

**DUAL PRECISION CMOS VOLTAGE COMPARATOR  
WITH PUSH-PULL DRIVER**

**GENERAL DESCRIPTION**

The ALD2332A/ALD2332B/ALD2332 is a monolithic high performance dual precision voltage comparator built with advanced silicon gate EPAD® CMOS technology intended for high precision analog applications. The ALD2332A/ALD2332B/ALD2332 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 520ns with only 10mV input step signal; very low power dissipation of 175µA per comparator; single (+5V) or dual ( $\pm 5V$ ) power supply operation; and 50 mA push-pull output drivers.

The input voltage range includes ground, which makes these comparators ideal for single supply low level signal detection with high source impedance. The outputs can source and sink current allowing for application flexibility. They can be used in either wired-OR connection without pull-up resistor or push-pull configuration. ALD2332A/ALD2332B/ALD2332 can also be used in wired-OR connection with other open drain circuits such as the ALD2331/ALD2303 voltage comparators.

The ALD2332A/ALD2332B/ALD2332 voltage comparators are ideal for a great variety of precision analog voltage comparator applications, especially in low level signal detection circuits which require low standby power and high output current.

**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

**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
- Eliminate pull-up resistor

**ORDERING INFORMATION**

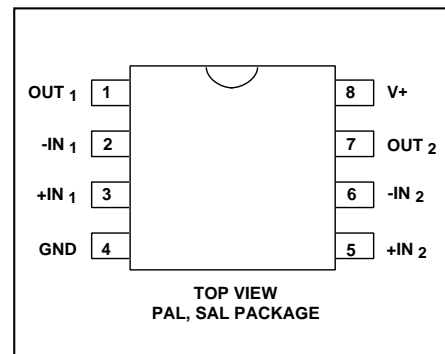
Operating Temperature Range *	
0°C to +70°C	0°C to +70°C
8-Pin Small Outline Package (SOIC)	8-Pin Plastic Dip Package
ALD2332A SAL	ALD2332A PAL
ALD2332B SAL	ALD2332B PAL
ALD2332 SAL	ALD2332 PAL

\* Contact factory for industrial temperature range

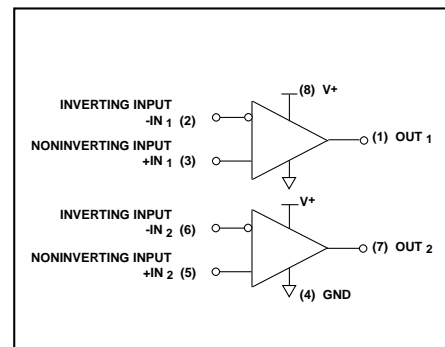
**FEATURES**

- Guaranteed to drive 200Ω loads
- Fanout of 30LS TTL loads
- Low supply current of 175µA each comparator
- Pinout of LM193 type industry standard voltage comparators
- Extremely low input bias currents -- 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 -- 180ns for TTL inputs and 400ns for 20mV overdrive
- CMOS, NMOS and TTL compatible
- Push-pull outputs-current sourcing/ sinking
- High output sinking current -- 50mA
- Low supply current spikes

**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

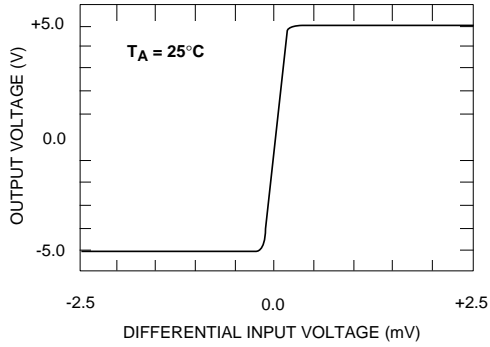
T<sub>A</sub> = 25°C V+ = +5V unless otherwise specified

