



## DUAL PRECISION MICROPPOWER CMOS VOLTAGE COMPARATOR WITH DRIVER

### GENERAL DESCRIPTION

The ALD2303A/ALD2303 is a precision 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  $10\text{pA}$ ; very low power dissipation of  $7.5\mu\text{A}$  per comparator; and single (+5V) or dual ( $\pm 5\text{V}$ ) power supply operation.

The input voltage range includes ground, making this comparator ideal for single supply low level signal detection with high source impedance. The ALD2303A/ALD2303 can be used in connection with other voltage comparator circuits such as the ALD2301/ALD2302/ALD4302 voltage comparators. The output can be connected to a higher external voltage than  $V^+$ .

The ALD2303A/ALD2303 is ideal for high precision micropower voltage comparator applications, especially low level signal detection circuits requiring low standby power, yet retaining high output current capability.

### APPLICATIONS

- Sensor detection circuits
- PCMCIA instruments
- MOSFET driver
- High source impedance voltage comparison circuits
- Multiple limit window comparator
- Power supply voltage monitor
- Photodetector sensor circuit
- High speed LED driver
- Oscillators
- Battery operated instruments
- Remote signal detection
- Multiple relay drivers

### BENEFITS

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

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

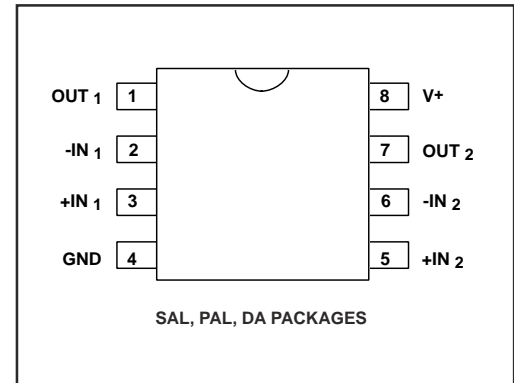
Operating Temperature Range *		
0°C to +70°C	0°C to +70°C	-55°C to +125°C
8-Pin Small Outline Package (SOIC)	8-Pin Plastic Dip Package	8-Pin CERDIP Package
ALD2303ASAL	ALD2303APAL	ALD2303ADA
ALD2303SAL	ALD2303APAL	ALD2303DA

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

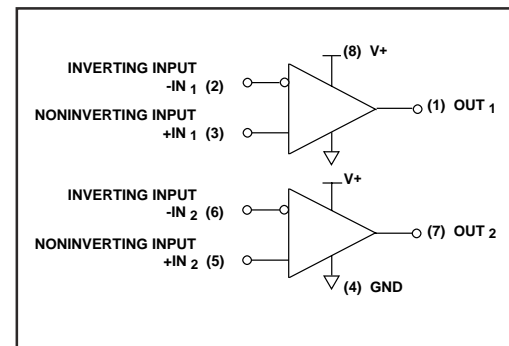
### FEATURES

- 3V, 5V, and 10V supply
- Guaranteed to drive  $200\Omega$  loads
- Fanout of 30LS TTL loads
- Guaranteed maximum supply current of  $20\mu\text{A}$  for each comparator
- Pinout of LM193 type industry standard comparators
- Extremely low input bias currents -- typically  $10\text{pA}$
- Virtually eliminates source impedance effects
- Single (+5V) and dual supply ( $\pm 5\text{V}$ ) operation
- CMOS, NMOS and TTL compatible
- Open drain wired-OR outputs
- High output sinking current -- typically 60mA
- Low supply current spikes
- High gain --  $100\text{V/mV}$

### 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	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>+</sub> = +5V unless otherwise specified

