钍地半导体
Tudi Semiconductor

Product Specification

TUDI-LM339B, LM2901B, LM339, LM239, LM139, LM2901

Quad Differential Comparators

网址 www.sztdbdt.com

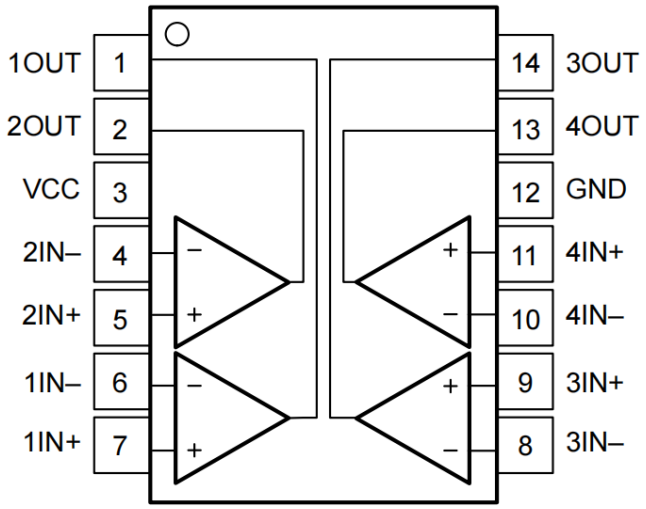
用芯智造·卓越品质

semiconductor device manufacturer

- Design
- research and development
- production
- and sales

Features

- NEW LM339B and LM2901B
- Improved specifications of B-version
  - Maximum rating: up to 38 V
  - ESD rating (HBM): 2k V
  - Low input offset: 0.37 mV
  - Low input bias current: 3.5 nA
  - Low supply-current: 200 µA per comparator
  - Faster response time of 1 µsec
  - Extended temperature range for LM339B
- B-version is drop-in replacement for LM239, LM339 and LM2901, A and V versions
- Common-mode input voltage range includes ground
- Differential input voltage range equal to maximum- rated supply voltage: ±38 V
- Low output saturation voltage
- Output compatible with TTL, MOS, and CMOS
- For single version, see the TL331B
- For dual version, see the LM393B or LM2903B



LM339B, LM2901B, LM339, LM239, LM139, LM2901
Pin Diagram

Description

The LM339B and LM2901B devices are the next generation versions of the industry-standard LM339 and LM2901 comparator family. These next generation B-version comparators feature lower offset voltage, higher supply voltage capability, lower supply current, lower input bias current, lower propagation delay, and improved 2 kV ESD performance and input ruggedness through dedicated ESD clamps. The LM339B and LM2901B can drop-in replace the LM239, LM339 and LM2901, for both "A" and "V" grades.

All devices consist of four independent voltage comparators that are designed to operate from a single power supply over a wide range of voltages.

Applications

- Vacuum robot
- Single phase UPS
- Server PSU
- Cordless power tool
- Wireless infrastructure
- Applicances
- Building automation
- Factory automation & control
- Motor drives
- Infotainment & cluster

Table 1. Pin Functions

PIN		I/O	DESCRIPTION
NAME(1)	D,DB,N, NS,PW,DYY,J		
OUT1(1)	1	Output	Output pin of the comparator 2
OUT2(1)	2	Output	Output pin of the comparator 1
Vcc	3	—	Positive supply
IN2-(1)	4	Input	Negative input pin of the comparator 1
IN2+(1)	5	Input	Positive input pin of the comparator 1
IN1-(1)	6	Input	Negative input pin of the comparator 2
IN1+(1)	7	Input	Positive input pin of the comparator 2
IN3-	8	Input	Negative input pin of the comparator 3
IN3+	9	Input	Positive input pin of the comparator 3
IN4-	10	Input	Negative input pin of the comparator 4
IN4+	11	Input	Positive input pin of the comparator 4
GND	12	—	Negative supply
OUT4	13	Output	Output pin of the comparator 4
OUT3	14	Output	Output pin of the comparator 3
NC	—	—	No Internal Connection-Leave floating or GND
NC	16	—	No Internal Connection-Leave floating or GND
Thermal Pad	17	—	Connect directly to GND pin

