

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

**GENERAL DESCRIPTION**

The ALD2301A/ALD2301B/ALD2301C/ALD2301 is a monolithic high performance dual voltage comparator built with advanced silicon gate CMOS technology. It features very high typical input impedance of  $10^{12}\Omega$ ; low input bias current of 10pA; fast response time of 300ns; very low power dissipation of 55µA per comparator; and single (+5V) or dual ( $\pm 5V$ ) power supply operation.

The input voltage range includes ground, making this comparator ideal for low level signal detection with high source impedance. The outputs are open-drain configuration, allowing maximum application flexibility, such as wired-OR connection. The outputs can be connected to a higher external voltage than V+.

The ALD2301A/ALD2301B/ALD2301C/ALD2301 is ideal for a great variety of voltage comparator applications, especially low level signal detection circuits requiring low standby power, yet retaining high output current capability as needed.

**APPLICATIONS**

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

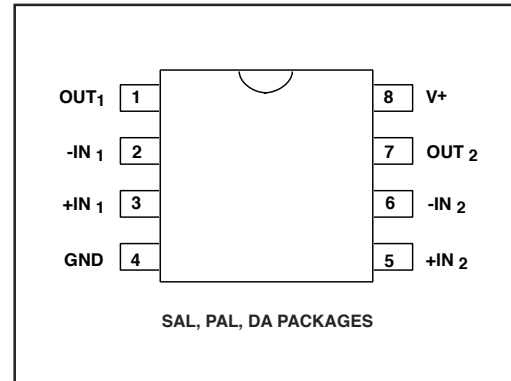
**BENEFITS**

- Low power and high precision combination
- Built-in high input impedance buffer
- Built-in output driver with up to 60mA sink current

**FEATURES**

- Fanout of 30LS TTL loads
- Low supply current of 110µA typical
- Functional equivalent to LM193 industry standard comparators
- Extremely low input bias currents -- typically 10pA
- Virtually eliminates source impedance effects
- Low operating supply voltage of 3V to 10V
- Single (+5V) and dual supply ( $\pm 5V$ ) operation
- High speed for both large signal and low level signals -- 300ns typical for TTL inputs
- CMOS, NMOS and TTL compatible
- Wired-OR open drain outputs
- High output sinking current -- typically 60mA
- Low supply current spikes

**PIN CONFIGURATION**

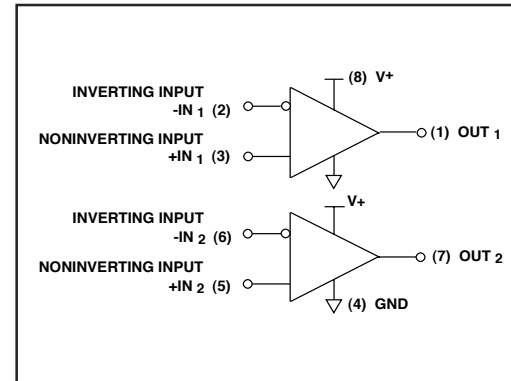


**ORDERING INFORMATION ("L" suffix for lead free version)**

Operating Temperature Range *		
0°C to +70°C	0°C to +70°C	-55°C to +125°C
8-Pin Small Outline Package (SOIC)	8-Pin Plastic Dip Package	8-Pin CERDIP Package
ALD2301ASAL	ALD2301APAL	ALD2301ADA
ALD2301BSAL	ALD2301BPAL	ALD2301BDA
ALD2301CSAL	ALD2301CPAL	ALD2301CDA
ALD2301SAL	ALD2301PAL	ALD2301DA

\* Contact factory for leaded (non-RoHS) or high temperature versions.

