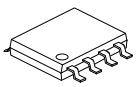
DUAL MICROPOWER CMOS VOLTAGE COMPARATOR



SOP-8

■ DESCRIPTION

The UTC **ULC393** consists of dual independent micropower voltage comparators designed to operate from a single supply. The UTC **ULC393** uses one-twentieth the power for similar response times. The open-drain MOS output stage interfaces to a variety of loads and supplies. For a similar device with a push-pull output configuration.

■ FEATURES

* Very Low Power: 110μW Typ at 5V
* Single-Supply Operation: 3V~16V
* On-Chip ESD Protection

■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
ULC393L-S08-R	ULC393G-S08-R	SOP-8	Tape Reel

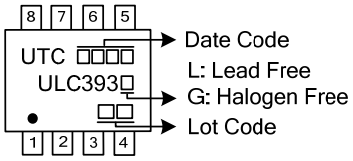
ULC393G-S08-R

(1)Packing Type — (1) R: Tape Reel

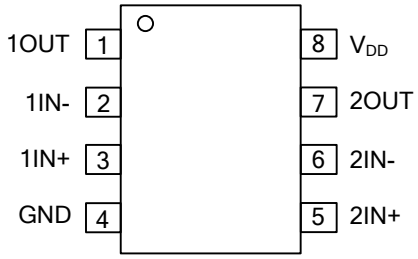
(2)Package Type — (2) S08: SOP-8

(3)Green Package — (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



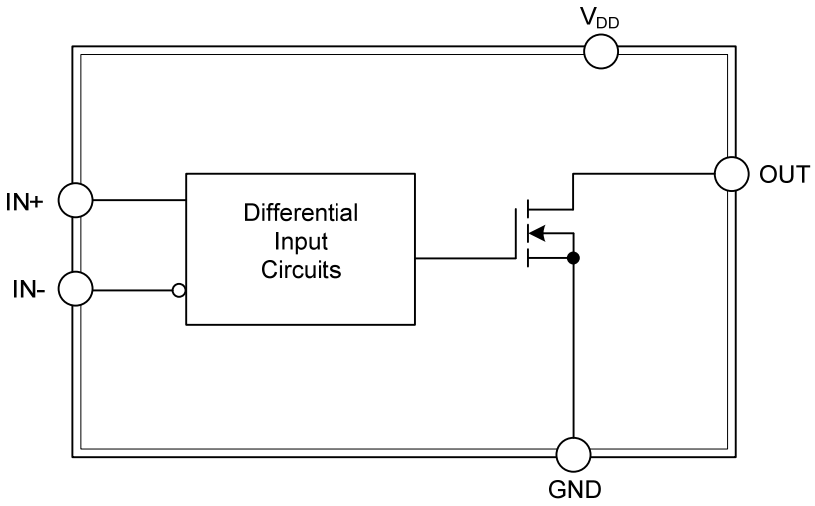
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	1OUT	Channel 1 output pin
2	1IN-	Inverting input for channel 1
3	1IN+	Non-inverting input for channel 1
4	GND	Ground
5	2IN+	Non-inverting input for channel 2
6	2IN-	Inverting input for channel 2
7	2OUT	Channel 2 output pin
8	V_{DD}	Supply voltage input pin

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (T_A = 25°C, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage Range (Note 2)	V_{DD}	-0.3 ~ 18	V
Differential Input Voltage (Note 3)	V_{ID}	±18	V
Input Voltage Range	V_I	-0.3 ~ V_{DD}	V
Output Voltage Range	V_O	-0.3 ~ 16	V
Input Current	I_I	±5	mA
Output Current (Each Output)	I_O	20	mA
Total Supply Current into V_{DD}		40	mA
Total Current Out of GND		40	mA
Power Dissipation	P_D	600	mW
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. All voltage values, except differential voltages, are with respect to network ground.
3. Differential voltages are at IN+ with respect to IN-.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Supply Voltage	V_{DD}	3	5	16	V
Common-Mode Input Voltage	V_{IC}	-0.2		V_{DD}-1.5	V
Low-Level Output Current	I_{OL}			20	mA
Operating Free-Air Temperature	T_A	-40		+85	°C