Specifications

Absolute Maximum Ratings for LM339B and LM2901B

over operating free-air temperature range (unless otherwise noted) (1)

	MIN	MAX	UNIT
Supply voltage:Vs=(V+)-(V-)	-0.3	38	V
Differential input voltage:V_{ID}(2)		± 38	V
Input pins(IN+,IN-)	-0.3	38	V
Current into input pins (IN+,IN-)		-50	mA
Output pin(OUT)	-0.3	38	V
Output sink current		25	mA
Output short-circuit duration(3)		Unlimited	s
Junction temperature,Tj	TBD	150	℃
Storage temperature,T_{stg}	-65	150	℃

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) Differential voltages are at IN+ with respect to IN-
(3) Short circuits from outputs to V+ can cause excessive heating and eventual destruction.

Absolute Maximum Ratings for Non-B Versions

over operating free-air temperature range (unless otherwise noted)(1)

		MIN	MAX	UNIT
V_{CC} Supply voltage(2)			36	V
V_{ID} Differential input voltage(3)			±36	V
V_I Input voltage range(either input)		-0.3	36	V
I_K Input current(5)			-50	mA
Vo Output voltage			36	V
Io Output current			20	mA
Duration of output short circuit to ground(4)		Unlimited		
T_J Operating virtual-junction temperature			150	℃
Case temperature for 60 s	FK package		260	℃
Lead temperature 1.6 mm(1/16 in)from case for 60 s	Jpackage		300	℃
T_{stg} Storage temperature		-65	150	℃

(1) 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.
(2) All voltage values, except differential voltages, are with respect to network ground.
(3) Differential voltages are at xIN+ with respect to xIN－.
(4) Short circuits from outputs to V_{CC} can cause excessive heating and eventual destruction.
(5) Input current flows through parasitic diode to ground and will turn on parasitic transistors that will increase I_{CC} and can cause output be incorrect. Normal operation resumes when input is removed.

ESD Ratings for LM339B and LM2901B

			VALUE	UNIT
V(ESD)	Electrostatic discharge	Human-body model(HBM),per ANSI/ESDA/JEDEC JS-001(1)	±2000	V
		Human-body model (HBM),per ANSI/ESDAJEDEC JS-002(2)	±1000	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process

ESD Ratings, Non-B Versions

		VALUE	UNIT
V(ESD) Electrostatic discharge	Human body model (HBM),per ANSVESDAJEDEC JS-001(1)	±500	V
	Charged-device model (CDM),per JEDEC specification JESD22-	±750	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process

Recommended Operating Conditions for LM339B and LM2901B

over operating free-air temperature range (unless otherwise noted)

	MIN	MAX	UNIT
Supply voltage:Vs=(V+)-(V-)	2	36	V
Ambient temperature,TA,LM339B	-40	85	℃
Ambient temperature,TA,LM2901B	-40	125	℃
Input Voltage Range,VIvR	(V-)-0.1	(V +)-2.0	V

Recommended Operating Conditions, Non-B Versions

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
Vcc Supply voltage	Non-V devices	2	30	V
	V devices	2	32	V
TJ Junction temperature	LM139x	-55	125	℃
	LM239x	-25	85	
	LM339x	-0	70	
	LM2901x	-40	125	

Thermal Information for LM339B and LM2901B

THERMAL METRIC		LM339B,LM2901B			UNIT
		D (SOIC)	PW (TSSOP)	DDY (SOT-23)	
		14	14	14	
ReJA	Junction-to-ambient thermal resistance	111.2	136.6		℃/W
ReJC(top)	Junction-to-case (top)thermal resistance	66.9	66.6		℃/W
ReJB	Junction-to-board thermal resistance	67.8	79.8		℃/W
ψJT	Junction-to-top characterization parameter	28.0	17.8		℃/W
ψJB	Junction-to-board characterization parameter	67.4	79.3		℃/W
ReJC(bot)	Junction-to-case(bottom)thermal resistance	-	-	-	℃/W

