UMW OPA2330AIDR

50-μV V_{OS}, 0.25-μV/°C, 35-μA CMOS Operational Amplifiers Zero-Drift Series

1.Description

The UMW OPA2330AIDR of CMOS operational amplifiers offer precision performance at a very competitive price. These devices are members simultaneously provide low offset voltage (50-μV maximum) and near-zero drift over time and temperature at only 35 μA (maximum) of quiescent current. The UMW OPA330 family features rail-to-rail input and output in addition to near-flat 1/f noise making this amplifier ideal for many applications and much easier to design into a system. These devices are optimized for low-voltage operation as low as 1.8V (±0.9 V) and up to 5.5 V (±2.75V).

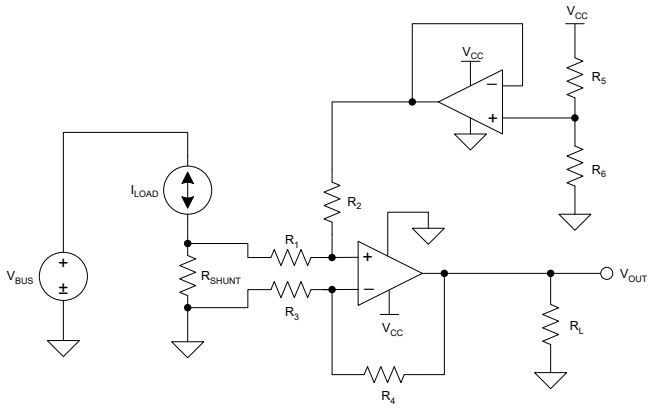
2.Features

- Unmatched Price Performance
- Low Offset Voltage: 50 μV (Maximum)
- Zero Drift: 0.25 μV/°C (Maximum)
- Low Noise: 1.1 μV_{PP}, 0.1 Hz to 10 Hz
- Quiescent Current: 35 μA (Maximum)
- Supply Voltage: 1.8 V to 5.5 V
- Rail-to-Rail Input and Output
- Internal EMI Filtering

3.Applications

- Battery-Powered Instruments
- Temperature Measurements
- Transducer Applications
- Electronic Scales
- Medical Instrumentation
- Handheld Test Equipment
- Current Sense

4.Bidirectional, Low-Side Current Sense



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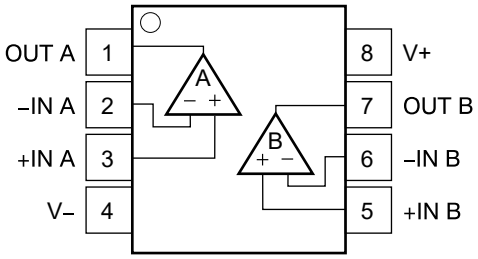
5.Pinning Information



SOP-8

Pin Functions

PIN			I/O	Description
Name	SOP	SON		
-INA	2	2	I	Negative (inverting) input signal, channel A
+INA	3	3	I	Positive (noninverting) input signal, channel A
-INB	6	6	I	Negative (inverting) input signal, channel B
+INB	5	5	I	Positive (noninverting)input signal, channel B
OUTA	1	1	O	Output channel A
OUTB	7	7	O	Output channel B
V-	4	4	-	Negative (lowest) power supply
V+	8	8	-	Positive (highest) power supply

6.Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

Parameter		Symbol	Min	Max	Units
Voltage	Supply, V_S = (V+) - (V-)			7	V
	Signal input terminals (2)(TBD should terminal be pin?)		(V-) -0.3	(V+) + 0.3	V
Current	Signal input terminals (2)		-10	10	mA
	Output short-circuit (3)		Continuous		
Temperature	Operating range	T_A	-40	150	°C
	Junction	T_J		150	°C
	Storage	T_{STG}	-65	150	°C

7.ESD Ratings

Parameter		Symbol	Value	Units
Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	$V_{(ESD)}$	±4000	V
	Charged-device model (CDM), per JEDEC specification JESD22-C101(2)		±4000	V
	Machine model (MM)		±400	V

8.Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

Parameter	Symbol	Min	Nom	Max	Units
Supply voltage	(V+) - (V-)	±0.9 (1.8)	±2.5 (5)	±2.75 (5.5)	V
Specified temperature	T_A	-40	25	125	°C

9.Thermal Information

Parameter	Symbol	(SOP)	Units
		8 Pins	
Junction-to-ambient thermal resistance	$R_{\theta JA}$	124	°C/W
Junction-to-case (top) thermal resistance	$R_{\theta JC(top)}$	73.7	°C/W
Junction-to-board thermal resistance	$R_{\theta JB}$	64.4	°C/W
Junction-to-top characterization parameter	ψ_{JT}	18	°C/W
Junction-to-board characterization parameter	ψ_{JB}	63.9	°C/W
Junction-to-case(bottom)thermal resistance	$R_{\theta JC(bot)}$	-	°C/W

10.Electrical Characteristics

At T_A=+25°C, R_L=10kΩ connected to V_S=1.8V to 5.5V, and V_{CM}=V_{OUT}=midsupply (unless otherwise noted).

