

M51209P

QUAD COMPARATOR

DESCRIPTION

The M51209P is a quad (four independent) comparator and operates over a wide voltage range from a single supply voltage. Especially the M51209P has superiority as to characteristics of input current (input resistance) and fits to wide ranged applications, for example CR Timer, oscillator, etc.

FEATURES

- Low input current (high input resistance) 20nA (typ.)
- Wide supply voltage range 2.5V~28V
- Low dissipation current 6.8mA (typ.)
- Capable of driving a relay or a lamp directly
200mA (max.)
- Includes voltage surge absorbing zener diodes
- High output breakdown voltage 30V (max.)
- Low output voltage ($I_{\text{sink}}=60\text{mA}$) 0.2V (typ.)
- Low input offset voltage 2mV (typ.)

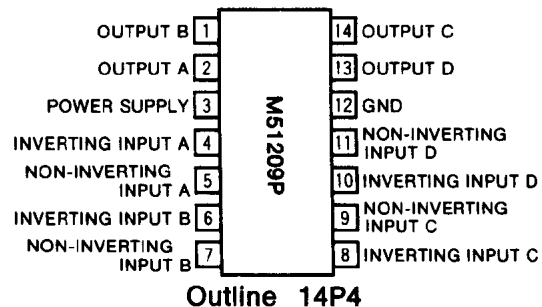
APPLICATION

Voltage comparator, sequential timer, pulse generator, analog / digital converter, time delay circuit

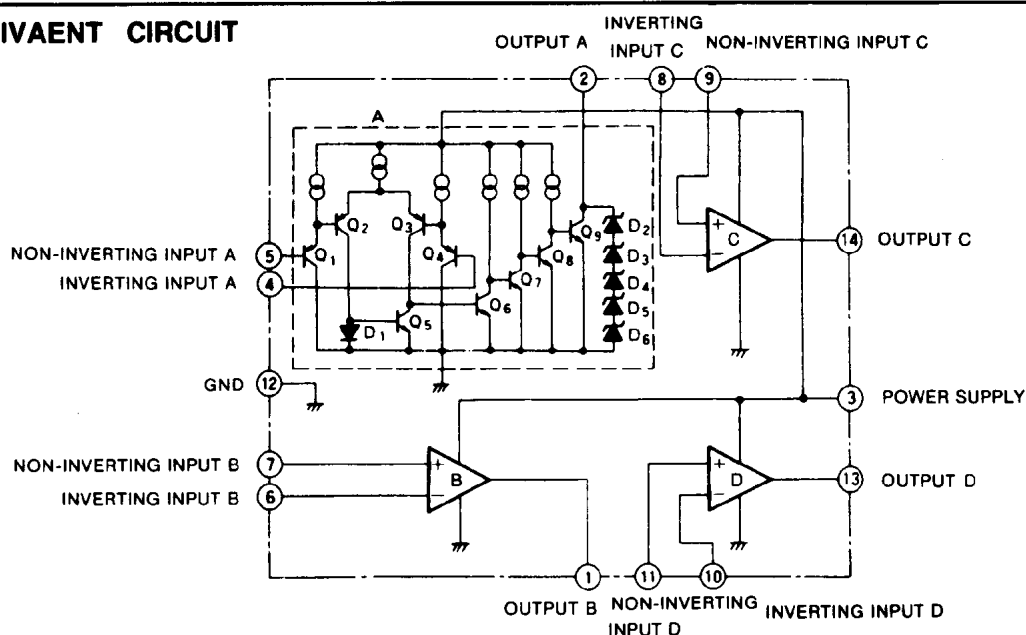
RECOMMENDED OPERATING CONDITIONS

- Supply voltage range 2.5~28V
Rated supply voltage 12V

PIN CONFIGURATION (TOP VIEW)



EQUIVALENT CIRCUIT



QUAD COMPARATOR

ABSOLUTE MAXIMUM RATINGS ($T_a=25^\circ\text{C}$, unless otherwise noted)