Thermal Information for Non-B Versions

THERMAL METRIC	LMx39,LM2901x					UNIT
	D (SOIC)	DB (SSOP)	N (PDIP)	NS (SO)	PW (TSSOP)	
RθJA Junction-to-ambient thermal resistance	98.8	111.8	79	96.2	120	℃/W
$R_{\theta JC(top)}$ Junction-to-case(top)thermal resistance	64.3	63.6	73.4	56.1	59	℃/W
$R_{\theta JB}$ Junction-to-board thermal resistance	59.7	60.5	58.7	56.9	68.8	℃/W
ψ_{JT} Junction-to-top characterization parameter	25.7	26.2	48.3	24.8	9.9	℃/W
ψ_{JB} parameter Junction-to-board characterization	59.3	59.8	58.5	56.4	68.2	℃/W
$R_{\theta JC(bot)}$ Junction-to-case (bottom)thermal resistance	—	—	—	—	—	℃/W

Electrical Characteristics for LM339B

V_S = 5 V, V_{CM} = (V –) ; T_A = 25 ° C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	Vs=5 to 36V	-3.4	±0.37	3.5	mV
		Vs=5 to 36V,T_A=-40℃ to+85℃	-5.5		5.5	
I_{IB}	Input bias current			-3	-25	nA
		T_A=-40℃ to+85℃			-50	nA
Ios	Input offset current		-25	±0.5	25	nA
		T_A=-40℃ to+85℃	-50		50	nA
V_{CM}	Common mode range(1)	Vs=3 to 36V	(V -)		(V +)-1.5	V
		Vs=3 to 36V,TA=-40℃ to+85℃	(V -)		(V +)-2.0	V
A_{VD}	Large signal differential voltage amplification (2)	Vs=15V,Vo=1.4V to 11.4V; RL≥15k to(V+)	50	200		V/mV
V_{OL}	Low level output Voltage {swing from(V-)}	I_{SINK}≤4mA,V_{ID}=-1V		110	400	mV
		I_{SINK}≤4mA,V_{ID}=-1V T_A=-40℃ to+85℃			550	mV
I_{OH-LKG}	High-level output leakage current	(V+)=Vo=5V;VD=1V		0.1	50	nA
		(V+)=Vo=36V;VD=1V			100	nA
I_{OL}	Low level output current	V_{OL}=1.5V;V_{ID}=-1V;Vs=5V	6	21		mA
I_Q	Quiescent current (allcomparators)	Vs=5V,no load		0.8	1.2	mA
		Vs=36V,no load,T_A=-40℃to+85℃		1	1.6	mA

(1) The voltage at either input should not be allowed to go negative by more than 0.3 V otherwise output may be incorrect and excessive input current can flow. The upper end of the common-mode voltage range is limited by V_{CC} – 2V. However only one input needs to be in the valid common mode range, the other input can go up the maximum V_{CC} level and the comparator provides a proper output state. Either or both inputs can go to maximum V_{CC} level without damage.

(2) This parameter is ensured by design and/or characterization and is not tested in production.

Electrical Characteristics for LM2901B

V_S = 5 V, V_{CM} = (V –) ; T_A = 25°C (unless otherwise noted).