Parameter	Symbol	2332A			2332B			2332			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
Supply Voltage	V <sub>S</sub> V+	±2 4		±5 10	2 4		±5 10	2 4		±5 10	V	
Supply Current	I <sub>S</sub>		350	500		350	500		350	500	µA	No Load Two Comparators
Voltage Gain	A <sub>VD</sub>	50	150		50	150		50	150		V/mV	R <sub>LOAD</sub> ≥ 15K
Input Offset Voltage	V <sub>OS</sub>		0.02	0.5		0.5	1.0		1.0	2.0	mV	R <sub>LOAD</sub> ≥ 1.5KΩ
Input Offset Current <sup>1</sup>	I <sub>OS</sub>		0.01	20		0.01	20		0.01	20	pA	
Input Bias Current <sup>1</sup>	I <sub>B</sub>		0.01	20		0.01	20		0.01	20	pA	
Common Mode Input Voltage Range <sup>2</sup>	V <sub>ICR</sub>	-0.3		V+ -1.5	-0.3		V+ -1.5	-0.3		V+ -1.5	V	
Low Level Sink Output Voltage	V <sub>OL</sub>		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 Sink Output Current	I <sub>OL</sub>	24	50		24	50		24	50		mA	V <sub>OL</sub> = 1.0 V SINK OUTPUT ON
High Level Source Output Voltage	V <sub>OH</sub>	3.5	4.5		3.5	4.5		3.5	4.5		V	I <sub>SOURCE</sub> = -2mA SOURCE OUTPUT ON
Response Time <sup>2</sup>	t <sub>RP</sub>		1.1			1.1			1.1		µs	R <sub>L</sub> = 5.1KΩ, C <sub>L</sub> = 15pF 5mV Input Step/ 0mV Overdrive
	t <sub>RP</sub>		2.4			2.4			2.4		µs	R <sub>L</sub> = 5.1KΩ, C <sub>L</sub> = 15pF 1mV Input Step/ 0mV Overdrive
	t <sub>RP</sub>		400			400			400		ns	R <sub>L</sub> = 5.1KΩ, C <sub>L</sub> = 15pF 100mV Input Step/ 20mV Overdrive
	t <sub>RP</sub>		180			180			180		ns	R <sub>L</sub> = 5.1KΩ, C <sub>L</sub> = 15pF TTL-Level Input Step
Common Mode Rejection Ratio	CMRR		80			80			80		dB	V <sub>INPUT</sub> = 0V to 2.5V
Power Supply Rejection Ratio	PSRR		75			75			75		dB	V+ = 4V to 5V

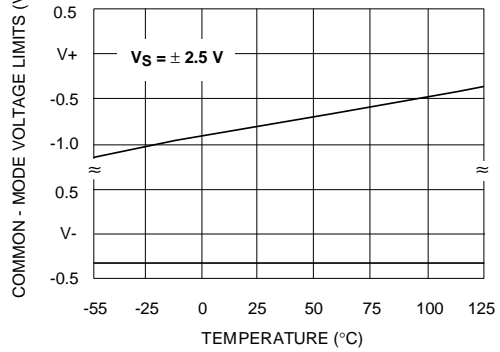
Notes: <sup>1</sup> Consists of junction leakage currents <sup>2</sup> Sample test parameter