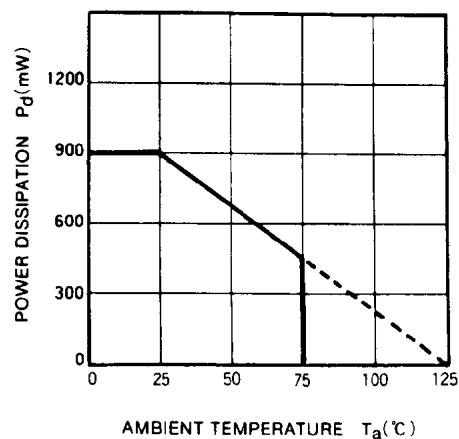
Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		28	V
V_{ID}	Differential input voltage		V_{CC}	V
V_{ICM}	Common mode input voltage range		$-0.3 \sim V_{CC}$	V
I_{sink}	Output sink current		200	mA
V_{OH}	"H" output voltage		30	V
P_d	Power dissipation		900	mW
T_{opr}	Operating temperature		$-20 \sim +75$	$^\circ\text{C}$
T_{stg}	Storage temperature		$-40 \sim +125$	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_a=25^\circ\text{C}$, $V_{CC}=2.5 \sim 28\text{V}$, unless otherwise noted)

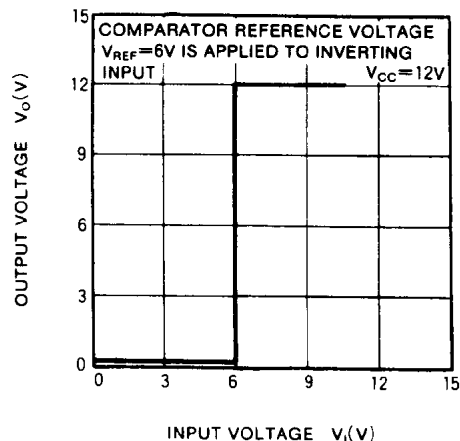
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{CC}	Supply voltage range		2.5		28	V
I_{CC}	Circuit current			6.8	9.5	mA
V_{IE}	Inverting input voltage range		0		$V_{CC}-1.5$	V
V_{IF}	Non-inverting input voltage range		0		$V_{CC}-1.5$	V
V_{IO}	Input offset voltage			2	7	mV
I_{IE}	Inverting input current			20	100	nA
I_{IF}	Non-inverting input current			20	100	nA
I_{IO}	Input offset current			5	50	nA
V_{OL}	"L" output voltage	$I_{sink}=60\text{mA}$		0.2	0.6	V
		$I_{sink}=200\text{mA}$		1		
I_{LO}	Output leak current				0.1	μA
t_{PLH}	Output "L $\rightarrow$ H" propagation delay time			2		μs
t_{PHL}	Output "H $\rightarrow$ L" propagation delay time			1		μs

TYPICAL CHARACTERISTICS ($T_a=25^\circ\text{C}$, unless otherwise noted)

**THERMAL DERATING
(MAXIMUM RATING)**

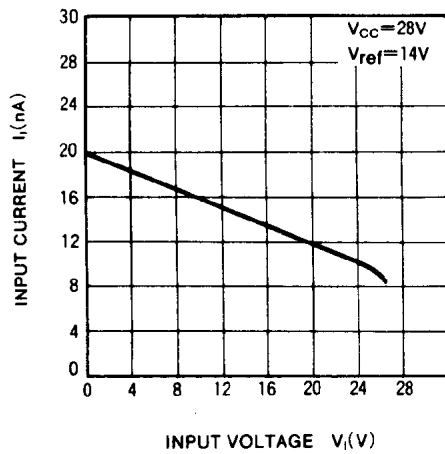


**OUTPUT VOLTAGE VS.
INPUT VOTAGE**

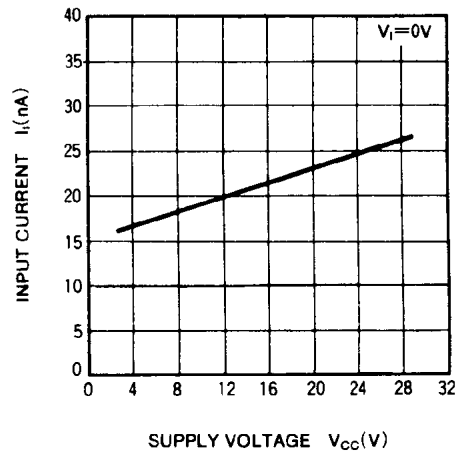


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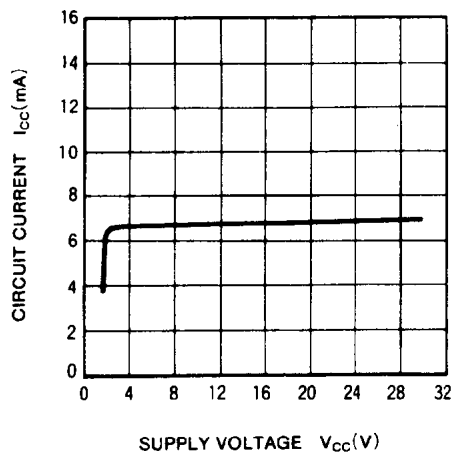
**INPUT CURRENT VS.
INPUT VOLTAGE**