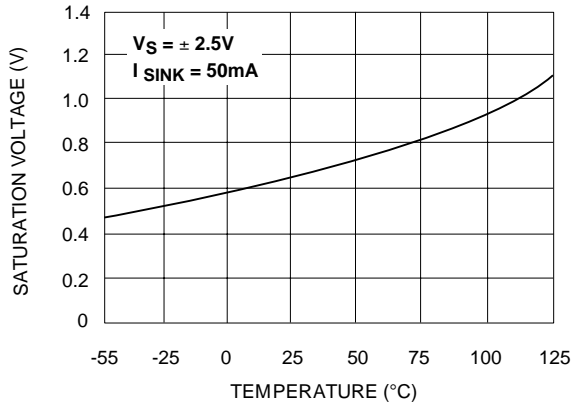
Parameter	Symbol	2303A			2303			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max		
Supply Voltage	V <sub>S</sub>	±1.5		±5	±1.5		±5	V	Dual Supply
	V <sup>+</sup>	3		10	3		10	V	Single Supply
Supply Current	I <sub>S</sub>		15	40		15	40	μA	R <sub>LOAD</sub> = ∞
Voltage Gain	A <sub>VD</sub>	10	100		10	100		V/mV	R <sub>LOAD</sub> ≥ 15KΩ
Input Offset Voltage	V <sub>OS</sub>		0.5	1.0 2.0		1.5	4.0 5.0	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	200 800		10	200 800	pA	0°C ≤ T <sub>A</sub> ≤ 70°C
Input Bias Current <sup>1</sup>	I <sub>B</sub>		10	200 1000		10	200 1000	pA	0°C ≤ T <sub>A</sub> ≤ 70°C
Common Mode Input Voltage Range <sup>2</sup>	V <sub>ICR</sub>	-0.3		V <sup>+</sup> -1.5	-0.3		V <sup>+</sup> -1.5	V	
Low Level Output Voltage	V <sub>OL</sub>		0.18	0.4		0.18	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		mA	V <sub>OL</sub> = 1.0V
High Level Leakage Current	I <sub>LH</sub>		0.01	20		0.01	20	nA	V <sub>OH</sub> = 5.0V
Response Time <sup>2</sup>	t <sub>RP</sub>		6.5			6.5		μs	R <sub>L</sub> = 50KΩ C <sub>L</sub> = 15pF 10mV Input Step/10mV Overdrive
			5			5		μs	R <sub>L</sub> = 50KΩ C <sub>L</sub> = 15pF TTL- Level Input Step

