

QUAD PRECISION CMOS VOLTAGE COMPARATOR WITH PUSH-PULL DRIVER

GENERAL DESCRIPTION

The ALD4302A/ALD4302 is a monolithic high performance quad 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 120ns; very low power dissipation of 150µA per comparator; and single (+5V) or dual ($\pm 5V$) 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 outputs can source and sink current, allowing application flexibility, and can be used in either wired-OR connection without pull up resistor or push-pull configuration. The ALD4302A/ALD4302 can be used in wired-OR connections with other open drain circuits such as the ALD2301 and ALD2303 voltage comparators.

The ALD4302A/ALD4302 is ideal for a great variety of precision voltage comparator applications, especially low level signal detection circuits requiring low standby power, yet retaining high output current capability.

FEATURES

- Guaranteed to drive 200Ω loads
- Fanout of 30LS TTL loads
- Low supply current of 150µA each comparator
- Extremely low input bias currents -- typically 10pA
- Virtually eliminates source impedance effects
- Low operating supply voltage of 4V to 10V
- Single (+5V) and dual supply ($\pm 5V$) operation
- High speed for both large and small signals - 120ns for TTL inputs and 400ns for 5mV overdrive
- CMOS, NMOS and TTL compatible
- Push-pull outputs
- High output sinking current -- typically 60mA
- Low supply current spikes
- High gain -- 100V/mV

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

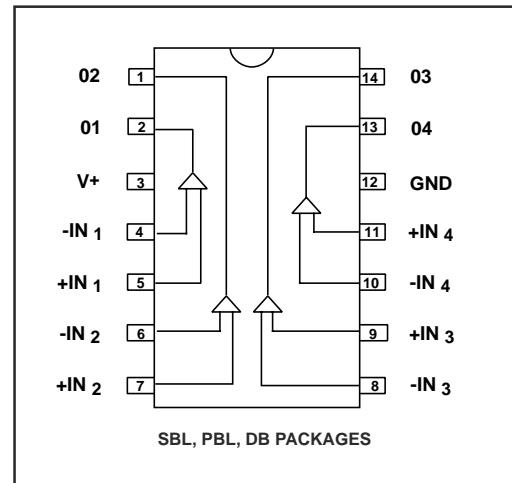
Operating Temperature Range *		
0°C to +70°C	0°C to +70°C	-55°C to +125°C
14-Pin Small Outline Package (SOIC)	14-Pin Plastic Dip Package	14-Pin CERDIP Package
ALD4302ASBL	ALD4302APBL	ALD4302ADB
ALD4302SBL	ALD4302PBL	ALD4302DB

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

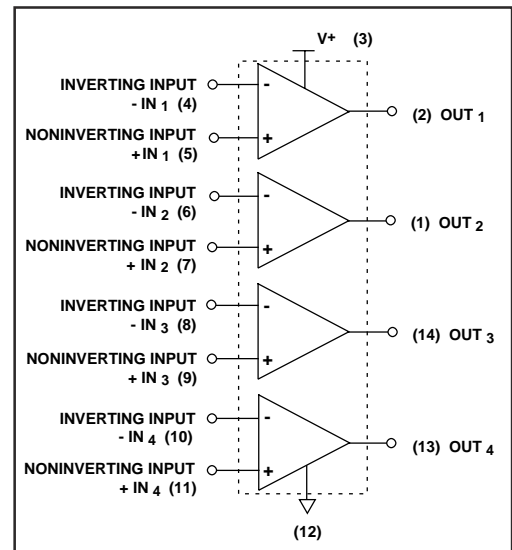
APPLICATIONS

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

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 SBL, PBL packages _____ 0°C to $+70^\circ\text{C}$
 DB package _____ -55°C to $+125^\circ\text{C}$
 Storage temperature range _____ -65°C to $+150^\circ\text{C}$
 Lead temperature, 10 seconds _____ $+260^\circ\text{C}$

