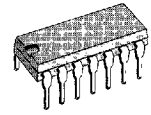
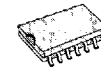
LOW POWER QUAD VOLTAGE COMPARATORS

- WIDE SINGLE SUPPLY VOLTAGE RANGE OR DUAL SUPPLIES FOR ALL DEVICES : +2V TO +36V OR ±1V TO ±18V
- VERY LOW SUPPLY CURRENT (1.1mA) INDEPENDENT OF SUPPLY VOLTAGE (1.4mW/comparator at +5V)
- LOW INPUT BIAS CURRENT : 25nA TYP
- LOW INPUT OFFSET CURRENT : ±5nA TYP
- LOW INPUT OFFSET VOLTAGE : ±1mV TYP
- INPUT COMMON-MODE VOLTAGE RANGE INCLUDES GROUND
- LOW OUTPUT SATURATION VOLTAGE : 250mV TYP. (I_O = 4mA)
- DIFFERENTIAL INPUT VOLTAGE RANGE EQUAL TO THE SUPPLY VOLTAGE
- TTL, DTL, ECL, MOS, CMOS COMPATIBLE OUTPUTS



N
DIP14
(Plastic Package)



D
SO14
(Plastic Micropackage)

J
CERDIP14
(Cerdip Package)

DESCRIPTION

These devices consist of four independent precision voltage comparators with an offset voltage specifications as low as 2mV max for LM339A, LM239A and LM139A. All these comparators were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible.

These comparators also have a unique characteristic in that the input common-mode voltage range includes ground even though operated from a single power supply voltage.

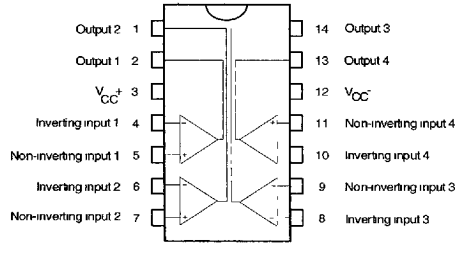
ORDER CODES

Part Number	Temperature Range	Package		
		N	J	D
LM139/A	–55, +125°C	•	•	•
LM239/A	–40, +105°C	•	•	•
LM339/A	0, +70°C	•	•	•
LM2901	–40, +105°C	•	•	•

Examples : LM139AN, LM2901D

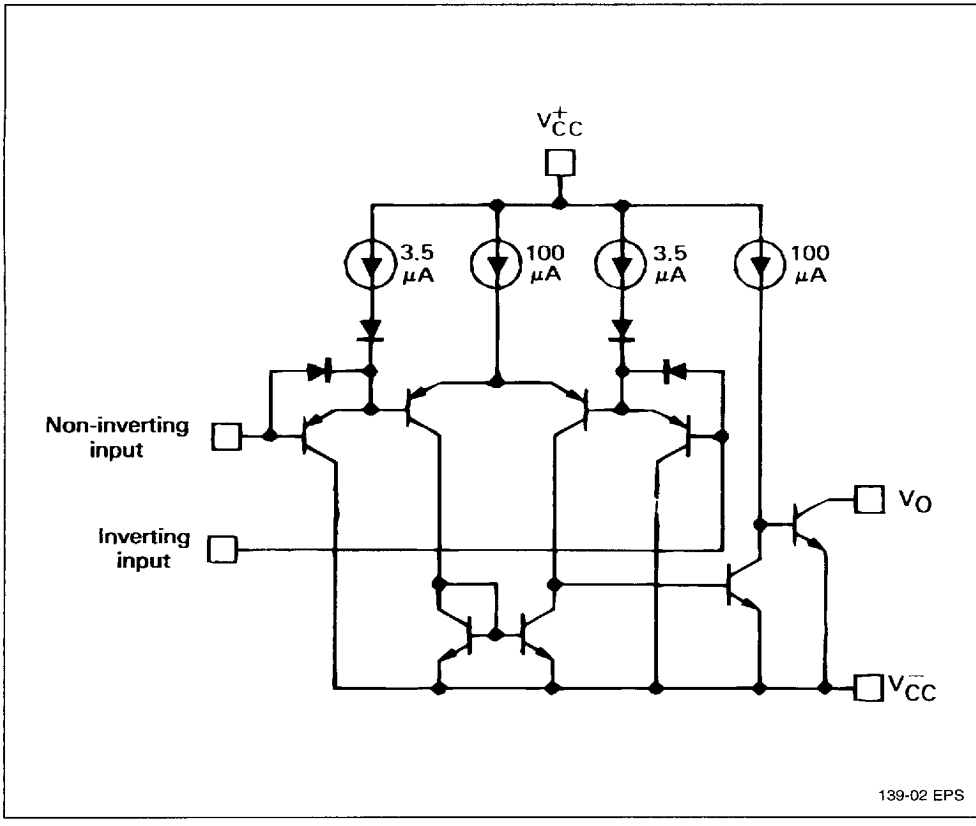
139-01 TBL

PIN CONNECTIONS (top view)