Notes: <sup>1</sup> Consists of junction leakage currents

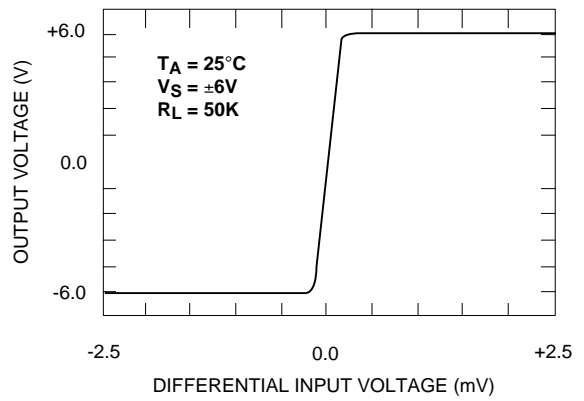
<sup>2</sup> Sample tested parameters

# TYPICAL PERFORMANCE CHARACTERISTICS

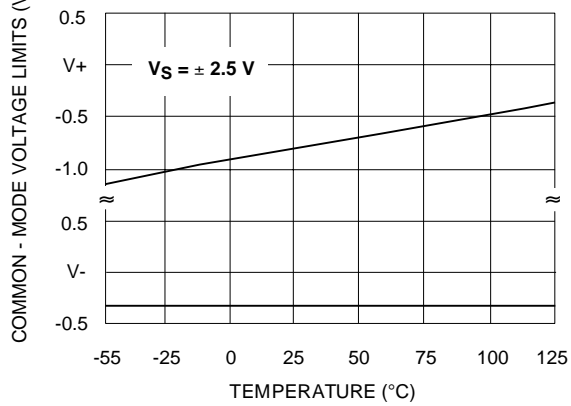
**SATURATION VOLTAGE vs. TEMPERATURE**



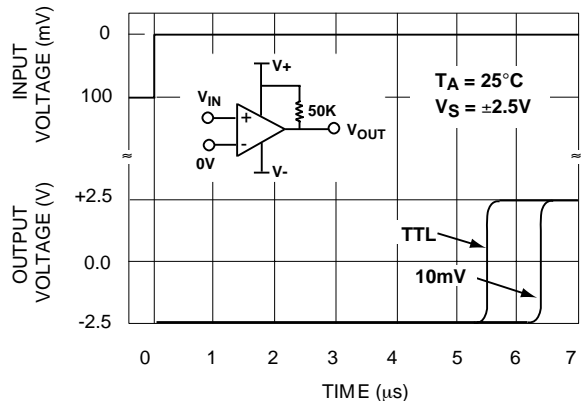
**TRANSFER FUNCTION**



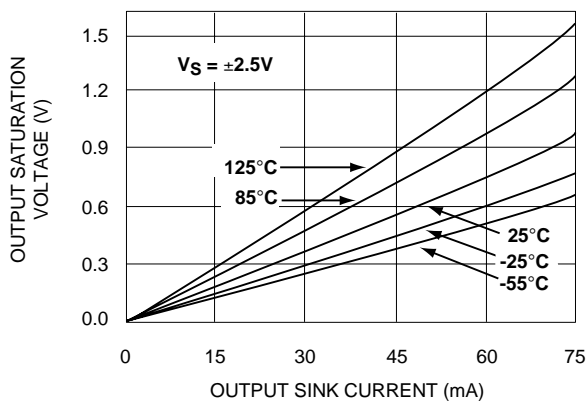
**COMMON - MODE VOLTAGE REFERRED TO SUPPLY VOLTAGE**



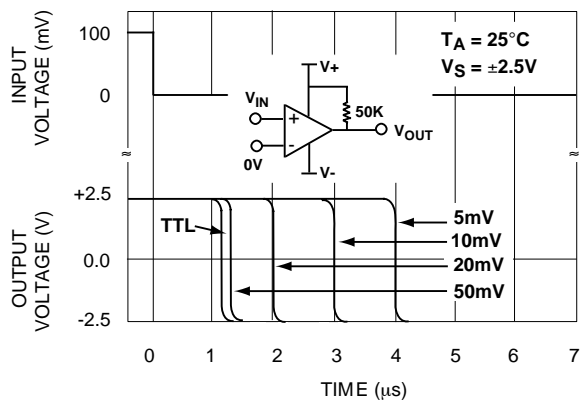
**RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES**



