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 (±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

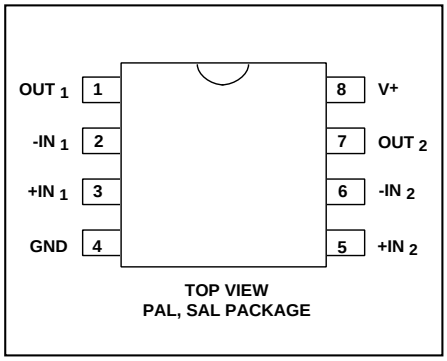
Operating Temperature Range *	
0°C to +70°C	0°C to +70°C
8-Pin Small Outline Package (SOIC)	8-Pin Plastic Dip Package
ALD2332A SAL ALD2332B SAL ALD2332 SAL	ALD2332A PAL ALD2332B PAL ALD2332 PAL

* Contact factory for industrial temperature range

FEATURES

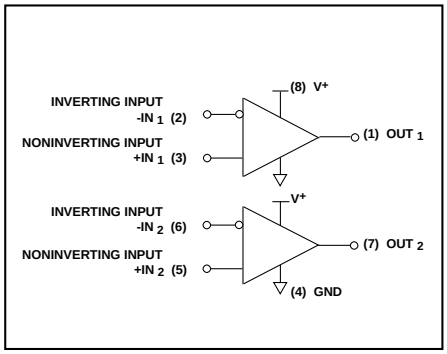
- Guaranteed to drive 200Ω loads
- Fanout of 30LS TTL loads
- Low supply current of 175µA each comparator
- Pinout of LM193 type industry standard voltage comparators
- Extremely low input bias currents -- 10pA
- Virtually eliminates source impedance effects
- Low operating supply voltage of 4V to 10V
- Single (+5V) and dual supply (±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



TOP VIEW
PAL, SAL PACKAGE

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

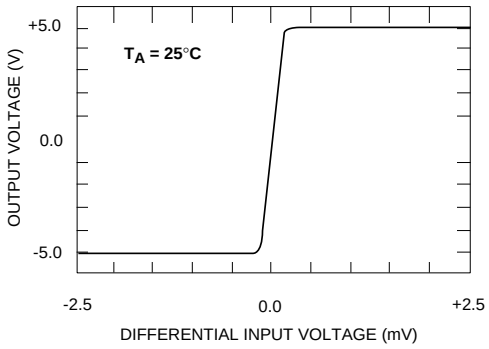
T_A = 25°C V^+ = +5V unless otherwise specified

Parameter	Symbol	2332A			2332B			2332			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
Supply Voltage	V_S V_+	±2 4		±5 10	2 4		±5 10	2 4		±5 10	V	
Supply Current	I_S		350	500		350	500		350	500	µA	No Load Two Comparators
Voltage Gain	A_{VD}	50	150		50	150		50	150		V/mV	$R_{LOAD} \geq 15K$
Input Offset Voltage	V_{OS}		0.02	0.5		0.5	1.0		1.0	2.0	mV	$R_{LOAD} \geq 1.5K\Omega$
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 Source Output Voltage	V_{OH}	3.5	4.5		3.5	4.5		3.5	4.5		V	I_{SOURCE} = -2mA SOURCE OUTPUT ON
Response Time[2]	t_{RP}		1.1			1.1			1.1		µs	R_L = 5.1KΩ, C_L = 15pF 5mV Input Step/ 0mV Overdrive
	t_{RP}		2.4			2.4			2.4		µs	R_L = 5.1KΩ ,C_L =15pF 1mVInput Step/ 0mV Overdrive
	t_{RP}		400			400			400		ns	R_L = 5.1KΩ, C_L = 15pF 100mV Input Step/ 20mV Overdrive
	t_{RP}		180			180			180		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

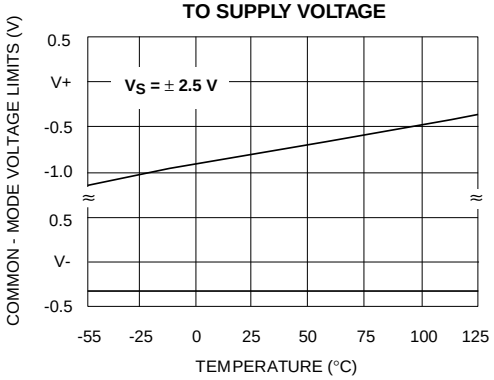
Notes: [1] Consists of junction leakage currents [2] Sample test parameter