OPERATING ELECTRICAL CHARACTERISTICS

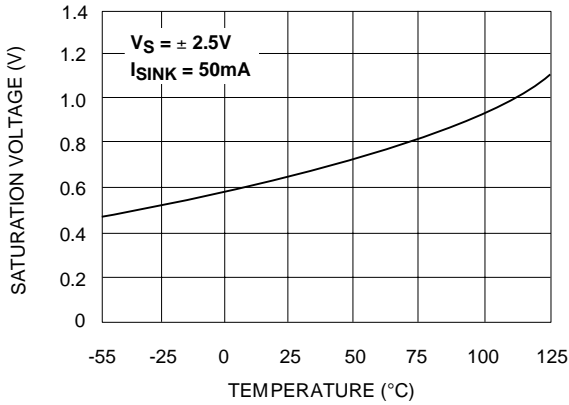
$T_A = 25^\circ\text{C}$ $V_+ = +5V$ unless otherwise specified

Parameter	Symbol	4302A			4302			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max		
Supply Voltage	V_S V_+	± 2 4		± 5 10	± 2 4		± 5 10	V V	Dual Supply Single Supply
Supply Current	I_S		600	1000		600	1000	μA	$R_{LOAD} = \infty$
Voltage Gain	A_{VD}	30	100		30	100		V/mV	$R_{LOAD} \geq 15K\Omega$
Input Offset Voltage	V_{OS}			5			10	mV	$R_{LOAD} = 1.5K\Omega$
Input Offset Current ¹	I_{OS}		10	200 800		10	200 800	pA	
Input Bias Current ¹	I_B		10	200 1000		10	200 1000	pA	$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$
Common Mode Input Voltage Range ²	V_{ICR}	-0.3		$V_+ - 1.5$	-0.3		$V_+ - 1.5$	V	$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$
Low Level Output Voltage	V_{OL}		0.18	0.4		0.18	0.4	V	$I_{SINK} = 12\text{mA}$ $V_{INPUT} = 1V$ Differential
Low Level Output Current	I_{OL}	24	60		24	60		mA	$V_{OL} = 1.0V$
High Level Output Voltage	V_{OH}	3.5	4.5		3.5	4.5		V	$I_{OH} = -2\text{mA}$
Response Time ²	t_{RP}		400			400		ns	$R_L = 5.1K\Omega$ $C_L = 15\text{pF}$ 100mV Input Step/5mV Overdrive
			120			120		ns	$R_L = 5.1K\Omega$ $C_L = 15\text{pF}$ TTL- Level Input Step

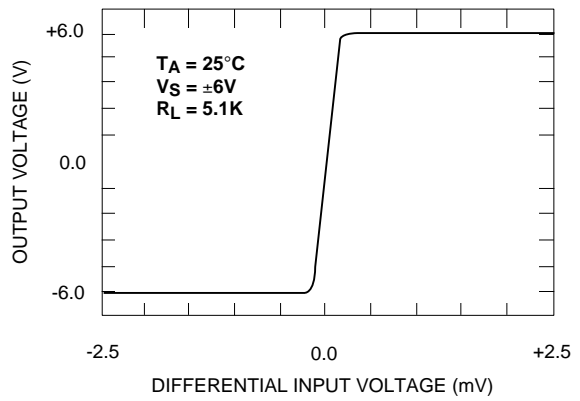
Notes: ¹ Consists of junction leakage currents
² Sample tested parameters