139-01 EPS

SCHEMATIC DIAGRAM (1/4 LM139)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	LM139,A LM239,A	LM339,A	LM2901	Unit
V_{CC}	Supply Voltage	±18 to 36	±18 to 36	±18 to 36	V
V_{id}	Differential Input Voltage	±36	±36	±36	V
V_i	Input Voltage	-0.3 to +36	-0.3 to +36	-0.3 to +36	V
	Output Short-circuit to Ground - (note 1)	Infinite			
P_{tot}	Power Dissipation	570	570	570	mW
T_{oper}	Operating Free-air Temperature Range LM239,A	-55, +125 -40, +105	0, +70	-40, +105	°C
T_{stg}	Storage Temperature Range	-65, +150	-65, +150	-65, +150	°C

139-02 TBI

Notes : 1. Short-circuit from the output to V_{CC}^+ can cause excessive heating and eventual destruction. The maximum output current is approximately 20mA, independent of the magnitude of V_{CC}^+

ELECTRICAL CHARACTERISTICS

V_{CC}^+ = +5V, V_{CC}^- = GND, T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	LM139A - LM239A LM339A			LM139 - LM239 LM339 - LM2901			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage – (note 2) T_{amb} = +25°C LM2901 $T_{min} \le T_{amb} \le T_{max}$. LM2901		1	2 4		1	5 7 9 15	mV
I_{io}	Input Offset Current T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$		3	25 100		5	50 150	nA
I_{ib}	Input Bias Current (I_I^+ or I_I^-) - (note 3) T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$		25	100 300		25	250 400	nA
A_{vd}	Large Signal Voltage Gain (V_{CC} = 15V, R_L =15kΩ, V_O = 1 to 11V) LM2901	50	200		50 25	200		V/mV
I_{CC}	Supply Current (all comparators) V_{CC} = +5V, no load V_{CC} = +30V, no load		1.1 1.3	2 2.5		1.1 1.3	2 2.5	mA
V_{icm}	Input Common Mode Voltage Range - (note 4) (V_{CC} = 30V) T_{amb} = +25°C $T_{min.} \le T_{amb} \le T_{max}$	0 0		V_{CC}^+-1.5 V_{CC}^+ -2	0 0		V_{CC}^+-1.5 V_{CC}^+ -2	V
V_{id}	Differential Input Voltage - (note 6)			V_{CC}^+			V_{CC}^+	V
V_{OL}	Low Level Output Voltage (V_{id} = -1V, I_{sink} = 4mA) T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$		250	400 700		250	400 700	mV
I_{OH}	High Level Output Current (V_{id} = 1V) (V_{CC} = V_O = 30V) T_{amb} = +25°C $T_{min.} \le T_{amb} \le T_{max}$.		0.1	 1		0.1	 1	nA µA
I_{sink}	Output Sink Current (V_{id} = -1V, V_O = 1.5V)	6	16		6	16		mA
t_{re}	Response Time – (note 5) (R_L = 5.1kΩ connected to V_{CC}^+, $V_{(ref)}$ = +1.4V)		1.3			1.3		µs
t_{rel}	Large Signal Response Time (R_L = 5.1kΩ connected to V_{CC}^+, e_I = TTL, $V_{(ref)}$ = +1.4V)		300			300		ns

139-03 TBL

Notes : 2. At output switch point, $V_O \approx$ 1.4V, R_S = 0 with V_{CC}^+ from 5Vto 30V, and over the full input common-mode range (0V to V_{CC}^+ –1.5V).

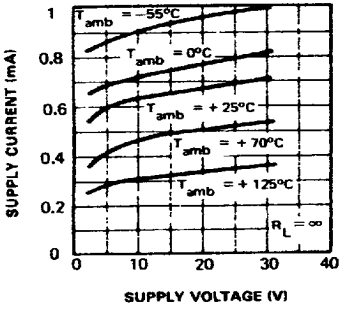
3 The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output, so no loading charge exists on the reference of input lines.