TYPICAL PERFORMANCE CHARACTERISTICS

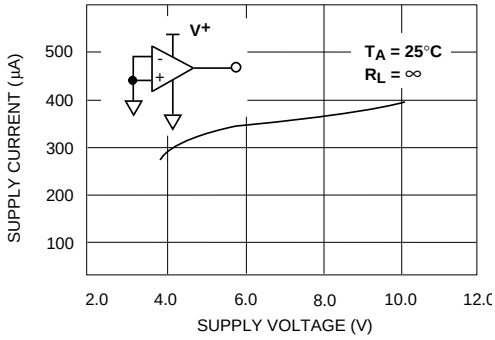
TRANSFER FUNCTION



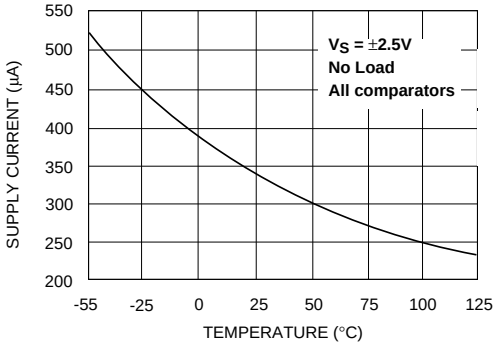
COMMON - MODE VOLTAGE REFERRED TO SUPPLY VOLTAGE



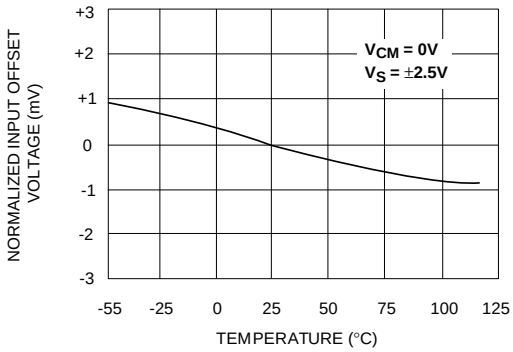
TOTAL SUPPLY CURRENT vs. TOTAL SUPPLY VOLTAGE