TYPICAL PERFORMANCE CHARACTERISTICS

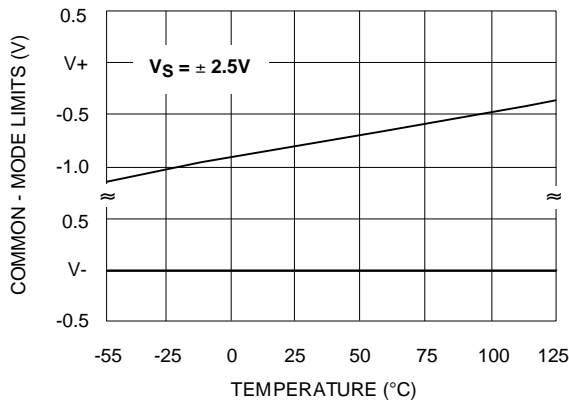
SATURATION VOLTAGE vs. TEMPERATURE



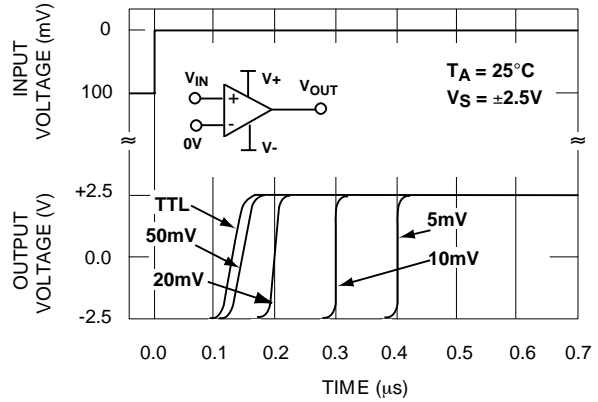
TRANSFER FUNCTION



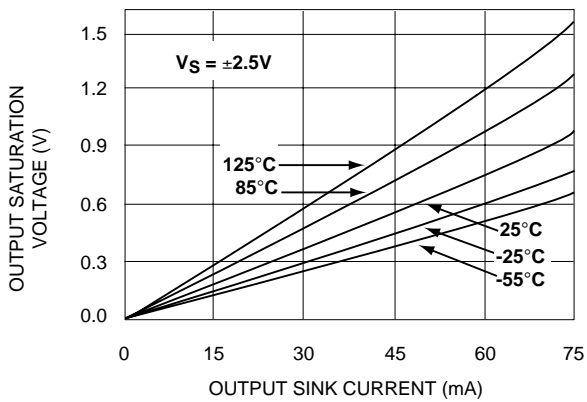
COMMON - MODE VOLTAGE REFERRED TO SUPPLY VOLTAGE



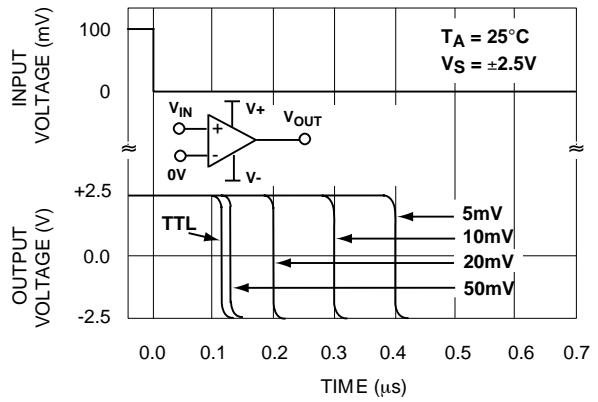
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



