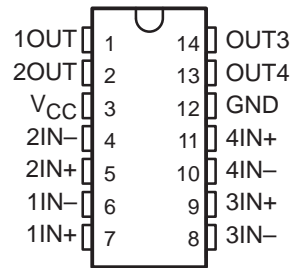


LM139, LM139A, LM239, LM239A, LM339, LM339A, LM339Y, LM2901 QUAD DIFFERENTIAL COMPARATORS

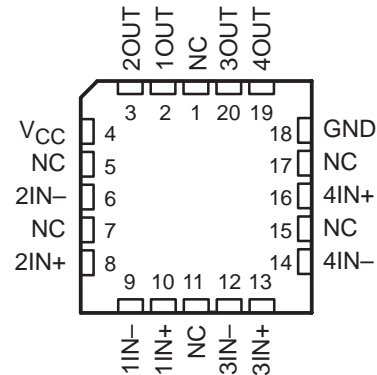
SLCS006E – OCTOBER 1979 – REVISED MAY 2000

- 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 . . . ± 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)



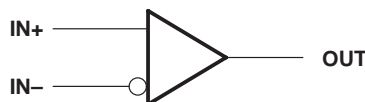
NC – No internal connection

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 wire-AND relationships.

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

symbol (each comparator)



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2000, Texas Instruments Incorporated
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, LM339Y, LM2901 QUAD DIFFERENTIAL COMPARATORS

SLCS006E – OCTOBER 1979 – REVISED MAY 2000

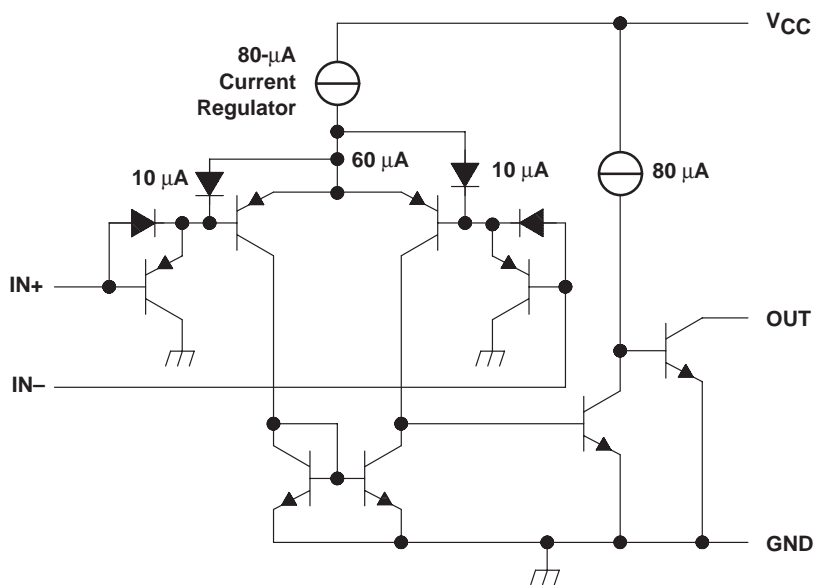
AVAILABLE OPTIONS

T _A	V _{IO} max 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, LM339Y, LM2901
QUAD DIFFERENTIAL COMPARATORS**

SLCS006E – OCTOBER 1979 – REVISED MAY 2000

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)	± 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, θ_{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.

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, LM339Y, LM2901
QUAD DIFFERENTIAL COMPARATORS**

SLCS006E – OCTOBER 1979 – REVISED MAY 2000

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	μA
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°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	LM139 LM139A			UNIT	
		MIN	TYP	MAX		
Response time	R_L connected to 5 V through 5.1 k Ω , $C_L = 15\text{ pF}$ §, See Note 5	100-mV input step with 5-mV overdrive			1.3	μs
		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, LM339Y, LM2901
QUAD DIFFERENTIAL COMPARATORS**

SLCS006E – OCTOBER 1979 – REVISED MAY 2000

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	μA
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	
	$V_{CC} = 30\text{ V}$, $V_O = 2.5\text{ V}$, No load									

† 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 Ω , $C_L = 15\text{ pF}$ §, See Note 5	100-mV input step with 5-mV overdrive			1.3
		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, LM339Y, LM2901**
QUAD DIFFERENTIAL COMPARATORS

SLCS006E – OCTOBER 1979 – REVISED MAY 2000

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	μA
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			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 Ω , $C_L = 15\text{ pF}$ §, See Note 5	100-mV input step with 5-mV overdrive			μs
		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, LM339Y, LM2901
QUAD DIFFERENTIAL COMPARATORS**

SLCS006E – OCTOBER 1979 – REVISED MAY 2000

electrical characteristics at $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITION†	LM339Y			UNIT
		MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{CC} = 5\text{ V to }30\text{ V}$, $V_{IC} = V_{ICR(\text{min})}$, $V_O = 1.4\text{ V}$		2	5	mV
I_{IO} Input offset current	$V_O = 1.4\text{ V}$		5	50	nA
I_{IB} Input bias current	$V_O = 1.4\text{ V}$		-25	-250	nA
V_{ICR} Common-mode input-voltage range			0 to $V_{CC}-1.5$		V
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	100		V/mV
I_{OH} High-level output current	$V_{ID} = 1\text{ V}$, $V_{OH} = 5\text{ V}$		0.1	50	nA
V_{OL} Low-level output voltage	$V_{ID} = -1\text{ V}$, $I_{OL} = 4\text{ mA}$		150	400	mV
I_{OL} Low-level output current	$V_{ID} = -1\text{ V}$, $V_{OL} = 1.5\text{ V}$	6	16		mA
I_{CC} Supply current (four comparators)	$V_O = 2.5\text{ V}$, No load		0.8	2	mA
	$V_O = 30\text{ V}$, $V_O = 15\text{ V}$, No load		1	2.5	

† 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		LM339Y			UNIT
			MIN	TYP	MAX	
Response time	R_L connected to 5 V through 5.1 k Ω , $C_L = 15\text{ pF}$ ‡, See Note 5	100-mV input step with 5-mV overdrive		1.3		μs
		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.

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Customers are responsible for their applications using TI components.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.