CA139, CA239, CA339 Types

Quad Voltage Comparators

For Industrial, Commercial, and Military Applications

The RCA-CA139, -CA239, -CA339, -CA139A, -CA239A, and -CA339A types consist of four independent single- or dual-supply voltage comparators on a single monolithic substrate. The common-mode input voltage range includes ground even when operated from a single supply, and the low power supply current drain makes these comparators suitable for battery operation. These types were designed to directly interface with TTL and and CMOS.

Types CA139A, CA239A, and CA339A have all the features and characteristics of their prototype counter parts CA139, CA239, and CA339 plus an even lower input-offset-voltage characteristic. These devices are supplied in a 14-lead dual-in-line plastic package (E suffix), or in a 14-lead dual-in-line plastic package with a hermetic chip (G suffix), to provide true hermetic performance. The CA339 is also available in chip form (H suffix), and as a hermetic chip (HG suffix).

"E" Suffix Types: Standard Dual-In-Line Plastic Package

"G" Suffix Types: Hermetic Gold-Chip Dual-In-Line Plastic Package

Features:

- **Operation from single or dual supplies**
- **Common-mode input-voltage range to ground**
- **Output voltage compatible with TTL, DTL, ECL, MOS, and CMOS**
- **Differential input-voltage range equal to the supply voltage**
- **Maximum input-offset voltage (V_{IO}):**
  CA139A, CA239A, CA339A – 2 mV
  CA139, CA239, CA339 – 5 mV
- **Replacement for industry types 139, 239 339, 139A, 239A, and 339A**

Applications:

- **Square-wave generators**
- **Time-delay generators**
- **Pulse generators**
- **Multivibrators**
- **High-voltage digital logic gates**
- **A/D converters**
- **MOS clock timers**

MAXIMUM RATINGS, *Absolute-Maximum Values at T_A = 25°C:*

DC SUPPLY VOLTAGE	36 V or ±18 V
DC DIFFERENTIAL INPUT VOLTAGE	±36 V
INPUT VOLTAGE	−0.3 V to +36 V
INPUT CURRENT ($V_I < -0.3$ V)*	50 mA
OUTPUT SHORT CIRCUIT TO GROUND▲	
(Single Supply)	Continuous
DEVICE DISSIPATION:	
Up to T_A = 55°C	750 mW
Above T_A = 55°C	derate linearly at 6.67 mW/°C
AMBIENT TEMPERATURE RANGE:	
Operating	−55 to +125°C
Storage	−65 to +150°C
LEAD TEMPERATURE (DURING SOLDERING):	
At distance 1/16 ± 1/32 in. (1.59 ± 0.79 mm)	
from case for 10 seconds max.	+265°C

* Inputs must not go more negative than −0.3 V.

▲Short circuits from the output to V^+ can cause excessive heating and eventual destruction. The maximum output current independent of V^+ is approximately 20 mA.

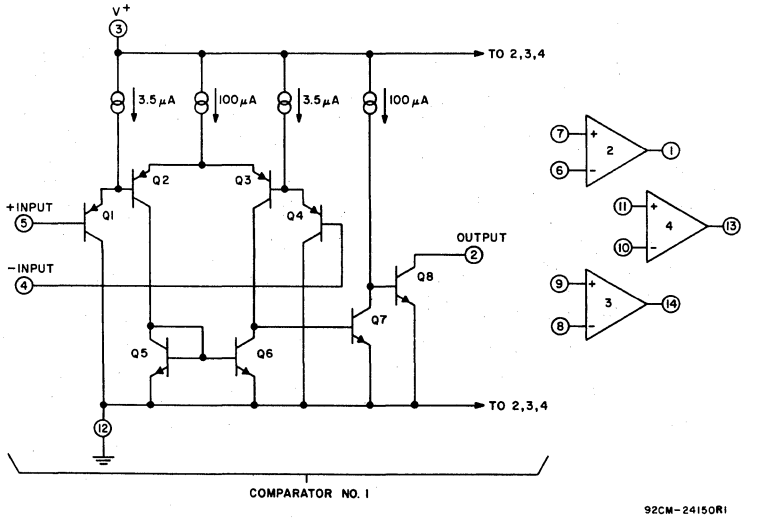

Fig. 1 –Schematic diagram.