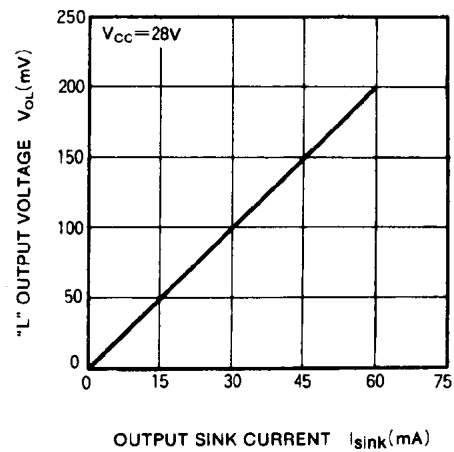
**INPUT CURRENT VS.
SUPPLY VOLTAGE**



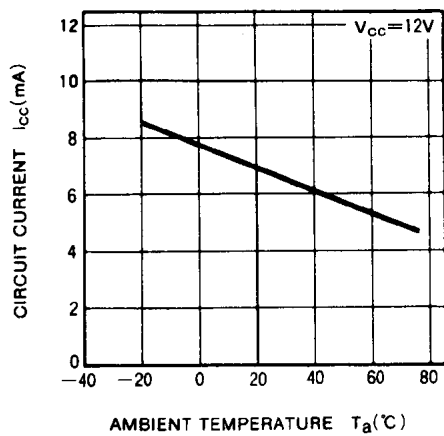
**CIRCUIT CURRENT VS.
SUPPLY VOLTAGE**



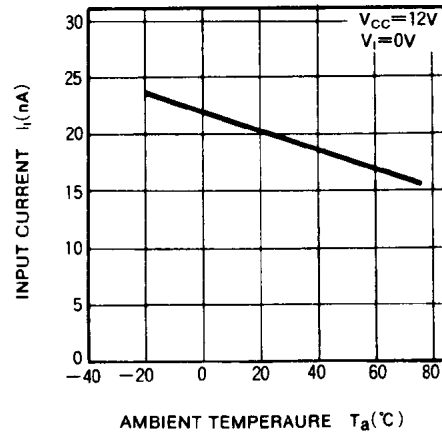
**"L" OUTPUT VOLTAGE VS.
OUTPUT SINK CURRENT**



**CIRCUIT CURRENT VS.
AMBIENT TEMPERATURE**



**INPUT CURRENT VS.
AMBIENT TEMPERATURE**



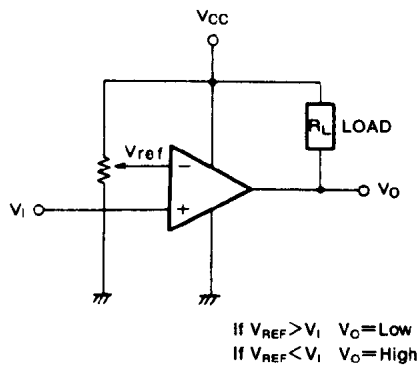
QUAD COMPARATOR

PRECAUTIONS FOR USE

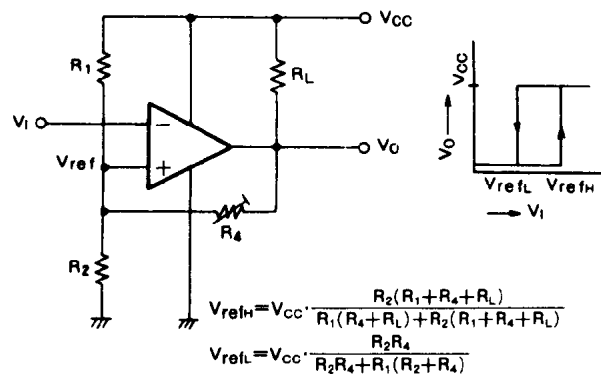
1. Special care must be taken to protect the M51209P from large surges in current, such as may result from the incorrect connection of the V_{CC} and GND terminals.
2. Output is "open collector" and a loading resistor is not included. Connect a loading resistor to stabilize operation, when driving another.