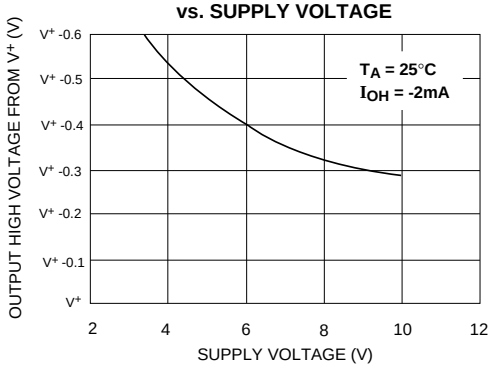
SUPPLY CURRENT vs. TEMPERATURE



NORMALIZED INPUT OFFSET VOLTAGE vs. TEMPERATURE

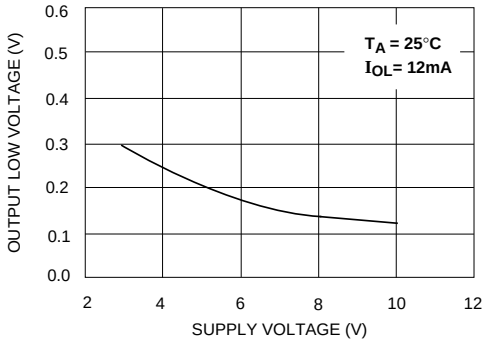


OUTPUT HIGH VOLTAGE vs. SUPPLY VOLTAGE

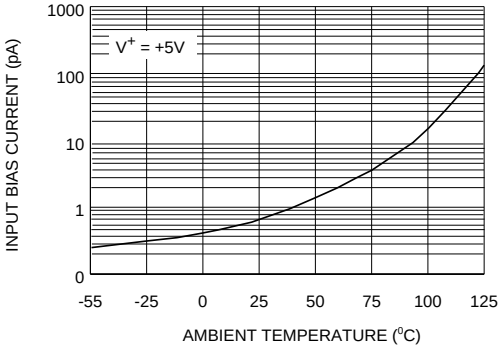


TYPICAL PERFORMANCE CHARACTERISTICS

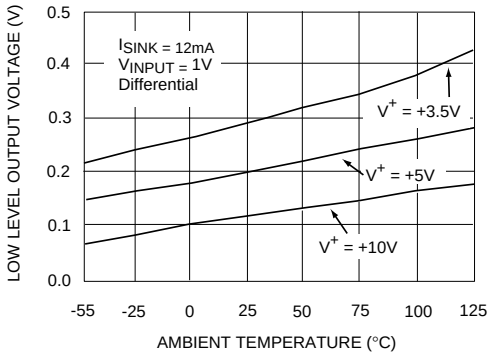
OUTPUT LOW VOLTAGE vs. SUPPLY VOLTAGE



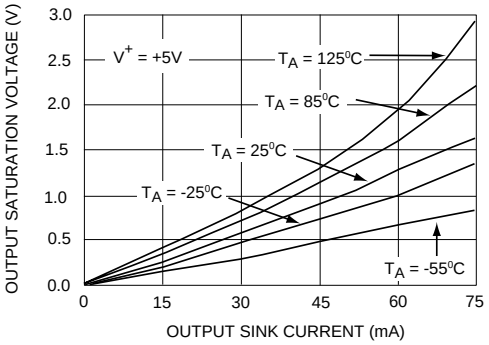
INPUT BIAS CURRENT vs. TEMPERATURE



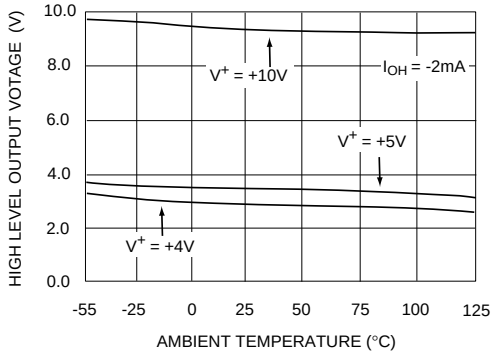
LOW LEVEL OUTPUT VOLTAGE vs. TEMPERATURE