■ ELECTRICAL CHARACTERISTICS

(Specified operating free-air temperature, V_{DD}=5V, T_C = 25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS (Note 1)		MIN	TYP	MAX	UNIT
Input Offset Voltage	V_{IO}	V_{DD}=5V~10V, V_{IC}=V_{ICR_MIN}, (Note 2)	T_A=25°C		1.4	5	mV
			T_A=-40°C~+85°C			10	mV
Input Offset Current	I_{IO}	V_{IC}=2.5V	T_A=25°C		1		pA
			T_A=85°C			15	nA
Input Bias Current	I_{IB}	V_{IC}=2.5V	T_A=25°C		5		pA
			T_A=85°C			30	nA
Common Mode Input Voltage Range	V_{ICR}		T_A=25°C	0		V_{DD}-1	V
			T_A=-40°C~+85°C	0		V_{DD}-1.5	V
Common-Mode Rejection Ratio	CMRR	V_{IC}= V_{ICR_MIN}	T_A=25°C		84		dB
			T_A=85°C		84		dB
			T_A=-40°C		84		dB
Supply-Voltage Rejection Ratio	k_{SVR}	V_{DD}=5V~10V	T_A=25°C		85		dB
			T_A=85°C		84		dB
			T_A=-40°C		84		dB
Low Level Output Voltage	V_{OL}	V_{ID}=-1V, I_{OL}=6mA	T_A=25°C		300	400	mV
			T_A=85°C			800	mV
High-Level Output Current	I_{OH}	V_{ID}=1V, V_O=5V	T_A=25°C		0.8	40	nA
			T_A=85°C			1	μA
Supply Current (Both Comparators)	I_{DD}	Outputs Low, No Load	T_A=25°C		22	40	μA
			T_A=-40°C~+85°C			90	μA

Notes: 1. All characteristics are measured with zero common-mode voltage unless otherwise specified.
2. The offset voltage limits given are the maximum values required to drive the output up to 4.5 V or down to 0.3 V.

■ SWITCHING CHARACTERISTICS【V_{DD}=5V, T_A=25°C, unless otherwise specified (see Figure 2)】

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Propagation Delay Time, Low-to-High-Level Output	t_{PLH}	f=10kHz, C_L=15pF	Overdrive=2mV		4.5		μs
			Overdrive=5mV		3.0		μs
			Overdrive=10mV		2.5		μs
			Overdrive=20mV		2.3		μs
			Overdrive=40mV		2.0		μs
Propagation Delay Time, High-to-Low-Level Output	t_{PHL}	V_I=1.4V Step at IN+			1.1		μs
		f=10kHz, C_L=15pF	Overdrive=2mV		9.0		μs
			Overdrive=5mV		7.0		μs
			Overdrive=10mV		5.0		μs
			Overdrive=20mV		3.0		μs
			Overdrive=40mV		2.0		μs
		V_I=1.4V Step at IN+			0.1		μs
Fall Time, Output	t_f	f=10kHz, C_L=15pF	Overdrive=50mV		22		ns

