C maximimum input bias current error at the output
3.	Tot error RSS	226.0 mmV	Root sum square of output offset errors
4.	Tot error Worst Case	226.0 mmV	Sum of output offset errors

Performance Values - Vout Gain vs. Resistor Tolerance

No calculated performance values for this design.

Performance Values - Error Over Temperature

#	Name	Value	Description
1.	Vos at maximum temperature	66.488 mmV	Maximum amplifer offset voltage drift error at high temperature
2.	Vos at minimum temperature	61.06 mmV	Maximum amplifier offset voltage drift error at low temperautre

Performance Values - Total Output Noise

#	Name	Value	Description
1.	Noise (rms)	56.76 uVrms	Total output rms noise error
2.	Noise (p-p)	374.617 uVp-p	Total peak-to-peak output noise (3 sigma)
3.	SNR	93.95 dB	Operational amplifier output Signal to Noise ratio

Design Assistance

1. **OPA2188** Product Folder : http://www.ti.com//product/OPA2188 : contains the data sheet and other resources.