SATURATION VOLTAGE vs. SINK CURRENT

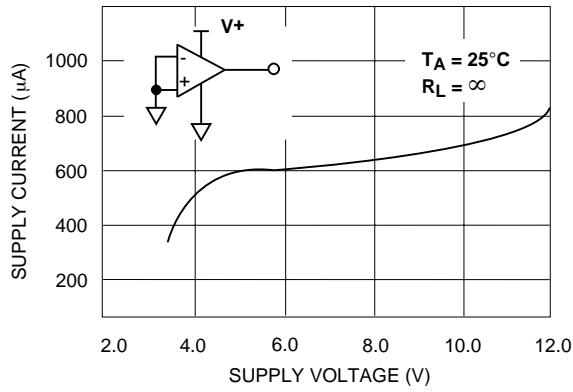


RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES

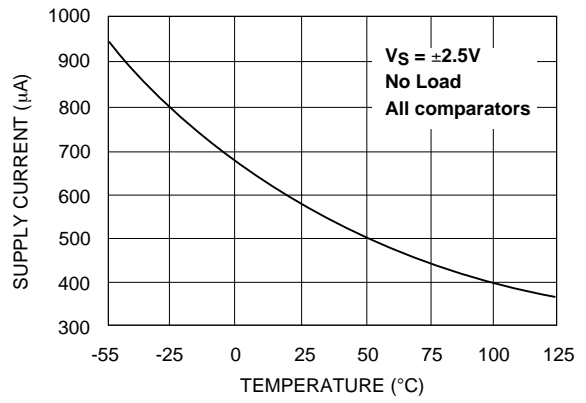


TYPICAL PERFORMANCE CHARACTERISTICS (cont'd)

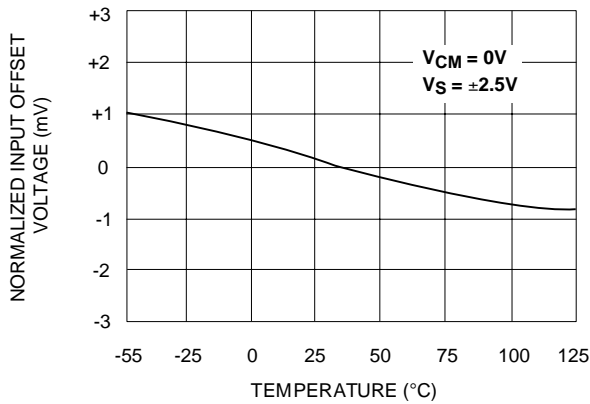
TOTAL SUPPLY CURRENT vs. TOTAL SUPPLY VOLTAGE



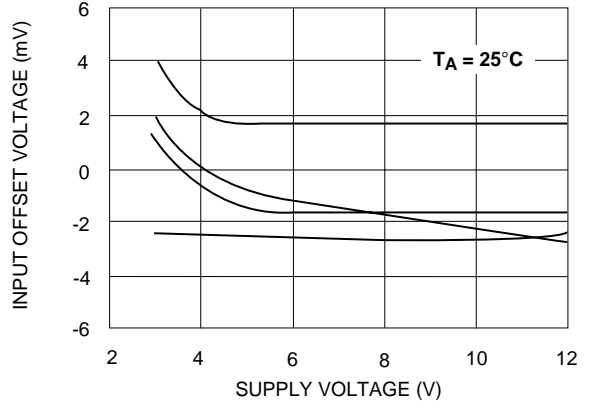
SUPPLY CURRENT vs. TEMPERATURE



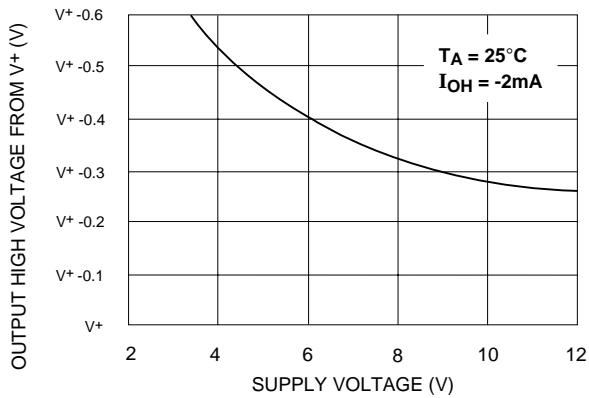
NORMALIZED INPUT OFFSET VOLTAGE vs. TEMPERATURE