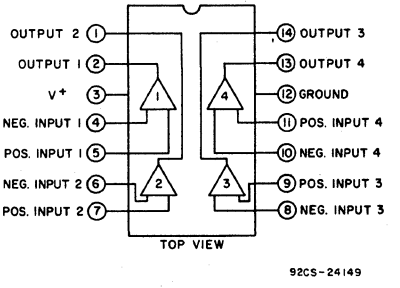

Fig. 2 –Functional diagram.

TYPICAL CHARACTERISTICS

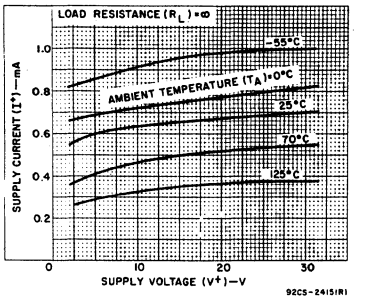

Fig. 3–Supply current vs. supply voltage.

ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	TEST CONDITIONS		LIMITS						UNITS
	$V^+ = 5$ V, Unless otherwise indicated		CA139			CA139A			
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Offset Voltage (V_{IO}) At Output Switch Point $V \cong 1.4$ V	V_{REF} = 1.4 V, R_S = 0	25°C	–	2	5	–	1	2	mV
		Note 1	–	–	9	–	–	4	
Differential Input Voltage (V_{ID})	Keep all inputs ≥0 V for V^- (If used), Notes 1, 2		–	–	36	–	–	36	V
Saturation Voltage (V_{sat})	V_I^- = 1 V, V_I^+ = 0 V, $I_{SINK} \leq$ 4 mA	25°C	–	250	500	–	250	500	mV
		Note 1	–	–	700	–	–	700	
Common-Mode Input Voltage Range (V_{ICR})	Note 3	25°C	0	–	$V^+-1.5$	0	–	$V^+-1.5$	V
		Note 1	0	–	V^+-2	0	–	V^+-2	
Input Offset Current (I_{IO})	$I_I^+ - I_I^-$	25°C	–	3	25	–	3	25	nA
		Note 1	–	–	100	–	–	100	
Input Bias Current (I_{IB})	I_I^+ or I_I^- with Output in Linear Range	25°C	–	25	100	–	25	100	nA
		Note 1	–	–	300	–	–	300	
Supply Current (I^+)	$R_L = \infty$ on all comparators, T_A = 25°C		–	0.8	2	–	0.8	2	mA
Output Leakage Current	$V_I^+ \geq 1$ V, V_I^- = 0, V_O = 5 V	25°C	–	0.1	–	–	0.1	–	nA
	$V_I^+ \geq 1$ V, V_I^- = 0, V_O = 30 V	Note 1	–	–	1	–	–	1	μA
Output Sink Current	$V_I^- \geq 1$ V, V_I^+ = 0, $V_O \leq$ +1.5 V, T_A = 25°C		6	16	–	6	16	–	mA
Voltage Gain (A_{OL})	$R_L \geq 15$ kΩ, V^+=15 V, T_A = 25°C		–	200	–	50	200	–	V/mV
Large Signal Response Time	V_I = TTL Logic Swing, V_{REF} = +1.4 V, V_{RL} = 50 V, R_L = 5.1 kΩ, T_A = 25°C		–	300	–	–	300	–	ns
Response Time See Figs. 5 & 6	V_{RL} = 5 V, R_L = 5.1 kΩ, T_A = 25°C		–	1.3	–	–	1.3	–	μs

Note 1: Ambient Temperature (T_A) applicable over operating temperature range as shown below.
CA139, CA139A (−55 to +125°C) | CA239, CA239A (−25 to +85°C) | CA339, CA339A (0 to +70°C)

Note 2: The comparator will provide a proper output state even if the positive swing of the inputs exceeds the power supply voltage level, if the other input remains within the common-mode voltage range. The low input voltage state must not be less than −0.3 V (or 0.3 V below the magnitude of the negative power supply, if used).

Note 3: The upper end of the common-mode voltage range is (V^+) − 1.5 V, but either or both inputs can go to +30 V without damage.

TYPICAL CHARACTERISTICS (Cont'd)

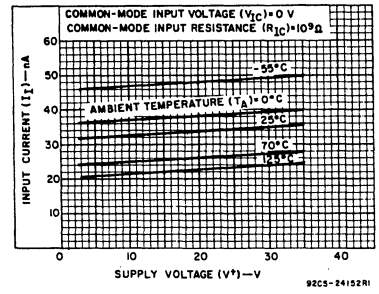

Fig. 4—Input current vs. supply voltage.