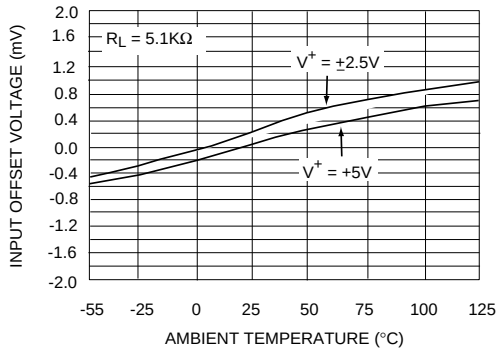
SATURATION VOLTAGE vs. SINK CURRENT



HIGH LEVEL OUTPUT VOLTAGE vs. TEMPERATURE

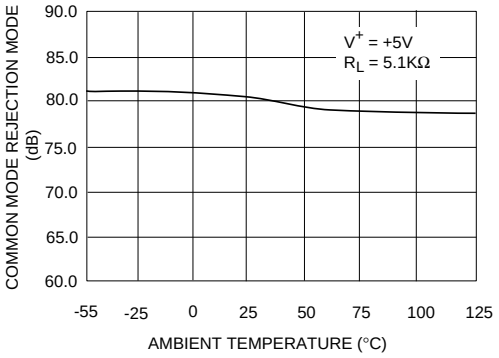


INPUT OFFSET VOLTAGE vs. TEMPERATURE

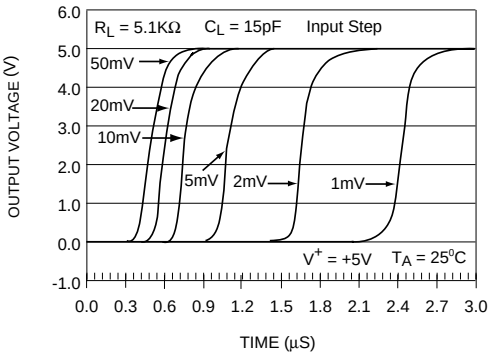


TYPICAL PERFORMANCE CHARACTERISTICS

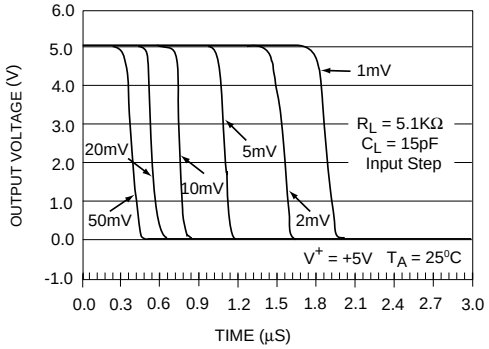
COMMON MODE REJECTION RATIO vs. TEMPERATURE



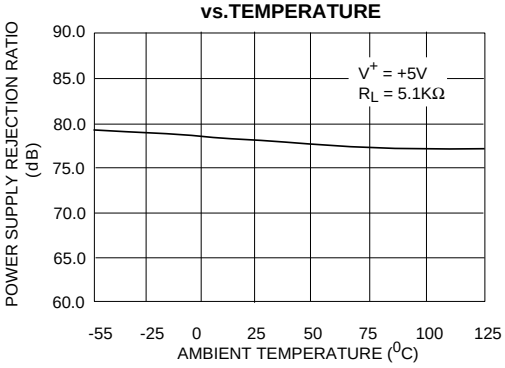
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES

