



**DUAL PRECISION CMOS VOLTAGE COMPARATOR
WITH OPEN DRAIN OUTPUT DRIVER**

GENERAL DESCRIPTION

The ALD2331A/ALD2331B/ALD2331 is a monolithic high performance dual precision voltage comparator built with advanced silicon gate EPAD[®] CMOS technology intended for high precision analog applications. The ALD2331A/ALD2331B/ALD2331 offers ultra-low input offset voltages and currents at its input pre-amplifier, precision voltage comparator and high-current output driver integrated on-chip, in one industry standard pinout 8 Lead PDIP or SOIC package. Primary features include: very high typical input impedance of $10^{12} \Omega$; low input bias current of 10pA; fast response time of 750ns with only 10mV input step signal; very low power dissipation of 55 μ A per comparator; and single +5V or dual \pm 5V power supply operation; and 50 mA open drain output drivers.

The input voltage range includes ground, making this comparator ideal for low level signal detection with high source impedance. The outputs are open-drain configurations, allowing maximum application flexibility, such as wired-OR connection and various different output loads. An external pull-up resistor is required for each output, although the value of the pull-up resistor can vary over a wide range in order to suit the application needs. The outputs can be connected to a higher external voltage than V^+ .

PRODUCT FEATURES

- Fanout of 30 LS TTL loads
- Guaranteed to drive 200 Ω loads
- Low supply current of 55 μ A typical
- Pinout of LM193 industry standard voltage comparators
- Extremely low input bias currents-10pA typical
- Virtually eliminates source impedance effects
- Low operating supply voltage of 3V to 10.6V
- Single +5V and dual supply \pm 5V operation
- High speed for both large and small level signals -- 300ns typical for TTL inputs
- CMOS, NMOS and TTL compatible
- Wired-OR open drain outputs
- High output sink current - typically 50mA
- Low supply current spikes

ORDERING INFORMATION

Operating Temperature Range *	
0°C to +70°C	0°C to +70°C
8-Pin Small Outline Package (SOIC)	8-Pin Plastic Dip Package
ALD2331A SAL	ALD2331A PAL
ALD2331B SAL	ALD2331B PAL
ALD2331 SAL	ALD2331 PAL

* Contact factory for industrial temperature range

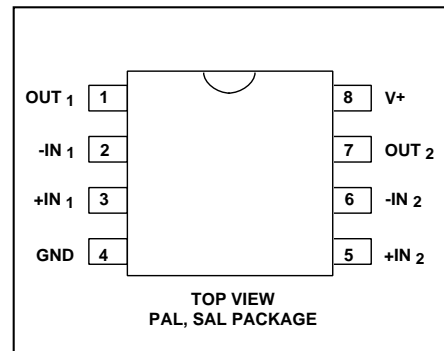
APPLICATIONS

- High source impedance voltage comparison circuits
- MOSFET driver
- Dual limit window comparator
- Power supply voltage monitor
- Photo-detector sensor circuit
- Relay or LED driver
- Oscillators
- Battery operated instruments
- Remote signal detection

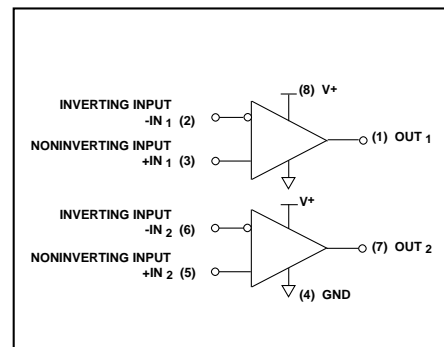
BENEFITS

- Simple precision reference voltage setting
- On-chip input pre-amplifier and output buffers
- Precision voltage comparison without pre-amplifier
- Eliminate need for second power supply
- Wide range of pull-up resistor values

PIN CONFIGURATION



BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Supply voltage, V+ _____ +10.6V
 Differential input voltage range _____ -0.3V to V+ +0.3V
 Power dissipation _____ 600 mW
 Operating temperature range PAL, SAL package _____ 0°C to +70°C
 Storage temperature range _____ -65°C to +150°C
 Lead temperature, 10 seconds _____ +260°C