## TYPICAL PERFORMANCE CHARACTERISTICS

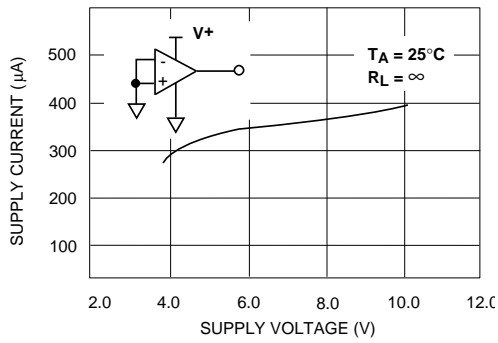
**TRANSFER FUNCTION**



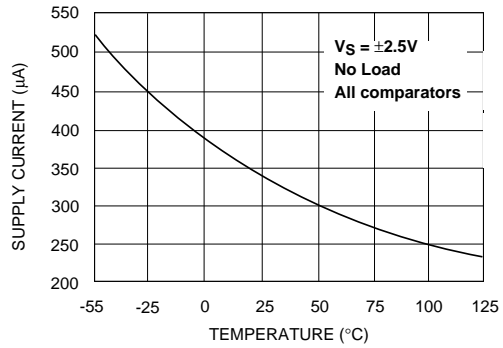
**COMMON - MODE VOLTAGE REFERRED TO SUPPLY VOLTAGE**



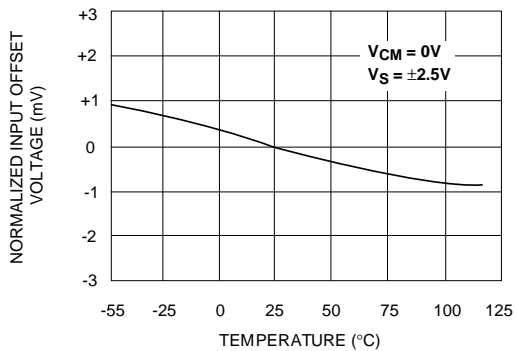
**TOTAL SUPPLY CURRENT vs. TOTAL SUPPLY VOLTAGE**



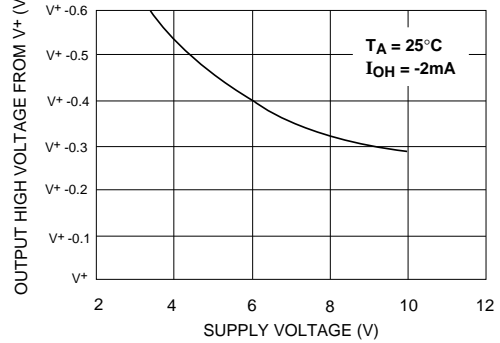
**SUPPLY CURRENT vs. TEMPERATURE**



**NORMALIZED INPUT OFFSET VOLTAGE vs. TEMPERATURE**

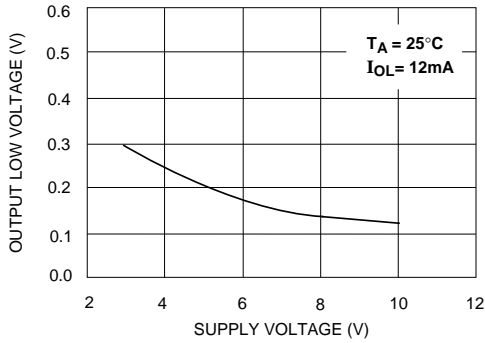


**OUTPUT HIGH VOLTAGE vs. SUPPLY VOLTAGE**

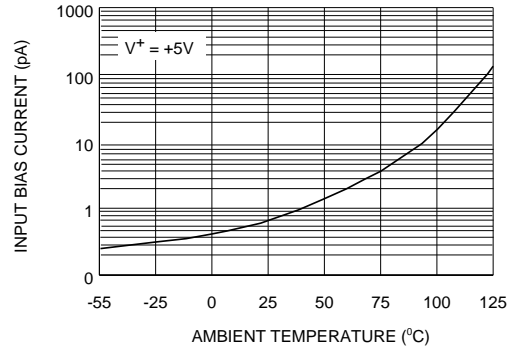


## TYPICAL PERFORMANCE CHARACTERISTICS

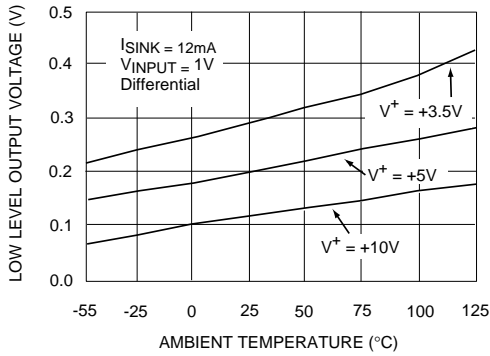
**OUTPUT LOW VOLTAGE vs. SUPPLY VOLTAGE**



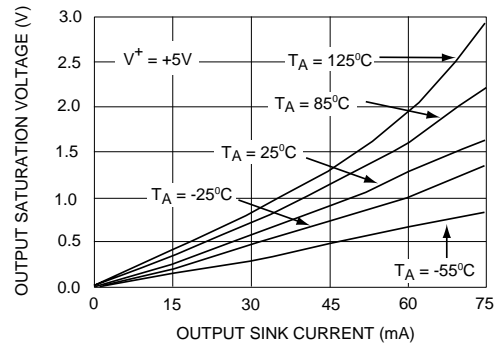
**INPUT BIAS CURRENT vs. TEMPERATURE**



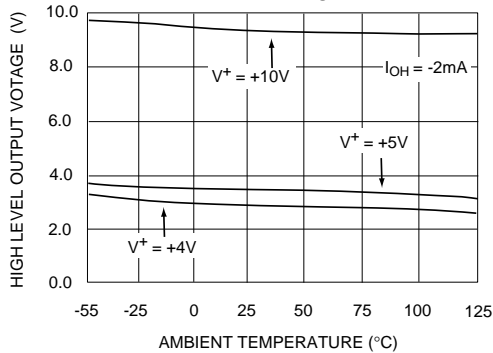
**LOW LEVEL OUTPUT VOLTAGE vs. TEMPERATURE**