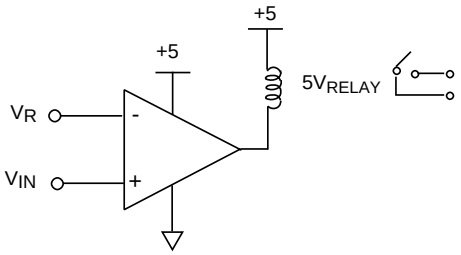


POWER SUPPLY REJECTION RATIO vs.TEMPERATURE

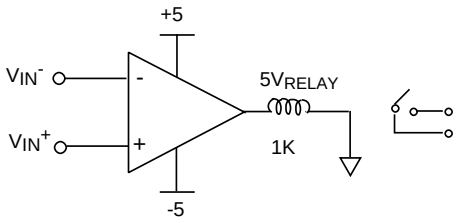


TYPICAL APPLICATIONS

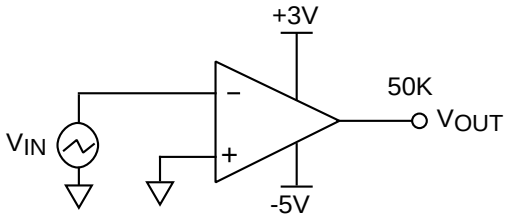
PRECISION SINGLE SUPPLY VOLTAGE COMPARATOR WITH DIRECT RELAY DRIVER



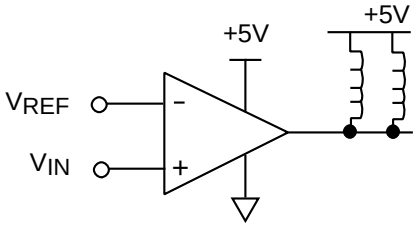
PRECISION SINGLE SUPPLY VOLTAGE COMPARATOR WITH DIRECT RELAY DRIVER



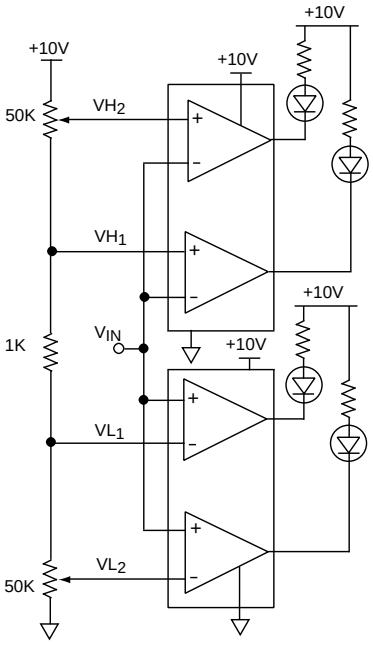
ZERO CROSSING DETECTOR



MULTIPLE RELAY DRIVE



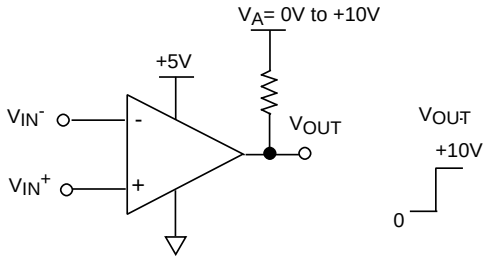
DOUBLE DUAL LIMIT WINDOW COMPARATOR



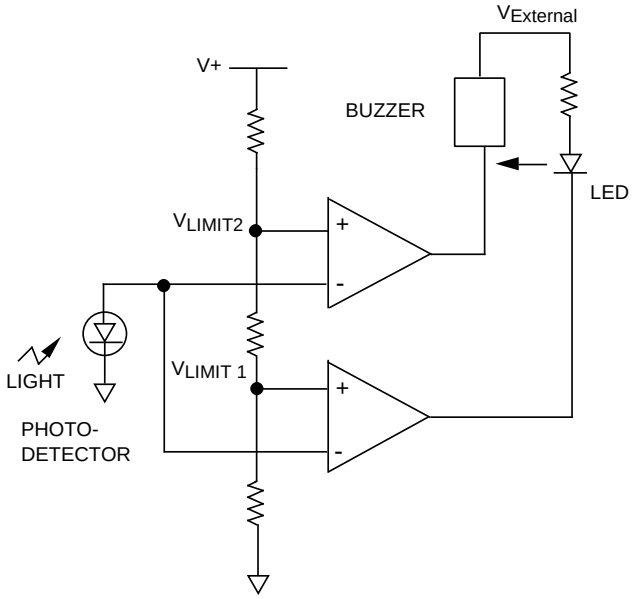
2302.TYP6.EPS

TYPICAL APPLICATIONS

VOLTAGE COMPARATOR WITH SINGLE SUPPLY AND OUTPUT LEVEL SHIFT

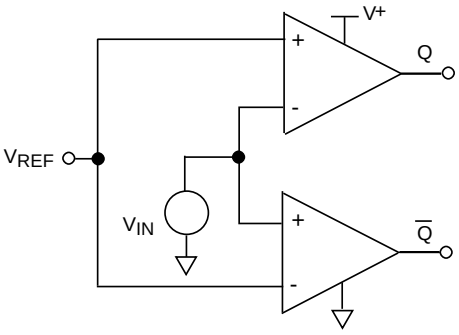


DOUBLE DUAL PRECISON PHOTO DETECTOR MONITOR



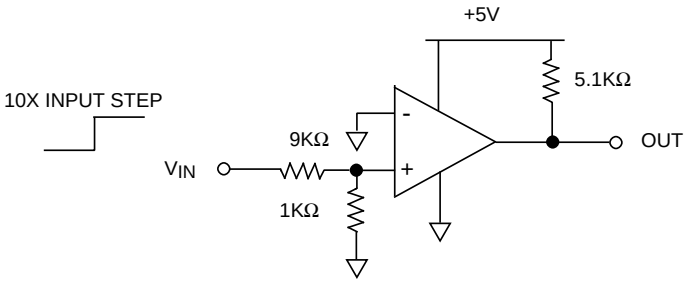
LED turns on as photo-detector voltage reaches V_{LIMIT} 1. Both LED and horn turns on as photo-detector voltage reaches V_{LIMIT} 2. $V_{External}$ = +10V, V+ = +5V.