APPLICATION EXAMPLES

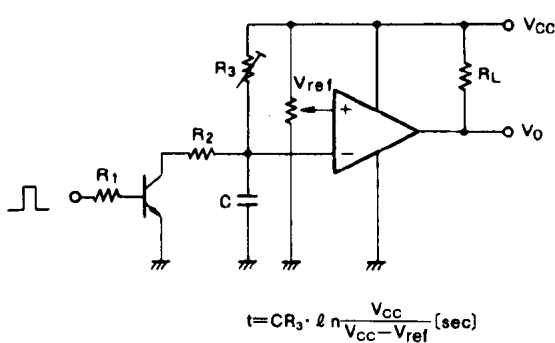
(1) Voltage comparator



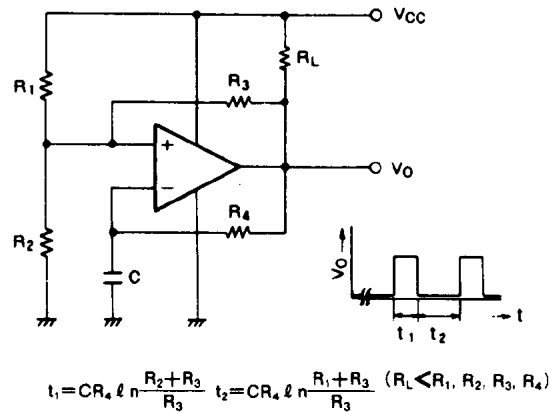
(2) Schmitt trigger circuit



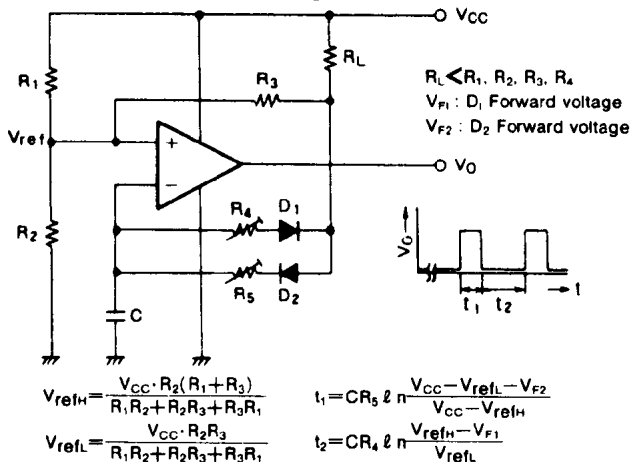
(3) Monostable multi-vibrator



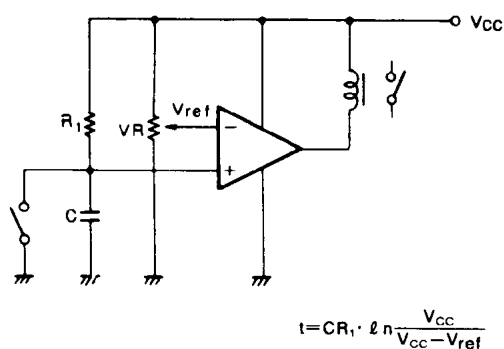
(4) Unstable multi-vibrator



(5) Pulse generator

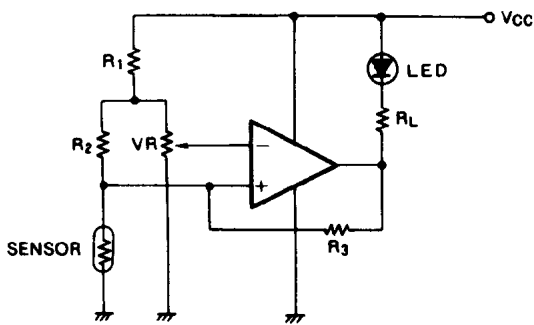


(6) CR Timer

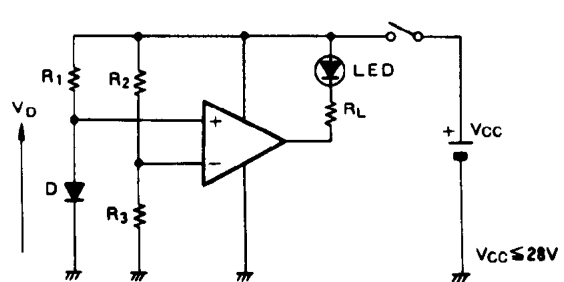


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(7) Sensor detector



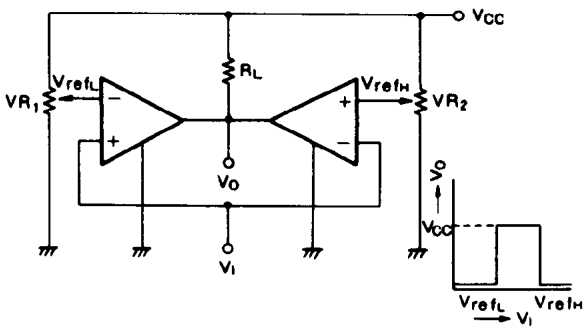
(8) Battery check circuit



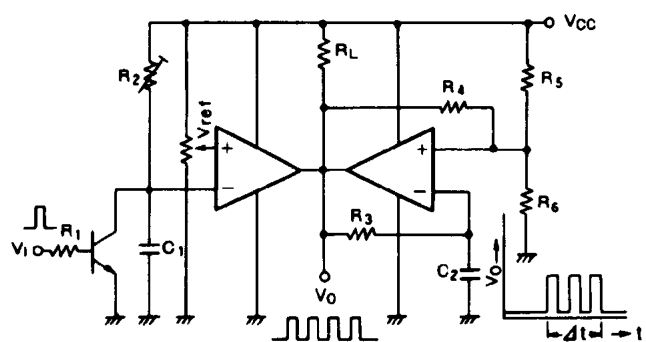
$$V_D < V_{CC} \cdot \frac{R_3}{R_2 + R_3}; \text{LED} \rightarrow \text{ON}$$

$$V_D > V_{CC} \cdot \frac{R_3}{R_2 + R_3}; \text{LED} \rightarrow \text{OFF}$$

(9) Window comparator

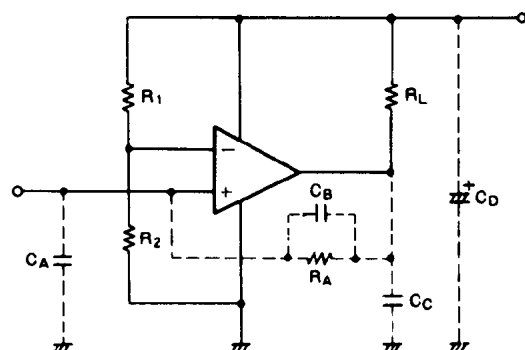