4 The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V The upper end of the common-mode voltage range is V_{CC}^+ –1.5V, but either or both inputs can go to +30V without damage.

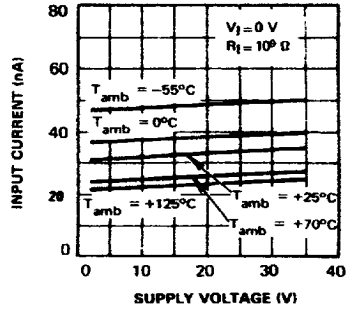
5. The response time specified is for a 100mV input step with 5mV overdrive For larger overdrive signals 300ns can be obtained

6. Positive excursions of input voltage may exceed the power supply level. As long as the other voltage remains within the common-mode range, the comparator will provide a proper output state. The low input voltage state must not be less than –0 3V (or 0.3V bellow the negative power supply, if used)

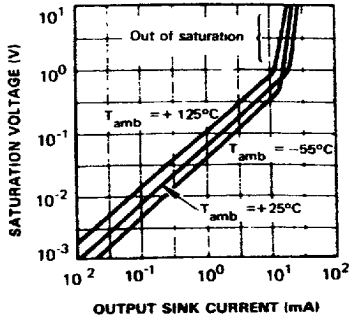
SUPPLY CURRENT



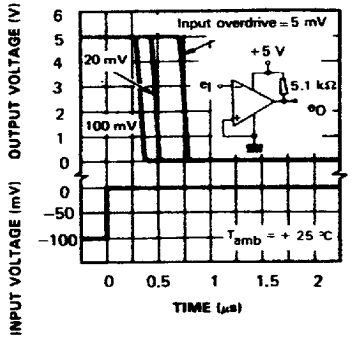
INPUT CURRENT



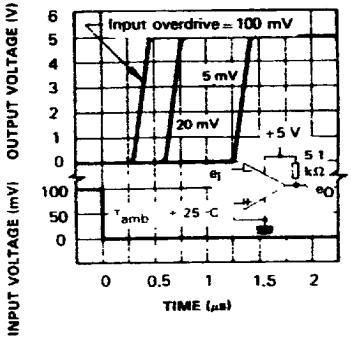
OUTPUT SATURATION VOLTAGE



RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES-NEGATIVE TRANSITION



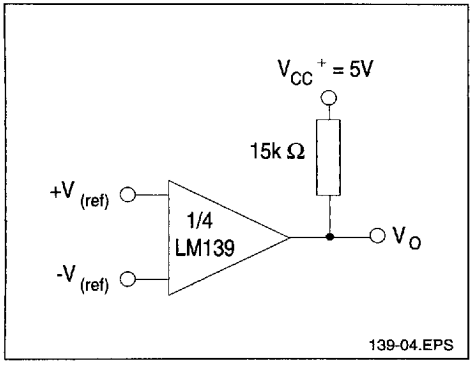
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - POSITIVE TRANSITION



