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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 55μA per comparator; and single (+5V) or dual (±5V) power supply operation; and 50mA 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^+.

The ALD2331A/ALD2331B/ALD2331 is ideal for a great variety of precison analog voltage comparator applications, especially low level signal detection circuits requiring low standby power, yet retaining high output current capability as needed.

FEATURES

- Fanout of 30LS TTL loads
- Guaranteed to drive 200Ω loads
- Low supply current of 55μA typical
- Pinout of LM193 industry standard voltage 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 (±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 spike

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

Operating Temperature Range *	
0°C to +70°C	0°C to +70°C
8-Pin Small Outline Package (SOIC)	8-PinPlastic Dip Package
ALD2331ASAL	ALD2331APAL
ALD2331BSAL	ALD2331BPAL
ALD2331SAL	ALD2331PAL

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

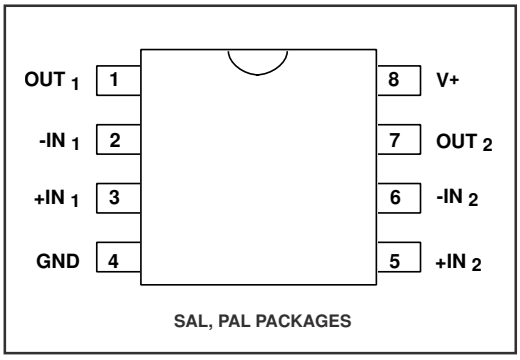
APPLICATIONS

- Simple precision reference voltage setting
- 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

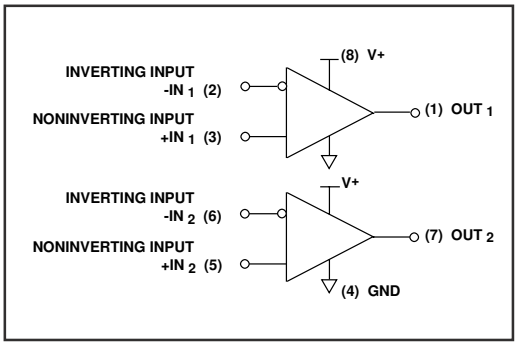
- Simple precision reference voltage setting
- On-chip input pre-amplifier and output buffers
- Precision voltage comparison without pre-amplifier
- Eliminates need for second power supply
- Wide range of pull-up resistor values

PIN CONFIGURATION



SAL, PAL PACKAGES

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 SAL, PAL packages	0°C to +70°C
Storage temperature range	-65°C to +150°C
Lead temperature, 10 seconds	+260°C

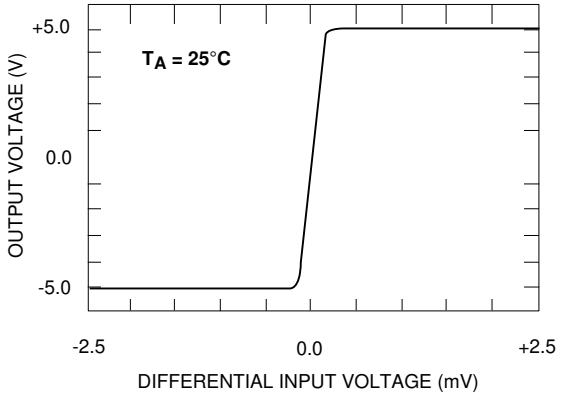
OPERATING ELECTRICAL CHARACTERISTICS
T_A = 25°C V+ = +5V unless otherwise specified

Parameter	Symbol	2331A			2331B			2331			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
Supply Voltage	V_S V+	±1.5 3		±5 10	±1.5 3		±5 10	±1.5 3		±5 10	V V	Dual Supply Single Supply
Supply Current	I_S		110	180		110	180		110	180	µA	No Load Two Comparators
Voltage Gain	A_{VD}	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 1mVInput 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

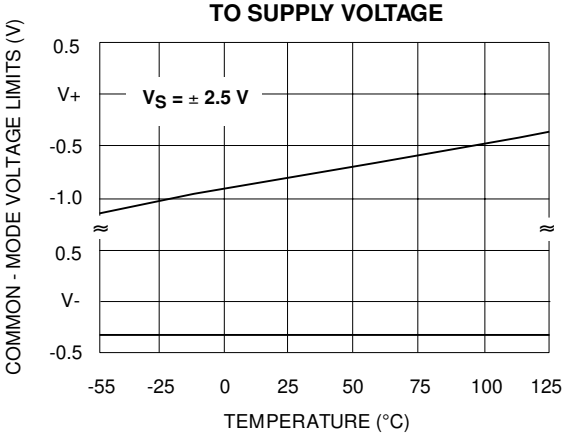
Notes: [1] Consists of junction leakage currents
[2] Sample test parameter

