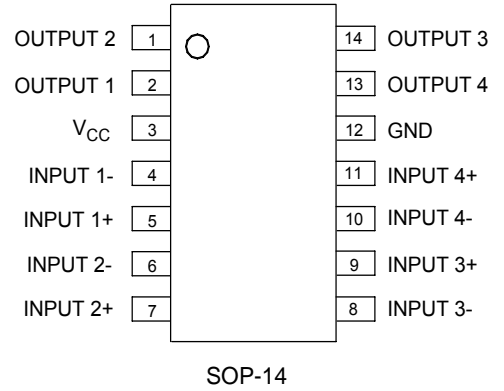
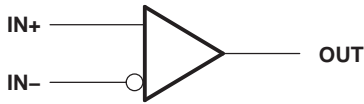


**FEATURES**

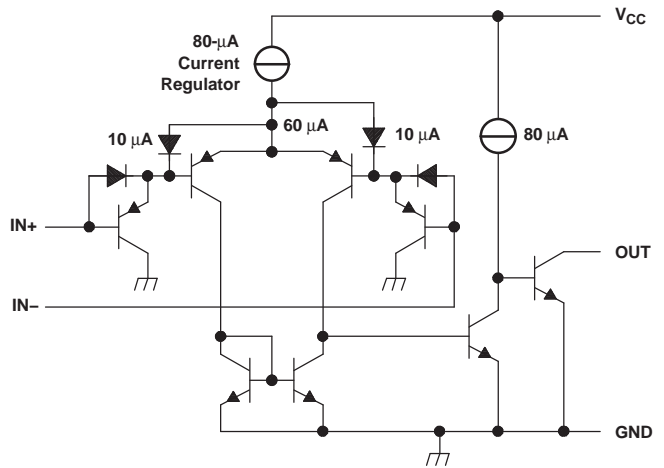
- Wide Supply Ranges
  - Single Supply: 2 V to 36 V  
(Tested to 30 V for Non-V Devices and 32 V for V-Suffix Devices)
  - Dual Supplies:  $\pm 1$  V to  $\pm 18$  V  
(Tested to  $\pm 15$  V for Non-V Devices and  $\pm 16$  V for V-Suffix Devices)
- Low Supply-Current Drain Independent of Supply Voltage: 0.8 mA (Typ)
- Low Input Bias Current: 25 nA (Typ)
- Low Input Offset Current: 3 nA (Typ) (LM139)
- Low Input Offset Voltage: 2 mV (Typ)
- Common-Mode Input Voltage Range Includes Ground
- Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage:  $\pm 36$  V
- Low Output Saturation Voltage
- Output Compatible With TTL, MOS, and CMOS



**SYMBOL (EACH COMPARATOR)**



**SCHEMATIC (EACH COMPARATOR)**



## ELECTRICAL CHARACTERISTICS

at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>(1)</sup>	$T_A$ <sup>(2)</sup>	LM139			UNIT
			MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_{CC} = 5\text{ V to } 30\text{ V}$ , $V_{IC} = V_{ICR\text{ min}}$ , $V_O = 1.4\text{ V}$	25°C		2	5	mV
		Full range			9	
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$	25°C		3	25	nA
		Full range			100	
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$	25°C		-25	-100	nA
		Full range			-300	
$V_{ICR}$ Common-mode input-voltage range <sup>(3)</sup>		25°C		0 to $V_{CC} - 1.5$		V
		Full range		0 to $V_{CC} - 2$		
$A_{VD}$ Large-signal differential-voltage amplification	$V_{CC+} = \pm 7.5\text{ V}$ , $V_O = -5\text{ V to } 5\text{ V}$	25°C		200		V/mV
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$	$V_{OH} = 5\text{ V}$	25°C	0.1		nA
		$V_{OH} = 30\text{ V}$	Full range			1
$V_{OL}$ Low-level output voltage	$V_{ID} = -1\text{ V}$ , $I_{OL} = 4\text{ mA}$	25°C		150	400	mV
		Full range		700		
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V}$ , $V_{OL} = 1.5\text{ V}$	25°C		6	16	mA
$I_{CC}$ Supply current (four comparators)	$V_O = 2.5\text{ V}$ , No load	25°C		0.8	2	mA

- (1) All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
- (2) Full range (MIN to MAX) for LM139 is  $-40^\circ\text{C}$  to  $105^\circ\text{C}$ . All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
- (3) The voltage at either input or common-mode should not be allowed to go negative by more than 0.3 V. The upper end of the common-mode voltage range is  $V_{CC+} - 1.5\text{ V}$ ; however, one input can exceed  $V_{CC}$ , and the comparator will provide a proper output state as long as the other input remains in the common-mode range. Either or both inputs can go to 30 V without damage.