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input offset voltage	V_{OS}	V_S=5V		8	50	μV
Input offset voltage versus temperature	dV_{OS}/dT	At T_A=-40°C to +125°C		0.02	0.25	μV/°C
Input offset voltage versus power supply	PSRR	At T_A=-40°C to +125°C		1	10	μV/V
Long-term stability (1)		V_S=1.8V to 5.5V		See(1)		
Channel separation, dc				0.1		μV/V
Input bias current	I_B	At 25°C		±200	±500	pA
		At T_A=-40°C to +125°C		±300		pA
Input offset current	I_{OS}	At 25°C		±400	±1000	pA
Input voltage noise density	e_n	f=1kHz		55		nV/√Hz
Input voltage noise		f=0.01Hz to 1Hz		0.3		$μV_{PP}$
		f=0.1Hz to 10Hz		1.1		$μV_{PP}$
Input current noise	i_n	f =10Hz		100		fA/√Hz
Common-mode voltage range	V_{CM}		(V-) - 0.1		(V+)+0.1	V
Common-mode rejection ratio	CMRR	At T_A=-40°C to +125°C (V-) - 0.1V < V_{CM} < (V+) + 0.1V	100	115		dB
Differential				2		pF
Common-mode				4		pF
Open-loop voltage gain	A_{OL}	At T_A=-40°C to +125°C (V-)+100mV<V_O<(V+) -100mV R_L=10kΩ	100	115		dB

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Gain-bandwidth product	GBW	C_L=100pF		350		kHz
Slew rate	SR	G=+1		0.16		V/μs
Voltage output swing from rail		At T_A=-40°C to +125°C		30	100	mV
Short-circuit current	I_{SC}			±5		mA
Capacitive load drive	C_L		See Typical Characteristics			
Open-loop output impedance		f=350 kHz, I_O=0mA		2		kΩ
Specified voltage range	V_S		1.8		5.5	V
Quiescent current per amplifier	I_Q	At T_A=-40°C to +125°C, I_O=0mA		21	35	μA
Turnon time		V_S=5V		100		μs

(1) 300-hour life test at 150°C demonstrated randomly distributed variation of approximately 1 μV.