TYPICAL PERFORMANCE CHARACTERISTICS

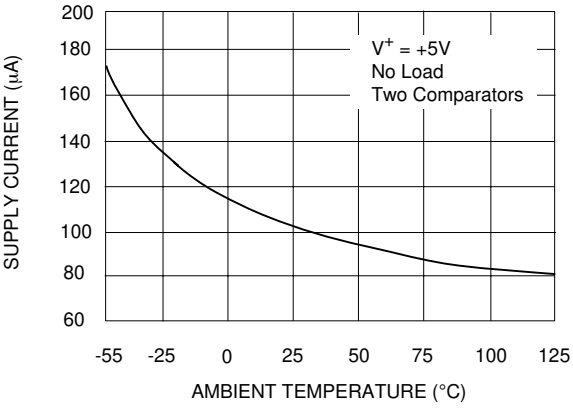
TRANSFER FUNCTION



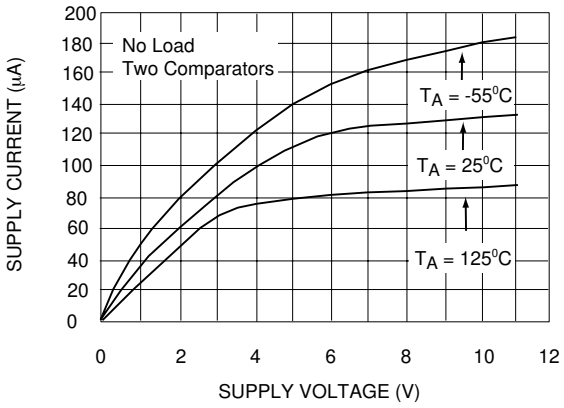
COMMON - MODE VOLTAGE REFERRED TO SUPPLY VOLTAGE



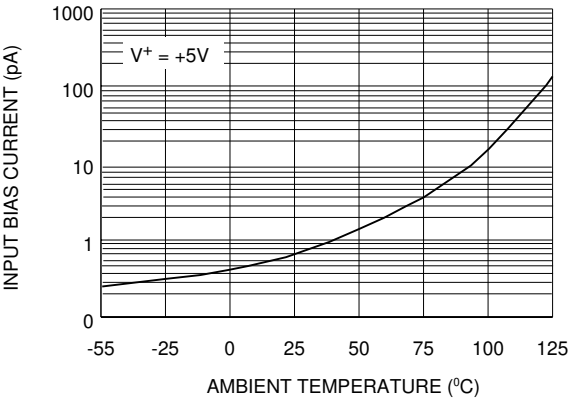
SUPPLY CURRENT vs.TEMPERATURE



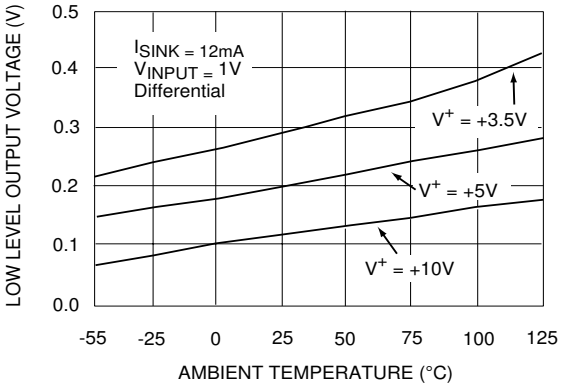
SUPPLY CURRENT vs. SUPPLY VOLTAGE