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	Vs=5 to 36V	-3.5	±0.37	3.5	mV
		Vs=5 to 36V,T_A=-40℃ to+125℃	-5.5		5.5	
I_{IB}	Input bias current			-3	-25	nA
		T_A=-40℃ to+125℃			-50	nA
Ios	Input offset current		-25	±0.5	25	nA
		T_A=-40℃ to+125℃	-50		50	nA
V_{CM}	Common mode range (1)	Vs=3 to 36V	(V -)		(V +)-1.5	V
		Vs=3 to 36V,TA=-40℃ to+125℃	(V -)		(V +)-2.0	V
A_{VD}	Large signal differential voltage amplification(2)	Vs=15V,Vo=1.4V to 11.4V; RL≥15k to(V+)	50	200		V/mV
V_{OL}	Low level output Voltage {swing from(V-)}	I_{SINK}≤4mA,VID=-1V		110	400	mV
		I_{SINK}≤4mA,VID=-1V T_A=-40℃ to+125℃			550	mV
I_{OH-LKG}	High-level output leakage current	(V+)=Vo=5V;VD=1V		0.1	50	nA
		(V+)=Vo=36V;VID=1V			100	nA
I_{OL}	Low level output current	V_{OL}=1.5V;VD=-1V;Vs=5V	6	21		mA
I_Q	Quiescent current (all comparators)	Vs=5V,no load		0.8	1.2	mA
		Vs=36V,no load,T_A=-40℃ to+125℃		1	1.6	mA

(1) The voltage at either input should not be allowed to go negative by more than 0.3 V otherwise output may be incorrect and excessive input current can flow. The upper end of the common-mode voltage range is limited by V_{CC} – 2V. However only one input needs to be in the valid common mode range, the other input can go up the maximum V_{CC} level and the comparator provides a proper output state. Either or both inputs can go to maximum V_{CC} level without damage.

(2) This parameter is ensured by design and/or characterization and is not tested in production.

7.11 Electrical Characteristics for LM139 and LM139A

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

PARAMETER	TEST CONDITIONS(1)	TA(2)	LM139			LM139A			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	Vcc=5V to 30 V, V_{IC}=VIcR min, Vo=1.4V	25℃		2	5		1	2	mV
		Full range			9			4	
I_{IO} Input offset current	Vo=1.4V	25℃		3	25		3	25	nA
		Full range			100			100	
I_{IB} Input bias current	Vo=1.4V	25℃		-25	100		-25	-100	nA
		Full range			-300			-300	
I_{ICR} Common-mode input-voltage range(3)		25℃	0 to Vcc-1.5			0 to Vcc-1.5			V
		Full range	0 to Vcc-2			0 to Vcc-2			
A_{VD} Large-signal differential-voltage amplification	Vcc+=±7.5V, Vo=-5Vto 5V	25℃		200		50	200		V/mV
I_{OH} High-level output current	V_{ID}=1V, V_{OH}=5V	25℃		0.1			0.1		nA
	V_{ID}=1V, V_{OH}=30V	Full range			1			1	μA
V_{OL} Low-level output voltage	V_{ID}=-1 V, IoL=4 mA	25℃		150	400		150	400	mV
		Full range			700			700	
I_{OL} Low-level output current	V_{ID}=-1 V, V_{OL}=1.5V	25℃	6	16		6	16		mA
Icc Supply current (four comparators)	Vo=2.5V, No load	25℃		0.8	2		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 and LM139A is −55°C to +125°C. All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
(3) The voltage at either input or common-mode must 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 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.

Electrical Characteristics for LMx39 and LMx39A

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

PARAMETER	TEST CONDITIONS(1)		TA(2)	LM239 LM339			LM239A LM339A			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	Vcc=5V to 30 V, V_{IC}=VICR min, Vo=1.4V		25℃		2	5		1	3	mV
			Full range			9			4	
I_{IO} Input offset current	Vo=1.4V		25℃		5	50		5	50	nA
			Full range			150			150	
I_{IB} Input bias current	Vo=1.4 V		25℃		-25	-250		-25	-250	nA
			Full range			-400			-400	
Common-mode input-V_{ICR} voltage range(3)			25℃	0 to Vcc-1.5			0 to Vcc-1.5			V
			Full range	0 to Vcc-2			0 to Vcc-2			
A_{VD} Large-signal differential-voltage amplification	Vcc=15V, Vo=1.4 V to 11.4V,		25℃	50	200		50	200		V/mV
I_{OH} High-level output current	V_{ID}=1V	V_{OH}=5V	25℃		0.1	50		0.1	50	nA
		V_{OH}=30V	Full range			1			1	μA
V_{OL} Low-level output voltage	V_{ID}=-1V,	I_{OL}=4 mA	25℃		150	400		150	400	mV
			Full range			700			700	
I_{OL} Low-level output current	V_{ID}=-1 V,	V_{OL}=1.5V	25℃	6	16		6	16		mA
Supply current Icc (four comparators)	Vo=2.5V,	No load	25℃		0.8	2		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/LM239A is −25°C to +85°C, and for LM339/LM339A is 0°C to 70°C. All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
(3) The voltage at either input or common-mode must 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 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.