## SWITCHING CHARACTERISTICS

$V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	LM139	UNIT
		TYP	
Response time	$R_L$ connected to 5 V through 5.1 kΩ, $C_L = 15\text{ pF}$ <sup>(1) (2)</sup>	100-mV input step with 5-mV overdrive	1.3
		TTL-level input step	0.3

- (1)  $C_L$  includes probe and jig capacitance.
- (2) The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V.

## ELECTRICAL CHARACTERISTICS

at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>(1)</sup>	$T_A$ <sup>(2)</sup>	LM239 LM339			UNIT	
			MIN	TYP	MAX		
$V_{IO}$ Input offset voltage	$V_{CC} = 5\text{ V to }30\text{ V}$ , $V_{IC} = V_{ICR\text{ min}}$ , $V_O = 1.4\text{ V}$	25°C		2	5	mV	
		Full range			9		
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$	25°C		5	50	nA	
		Full range			150		
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$	25°C		-25	-250	nA	
		Full range			-400		
$V_{ICR}$ Common-mode input-voltage range <sup>(3)</sup>		25°C		0 to $V_{CC} - 1.5$		V	
		Full range		0 to $V_{CC} - 2$			
$A_{VD}$ Large-signal differential-voltage amplification	$V_{CC} = 15\text{ V}$ , $V_O = 1.4\text{ V to }11.4\text{ V}$ , $R_L \geq 15\text{ k}\Omega\text{ to }V_{CC}$	25°C		50	200	V/mV	
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$	$V_{OH} = 5\text{ V}$	25°C		0.1	50	nA
		$V_{OH} = 30\text{ V}$	Full range			1	$\mu\text{A}$
$V_{OL}$ Low-level output voltage	$V_{ID} = -1\text{ V}$ , $I_{OL} = 4\text{ mA}$	25°C		150	400	mV	
		Full range			700		
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V}$ , $V_{OL} = 1.5\text{ V}$	25°C		6	16	mA	
$I_{CC}$ Supply current (four comparators)	$V_O = 2.5\text{ V}$ , No load	25°C		0.8	2	mA	

- (1) All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
- (2) Full range (MIN to MAX) for LM239 is  $-20^\circ\text{C}$  to  $85^\circ\text{C}$ , and for LM339 is  $0^\circ\text{C}$  to  $70^\circ\text{C}$ . All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
- (3) The voltage at either input or common-mode should not be allowed to go negative by more than 0.3 V. The upper end of the common-mode voltage range is  $V_{CC+} - 1.5\text{ V}$ ; however, one input can exceed  $V_{CC-}$ , and the comparator will provide a proper output state as long as the other input remains in the common-mode range. Either or both inputs can go to 30 V without damage.

## SWITCHING CHARACTERISTICS

$V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	LM239 LM339	UNIT
		TYP	
Response time	$R_L$ connected to 5 V through 5.1 k $\Omega$ , $C_L = 15\text{ pF}$ <sup>(1) (2)</sup>	100-mV input step with 5-mV overdrive	1.3
		TTL-level input step	0.3

- (1)  $C_L$  includes probe and jig capacitance.
- (2) The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V.

## ELECTRICAL CHARACTERISTICS

at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>(1)</sup>		$T_A$ <sup>(2)</sup>	LM2901			UNIT
				MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_{IC} = V_{ICR\ min},$ $V_O = 1.4\text{ V},$ $V_{CC} = 5\text{ V to MAX}^{(3)}$	Non-A devices	25°C	2	7	mV	
			Full range	15			
		A-suffix devices	25°C	1	2		
			Full range	4			
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$		25°C	5	50	nA	
			Full range	200			
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$		25°C	-25	-250	nA	
			Full range	-500			
$V_{ICR}$ Common-mode input-voltage range <sup>(4)</sup>			25°C	0 to $V_{CC} - 1.5$		V	
			Full range	0 to $V_{CC} - 2$			
$A_{VD}$ Large-signal differential-voltage amplification	$V_{CC} = 15\text{ V}, V_O = 1.4\text{ V to }11.4\text{ V},$ $R_L \geq 15\text{ k}\Omega\text{ to }V_{CC}$		25°C	25	100	V/mV	
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$		$V_{OH} = 5\text{ V}$	25°C	0.1	50	nA
			$V_{OH} = V_{CC}\text{ MAX}^{(3)}$	Full range	1		$\mu\text{A}$
$V_{OL}$ Low-level output voltage	$V_{ID} = -1\text{ V},$ $I_{OL} = 4\text{ mA}$	Non-V devices	25°C	150	500	mV	
		V-suffix devices		150	400		
		All devices	Full range	700			
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V},$	$V_{OL} = 1.5\text{ V}$	25°C	6	16	mA	
$I_{CC}$ Supply current (four comparators)	$V_O = 2.5\text{ V},$ No load		25°C	$V_{CC} = 5\text{ V}$	0.8	2	mA
				$V_{CC} = \text{MAX}^{(3)}$	1	2.5	