11.1 Typical characteristic

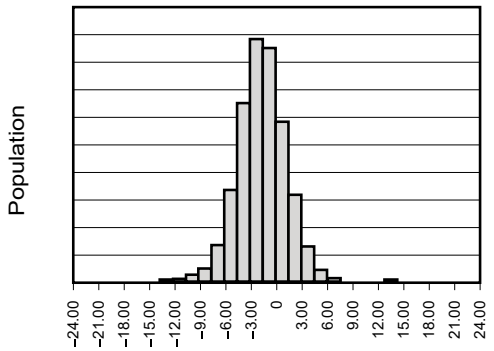


Figure 1: Offset Voltage Production Distribution

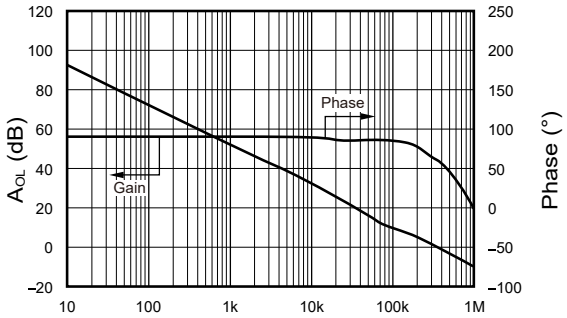


Figure 2: Open-Loop Gain vs Frequency

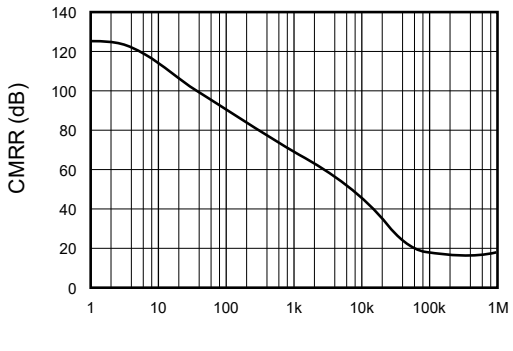


Figure 3: Common-Mode Rejection Ratio vs Frequency

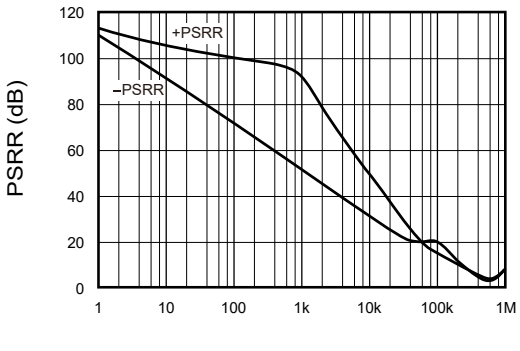


Figure 4: Power-Supply Rejection Ratio vs Frequency

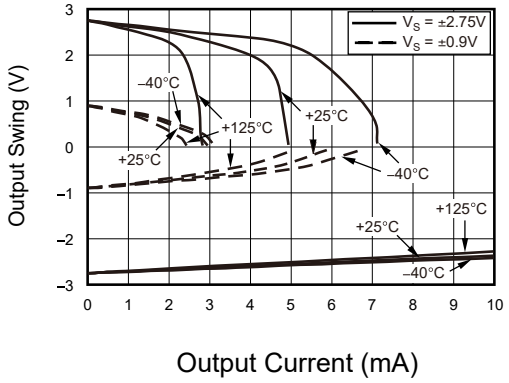


Figure 5: Output Voltage Swing vs Output Current

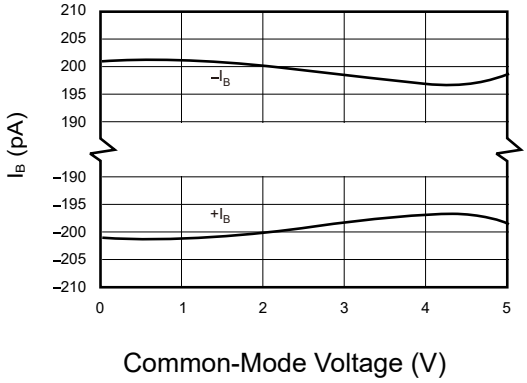


Figure 6: Input Bias Current vs Common-Mode Voltage

11.2 Typical characteristic

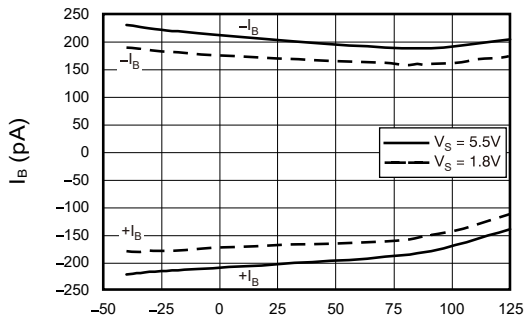


Figure 7: Input Bias Current vs Temperature