Electrical Characteristics for LM2901, LM2901V and LM2901AV

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

PARAMETER	TEST CONDITIONS(1)		TA(2)	LM2901			UNIT
				MIN	TYP	MAX	
V_{IO} Input offset voltage	V_{IC}=VIcR min, Vo=1.4 V, Vcc=5V to MAX(3)	Non-A devices	25℃		2	7	mV
			Fullrange			15	
		A-suffix devices	25℃		1	2	
			Full range			4	
I_{IO} Input offset current	Vo=1.4 V		25℃		5	50	nA
			Full range			200	
I_{IB} Input bias current	Vo=1.4V		25℃		-25	-250	nA
			Full range			-500	
V_{ICR} Common-mode input-voltage range((4)			25℃	0 to Vcc-1.5			V
			Full range	0 to Vcc-2			
A_{VD} Large-signal differential-voltage amplification	Vcc=15V,Vo=1.4 Vto 11.4 V, R_L≥15kQ to Vcc		25℃	25	100		V/mV
I_{OH} High-level output current	V_{ID}=1V	VoH=5V	25℃		0.1	50	nA
		VoH=Vcc MAX(3)	Full range			1	μA
V_{OL} Low-level output voltage	V_{ID}=-1V, I_{OL}=4 mA	Non-V devices	25℃		150	500	mV
		V-suffix devices			150	400	
		All devices	Full range			700	
Low-level output current	V_{ID}=-1V,	VoL=1.5V	25℃	6	16		mA
I_{CC} Supply current (four comparators)	Vo=2.5V, No load	Vcc=5V	25℃		0.8	2	mA
		Vcc=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°C to +125°C. All characteristics are measured with zero common-mode input voltage, unless otherwise specified.
(3) V_{CC} MAX = 30 V for non-V devices, and 32 V for V-suffix devices
(4) The voltage at either input or common-mode must 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 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} MAX without damage.

Switching Characteristics for LM139 and LM139A

V_{CC} = 5 V, T_A = 25°C

PARAMETER	TEST CONDITIONS		LM139 LM139A TYP	UNIT
Response time	RL connected to 5V through 5.1 kΩ, CL=15 pF(1)(2)	100-mV input step with 5-mV	1.3	µs
		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

Switching Characteristics for LM339B and LM2901B

V_S = 5V, V_{O_PULLUP} = 5V, V_{CM} = V_S/2, C_L = 15pF, R_L = 5.1k Ohm, T_A = 25°C (unless otherwise noted).

PARAMETER		TEST CONDITIONS	MIN TYP MAX	UNIT
tresponse	Propagation delay time,high-to-low;	Input overdrive =5mV,Input step=100mV	1000	ns
tresponse	Propagation delay time,high-to-low;	TTL input with Vref=1.4V	300	ns

(1) High-to-low and low-to-high refers to the transition at the input.