**BLOCK DIAGRAM**



## ABSOLUTE MAXIMUM RATINGS

Supply voltage, V<sub>S</sub> \_\_\_\_\_ 10.6V  
 Differential input voltage range \_\_\_\_\_ -0.3V to V<sub>S</sub> +0.3V  
 Power dissipation \_\_\_\_\_ 600 mW  
 Operating temperature range SAL, PAL packages \_\_\_\_\_ 0°C to +70°C  
 DA package \_\_\_\_\_ -55°C to +125°C  
 Storage temperature range \_\_\_\_\_ -65°C to +150°C  
 Lead temperature, 10 seconds \_\_\_\_\_ +260°C

## OPERATING ELECTRICAL CHARACTERISTICS

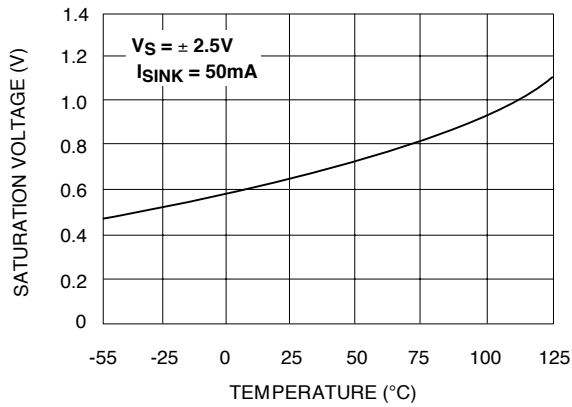
T<sub>A</sub> = 25°C V<sub>S</sub> = +5V unless otherwise specified

Parameter	Symbol	2301A			2301B			2301C			2301			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
Supply Voltage	V <sub>S</sub> V <sub>S</sub>	±1.5 3		±5 10	±1.5 3		±5 10	±1.5 3		±5 10	±1.5 3		±5 10	V V	Dual Supply Single Supply
Supply Current	I <sub>S</sub>		110	180		110	180		110	180		110	180	μA	R <sub>LOAD</sub> = ∞
Voltage Gain	A <sub>VD</sub>	50	150		50	150		50	150		50	150		V/mV	R <sub>LOAD</sub> ≥ 15KΩ
Input Offset Voltage	V <sub>OS</sub>			2 2.5			5 5.8			20 20			10 11	mV mV	R <sub>LOAD</sub> ≥ 1.5KΩ 0°C ≤ T <sub>A</sub> ≤ +70°C
Input Offset Current <sup>1</sup>	I <sub>OS</sub>		10	200		10	200		10	400		10	200	pA	
Input Bias Current <sup>1</sup>	I <sub>B</sub>		10	200		10	200		10	400		10	200	pA	
Common Mode Input Voltage Range <sup>2</sup>	V <sub>ICR</sub>	-0.3		V <sub>S</sub> -1.5	-0.3		V <sub>S</sub> -1.5	-0.3		V <sub>S</sub> -1.5	-0.3		V <sub>S</sub> -1.5	V	
Low Level Output Voltage	V <sub>OL</sub>		0.15	0.4		0.15	0.4		0.15	0.4		0.15	0.4	V	I <sub>SINK</sub> = 12mA V <sub>INPUT</sub> = 1V Differential
Low Level Output Current	I <sub>OL</sub>	24	60		24	60		24	60		24	60		mA	V <sub>OL</sub> = 1.0 V
High Level Leakage Current	I <sub>OH</sub>		.01	20		.01	20		.01	20		.01	20	nA	V <sub>OH</sub> = 5.0 V
Response Time <sup>2</sup>	t <sub>RP</sub>		650			650			650			650		ns	R <sub>L</sub> = 5.1KΩ C <sub>L</sub> = 15pF 100mV Input Step/5mV Overdrive
			300			300			300			300		ns	R <sub>L</sub> = 5.1KΩ C <sub>L</sub> = 15pF TTL - Level Input Step