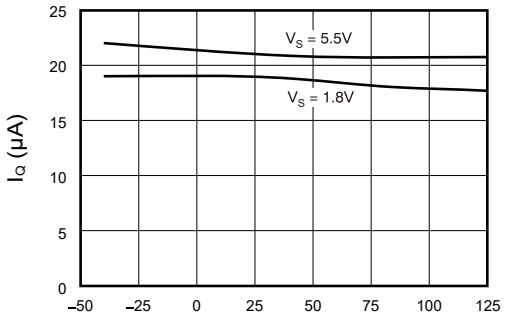


Figure 8: Quiescent Current vs Temperature

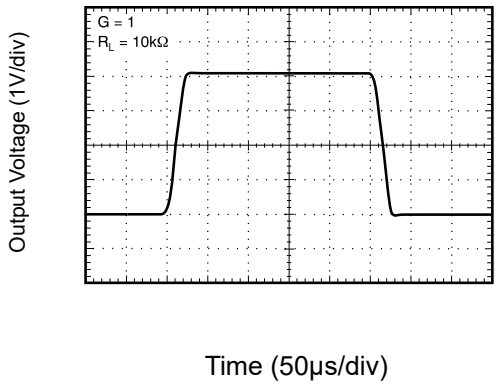


Figure 9: Large-Signal Step Response

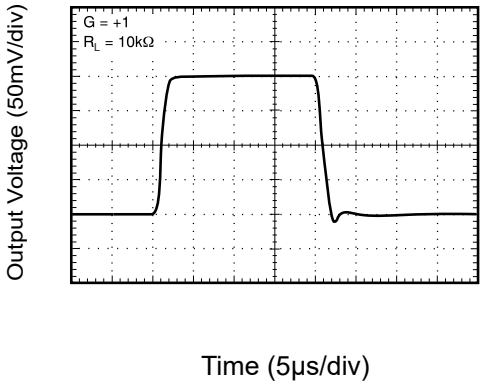


Figure 10: Small-Signal Step Response

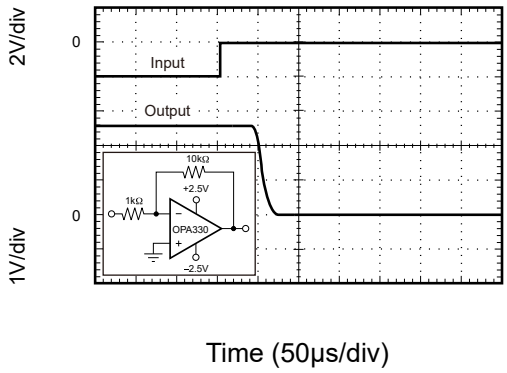


Figure 11: Positive Overvoltage Recovery

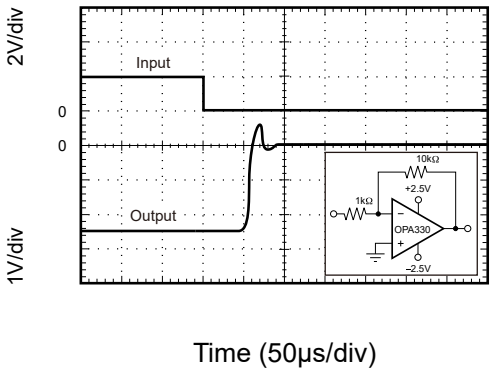


Figure 12: Negative Overvoltage Recovery

11.3 Typical characteristic

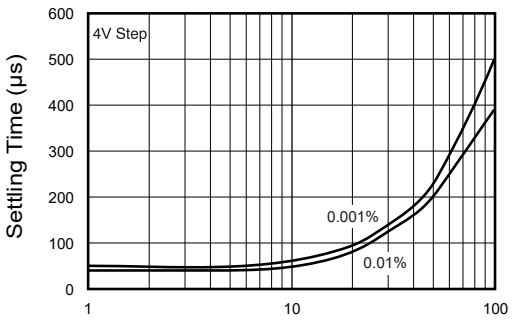


Figure 13: Settling Time vs Closed-Loop Gain

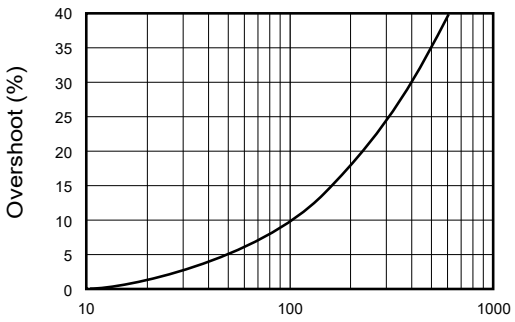


Figure 14: Small-Signal Overshoot vs Load Capacitance

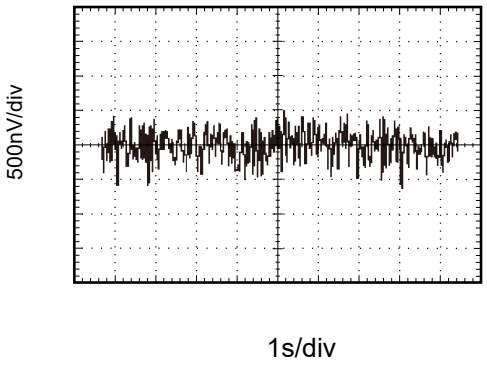


Figure 15: 0.1-Hz to 10-Hz Noise