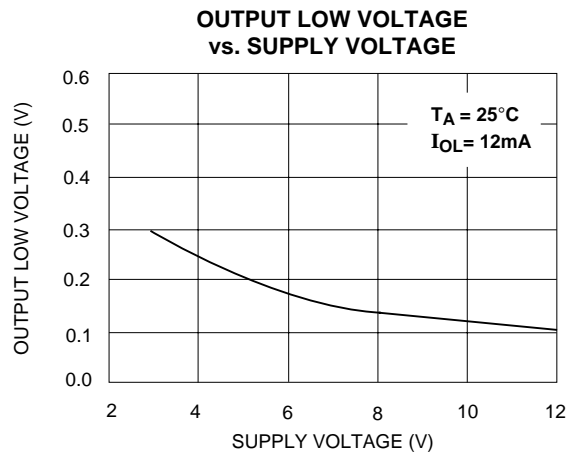
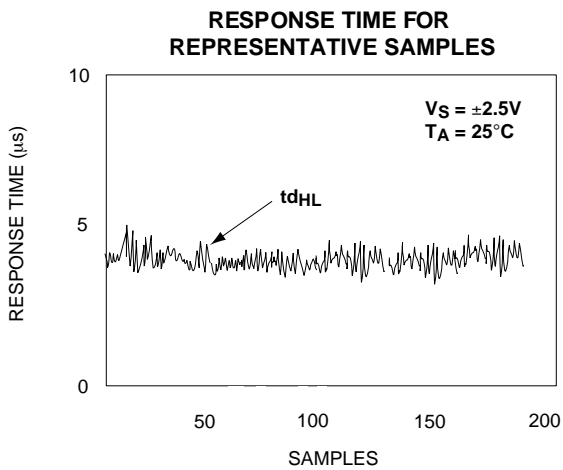
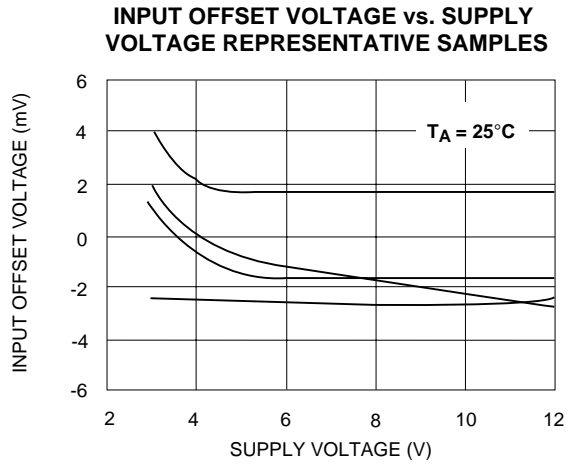
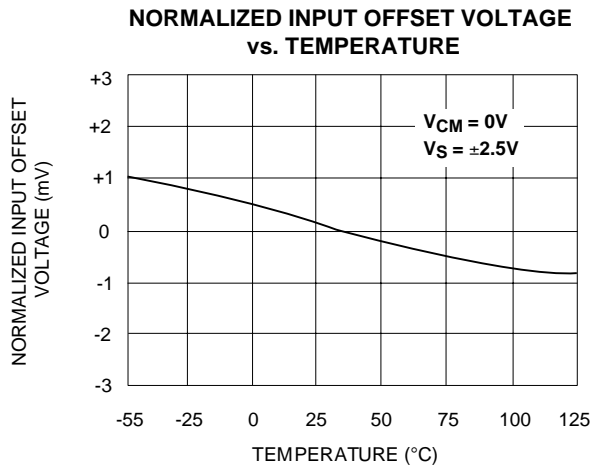
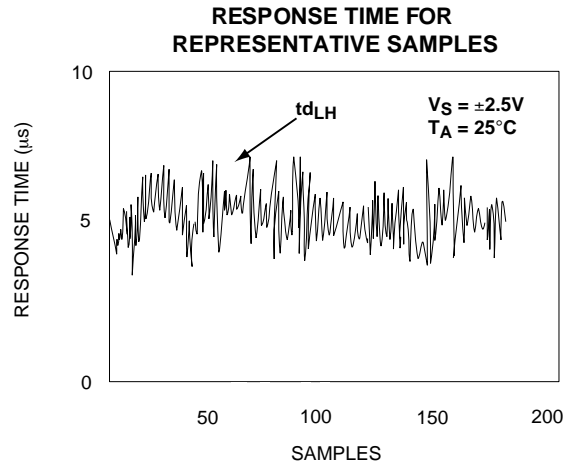
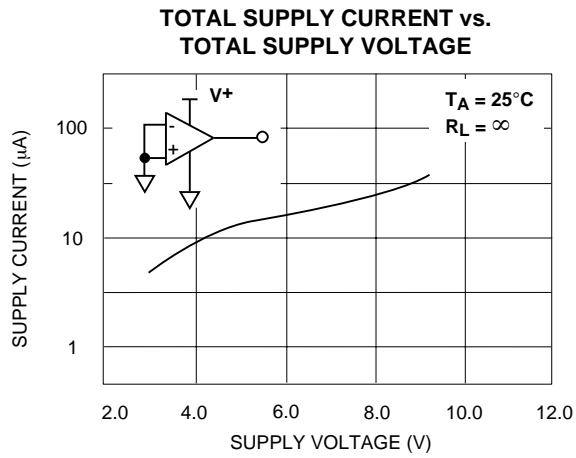
**SATURATION VOLTAGE vs. SINK CURRENT**



**RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES**

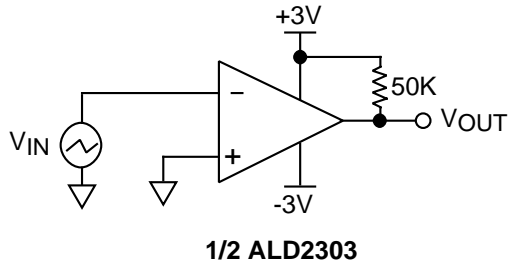


## TYPICAL PERFORMANCE CHARACTERISTICS (cont'd)

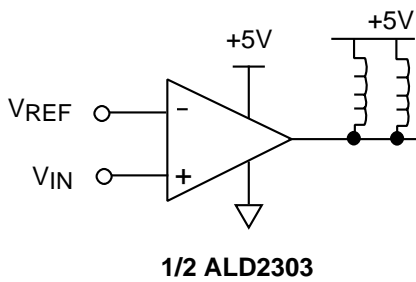


## TYPICAL APPLICATIONS

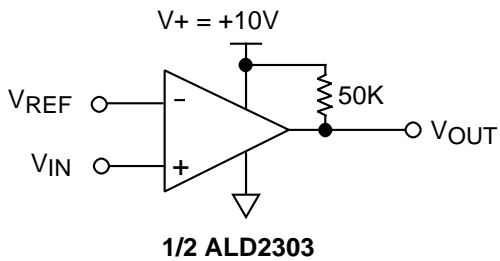
### ZERO CROSSING DETECTOR



### MULTIPLE RELAY DRIVE



### VOLTAGE LEVEL TRANSLATOR

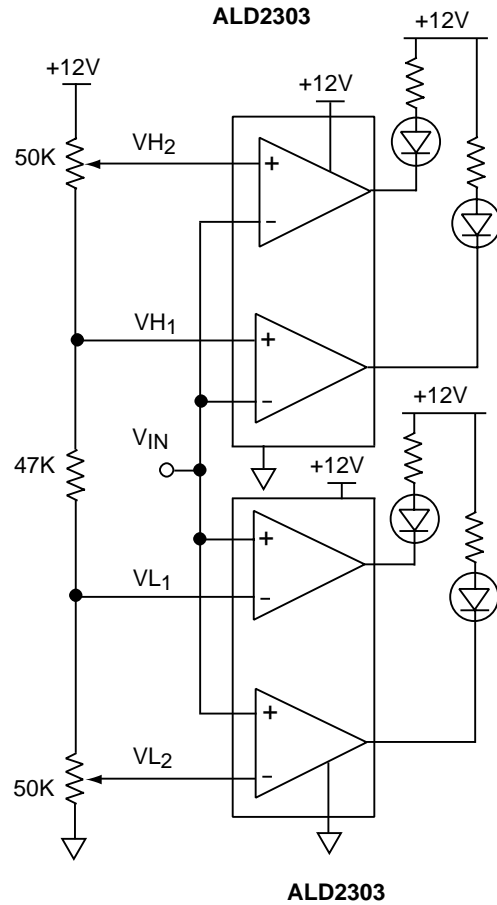


$V_{REF} = 1.4V$  for TTL input

$V_{REF} = \frac{V^+}{2}$  for CMOS input

Output  $V_{OUT}$  swings from rail-to-rail

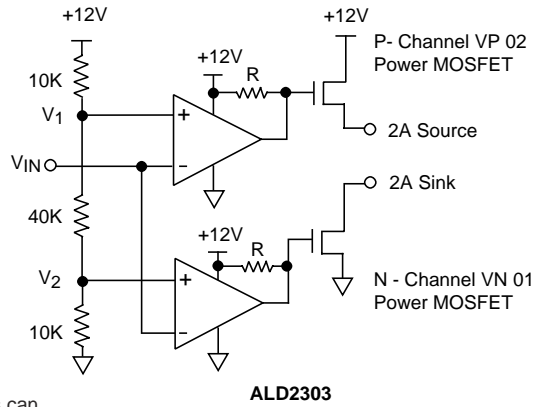
### DOUBLE DUAL LIMIT WINDOW COMPARATOR



VL1 and VH1 first limit window send warning.  
VL2 and VH2 second limit window execute system cutoff.

## TYPICAL APPLICATIONS (cont'd)

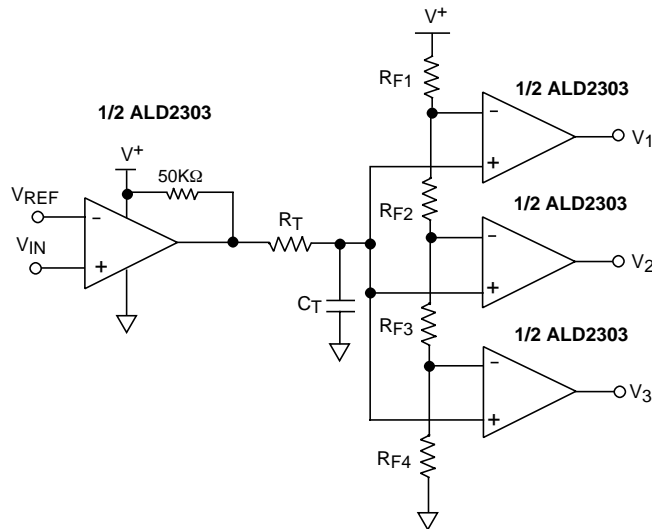
### PUSH-PULL COMPLEMENTARY POWER MOSFET DRIVER



$R \geq 50 \text{ K}\Omega$

This circuit eliminates crossover current in the complementary power transistors. The outputs can be used to source and sink different loads or tied together to provide push-pull drive of the same load.