- (1) All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
- (2) Full range (MIN to MAX) for LM2901 is  $-40^\circ\text{C}$  to  $105^\circ\text{C}$ . All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
- (3)  $V_{CC}\text{ MAX} = 30\text{ V}$  for non-V devices, and  $32\text{ V}$  for V-suffix devices
- (4) The voltage at either input or common-mode should not be allowed to go negative by more than  $0.3\text{ V}$ . The upper end of the common-mode voltage range is  $V_{CC+} - 1.5\text{ V}$ ; however, one input can exceed  $V_{CC}$ , and the comparator will provide a proper output state as long as the other input remains in the common-mode range. Either or both inputs can go to  $V_{CC}\text{ MAX}$  without damage.

## SWITCHING CHARACTERISTICS

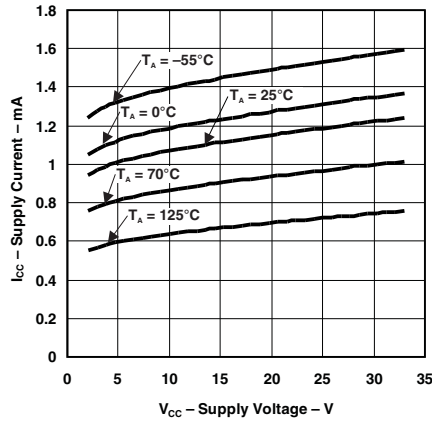
$V_{CC} = 5\text{ V}, T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS		LM2901	UNIT
			TYP	
Response time	$R_L$ connected to $5\text{ V}$ through $5.1\text{ k}\Omega,$ $C_L = 15\text{ pF}^{(1)}\text{ }^{(2)}$	100-mV input step with 5-mV overdrive	1.3	$\mu\text{s}$
		TTL-level input step	0.3	

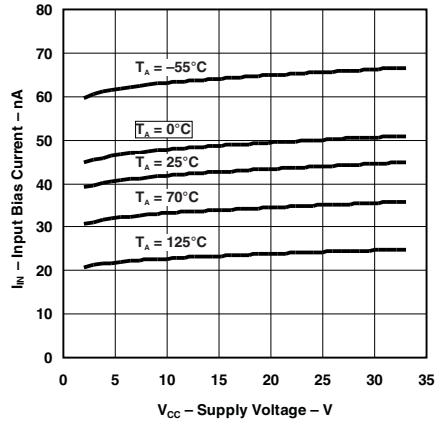
- (1)  $C_L$  includes probe and jig capacitance.
- (2) The response time specified is the interval between the input step function and the instant when the output crosses  $1.4\text{ V}$ .

