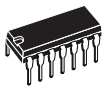
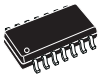
LM139,A
LM239,A - LM339,A

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; (Io = 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)

P
TSSOP14
(Thin Shrink Small Outline 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 aver a wide range of voltages. Operation from split power supplies is also possible.

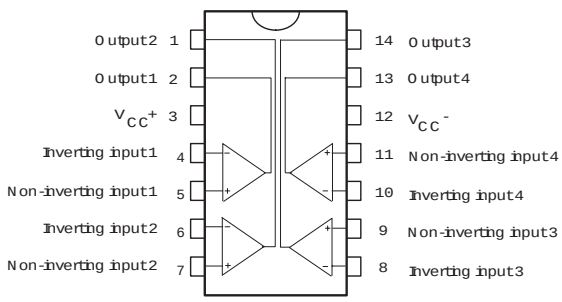
These comparators also have a unique characteristic in that the input common-mode voltage range includes ground even though operated from a single power supply voltage.

ORDER CODE

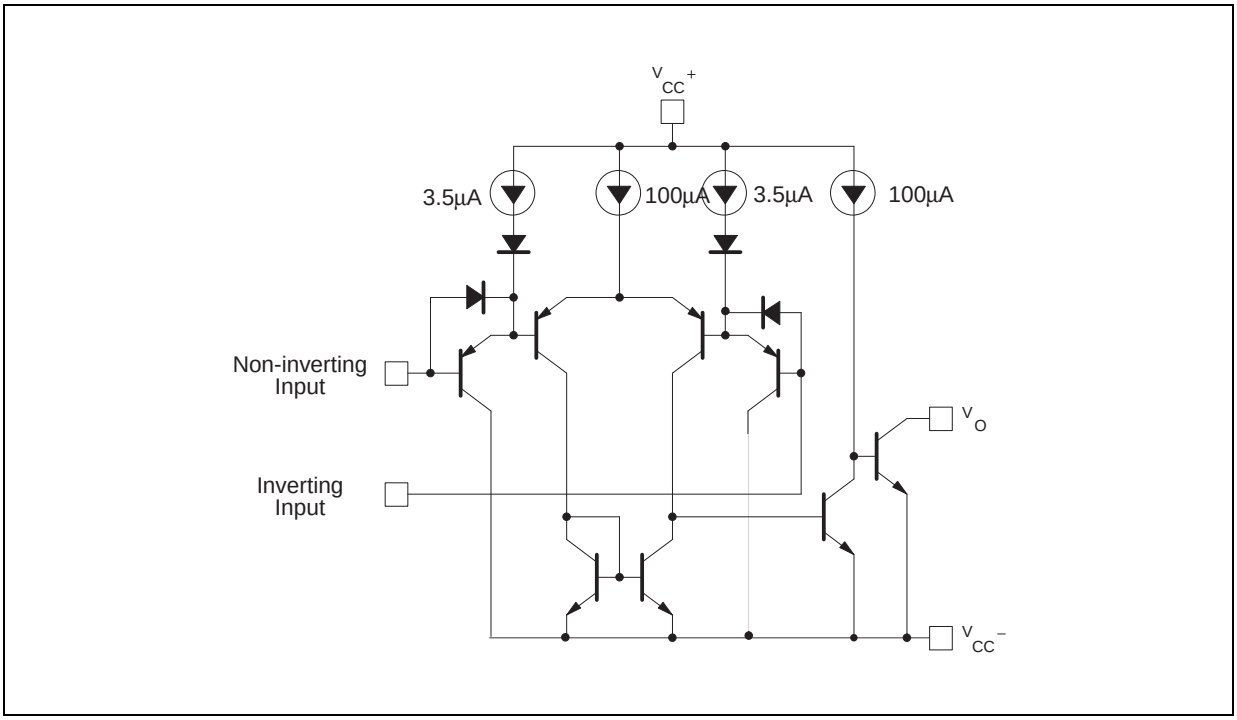
Part Number	Temperature Range	Package		
		N	D	P
LM139,A	-55°C, +125°C	•	•	•
LM239,A	-40°C, +105°C	•	•	•
LM339,A	0°C, +70°C	•	•	•
Example : LM139AN				

N = Dual in Line Package (DIP)
D = Small Outline Package (SO) - also available in Tape & Reel (DT)
P = Thin Shrink Small Outline Package (TSSOP) - only available in Tape &Reel (PT)

PIN CONNECTIONS (top view)



