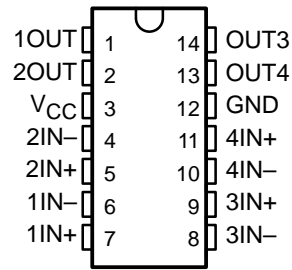


# LM139, LM139A, LM239, LM239A, LM339, LM339A, LM2901 QUAD DIFFERENTIAL COMPARATORS

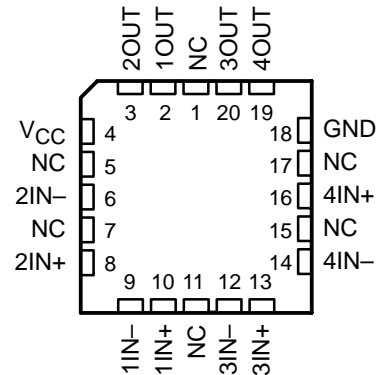
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- Single Supply or Dual Supplies
- Wide Range of Supply Voltage . . . 2 V to 36 V
- Low Supply-Current Drain Independent of Supply Voltage . . . 0.8 mA Typ
- Low Input Bias Current . . . 25 nA Typ
- Low Input Offset Current . . . 3 nA Typ (LM139)
- 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
- Package Options Include Plastic Small-Outline (D, NS), Shrink Small-Outline (DB), Thin Shrink Small-Outline (PW), and Ceramic Dual Flatpack (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) DIPs

D, DB, J, N, NS, PW, OR W PACKAGE  
(TOP VIEW)



FK PACKAGE  
(TOP VIEW)



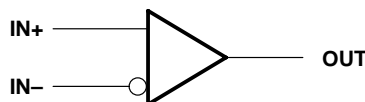
NC – No internal connection

## description

These devices consist of four independent voltage comparators that are designed to operate from a single power supply over a wide range of voltages. Operation from dual supplies also is possible as long as the difference between the two supplies is 2 V to 36 V and  $V_{CC}$  is at least 1.5 V more positive than the input common-mode voltage. Current drain is independent of the supply voltage. The outputs can be connected to other open-collector outputs to achieve wired-AND relationships.

The LM139 and LM139A are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The LM239 and LM239A are characterized for operation from  $-25^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The LM339 and LM339A are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ . The LM2901 is characterized for operation from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ .

## symbol (each comparator)



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

# LM139, LM139A, LM239, LM239A, LM339, LM339A, LM2901 QUAD DIFFERENTIAL COMPARATORS

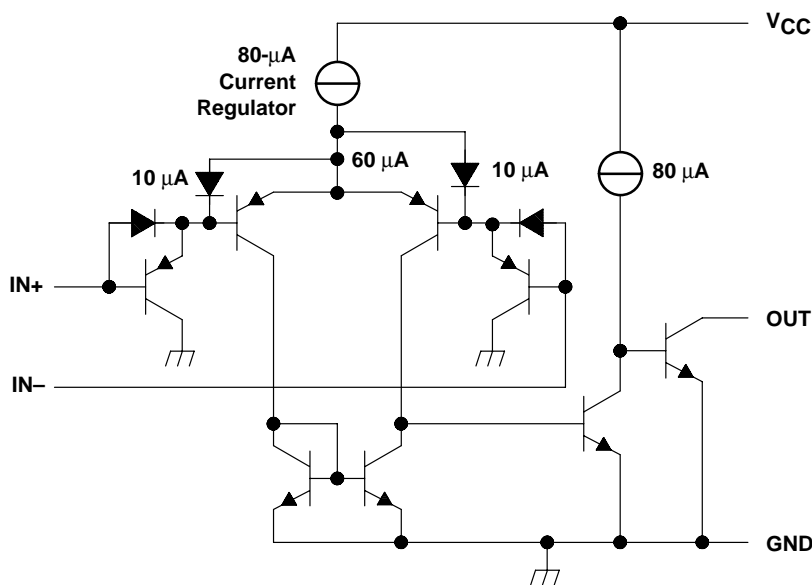
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## AVAILABLE OPTIONS