INPUT BIAS CURRENT vs. TEMPERATURE

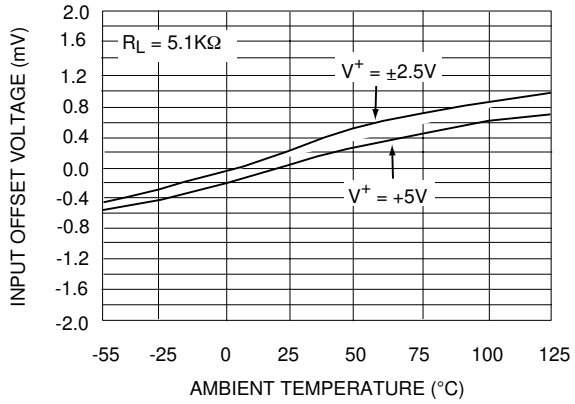


LOW LEVEL OUTPUT VOLTAGE vs. TEMPERATURE

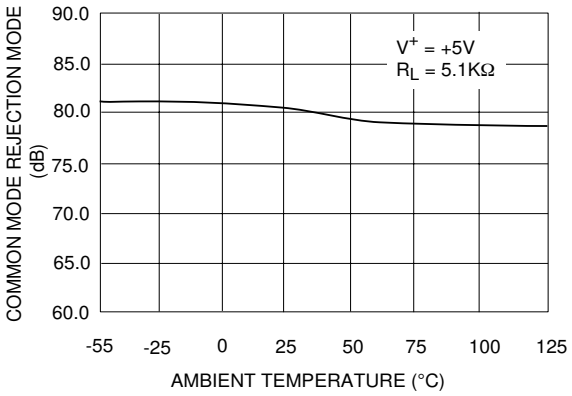


TYPICAL PERFORMANCE CHARACTERISTICS (cont'd)

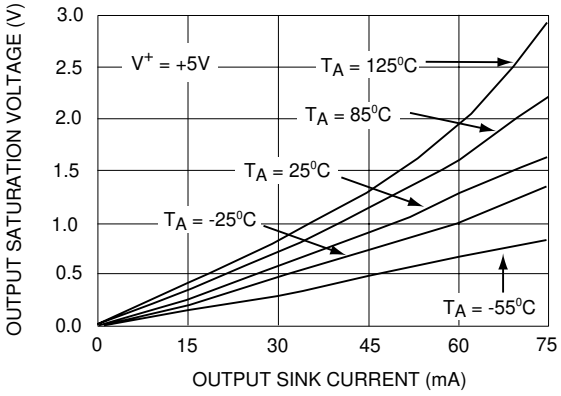
INPUT OFFSET VOLTAGE vs. TEMPERATURE



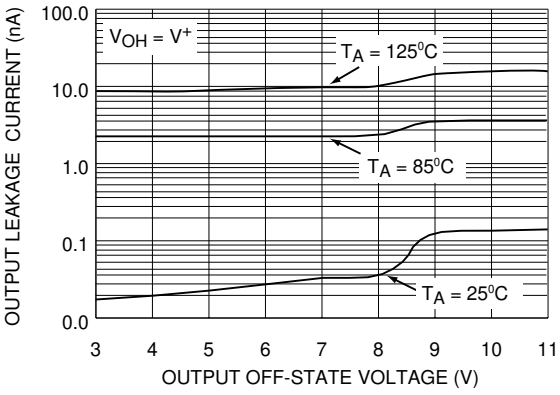
COMMON MODE REJECTION RATIO vs. TEMPERATURE