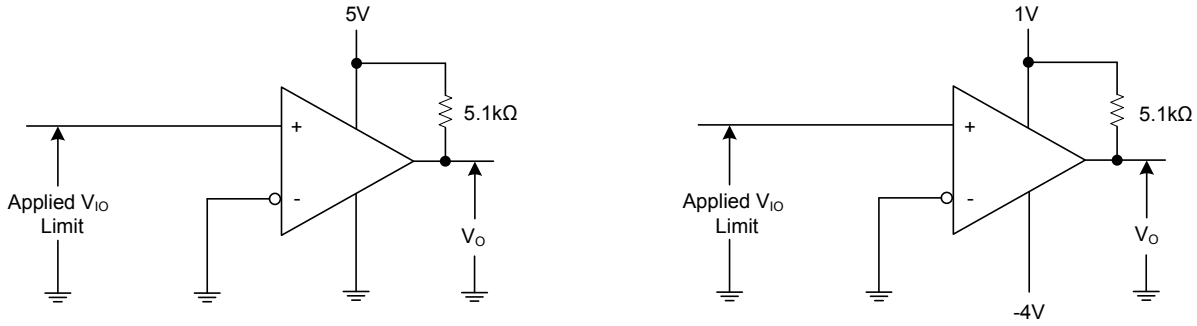
■ PARAMETER MEASUREMENT INFORMATION

The UTC **ULC393** contains a digital output stage which, if held in the linear region of the transfer curve, can cause damage to the device. Conventional operational amplifier/comparator testing incorporates the use of a servo loop that is designed to force the device output to a level within this linear region. Since the servo-loop method of testing cannot be used, the following alternatives for testing parameters such as input offset voltage, common-mode rejection ratio, etc., are suggested.

To verify that the input offset voltage falls within the limits specified, the limit value is applied to the input as shown in Figure 1(a). With the noninverting input positive with respect to the inverting input, the output should be high.

With the input polarity reversed, the output should be low.

A similar test can be made to verify the input offset voltage at the common-mode extremes. The supply voltages can be slewed as shown in Figure 1(b) for the V_{ICR} test, rather than changing the input voltages, to provide greater accuracy.

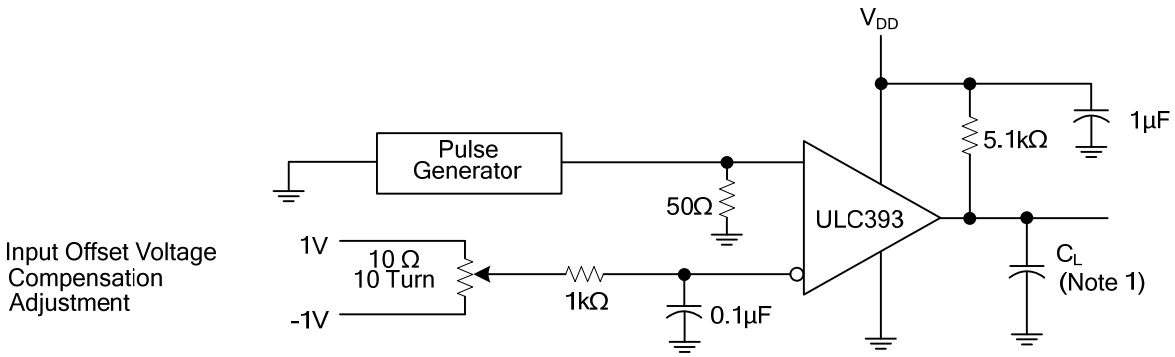


(a) V_{IO} WITH V_{IC}=0V (b) V_{IO} WITH V_{IC}=4V

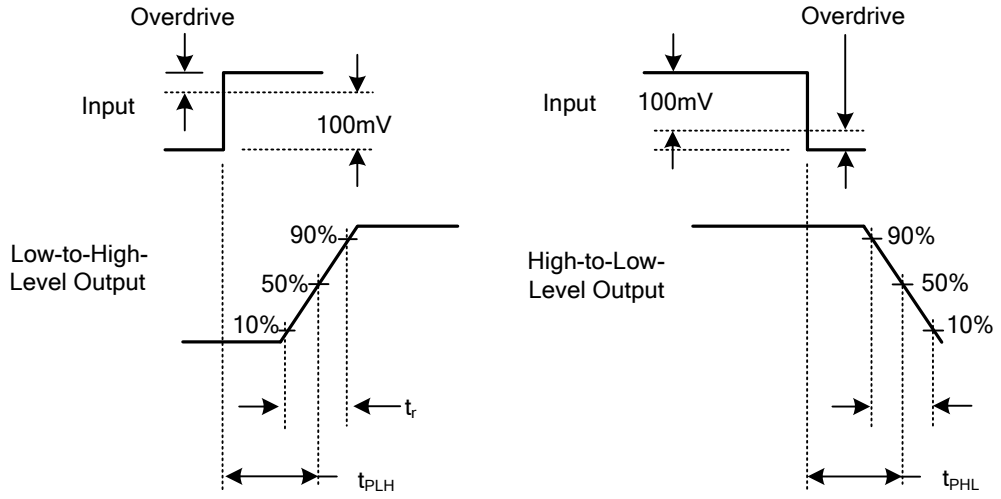
Figure 1. Method for Verifying That Input Offset Voltage Is Within Specified Limits

■ PARAMETER MEASUREMENT INFORMATION (Cont.)