PRECISION VOLTAGE COMPARATOR WITH COMPLEMENTARY PUSH-PULL OUTPUTS



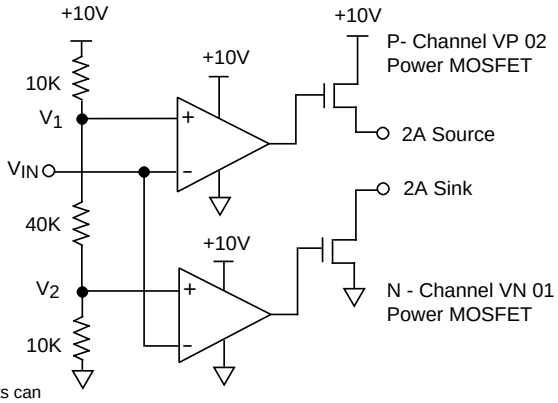
RESPONSE TIME MEASUREMENT CIRCUIT

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:



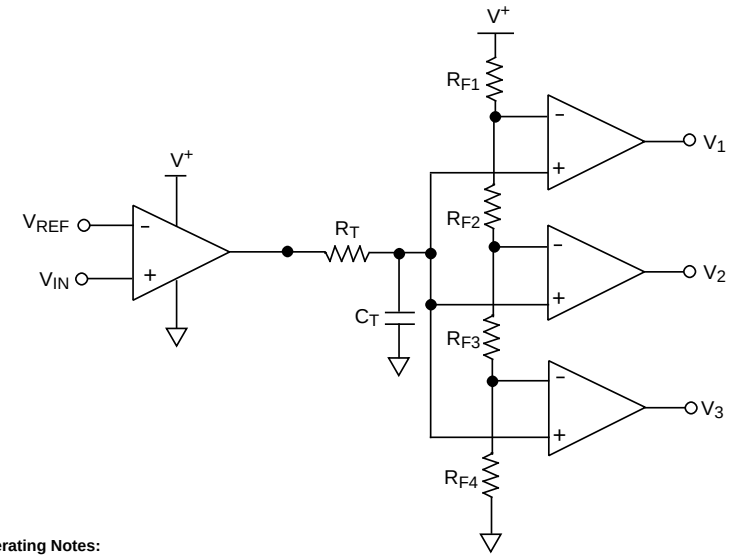
TYPICAL APPLICATIONS

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 of the same load.

TIME DELAY GENERATOR

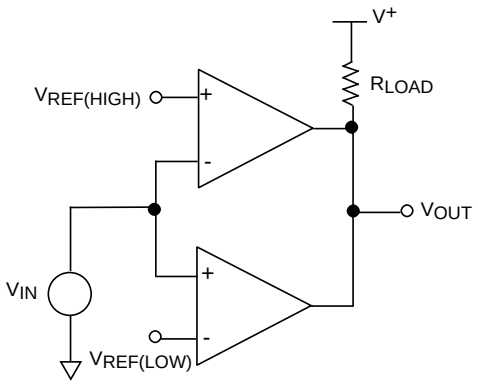


Design & Operating Notes:

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 ALD2302 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 1 pA at room temperature. The 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.

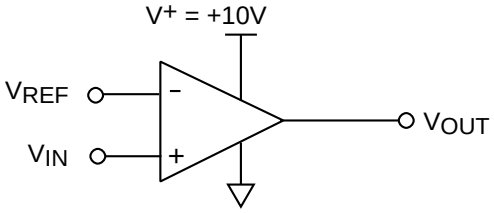
TYPICAL APPLICATIONS

PRECISION DUAL LIMIT WINDOW COMPARATAOR



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

VOLTAGE LEVEL TRANSLATOR

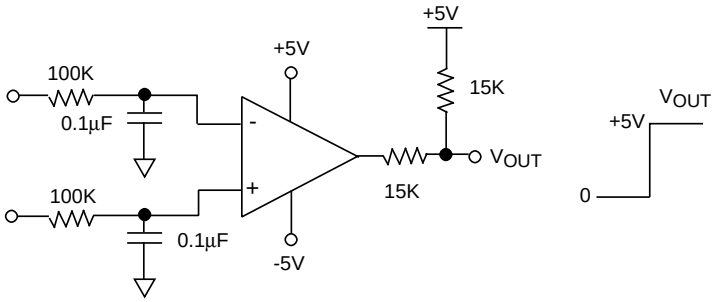


V_{REF} = 1.4V for TTL input

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

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

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



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