Single Supply Quad Comparators

LM339, LM339E, LM239, LM2901, LM2901E, LM2901V, NCV2901, MC3302

These comparators are designed for use in level detection, low−level sensing and memory applications in consumer, automotive, and industrial electronic applications.

Features

- Single Supply Operation: 3.0 V to 36 V
- Split Supply Operation: 1.5 V to 18 V
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MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Supply Voltage LM239/LM339, E/LM2901, E, V MC3302, NCV2901	V_{CC}	 +36 or 18 +30 or 15	Vdc
Input Differential Voltage Range LM239/LM339, E/LM2901, E, V MC3302, NCV2901	V_{IDR}	 36 30	Vdc
Input Common Mode Voltage Range	V_{ICMR}	−0.3 to 36	Vdc
Output Short Circuit to Ground (Note 1)	I_{SC}	Continuous	
Power Dissipation @ T_A = 25 C Plastic Package Derate above 25 C	P_D $1/R_{\theta JA}$	 1.0 8.0	 W mW/ C
Junction Temperature	T_J	150	C
Operating Ambient Temperature Range LM239 MC3302 LM2901, LM2901E LM2901V, NCV2901 LM339, LM339E	T_A	 −25 to +85 −40 to +85 −40 to +105 −40 to +125 0 to +70	C
Storage Temperature Range	T_{stg}	−65 to +150	C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. The maximum output current may be as high as 20 mA, independent of the magnitude of V_{CC}. Output short circuits to V_{CC} can cause excessive heating and eventual destruction.

ESD RATINGS

Rating	HBM	MM	Unit
ESD Protection at any Pin (Human Body Model − HBM, Machine Model − MM)			
NCV2901	2000	200	V
LM339E, LM2901E	1500	200	V
LM339DG/DR2G, LM2901DG/DR2G	250	100	V
All Other Devices	1500	200	V

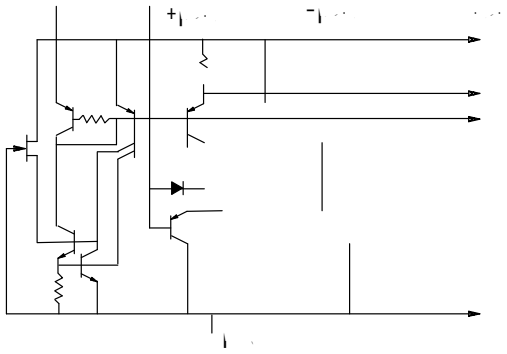

Figure 1. Circuit Schematic

ELECTRICAL CHARACTERISTICS (V_{CC} = +5.0 Vdc, T_A = +25 C, unless otherwise noted)

Characteristic	Symbol	LM239/339/339E			LM2901/2901E/2901V /NCV2901			MC3302			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage (Note 3)	V_{IO}	–	2.0	5.0	–	2.0	7.0	–	3.0	20	mVdc
Input Bias Current (Notes 3, 4)	I_{IB}	–	25	250	–	25	250	–			

PERFORMANCE CHARACTERISTICS (V_{CC} = +5.0 Vdc, T_A = T_{low} to T_{high} [Note 7])

Characteristic	Symbol	LM239/339/339E			LM2901/2901E/2901V /NCV2901			MC3302			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage (Note 8)	V_{IO}	–	–	9.0	–	–	15	–	–	40	mVdc
Input Bias Current (Notes 8, 9) (Output in Analog Range)	I_{IB}	–	–	400	–	–	500	–	–	1000	nA
Input Offset Current (Note 8)	I_{IO}	–	–	150	–	–	200	–	–	300	nA
Input Common Mode Voltage Range	V_{ICMR}	0	–	V_{CC} –2.0	0	–	V_{CC} –2.0	0	–	V_{CC} –2.0	V
Saturation Voltage $V_I(-)$ +1.0 Vdc, $V_I(+)$ = 0, $I_{sink} \le$ 4.0 mA	V_{sat}	–	–	700	–	–	700	–	–	700	mV
Output Leakage Current $V_I(+)$ +1.0 Vdc, $V_I(-)$ = 0, V_O = 30 Vdc	I_{OL}	–	–	1.0	–	–	1.0	–	–	1.0	μA
Differential Input Voltage All V_I 0 Vdc	V_{ID}	–	–	V_{CC}	–	–	V_{CC}	–	–	V_{CC}	Vdc