SCHEMATIC DIAGRAM (1/4 LM139)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{CC}	Supply voltage		±18 or 36	V
V_{id}	Differential Input Voltage		±36	V
V_i	Input Voltage		-0.3 to +36	V
	Output Short-circuit to Ground - note 1)		Infinite	
p_d	Power Dissipation 2)	DIP14 SO14 TSSOP14	1500 830 710	mW
T_{stg}	Storage Temperature Range		-65 to +150	°C
T_j	Junction Temperature		+150	°C

1. Short-circuits 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}^+.
2. Pd is calculated with T_{amb} = +25°C, T_j = +150°C and R_{thja} = 80°C/W for DIP14 package
= 150°C/W for SO14 package
= 175°C/W for TSSOP14 package

OPERATING CONDITIONS (T_{amb} = 25°C)

Symbol	Parameter		Value	Unit
V_{CC}	Supply Voltage		2 to 32 ±1 to ±16	V
Vicm	Common Mode Input Voltage Range		0 to (V_{CC}^+ - 1.5)	V
T_{oper}	Operating Free-air Temperature Range	LM139, LM139A LM239, LM239A LM339, LM339A	-55, +125 -40, +105 0, +70	°C

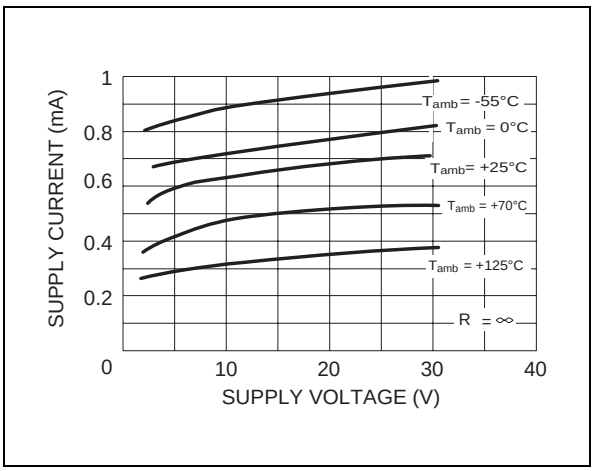
ELECTRICAL CHARACTERISTICS

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

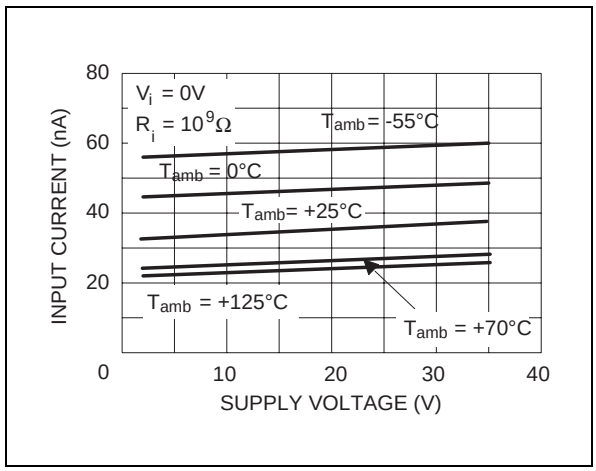
Symbol	Parameter	LM139A - LM239A LM339A			LM139- LM239 LM339			Unit
		Min.	Typ.	Max.	Min	Typ.	Max.	
V_{io}	Input Offset Voltage - note 1) T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$		1	2 4		1	5 9	mV
I_{io}	Input Offset Current T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$		3	25 100		5	50 150	nA
I_{ib}	Input Bias Current (I^+ or I^-) - note 2) 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 = 1V to 11V	50	200		50	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 3) 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 4)			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
Isink	Output Sink Currrent V_{id}= 1V, V_o = 1.5V	6	16		6	16		mA
tre	Response Time - note 5) R_L= 5.1kΩ connected to V_{CC}^+		1.3			1.3		µs
trel	Large Signal Response Time R_L= 5.1kΩ connected to V_{CC}^+, e_I = TTL, $V_{(ref)}$ = +1.4v		300			300		ns

1. At output switch point, $V_o \approx$ 1.4V, R_s = 0 with V_{CC}^+ from 5V to 30V, and over the full common-mode range (0V to V_{CC}^+ -1.5V).
2. 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.
3. 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
4. The response time specified is for a 100mV input step with 5mV overdrive. For larger overdrive signals 300ns can be obtained
5. Posistive 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).