### TIME DELAY GENERATOR

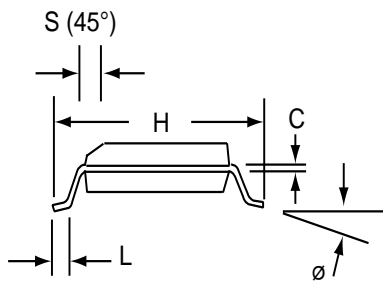
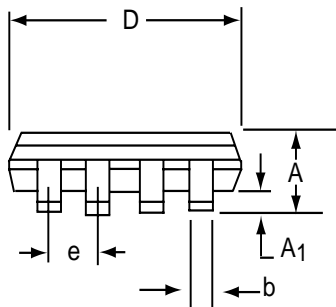
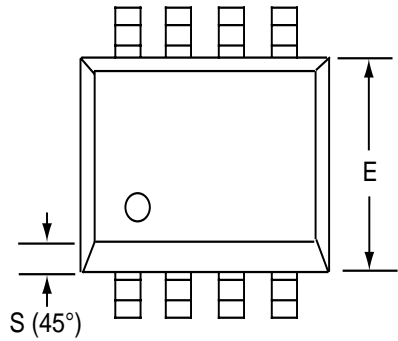


#### Design & Operating Notes:

1. In order to minimize stray oscillation, all unused inputs must be tied to ground.
2. The input bias and offset currents are essentially input protection diode reverse bias leakage currents, and are typically less than 1pA at room temperature. These currents are a function of ambient temperature, and would have to be considered in applications where very high source impedance or high accuracy are involved.
3. The high output sinking current of 60mA for each output offers flexibility in many applications, as a separate buffer or driver would not be necessary to drive the intended load. However, as the circuit normally operates close to ambient temperature due to its very low power consumption, thermal effects caused by large output current transients must be considered in certain applications.