OPERATING ELECTRICAL CHARACTERISTICS

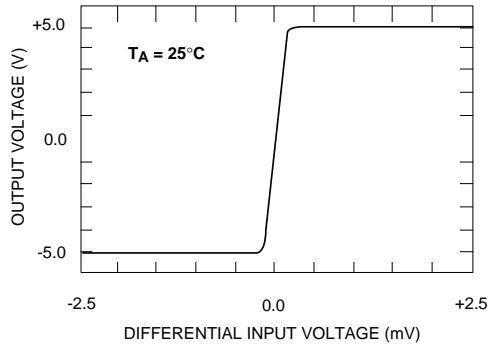
T_A = 25°C V+ = +5V unless otherwise specified

Parameter	Symbol	2331A			2331B			2331			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
Supply Voltage	V+	3		10	3		10	3		10	V	
Supply Current	I _S		110	180		110	180		110	180	μA	No Load Two Comparators
Voltage Gain	A _V D	50	150		50	150		50	150		V/mV	R _{LOAD} ≥ 15K
Input Offset Voltage	V _{OS}		0.2	0.5		0.5	1.0		1.0	2.0	mV	R _{LOAD} ≥ 1.5KΩ
Input Offset Current ¹	I _{OS}		0.01	20		0.01	20		0.01	20	pA	
Input Bias Current ¹	I _B		0.01	20		0.01	20		0.01	20	pA	
Common Mode Input Voltage Range ²	V _{ICR}	-0.3		V+ -1.5	-0.3		V+ -1.5	-0.3		V+ -1.5	V	
Low Level Sink Output Voltage	V _{OL}		0.15	0.4		0.15	0.4		0.15	0.4	V	I _{SINK} = 12mA V _{INPUT} = 1V Differential
Low Level Sink Output Current	I _{OL}	24	50		24	50		24	50		mA	V _{OL} = 1.0 V SINK OUTPUT ON
High Level Sink Output Leakage Current	I _L		0.01	20		0.01	20		0.01	20	nA	V _{OUT} = 5.0 V SINK OUTPUT OFF
Response Time ²	t _{RP}		1.1			1.1			1.1		μs	R _L = 5.1KΩ, C _L = 15pF 5mV Input Step/ 5mV Overdrive
	t _{RP}		2.4			2.4			2.4		μs	R _L = 5.1KΩ, C _L = 15pF 1mV Input Step/ 1mV Overdrive
	t _{RP}		600			600			600		ns	R _L = 5.1KΩ, C _L = 15pF 100mV Input Step/ 5mV Overdrive
	t _{RP}		300			300			300		ns	R _L = 5.1KΩ, C _L = 15pF TTL level Input Step
Common Mode Rejection Ratio	CMRR		80			80			80		dB	V _{INPUT} = 0V to 2.5V
Power Supply Rejection Ratio	PSRR		75			75			75		dB	V+ = 4V to 5V

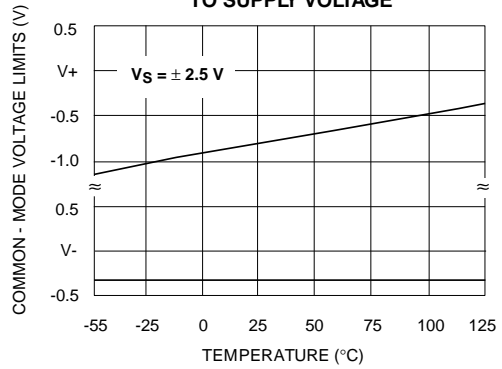
Notes: ¹ Consists of junction leakage currents
² Sample test parameter