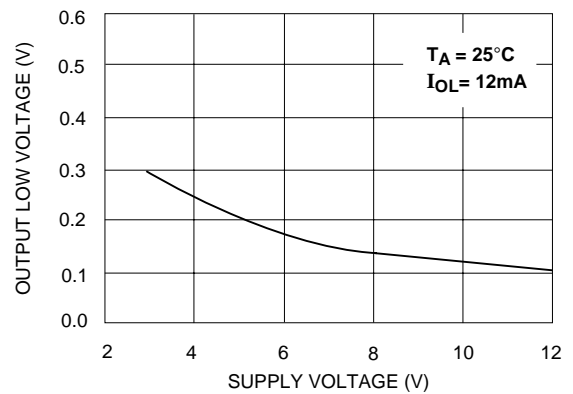
INPUT OFFSET VOLTAGE vs. SUPPLY VOLTAGE REPRESENTATIVE SAMPLES



OUTPUT HIGH VOLTAGE vs. SUPPLY VOLTAGE

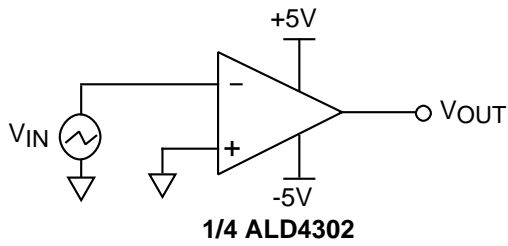


OUTPUT LOW VOLTAGE vs. SUPPLY VOLTAGE

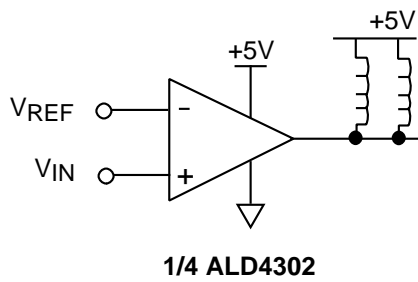


TYPICAL APPLICATIONS

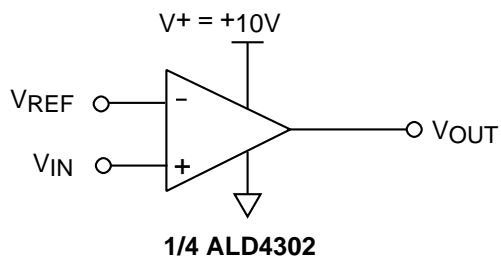
ZERO CROSSING DETECTOR



MULTIPLE RELAY DRIVE



VOLTAGE LEVEL TRANSLATOR

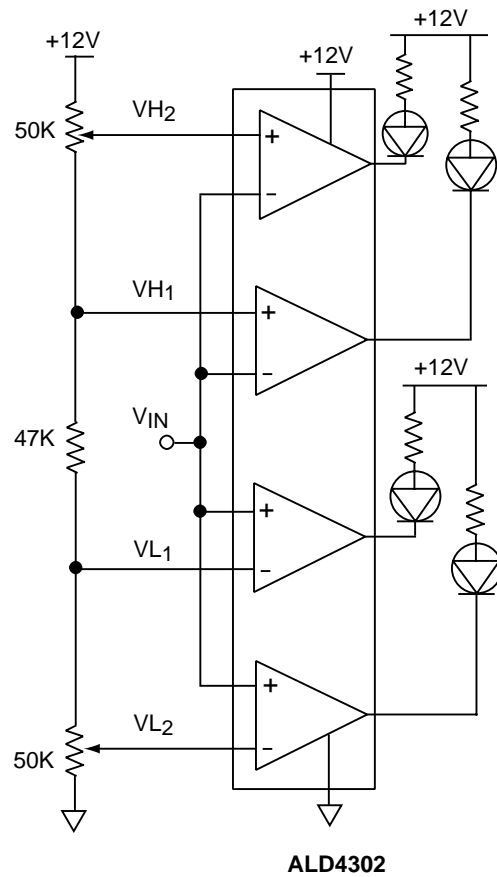


$V_{REF} = 1.4V$ for TTL input

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

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

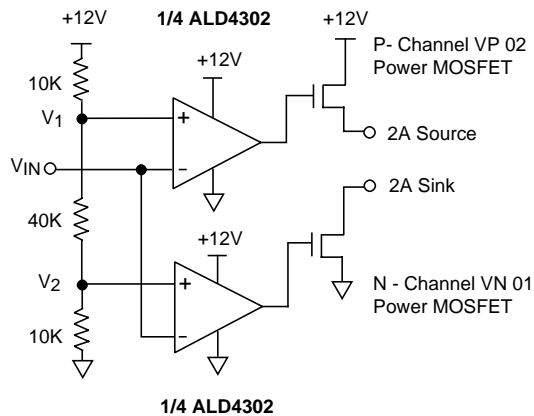
DOUBLE DUAL LIMIT WINDOW COMPARATOR



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

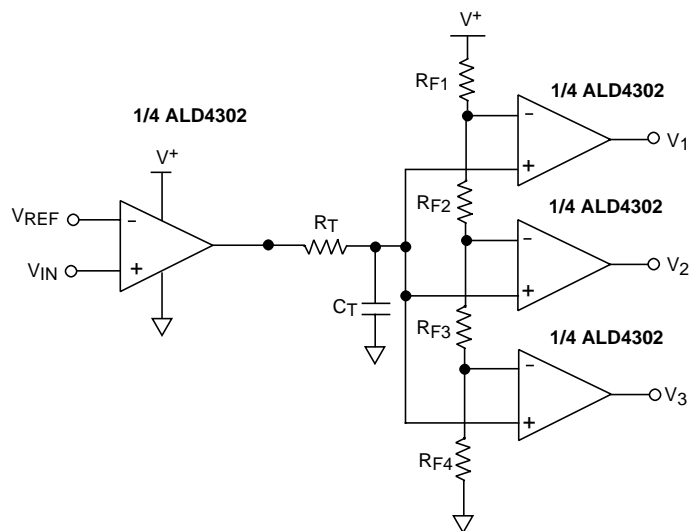
TYPICAL APPLICATIONS (cont'd)