# SOIC-8 PACKAGE DRAWING

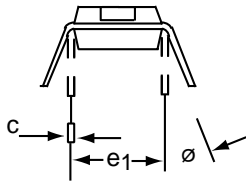
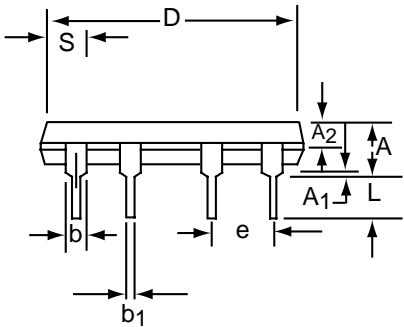
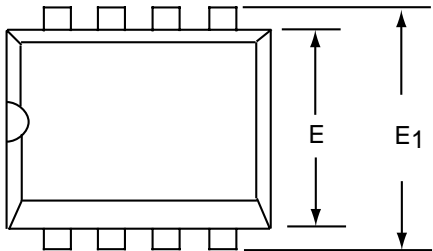
## 8 Pin Plastic SOIC Package



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
Ø	0°	8°	0°	8°
S	0.25	0.50	0.010	0.020

# PDIP-8 PACKAGE DRAWING

## 8 Pin Plastic DIP Package

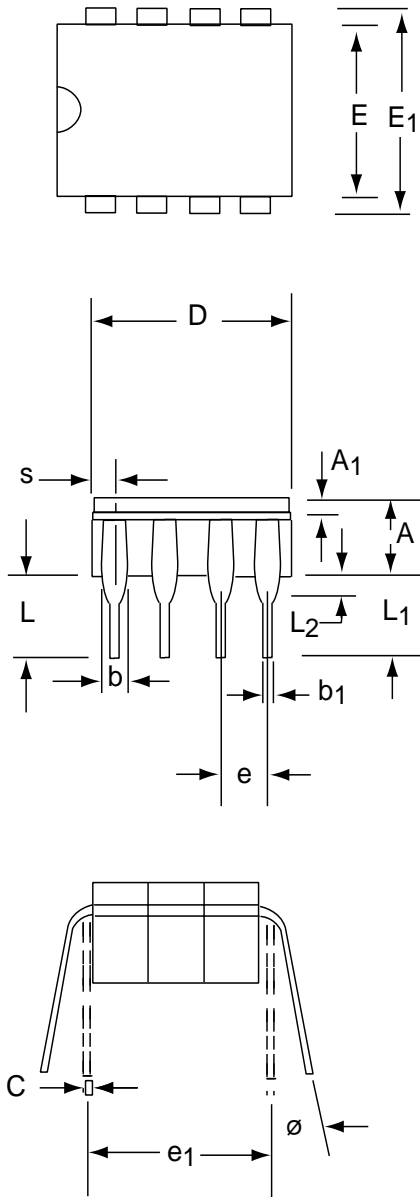


Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	3.81	5.08	0.105	0.200
A <sub>1</sub>	0.38	1.27	0.015	0.050
A <sub>2</sub>	1.27	2.03	0.050	0.080
b	0.89	1.65	0.035	0.065
b <sub>1</sub>	0.38	0.51	0.015	0.020
c	0.20	0.30	0.008	0.012
D-8	9.40	11.68	0.370	0.460
E	5.59	7.11	0.220	0.280
E <sub>1</sub>	7.62	8.26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