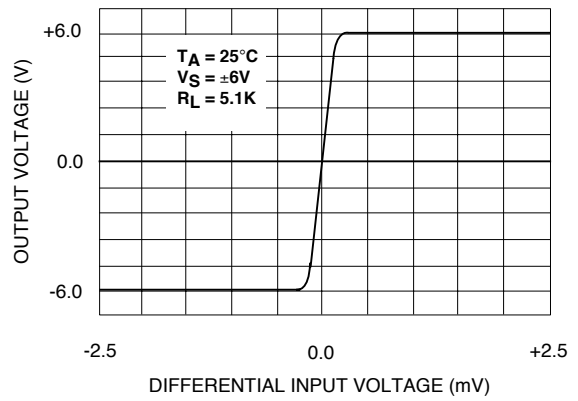
Notes : <sup>1</sup> Consists of junction leakage currents.  
<sup>2</sup> Sample tested parameters.

# TYPICAL PERFORMANCE CHARACTERISTICS

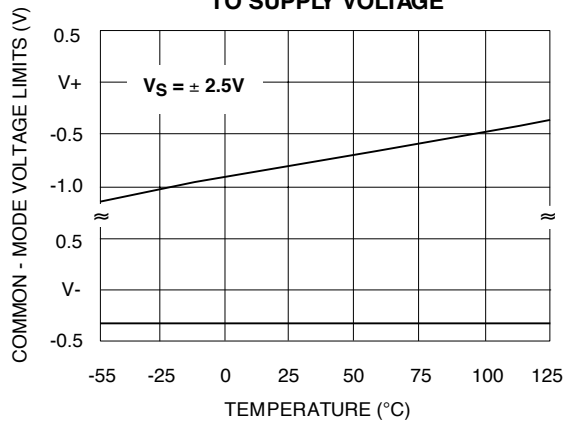
**SATURATION VOLTAGE vs. TEMPERATURE**



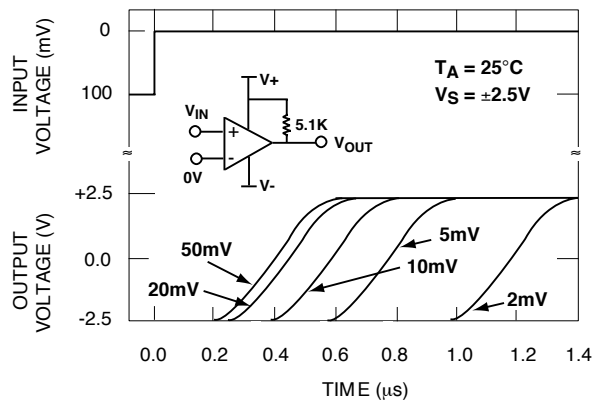
**TRANSFER FUNCTION**



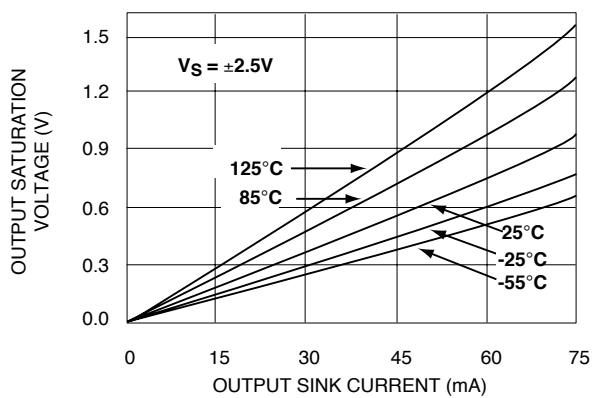
**COMMON - MODE VOLTAGE REFERRED TO SUPPLY VOLTAGE**



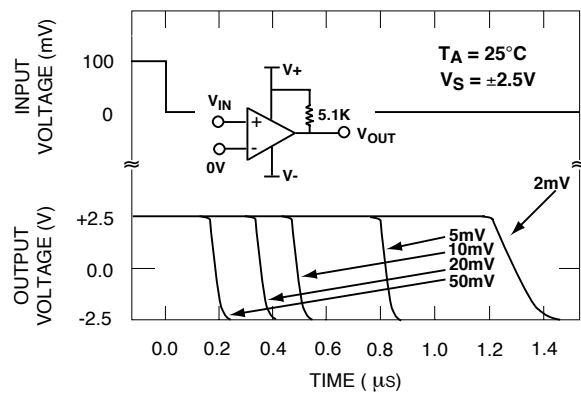
**RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES**