TYPICAL PERFORMANCE CHARACTERISTICS

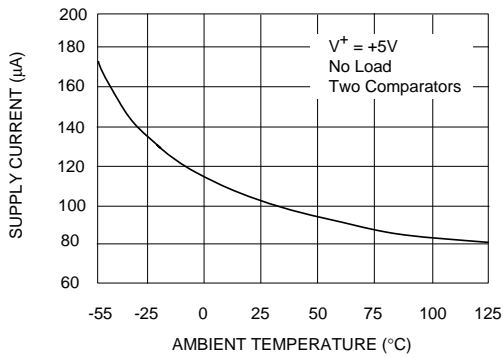
TRANSFER FUNCTION



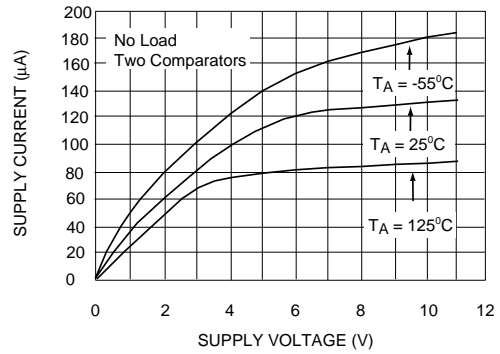
COMMON - MODE VOLTAGE REFERRED TO SUPPLY VOLTAGE



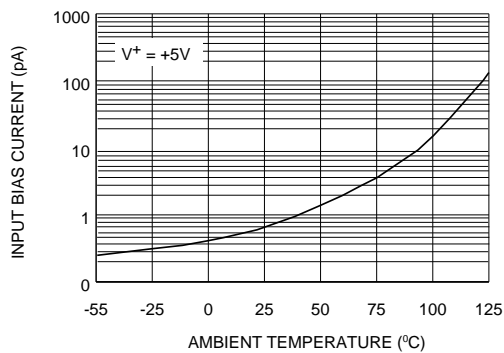
SUPPLY CURRENT vs. TEMPERATURE



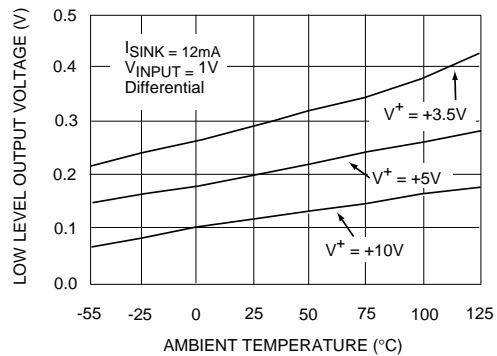
SUPPLY CURRENT vs. SUPPLY VOLTAGE



INPUT BIAS CURRENT vs. TEMPERATURE

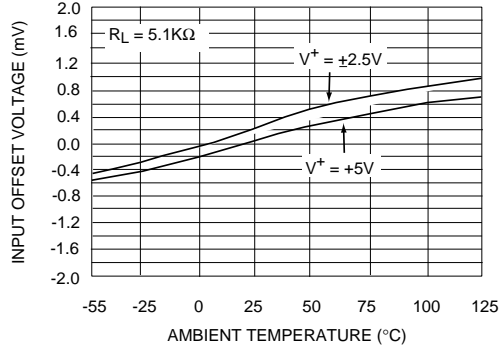


LOW LEVEL OUTPUT VOLTAGE vs. TEMPERATURE

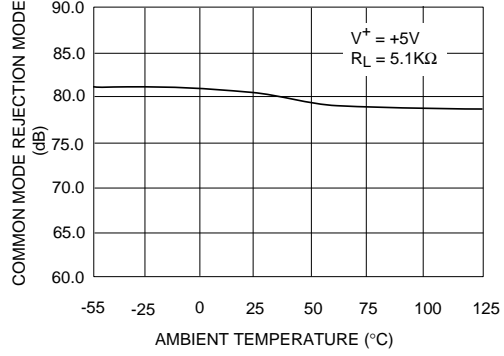


TYPICAL PERFORMANCE CHARACTERISTICS

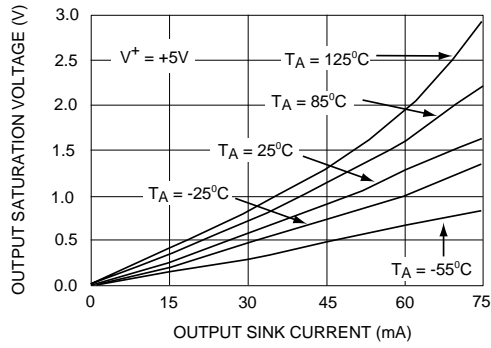
INPUT OFFSET VOLTAGE vs. TEMPERATURE



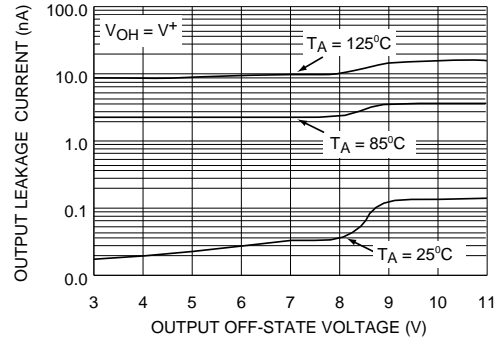
COMMON MODE REJECTION RATIO vs. TEMPERATURE