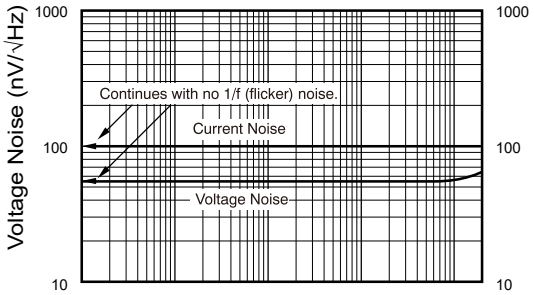


Figure 16: Current and Voltage Noise Spectral Density vs Frequency

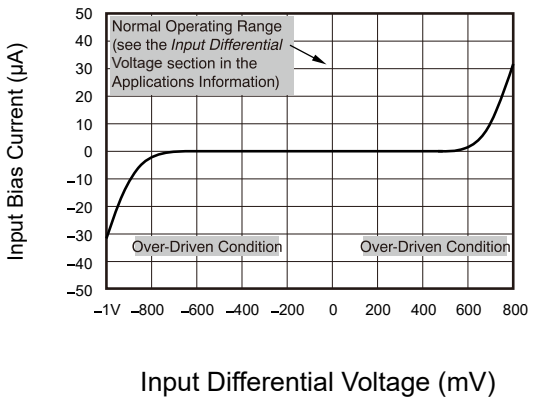
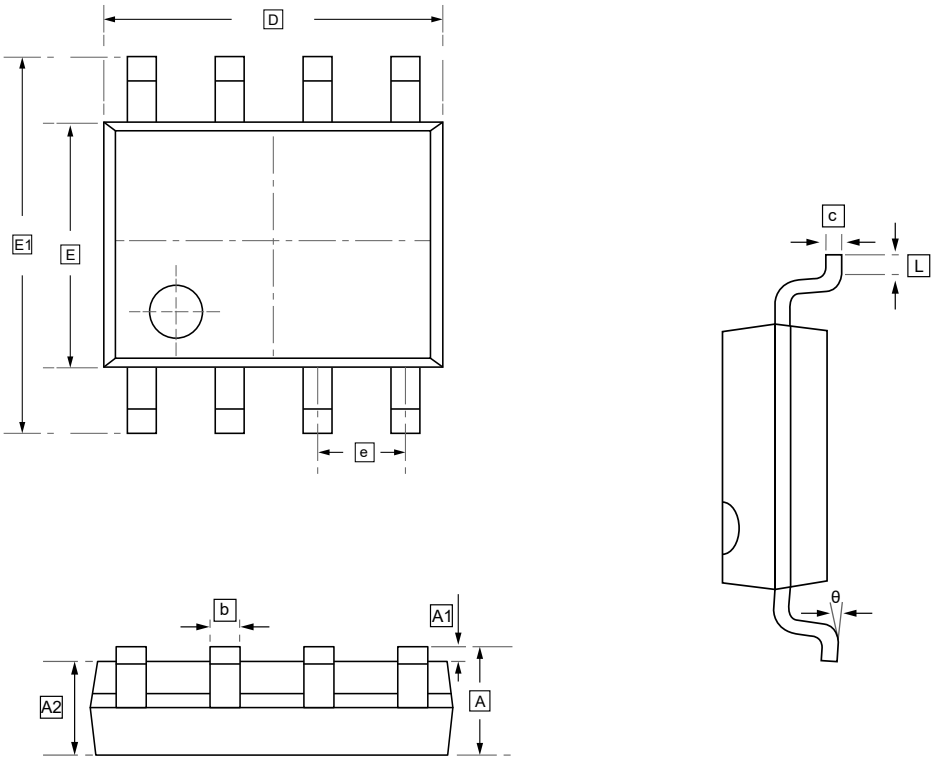


Figure 17: Input Bias Current vs Input Differential Voltage

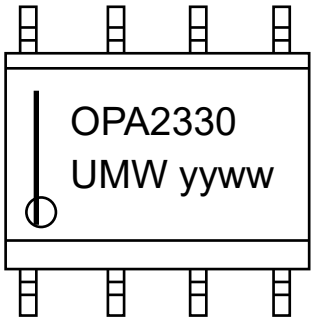
12.SOP-8 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E	E1	e	L	θ
Min	1.350	0.000	1.350	0.330	0.170	4.700	3.800	5.800	1.270	0.400	0°
Max	1.750	0.100	1.550	0.510	0.250	5.100	4.000	6.200	BSC	1.270	8°

13.Ordering information



yy: Year Code
ww: Week Code

Order Code	Package	Base QTY	Delivery Mode
UMW OPA2330AIDR	SOP-8	2500	Tape and reel

14.Disclaimer

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