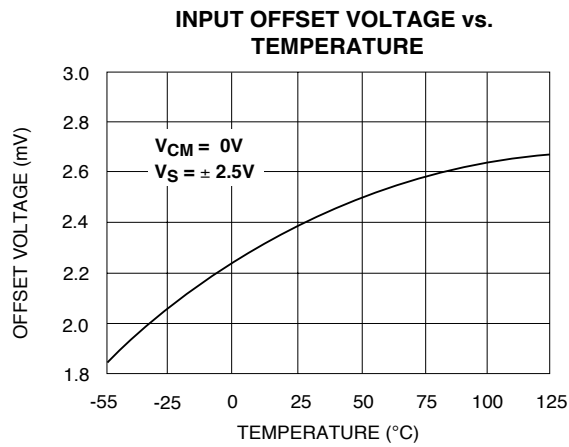
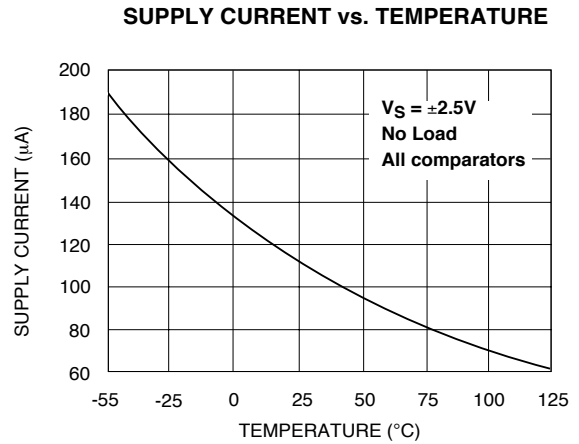
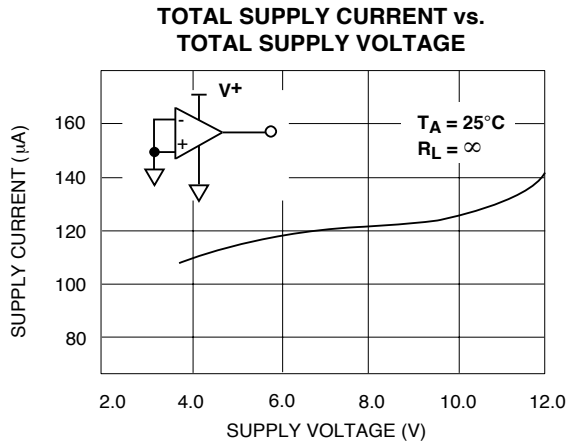
**SATURATION VOLTAGE vs. SINK CURRENT**



**RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES**

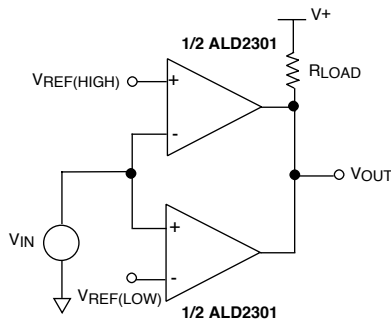


## TYPICAL PERFORMANCE CHARACTERISTICS (cont'd)



## TYPICAL APPLICATIONS

### DUAL LIMIT WINDOW COMPARATOR

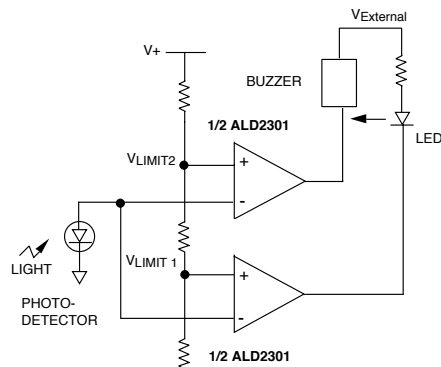


MINIMUM  $R_{LOAD} = 1.5K\Omega$

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

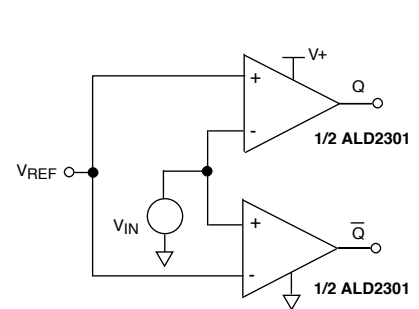
AND  $V_{IN} > V_{REF(LOW)}$

### DUAL LIMIT PHOTO-DETECTOR MONITOR



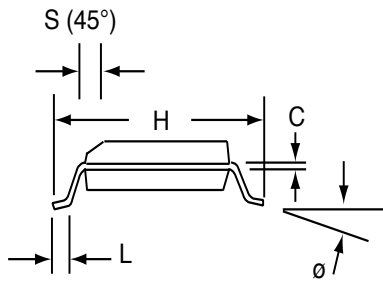
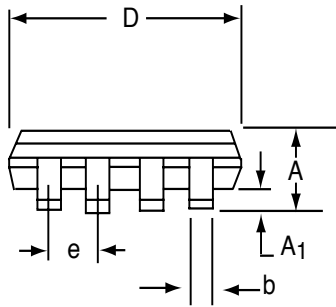
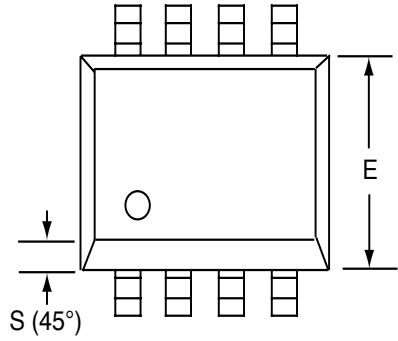
LED turns on as photo-detector voltage reaches  $V_{LIMIT1}$ . Both LED and horn turns on as photo-detector voltage reaches  $V_{LIMIT2}$ .  
VEXTERNAL = +12V V+ = +5V.

### VOLTAGE COMPARATOR WITH COMPLEMENTARY OUTPUTS



# SOIC-8 PACKAGE DRAWING

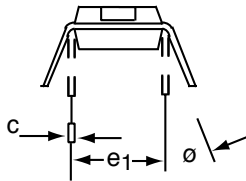
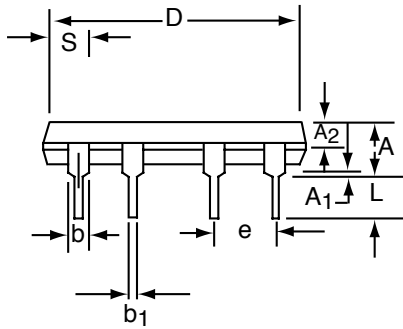
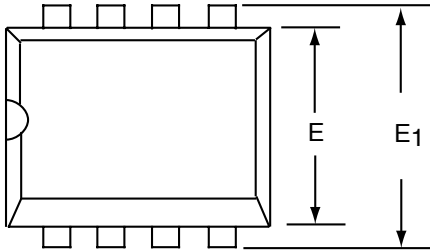
## 8 Pin Plastic SOIC Package



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A <sub>1</sub>	0.10	0.25	0.004	0.010
b	0.35	0.45	0.014	0.018
C	0.18	0.25	0.007	0.010
D-8	4.69	5.00	0.185	0.196
E	3.50	4.05	0.140	0.160
e	1.27 BSC		0.050 BSC	
H	5.70	6.30	0.224	0.248
L	0.60	0.937	0.024	0.037
∅	0°	8°	0°	8°
S	0.25	0.50	0.010	0.020