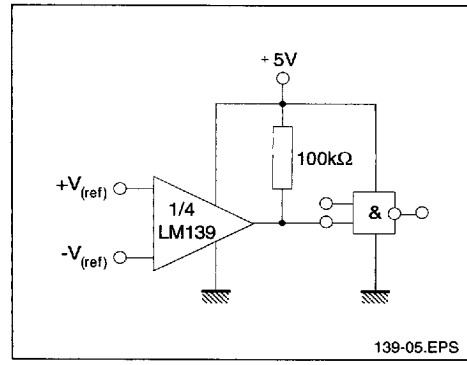
139-03.EPS

TYPICAL APPLICATIONS

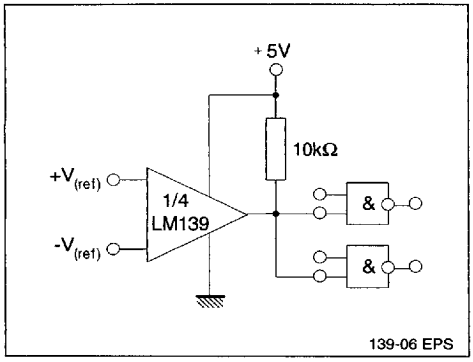
BASIC COMPARATOR



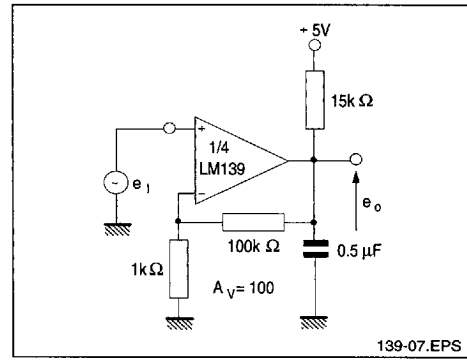
DRIVING CMOS



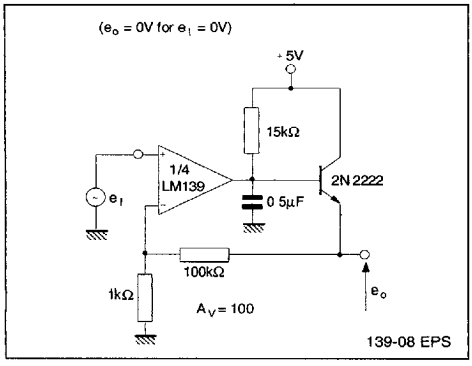
DRIVING TTL



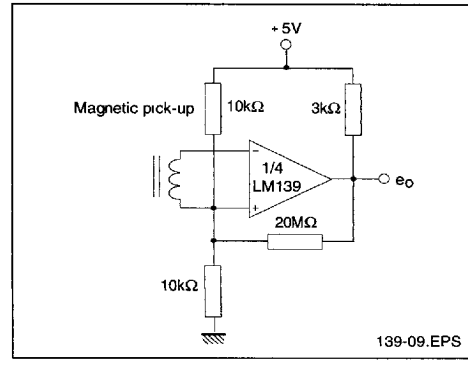
LOW FREQUENCY OP AMP



LOW FREQUENCY OP AMP

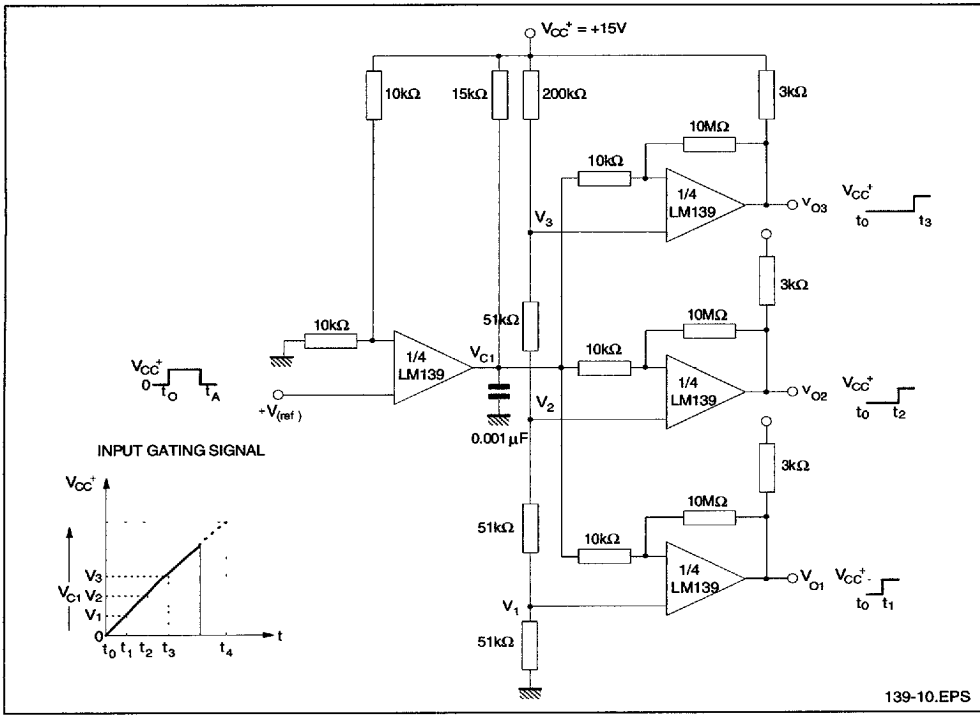


TRANSDUCER AMPLIFIER

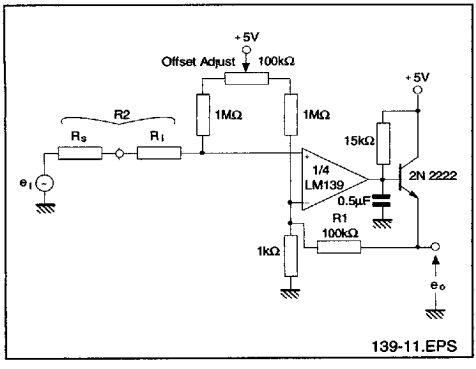


TYPICAL APPLICATIONS (continued)