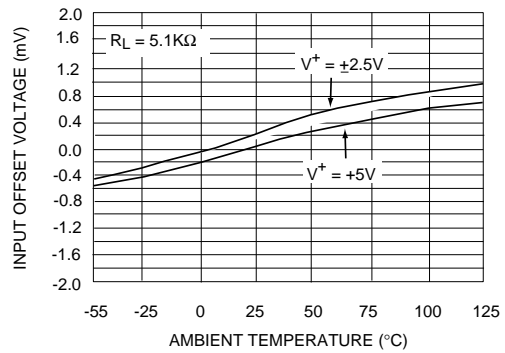
**SATURATION VOLTAGE vs. SINK CURRENT**



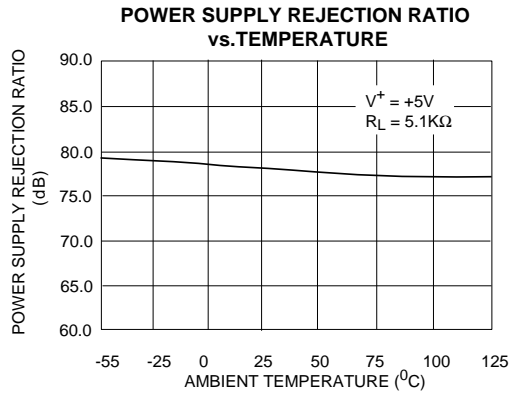
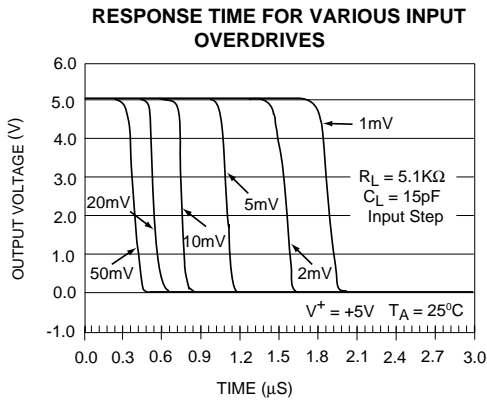
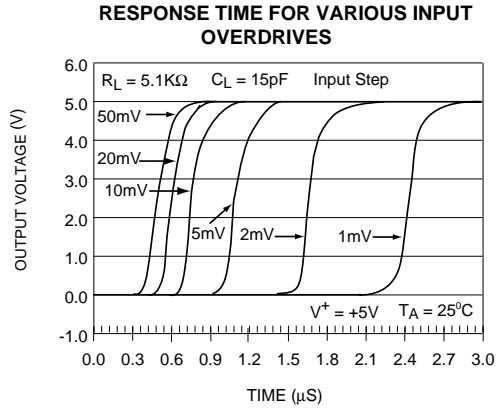
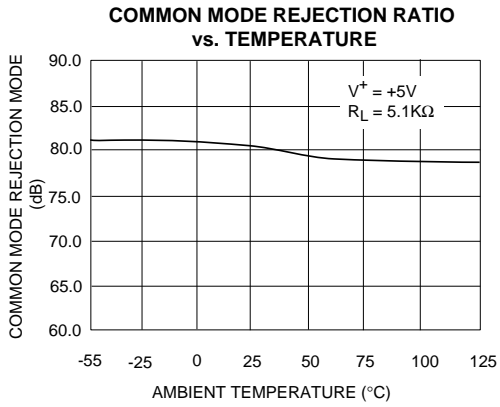
**HIGH LEVEL OUTPUT VOLTAGE vs. TEMPERATURE**