# PDIP-8 PACKAGE DRAWING

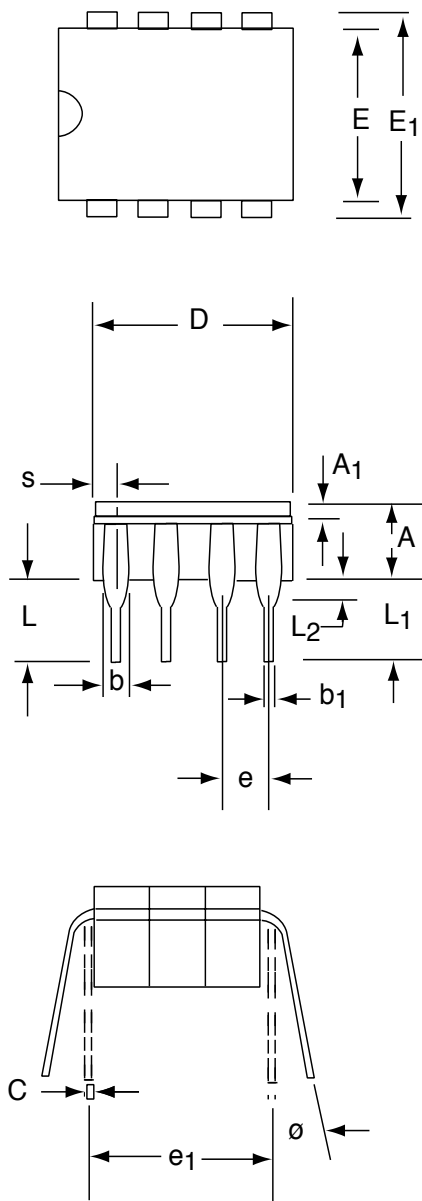
## 8 Pin Plastic DIP Package



Dim	Millimeters		Inches	
	Min	Max	Min	Max
<b>A</b>	3.81	5.08	0.105	0.200
<b>A<sub>1</sub></b>	0.38	1.27	0.015	0.050
<b>A<sub>2</sub></b>	1.27	2.03	0.050	0.080
<b>b</b>	0.89	1.65	0.035	0.065
<b>b<sub>1</sub></b>	0.38	0.51	0.015	0.020
<b>c</b>	0.20	0.30	0.008	0.012
<b>D-8</b>	9.40	11.68	0.370	0.460
<b>E</b>	5.59	7.11	0.220	0.280
<b>E<sub>1</sub></b>	7.62	8.26	0.300	0.325
<b>e</b>	2.29	2.79	0.090	0.110
<b>e<sub>1</sub></b>	7.37	7.87	0.290	0.310
<b>L</b>	2.79	3.81	0.110	0.150
<b>S-8</b>	1.02	2.03	0.040	0.080
<b>θ</b>	0°	15°	0°	15°

# CERDIP-8 PACKAGE DRAWING

## 8 Pin CERDIP Package



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	3.55	5.08	0.140	0.200
A <sub>1</sub>	1.27	2.16	0.050	0.085
b	0.97	1.65	0.038	0.065
b <sub>1</sub>	0.36	0.58	0.014	0.023
C	0.20	0.38	0.008	0.015
D-8	--	10.29	--	0.405
E	5.59	7.87	0.220	0.310
E <sub>1</sub>	7.73	8.26	0.290	0.325
e	2.54 BSC		0.100 BSC	
e <sub>1</sub>	7.62 BSC		0.300 BSC	
L	3.81	5.08	0.150	0.200
L <sub>1</sub>	3.18	--	0.125	--
L <sub>2</sub>	0.38	1.78	0.015	0.070
S	--	2.49	--	0.098
Ø	0°	15°	0°	15°