(10) Pulse train generator



$$\Delta t = C_1 R_2 \cdot \ln \frac{V_{CC}}{V_{CC} - V_{ref}}$$

(11) Countermeasure against oscillation



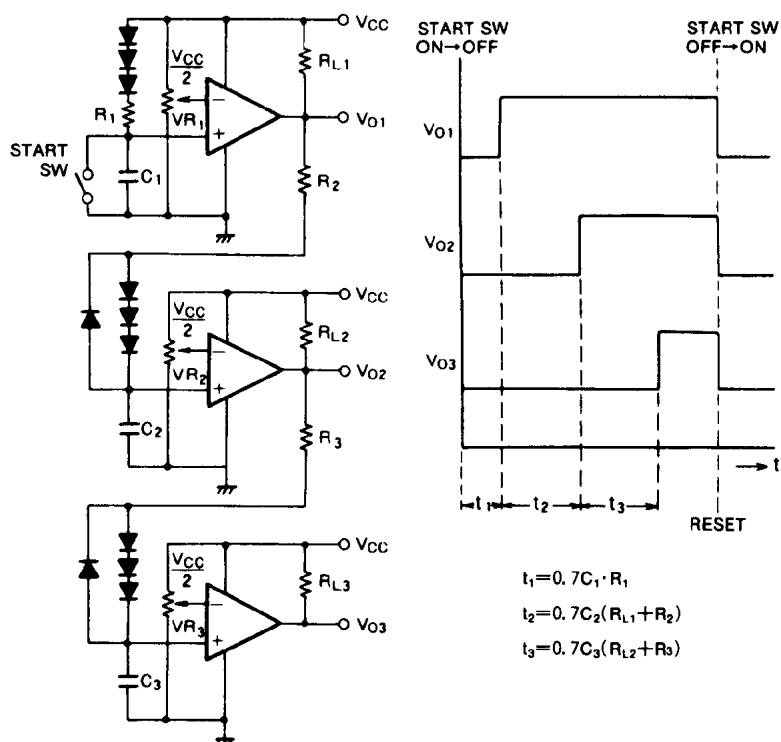
(Note) Taking steps against oscillation

The M51209P may oscillate according to input condition. If the M51209P should oscillate, the following countermeasures are applicable.

- In case of connecting input signal with chattering, connect a capacitor of small C_A value.
- In case of oscillation with ordinary input, employ positive feedback inserting R_A (large resistor), C_B (no polar) or connect C_C .
- When the supply voltage is not stabilized, connect C_D (a large electrolytic capacitor) to absorb the supply voltage change.

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(12) Sequential timer



(13) Analog/Digital converter