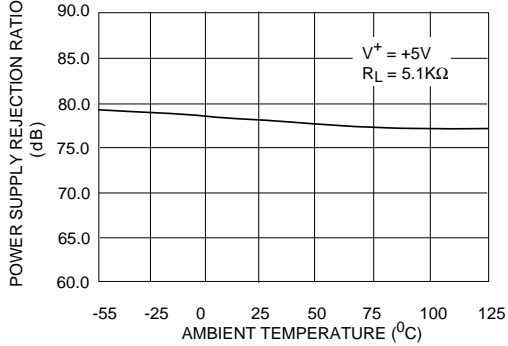
SATURATION VOLTAGE vs. SINK CURRENT



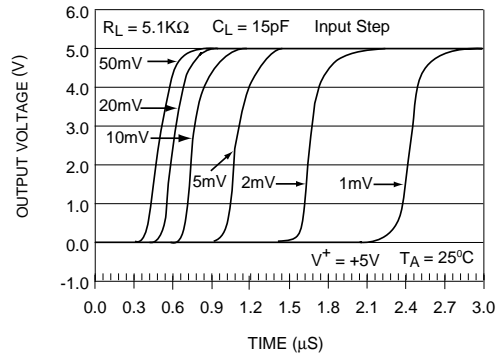
OUTPUT OFF-STATE VOLTAGE vs. OUTPUT LEAKAGE CURRENT



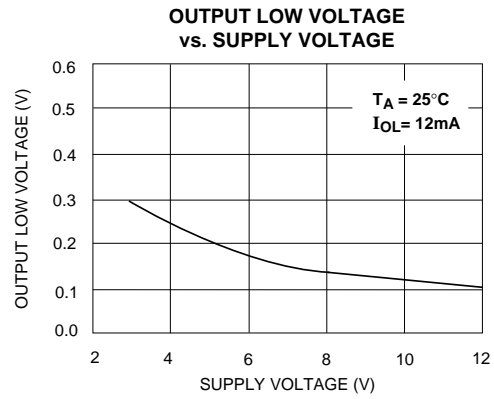
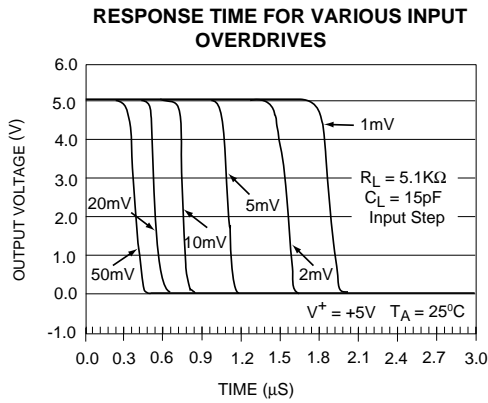
POWER SUPPLY REJECTION RATIO vs. TEMPERATURE



RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES

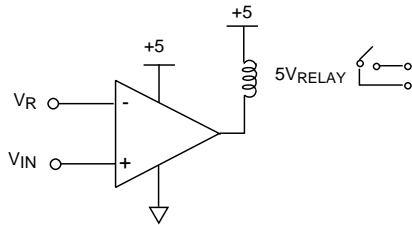


TYPICAL PERFORMANCE CHARACTERISTICS

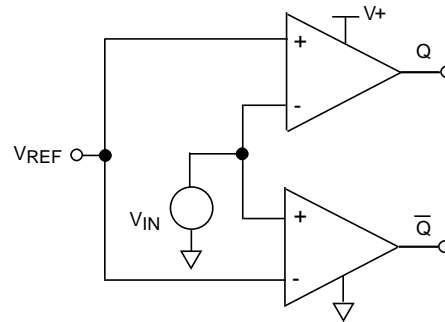


TYPICAL APPLICATIONS

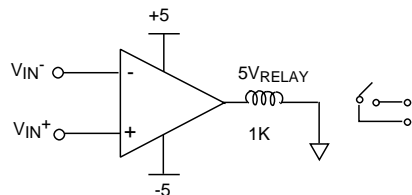
PRECISION SINGLE SUPPLY VOLTAGE COMPARATOR WITH DIRECT RELAY DRIVER



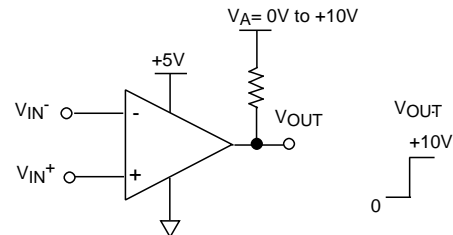
VOLTAGE COMPARATOR WITH COMPLEMENTARY OUTPUTS



VOLTAGE COMPARATOR WITH +/-5V SUPPLY AND +5V RELAY DRIVE

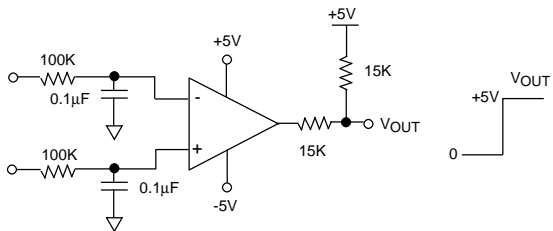


VOLTAGE COMPARATOR WITH SINGLE SUPPLY AND OUTPUT LEVEL SHIFT

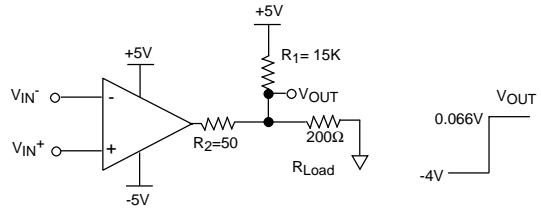


TYPICAL APPLICATIONS

VOLTAGE COMPARATOR WITH +/-5V SUPPLY AND OUTPUT LEVEL SHIFT

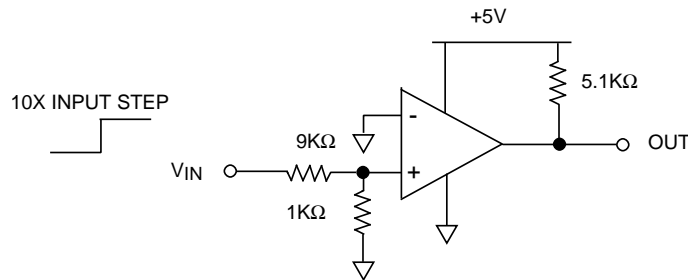


VOLTAGE COMPARATOR WITH OUTPUT LEVEL SHIFT AND HIGH CURRENT LOAD DRIVER

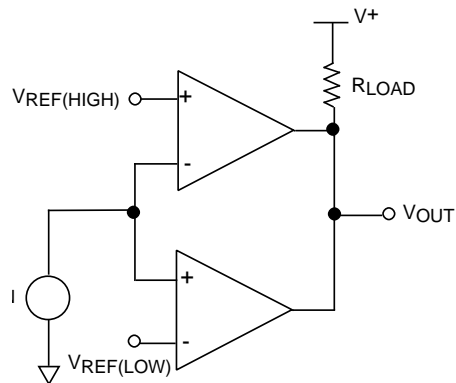


RESPONSE TIME MEASUREMENT CIRCUIT

Response time is defined as the interval between the application of an input step function and the instant when the output reaches 50% of its maximum value as measured by the following test circuit:



DUAL LIMIT WINDOW COMPARATOR

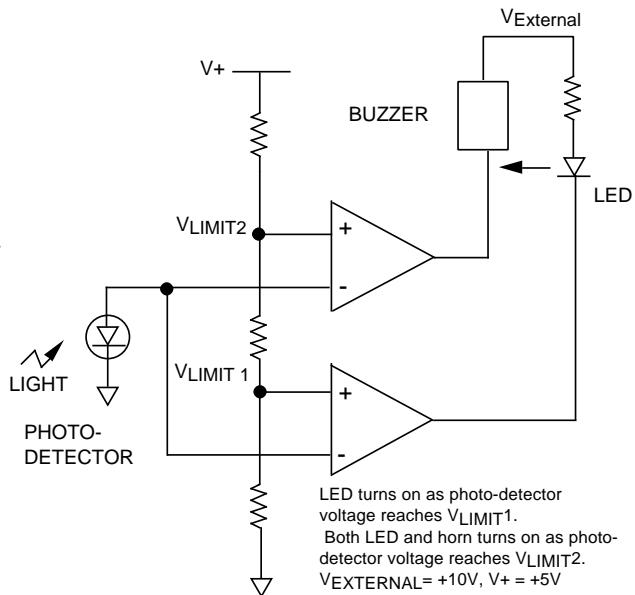


MINIMUM $R_{LOAD} = 1.5K\Omega$

OUTPUT HIGH FOR $V_{IN} < V_{REF(HIGH)}$

AND $V_{IN} > V_{REF(LOW)}$

DUAL LIMIT PHOTO DETECTOR MONITOR



LED turns on as photo-detector voltage reaches V_{LIMIT1} .
Both LED and horn turns on as photo-detector voltage reaches V_{LIMIT2} .
 $V_{EXTERNAL} = +10V$, $V_+ = +5V$