Switching Characteristics for LMx39 and LMx39A

V_{CC} = 5 V, T_A = 25°C

PARAMETER	TEST CONDITIONS		LM239 LM239A LM339 TYP	UNIT
Response time	RL connected to 5V through 5.1 kQ, CL=15 pF(1)(2)	100-mV input step with 5-mV	1.3	µs
		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

Switching Characteristics for LM2901

V_{CC} = 5 V, T_A = 25°C

PARAMETER	TEST CONDITIONS		LM2901 TYP	UNIT
Response time	RL connected to 5V through 5.1kΩ,CL=15 pF(1)(2)	100-mV input step with 5-mV	1.3	µs
		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

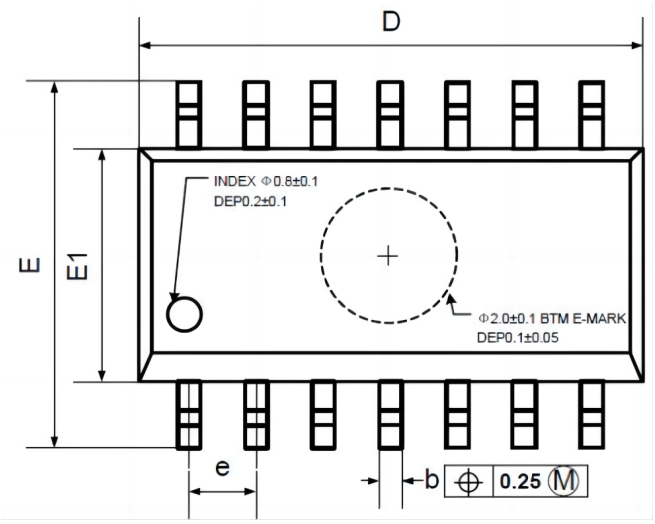
The following list describes the outcomes of some input voltage situations.

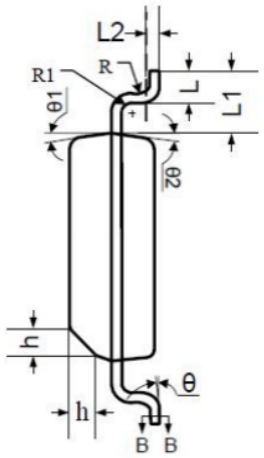
- When both IN – and IN+ are both within the common-mode range:
  - If IN – is higher than IN+ and the offset voltage, the output is low and the output transistor is sinking current
  - If IN – is lower than IN+ and the offset voltage, the output is high impedance and the output transistor is not conducting
- When IN – is higher than common mode and IN+ is within common mode, the output is low and the output transistor is sinking current
- When IN+ is higher than common mode and IN – is within common mode, the output is high impedance and the output transistor is not conducting
- When IN – and IN+ are both higher than common mode, the output is low and the output transistor is sinking current