T <sub>A</sub>	V <sub>IO(max)</sub> at 25°C	PACKAGED DEVICES						
		PLASTIC SOIC (D, NS)	PLASTIC SSOP (DB)	CERAMIC CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)	PLASTIC TSSOP (PW)	CERAMIC DUAL FLATPACK (W)
0°C to 70°C	5 mV 5 mV 2 mV 2 mV	LM339D LM339NS LM339AD LM339ANS	LM339DBR — — —	— — — —	— — — —	LM339N — LM339AN —	LM339PWR — — —	— — — —
-25°C to 85°C	5 mV 2 mV	LM239D LM239AD	— —	— —	— —	LM239N LM239AN	— —	— —
-40°C to 125°C	7 mV 7 mV	LM2901D LM2901NS	LM2901DBR	—	—	LM2901N	LM2901PWR	—
-55°C to 125°C	5 mV 2 mV	LM139D LM139AD	—	LM139FK LM139AFK	LM139J LM139AJ	—	—	LM139W LM139AW

The D and NS packages are available taped and reeled. Add the suffix R to the device type (e.g., LM339DR). The DB and PW packages are only available taped and reeled.

## schematic (each comparator)



All current values shown are nominal.

**LM139, LM139A, LM239, LM239A,  
LM339, LM339A, LM2901**  
**QUAD DIFFERENTIAL COMPARATORS**  
SLCS006F – OCTOBER 1979 – REVISED NOVEMBER 2001

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†**

Supply voltage, $V_{CC}$ (see Note 1)	36 V
Differential input voltage, $V_{ID}$ (see Note 2)	$\pm 36$ V
Input voltage range, $V_I$ (either input)	–0.3 V to 36 V
Output voltage, $V_O$	36 V
Output current, $I_O$	20 mA
Duration of output short circuit to ground (see Note 3)	Unlimited
Package thermal impedance, $\theta_{JA}$ (see Note 4): D package	86°C/W
DB package	96°C/W
N package	80°C/W
NS package	76°C/W
PW package	113°C/W
Continuous total dissipation	See Dissipation Rating Table
Case temperature for 60 seconds: FK package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D, DB, N, or PW package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package	300°C
Storage temperature range, $T_{stg}$	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. All voltage values, except differential voltages, are with respect to network ground.
  2. Differential voltages are at  $IN+$  with respect to  $IN-$ .
  3. Short circuits from outputs to  $V_{CC}$  can cause excessive heating and eventual destruction.
  4. The package thermal impedance is calculated in accordance with JESD 51-7.

**DISSIPATION RATING TABLE**

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR	DERATE ABOVE $T_A$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
FK	900 mW	11 mW/°C	68°C	880 mW	715 mW	275 mW
J	900 mW	11 mW/°C	68°C	880 mW	715 mW	275 mW



**LM139, LM139A, LM239, LM239A,  
LM339, LM339A, LM2901  
QUAD DIFFERENTIAL COMPARATORS**

SLCS006F – OCTOBER 1979 – REVISED NOVEMBER 2001

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

PARAMETER	TEST CONDITIONS†	$T_A$ ‡	LM139			LM139A			UNIT
			MIN	TYP	MAX	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		1	2	mV
		Full range			9			4	
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$	25°C		3	25		3	25	nA
		Full range			100			100	
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$	25°C		-25	-100		-25	-100	nA
		Full range			-300			-300	
$V_{ICR}$ Common-mode input-voltage range		25°C		0 to $V_{CC}-1.5$			0 to $V_{CC}-1.5$		V
		Full range		0 to $V_{CC}-2$			0 to $V_{CC}-2$		
$A_{VD}$ Large-signal differential-voltage amplification	$V_{CC} \pm = \pm 7.5\text{ V},$ $V_O = -5\text{ V to }5\text{ V}$	25°C		200		50	200	V/mV	
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$	$V_{OH} = 5\text{ V}$	25°C		0.1		0.1	nA	
		$V_{OH} = 30\text{ V}$	Full range			1		1	$\mu\text{A}$
$V_{OL}$ Low-level output voltage	$V_{ID} = -1\text{ V},$ $I_{OL} = 4\text{ mA}$	25°C		150	400		150	400	mV
		Full range			700			700	
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V},$ $V_{OL} = 1.5\text{ V}$	25°C		6	16		6	16	mA
$I_{CC}$ Supply current (four comparators)	$V_O = 2.5\text{ V},$ No load	25°C		0.8	2		0.8	2	mA