PUSH-PULL COMPLEMENTARY POWER MOSFET DRIVER



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.

TIME DELAY GENERATOR

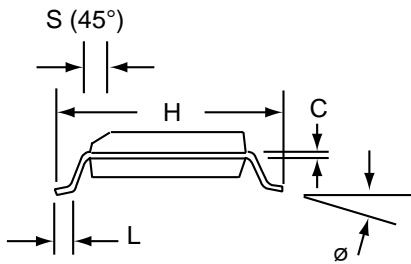
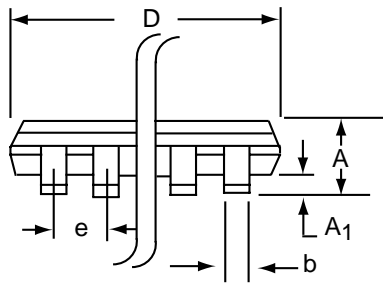
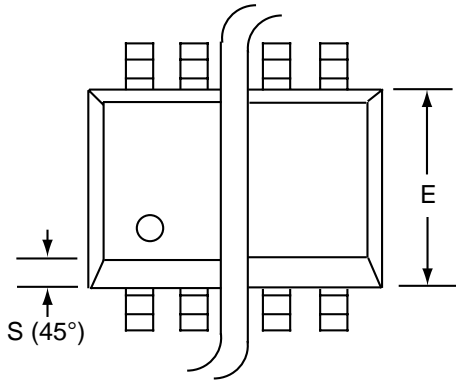


Design & Operating Notes:

1. As each output sources up to 10mA in the output high state, the output stage of a wired-OR low output circuit must be able to sink this current and still provide desired output voltage levels. For TTL output levels, this consideration limits the number to a maximum of three ALD4302 outputs wired-OR together.
2. In order to minimize stray oscillation, all unused inputs must be tied to ground.
3. 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.
4. 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-14 PACKAGE DRAWING