**TYPICAL CHARACTERISTICS**

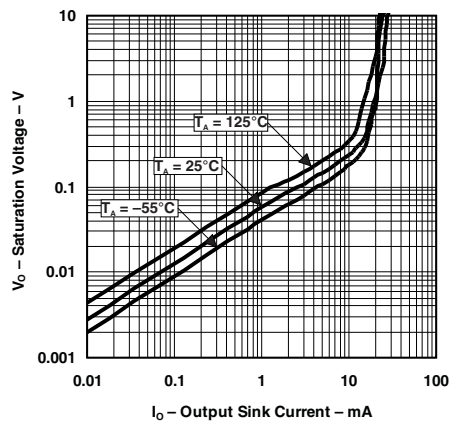
**SUPPLY CURRENT vs SUPPLY VOLTAGE**



**INPUT BIAS CURRENT vs SUPPLY VOLTAGE**

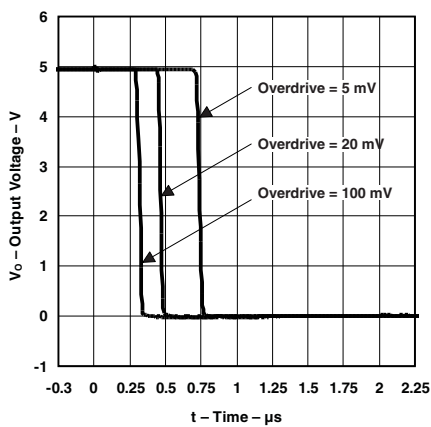


**OUTPUT SATURATION VOLTAGE**

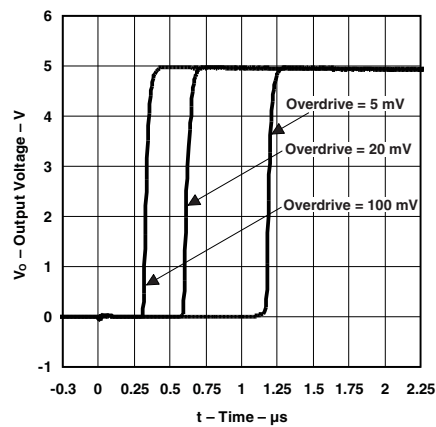


**TYPICAL CHARACTERISTICS (continued)**

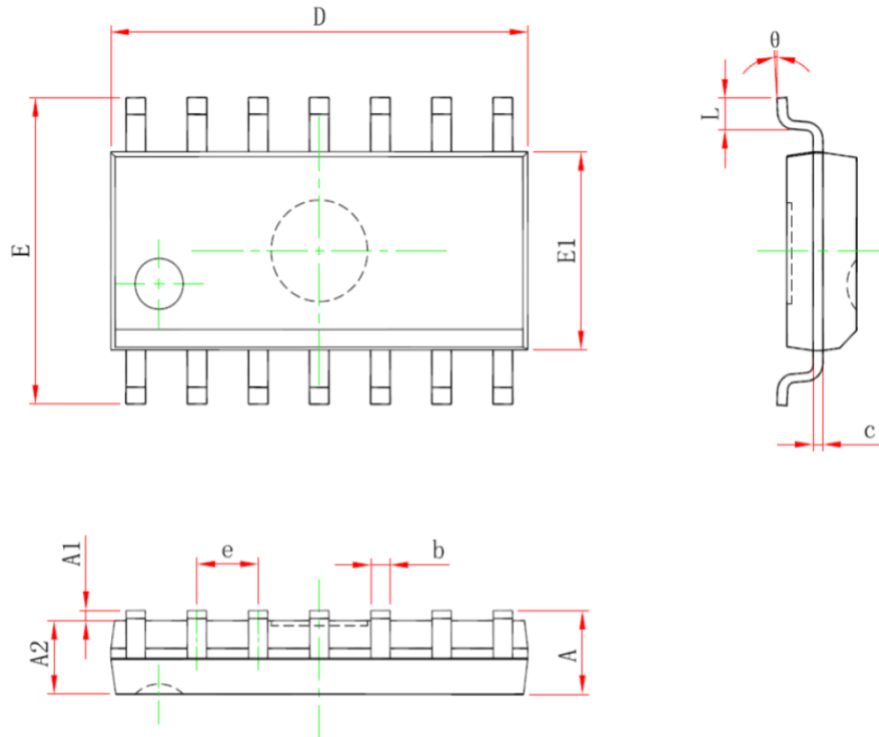
**RESPONSE TIME FOR VARIOUS OVERDRIVES NEGATIVE TRANSITION**



**RESPONSE TIME FOR VARIOUS OVERDRIVES POSITIVE TRANSITION**



PACKAGE SOP-14



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	---	1.750	---	0.069
A1	0.100	0.250	0.004	0.010
A2	1.250	---	0.049	---
b	0.310	0.510	0.012	0.020
c	0.100	0.250	0.004	0.010
D	8.450	8.850	0.333	0.348
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

**Ordering information**

<b>Order code</b>	<b>Package</b>	<b>Baseqty</b>	<b>Deliverymode</b>
UMW LM339DR	SOP-14	2500	Tape and reel
UMW LM239DR	SOP-14	2500	Tape and reel
UMW LM139DR	SOP-14	2500	Tape and reel
UMW LM2901DR	SOP-14	2500	Tape and reel