Propagation delay 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. Propagation delay time, low-to-high-level output, is measured from the leading edge of the input pulse, while propagation delay time, high-to-low-level output, is measured from the trailing edge of the input pulse. Propagation delay time measurement at low input signal levels can be greatly affected by the input offset voltage. The offset voltage should be balanced by the adjustment at the inverting input (as shown in Figure 2) so that the circuit is just at the transition point. Then a low signal, for example, 105mV or 5mV overdrive, causes the output to change state.



TEST CIRCUIT

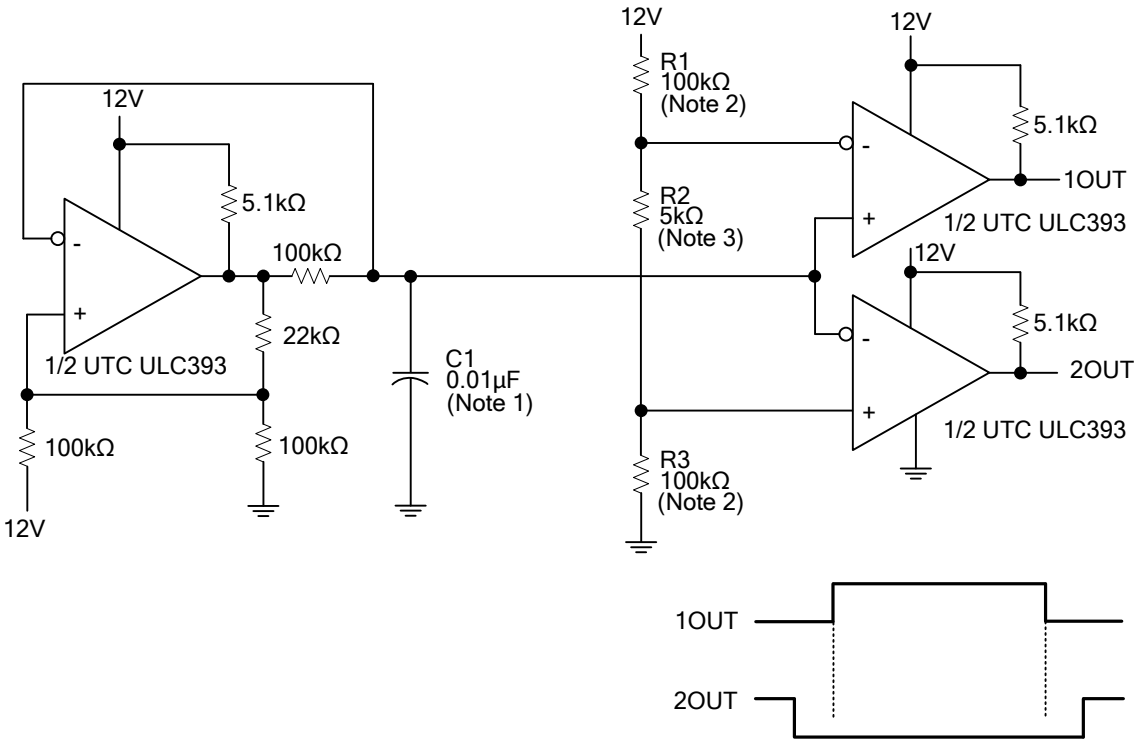


VOLTAGE WAVEFORMS

(Note 1:C_L includes probe and jig capacitance.

Figure 2. Propagation Delay, Rise Time, and Fall Time Circuit and Voltage Waveforms

■ TYPICAL APPLICATION CIRCUIT



Notes: 1. Adjust C1 for a change in oscillator frequency where:
1/f=1.85(100kΩ)C1
2. Adjust R1 and R3 to change duty cycle
3. Adjust R2 to change deadtime

Figure 3. Two-Phase Nonoverlapping Clock Generator