**INPUT OFFSET VOLTAGE vs. TEMPERATURE**

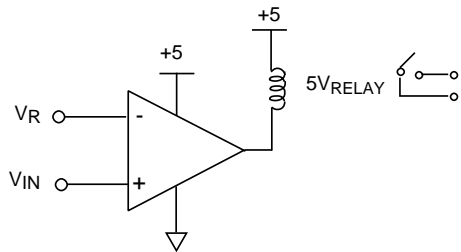


## TYPICAL PERFORMANCE CHARACTERISTICS

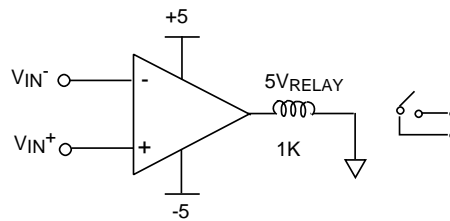


## TYPICAL APPLICATIONS

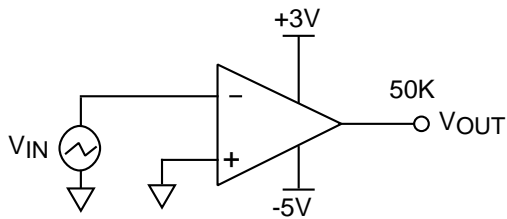
PRECISION SINGLE SUPPLY VOLTAGE  
COMPARATOR WITH DIRECT RELAY DRIVER



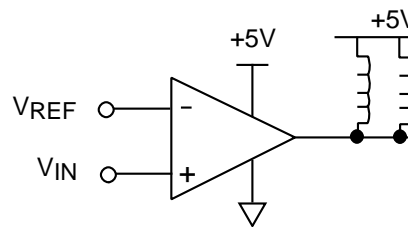
PRECISION SINGLE SUPPLY VOLTAGE  
COMPARATOR WITH DIRECT RELAY DRIVER



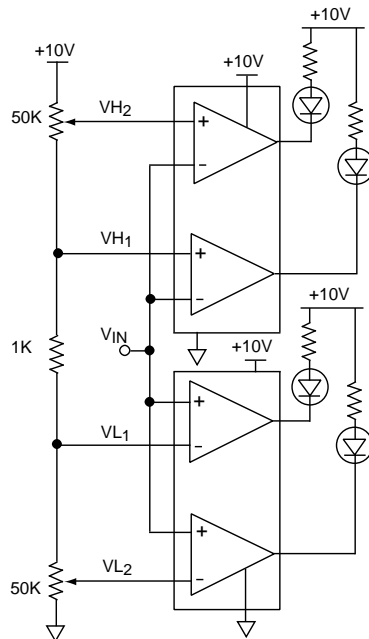
ZERO CROSSING DETECTOR



MULTIPLE RELAY DRIVE

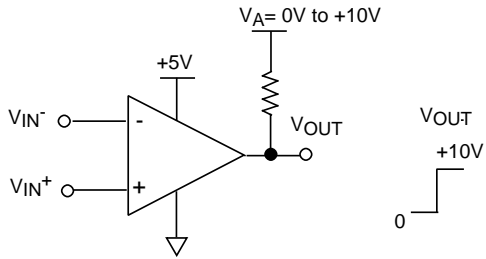


DOUBLE DUAL LIMIT WINDOW COMPARATOR

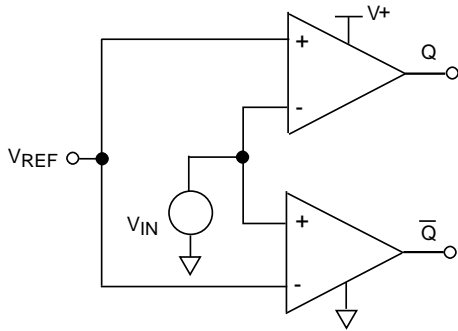


## TYPICAL APPLICATIONS

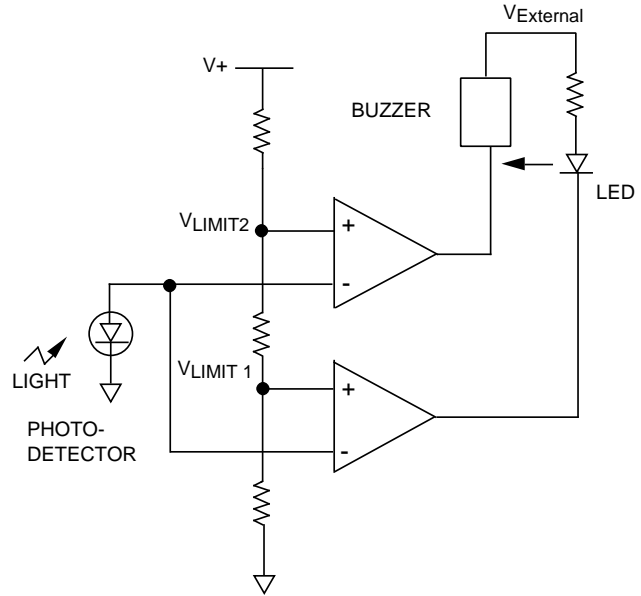
**VOLTAGE COMPARATOR WITH SINGLE SUPPLY AND OUTPUT LEVEL SHIFT**



**PRECISION VOLTAGE COMPARATOR WITH COMPLEMENTARY PUSH-PULL OUTPUTS**



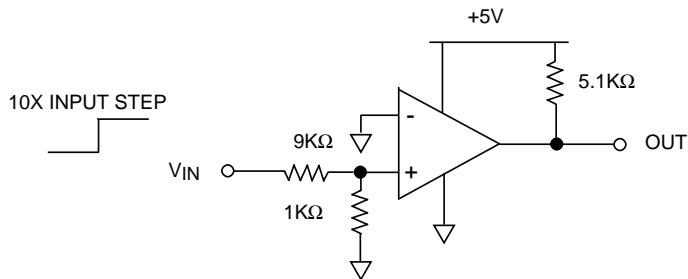