7. (LM239) T_{low} = –25 C, T_{high} = +85
   (LM339, LM339E) T_{low} = 0 C, T_{high} = +70 C
   (MC3302) T_{low} = –40 C, T_{high} = +85 C
   (LM2901, LM2901E) T_{low} = –40 C, T_{high} = +105
   (LM2901V & NCV2901) T_{low} = –40 C, T_{high} = +125 C
   NCV2901 is qualified for automotive use.
8. At the output switch point, $V_O \simeq$ 1.4 Vdc, $R_S \le$ 100 Ω 5.0 Vdc ≤ $V_{CC} \le$ 30 Vdc, with the inputs over the full common mode range (0 Vdc to V_{CC} –1.5 Vdc).
9. The bias current flows out of the inputs due to the PNP input stage. This current is virtually constant, independent of the output state.

APPLICATIONS INFORMATION

These quad comparators feature high gain, wide bandwidth characteristics. This gives the device oscillation tendencies if the outputs are capacitively coupled to the inputs via stray capacitance. This oscillation manifests itself during output transitions (V_{OL} to V_{OH}). To alleviate this situation input resistors < 10 kΩ should be used. The addition of positive feedback (< 10 mV) is also recommended. It is good design practice to ground all unused input pins.

Differential input voltages may be larger than supply voltages without damaging the comparator's inputs. Voltages more negative than −300 mV should not be used.

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Figure 9. Zero Crossing Detector (Single Supply)

Figure 10. Zero Crossing Detector (Split Supplies)

MARKING DIAGRAMS

SOIC−14
D SUFFIX
CASE 751A

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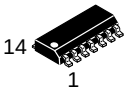
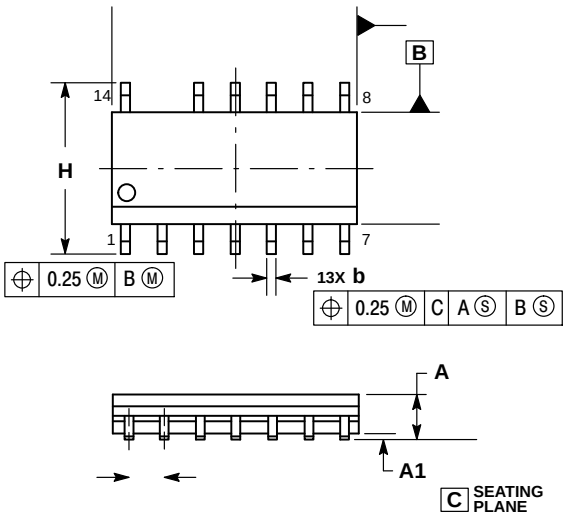


SCALE 1:1

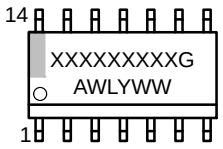
SOIC 14 NB
CASE 751A−03
ISSUE L

DATE 03 FEB 2016



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

GENERIC
MARKING DIAGRAM*



XXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
G = Pb−Free Package

STYLES ON PAGE 2

SOIC 14
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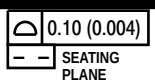
ISSUE L

DATE 03 FEB 2016

STYLE 7:
PIN 1. ANODE/CATHODE
2. COMMON ANODE
3. COMMON CATHODE
4. ANODE/CATHODE
5. ANODE/CATHODE


D
0.10 (0.004)
SEATING
PLANE