† All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

‡ Full range (MIN to MAX) for LM139 and LM139A is  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

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

PARAMETER	TEST CONDITIONS	LM139 LM139A			UNIT	
		MIN	TYP	MAX		
Response time	$R_L$ connected to 5 V through 5.1 k $\Omega$ , $C_L = 15\text{ pF}$ §, See Note 5	100-mV input step with 5-mV overdrive			1.3	$\mu\text{s}$
		TTL-level input step			0.3	

§  $C_L$  includes probe and jig capacitance.

NOTE 5: The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V.



**LM139, LM139A, LM239, LM239A,  
LM339, LM339A, LM2901**  
**QUAD DIFFERENTIAL COMPARATORS**  
SLCS006F – OCTOBER 1979 – REVISED NOVEMBER 2001

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

PARAMETER	TEST CONDITIONS†	$T_A$ ‡	LM239 LM339			LM239A LM339A			UNIT	
			MIN	TYP	MAX	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		1	3	mV	
		Full range			9			4		
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$	25°C		5	50		5	50	nA	
		Full range			150			150		
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$	25°C		-25	-250		-25	-250	nA	
		Full range			-400			-400		
$V_{ICR}$ Common-mode input-voltage range		25°C		0 to $V_{CC}-1.5$			0 to $V_{CC}-1.5$		V	
		Full range		0 to $V_{CC}-2$			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		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		0.1	50	nA
		$V_{OH} = 30\text{ V}$	Full range			1			1	$\mu\text{A}$
$V_{OL}$ Low-level output voltage	$V_{ID} = -1\text{ V}$ , $I_{OL} = 4\text{ mA}$	25°C		150	400		150	400	mV	
		Full range			700			700		
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V}$ , $V_{OL} = 1.5\text{ V}$	25°C		6	16		6	16	mA	
$I_{CC}$ Supply current (four comparators)	$V_O = 2.5\text{ V}$ , No load	25°C		0.8	2		0.8	2	mA	

† All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

‡ Full range (MIN to MAX) for LM239 and LM239A is -25°C to 85°C, for LM339 and LM339A is 0°C to 70°C. All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

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

PARAMETER	TEST CONDITIONS	LM239, LM239A, LM339, LM339A			UNIT
		MIN	TYP	MAX	
Response time	$R_L$ connected to 5 V through 5.1 k $\Omega$ , $C_L = 15\text{ pF}$ §, See Note 5	100-mV input step with 5-mV overdrive			$\mu\text{s}$
		TTL-level input step			

§  $C_L$  includes probe and jig capacitance.

NOTE 5: The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V.

**LM139, LM139A, LM239, LM239A,  
LM339, LM339A, LM2901  
QUAD DIFFERENTIAL COMPARATORS**

SLCS006F – OCTOBER 1979 – REVISED NOVEMBER 2001

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

PARAMETER	TEST CONDITIONS†	$T_A$ ‡	LM2901			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	7	mV
		Full range			15	
$I_{IO}$ 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		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
		$V_{OH} = 30\text{ V}$	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	500	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
	$V_{CC} = 30\text{ V},$ No load $V_O = 2.5\text{ V},$			1	2.5	

† All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

‡ Full range (MIN to MAX) for LM2901 is -40°C to 125°C. All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

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

PARAMETER	TEST CONDITIONS	LM2901			UNIT
		MIN	TYP	MAX	
Response time	$R_L$ connected to 5 V through 5.1 k $\Omega$ , $C_L = 15\text{ pF}$ §, See Note 5	100-mV input step with 5-mV overdrive			$\mu\text{s}$
		TTL-level input step			

§  $C_L$  includes probe and jig capacitance.

NOTE 5: The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V.



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