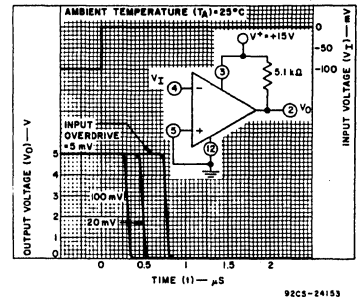

Fig. 5—Response time for various input overdrives—negative transition.

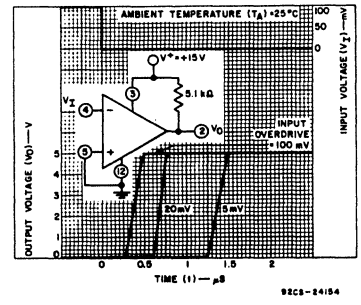

Fig. 6—Response time for various input overdrives—positive transition.

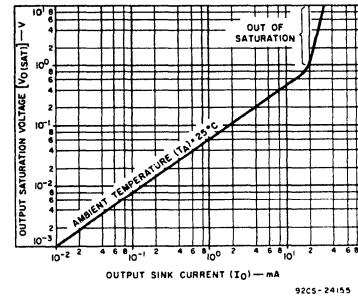

Fig. 7—Output saturation voltage vs. output sink current.

ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	TEST CONDITIONS (V^+ = 5 V, Unless otherwise indicated)		LIMITS						UNITS
			CA239, CA339			CA239A, CA339A			
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Offset Voltage (V_{IO}) At Output Switch Point V ≅ 1.4 V	V_{REF} = 1.4 V, R_S = 0	25°C	–	2	5	–	1	2	mV
		Note 1	–	–	9	–	–	4	
Differential Input Voltage (V_{ID})	Keep all inputs ≥0 V for V^- (If used), Notes 1, 2		–	–	36	–	–	36	V
Saturation Voltage (V_{sat})	V_I^- = 1 V, V_I^+ = 0 V, I_{SINK} ≤ 4 mA	25°C	–	250	500	–	250	500	mV
		Note 1	–	–	700	–	–	700	
Common-Mode Input Voltage Range (V_{ICR})	Note 3	25°C	0	–	V^+–1.5	0	–	V^+–1.5	V
		Note 1	0	–	V^+–2	0	–	V^+–2	
Input Offset Current (I_{IO})	$I_I^+ - I_I^-$	25°C	–	5	50	–	5	50	nA
		Note 1	–	–	150	–	–	150	
Input Bias Current (I_{IB})	I_I^+ or I_I^- with Output in Linear Range	25°C	–	25	250	–	25	250	nA
		Note 1	–	–	400	–	–	400	
Supply Current (I^+)	R_L = ∞ on all comparators, T_A = 25°C		–	0.8	2	–	0.8	2	mA
Output Leakage Current	V_I^+ ≥1 V, V_I^- = 0, V_O = 5 V	25°C	–	0.1	–	–	0.1	–	nA
	V_I^+ ≥1 V, V_I^- = 0, V_O = 30 V	Note 1	–	–	1	–	–	1	μA
Output Sink Current	V_I^- ≥1 V, V_I^+ = 0, V_O ≤+1.5 V, T_A = 25°C		6	16	–	6	16	–	mA
Voltage Gain (A_{OL})	R_L ≥15 kΩ V^+=15 V, T_A = 25°C		–	200	–	50	200	–	V/mV
Large Signal Response Time	V_I = TTL Logic Swing, V_{REF} = +1.4 V, V_{RL} = 50 V, R_L = 5.1 kΩ, T_A = 25°C		–	300	–	–	300	–	ns
Response Time See Figs. 5 & 6	V_{RL} = 5 V, R_L = 5.1 kΩ, T_A = 25°C		–	1.3	–	–	1.3	–	μs

Note 1: Ambient Temperature (T_A) applicable over operating temperature range as shown below.
CA139 / CA139A (–55 to +125°C) CA239 / CA239A (–25 to +85°C) CA339 / CA339A (0 to +70°C)

Note 2: The comparator will provide a proper output state even if the positive swing of the inputs exceeds the power supply voltage level, if the other input remains within the common-mode voltage range. The low input voltage state must not be less than –0.3 V (or 0.3 V below the magnitude of the negative power supply, if used).

Note 3: The upper end of the common-mode voltage range is (V^+) – 1.5 V, but either or both inputs can go to +30 V without damage.