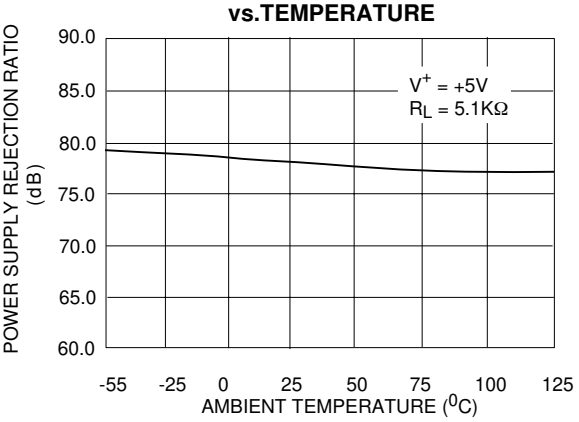
SATURATION VOLTAGE vs. SINK CURRENT



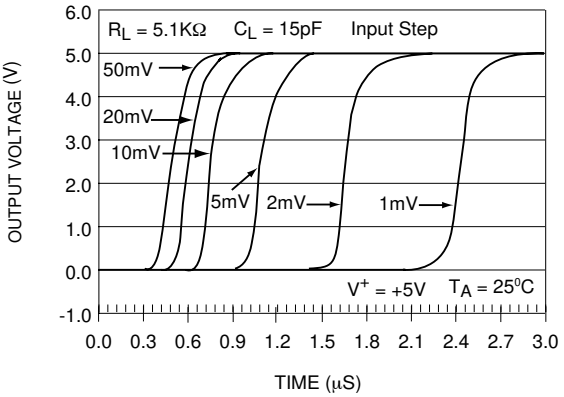
OUTPUT OFF-STATE VOLTAGE vs. OUTPUT LEAKAGE CURRENT



POWER SUPPLY REJECTION RATIO vs.TEMPERATURE

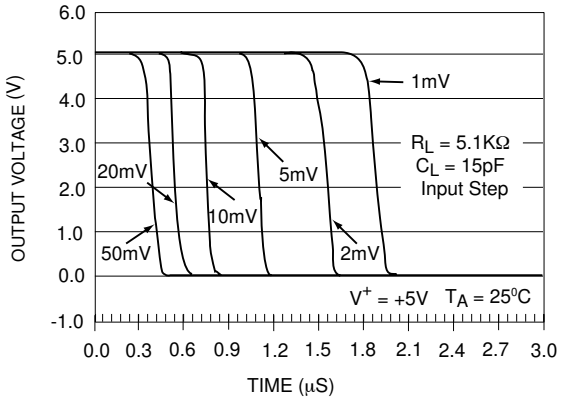


RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES

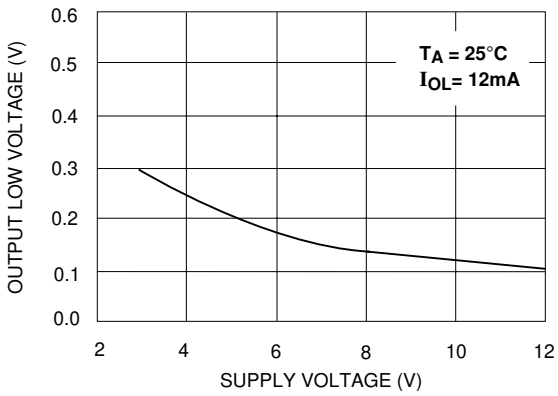


TYPICAL PERFORMANCE CHARACTERISTICS (cont'd)

RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES

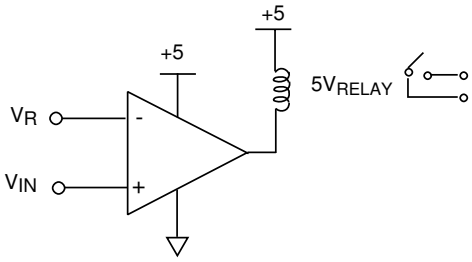


OUTPUT LOW VOLTAGE vs. SUPPLY VOLTAGE

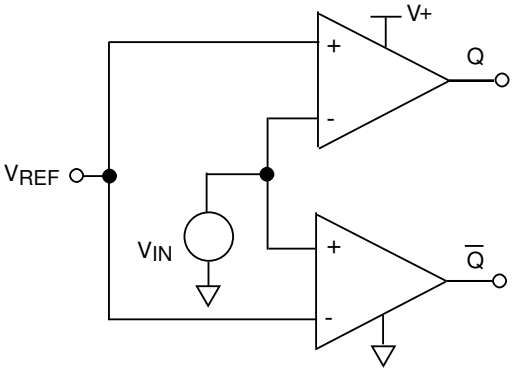


TYPICAL APPLICATIONS

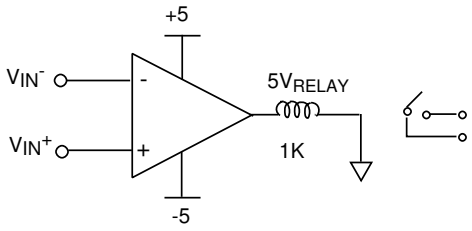
PRECISION SINGLE SUPPLY VOLTAGE COMPARATOR WITH DIRECT RELAY DRIVER



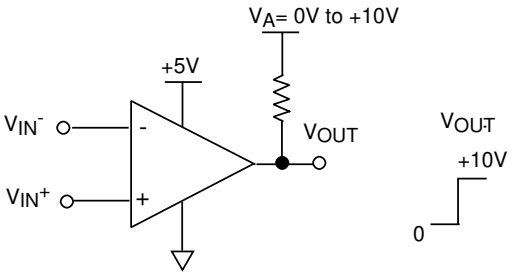
VOLTAGE COMPARATOR WITH COMPLEMENTARY OUTPUTS



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

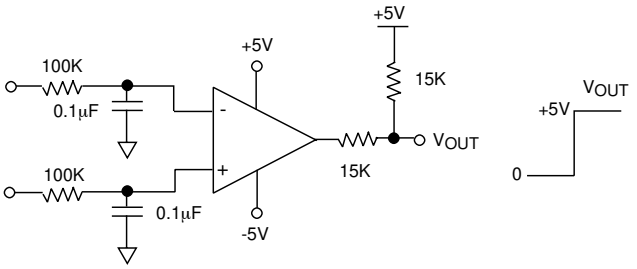


VOLTAGE COMPARATOR WITH SINGLE SUPPLY AND OUTPUT LEVEL SHIFT

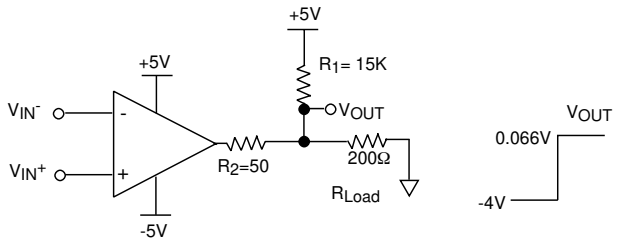


TYPICAL APPLICATIONS (cont'd)

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

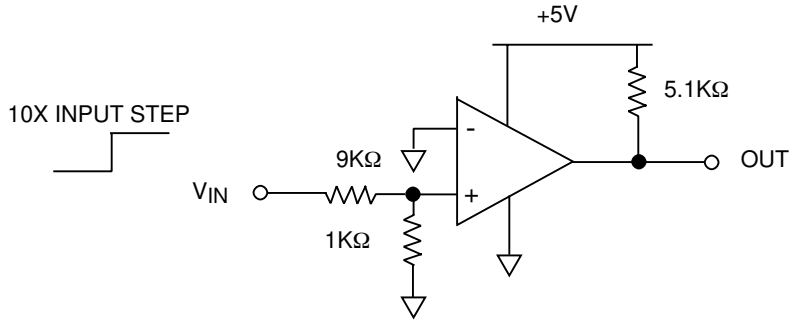


VOLTAGE COMPARATOR WITH OUTPUT LEVEL SHIFT AND HIGH CURRENT LOAD DRIVER

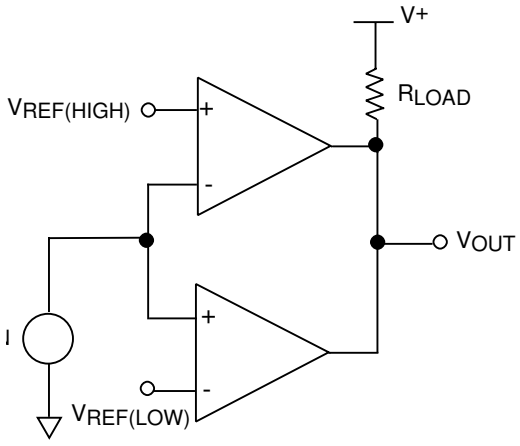


RESPONSE TIME MEASUREMENT CIRCUIT

Response time is defined as the internal 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