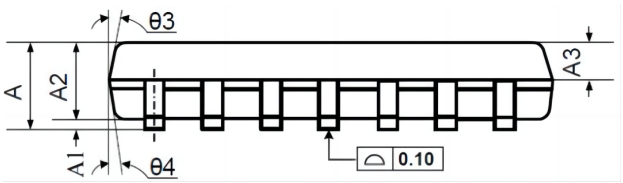
ORDERING INFORMATION

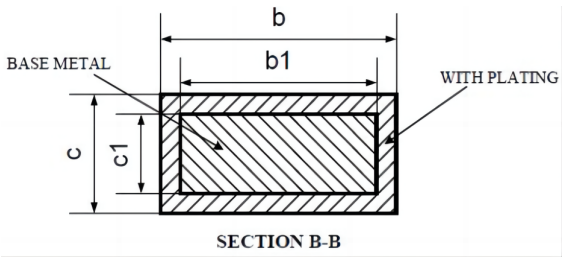
Order Number	Package	Package Quantity	Marking On The park	Temperature
LM139ADR-TUDI	SOP14	Tape,Reel,4000	LM139A	-55℃ to 125℃
LM139DR-TUDI	SOP14	Tape,Reel,4000	LM139	
LM239ADR-TUDI	SOP14	Tape,Reel,4000	LM239A	-25℃ to 85℃
LM239DR-TUDI	SOP14	Tape,Reel,4000	LM239	
LM239N-TUDI	DIP14	Tube,25,A box of 1000	LM239N	
LM239PWR-TUDI	TSSOP14	Tape,Reel,4000	L239	
LM2901AVQDR-TUDI	SOP14	Tape,Reel,4000	L2901AV	-40℃ to 125℃
LM2901AVQPWR-TUDI	TSSOP14	Tape,Reel,4000	L2901AV	
LM2901BIPWR-TUDI	TSSOP14	Tape,Reel,4000	LM2901B	
LM2901DR-TUDI	SOP14	Tape,Reel,4000	LM2901	
LM2901N-TUDI	DIP14	Tube,25,A box of 1000	LM2901N	
LM2901PWR-TUDI	TSSOP14	Tape,Reel,4000	L2901	
LM2901VQDR-TUDI	SOP14	Tape,Reel,4000	L2901V	
LM2901VQPWR-TUDI	TSSOP14	Tape,Reel,4000	L2901V	
LM339ADR-TUDI	SOP14	Tape,Reel,4000	LM339A	0℃ to 70℃
LM339AN-TUDI	DIP14	Tube,25,A box of 1000	LM339AN	
LM339ANSR-TUDI	SOP14	Tape,Reel,4000	LM339A	
LM339APWR-TUDI	TSSOP14	Tape,Reel,4000	L339A	
LM339BIPWR-TUDI	TSSOP14	Tape,Reel,4000	LM339B	-40℃ to 85℃
LM339DR-TUDI	SOP14	Tape,Reel,4000	LM339	0℃ to 70℃
LM339N-TUDI	DIP14	Tube,25,A box of 1000	LM339N	
LM339PWR-TUDI	TSSOP14	Tape,Reel,4000	L339	