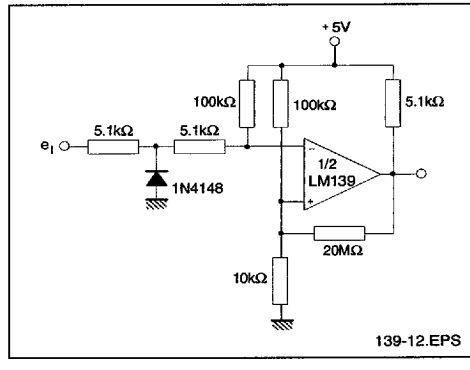
TIME DELAY GENERATOR



LOW FREQUENCY OP AMP WITH OFFSET ADJUST

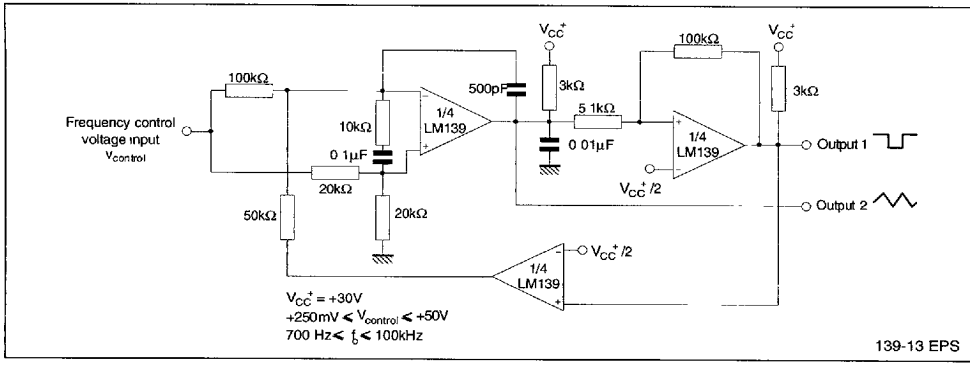


ZERO CROSSING DETECTOR (single power supply)

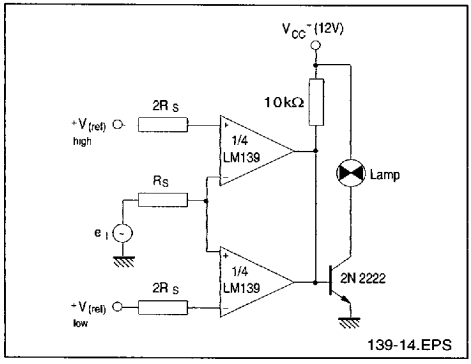


TYPICAL APPLICATIONS (continued)

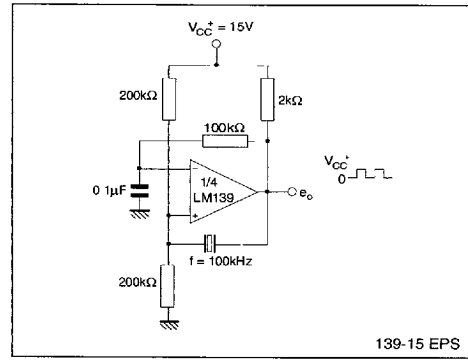
TWO-DECADE HIGH-FREQUENCY VCO



LIMIT COMPARATOR

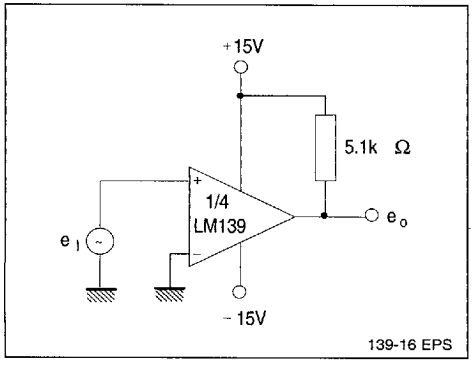


CRYSTAL CONTROLLED OSCILLATOR



SPLIT-SUPPLY APPLICATIONS

ZERO CROSSING DETECTOR



COMPARATOR WITH A NEGATIVE REFERENCE