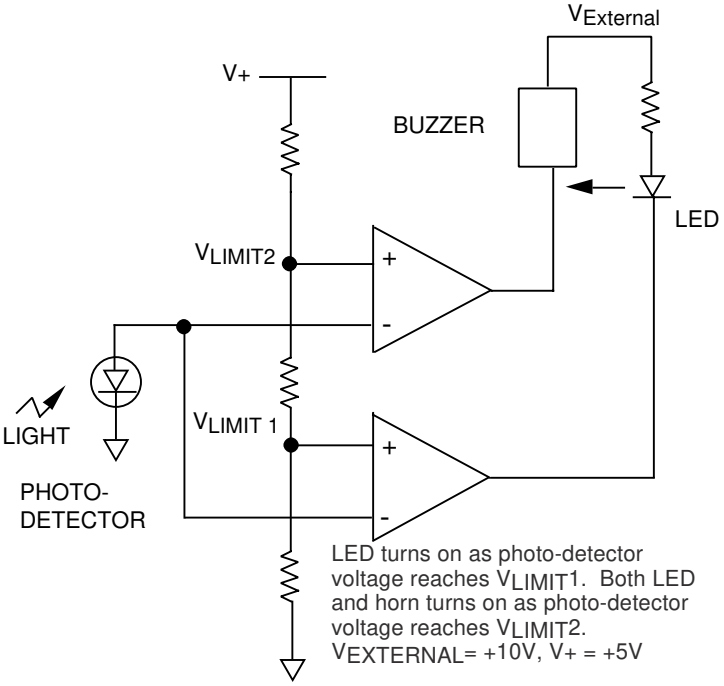


MINIMUM R_{LOAD} = 1.5KΩ

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

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

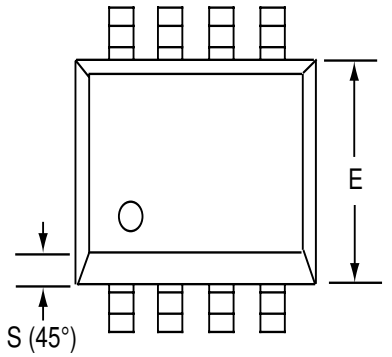
DUAL LIMIT PHOTO DETECTOR MONITOR

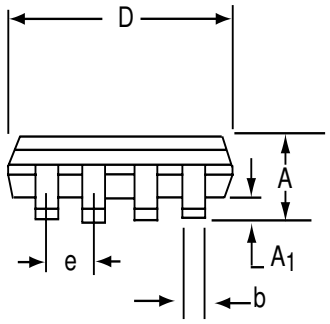


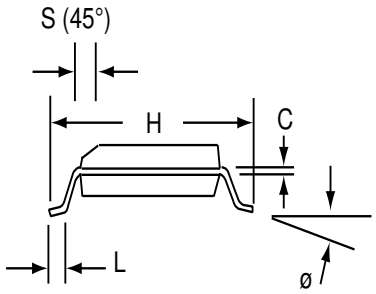
LED turns on as photo-detector voltage reaches $V_{LIMIT}1$. Both LED and horn turns on as photo-detector voltage reaches $V_{LIMIT}2$. $V_{EXTERNAL}$= +10V, V+ = +5V

SOIC-8 PACKAGE DRAWING

8 Pin Plastic SOIC Package



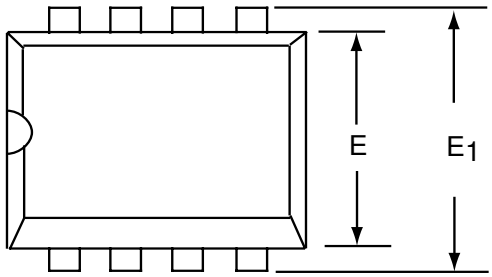


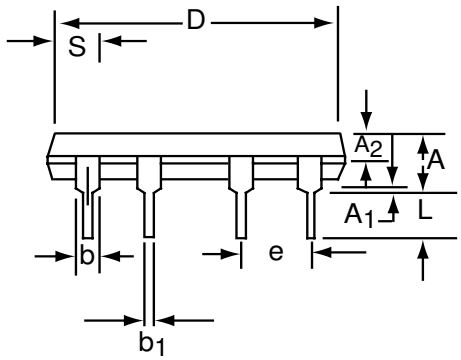


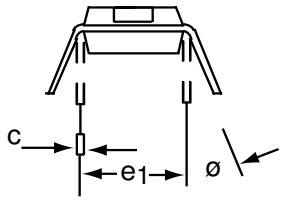
Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A_1	0.10	0.25	0.004	0.010
b	0.35	0.45	0.014	0.018
C	0.18	0.25	0.007	0.010
D-8	4.69	5.00	0.185	0.196
E	3.50	4.05	0.140	0.160
e	1.27 BSC		0.050 BSC	
H	5.70	6.30	0.224	0.248
L	0.60	0.937	0.024	0.037
Ø	0°	8°	0°	8°
S	0.25	0.50	0.010	0.020

PDIP-8 PACKAGE DRAWING

8 Pin Plastic DIP Package







Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	3.81	5.08	0.105	0.200
A_1	0.38	1.27	0.015	0.050
A_2	1.27	2.03	0.050	0.080
b	0.89	1.65	0.035	0.065
b_1	0.38	0.51	0.015	0.020
c	0.20	0.30	0.008	0.012
D-8	9.40	11.68	0.370	0.460
E	5.59	7.11	0.220	0.280
E_1	7.62	8.26	0.300	0.325
e	2.29	2.79	0.090	0.110
e_1	7.37	7.87	0.290	0.310
L	2.79	3.81	0.110	0.150
S-8	1.02	2.03	0.040	0.080
ø	0°	15°	0°	15°