Package SOP14



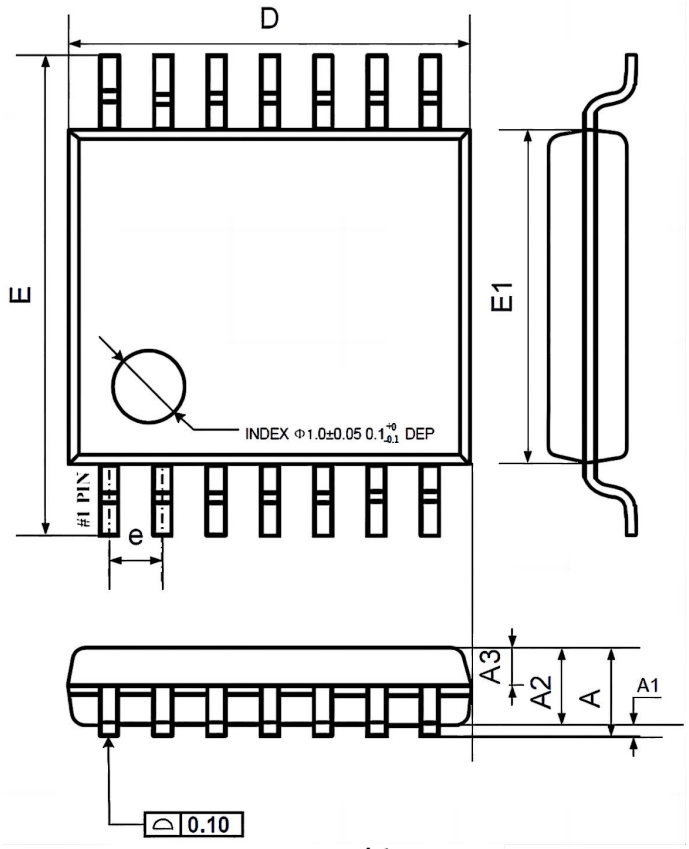


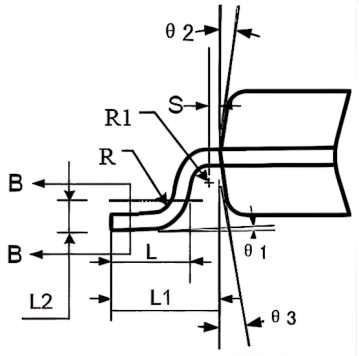


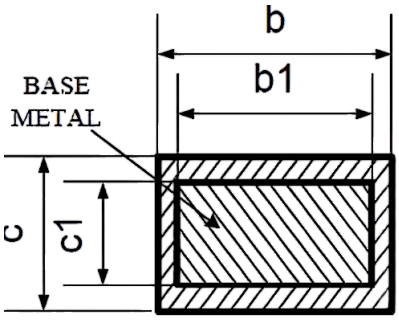


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	1.35	1.60	1.75
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
A3	0.55	0.65	0.75
b	0.36		0.49
b1	0.35	0.40	0.45
C	0.16		0.25
c1	0.15	0.20	0.25
D	8.53	8.63	8.73
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
L	0.45	0.60	0.80
L1	1.04 REF		
L2	0.25 BSC		
R	0.07		
R1	0.07		
h	0.30	0.40	0.50
θ	0°		8°
θ1	6°	8°	10°
θ2	6°	8°	10°
θ3	5°	7°	9°
θ4	5°	7°	9°

Package TSSOP14

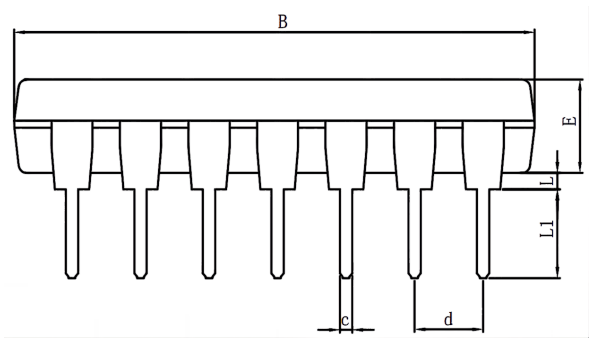


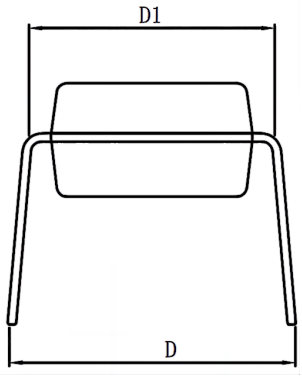


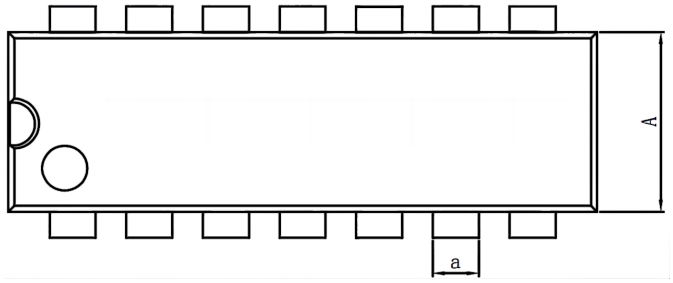


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	—	—	1.20
A1	0.05	—	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	—	0.28
b1	0.20	0.22	0.24
C	0.10	—	0.19
c1	0.10	0.13	0.15
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	—	—
R1	0.09	—	—
S	0.20	—	—
θ1	0°	—	8°
θ2	10°	12°	14°
θ3	10°	12°	14°

Package DIP14







DIM.	MIN	TYP	MAX	DIM.	MIN	TYP	MAX
A	6.100	6.300	6.680	a	1.504	1.524	1.544
B	18.940	19.200	19.560	C	0.437	0.457	0.477
D	8.200	8.700	9.200	d	2.530	2.540	2.550
D1	7.42	7.62	7.82	L	0.500	—	0.800
E	3.100	3.300	3.550	L1	3.000	3.200	3.600

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