**DOUBLE DUAL PRECISION PHOTO DETECTOR MONITOR**



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

### RESPONSE TIME MEASUREMENT CIRCUIT

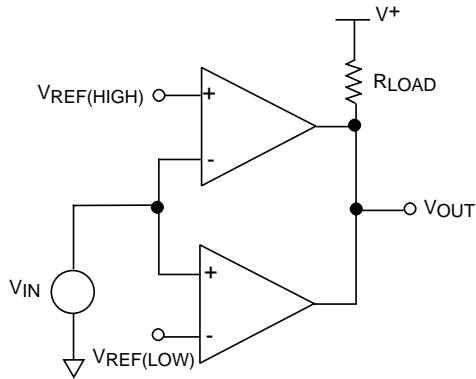
Response time is defined as the interval between the application of an input step function and the instant when the output reaches 50% of its maximum value as measured by the following test circuit:





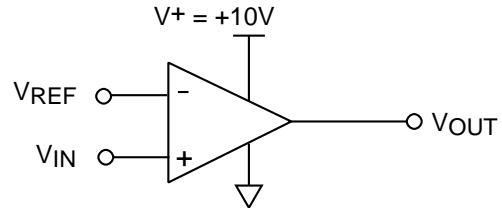
## TYPICAL APPLICATIONS

### PRECISION DUAL LIMIT WINDOW COMPARATOR



$R_{LOAD} = 1.5K\Omega$   
 OUTPUT HIGH FOR  $V_{IN} < V_{REF(HIGH)}$   
 AND  $V_{IN} > V_{REF(LOW)}$

### VOLTAGE LEVEL TRANSLATOR

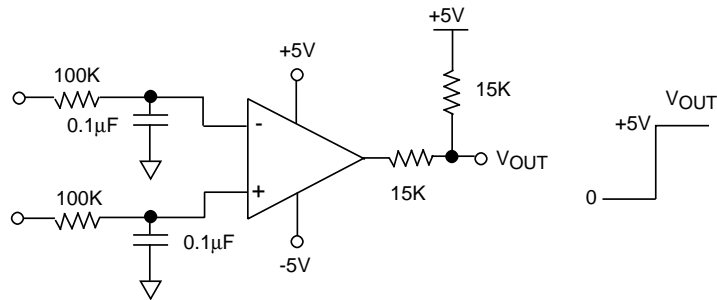


$V_{REF} = 1.4V$  for TTL input

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

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

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



### PRECISION VOLTAGE COMPARATOR WITH OUTPUT LEVEL SHIFT AND HIGH CURRENT LOAD DRIVER