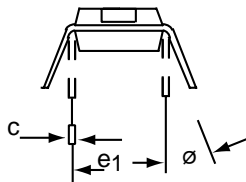
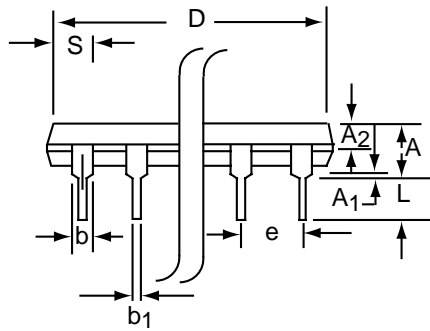
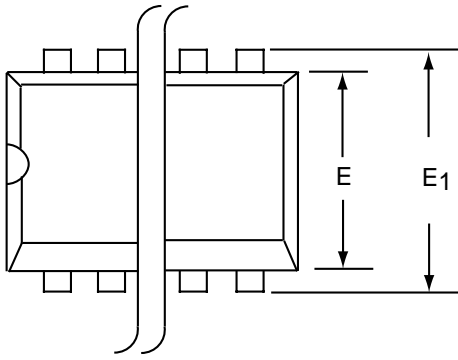
14 Pin Plastic SOIC Package



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-14	8.55	8.75	0.336	0.345
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

OPDIP-14 PACKAGE DRAWING

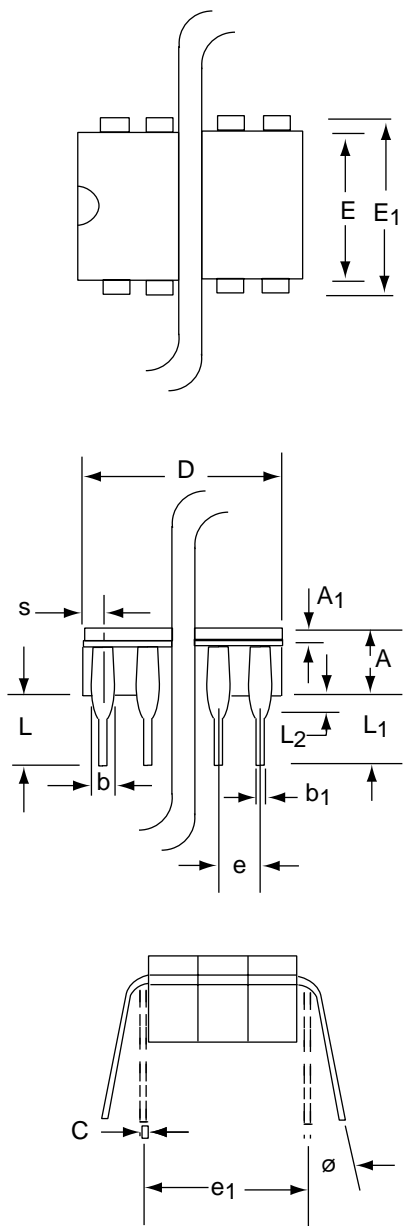
14 Pin Plastic DIP Package



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-14	17.27	19.30	0.680	0.760
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-14	1.02	2.03	0.040	0.080
ø	0°	15°	0°	15°

CERDIP-14 PACKAGE DRAWING

14 Pin CERDIP Package



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	3.55	5.08	0.140	0.200
A₁	1.27	2.16	0.050	0.085
b	0.97	1.65	0.038	0.065
b₁	0.36	0.58	0.014	0.023
C	0.20	0.38	0.008	0.015
D-14	--	19.94	--	0.785
E	5.59	7.87	0.220	0.310
E₁	7.73	8.26	0.290	0.325
e	2.54 BSC		0.100 BSC	
e₁	7.62 BSC		0.300 BSC	
L	3.81	5.08	0.150	0.200
L₁	3.18	--	0.125	--
L₂	0.38	1.78	0.015	0.070
S	--	2.49	--	0.098
Ø	0°	15°	0°	15°