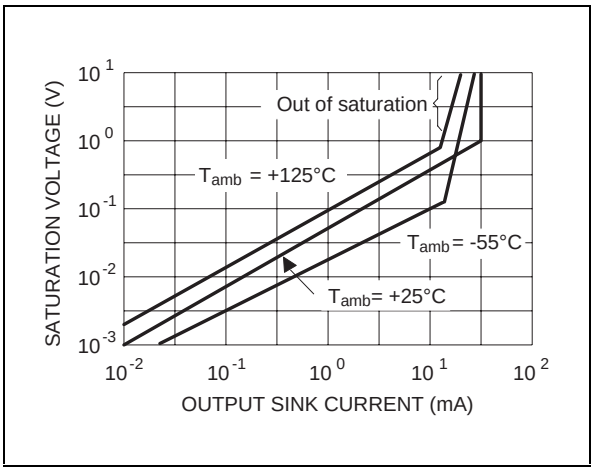
SUPPLY CURRENT versus SUPPLY VOLTAGE



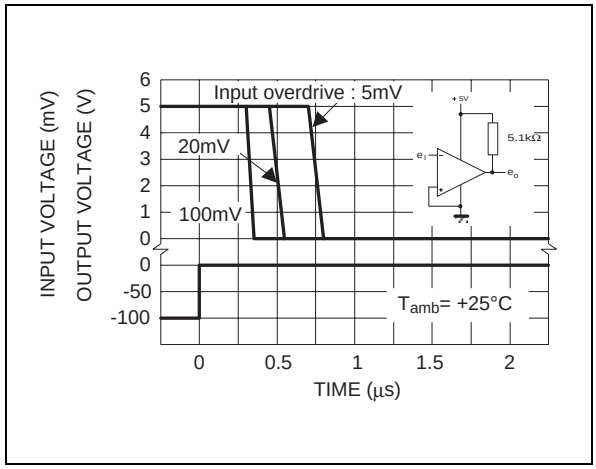
INPUT CURRENT versus SUPPLY VOLTAGE



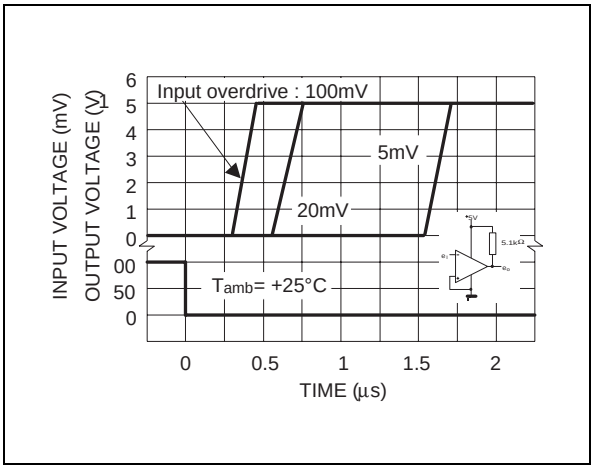
OUTPUT SATURATION VOLTAGE versus OUTPUT CURRENT



RESPONSE TIME FOR VAROIOUS INPUT OVERDRIVES - NEGATIVE TRANSITION

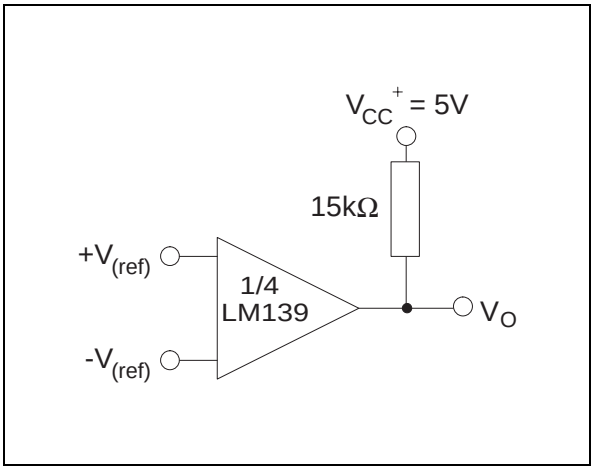


RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - POSITIVE TRANSITION

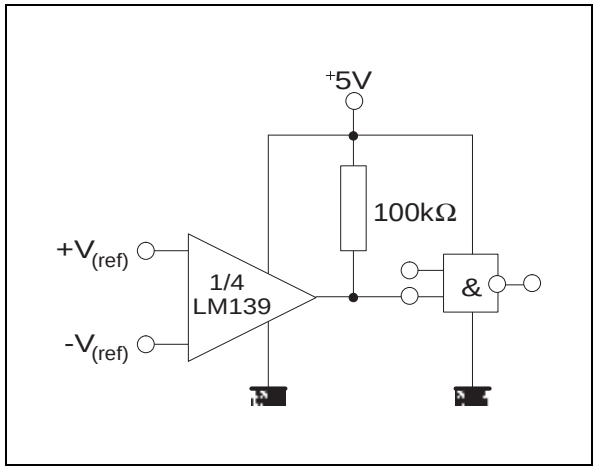


TYPICAL APPICATIONS

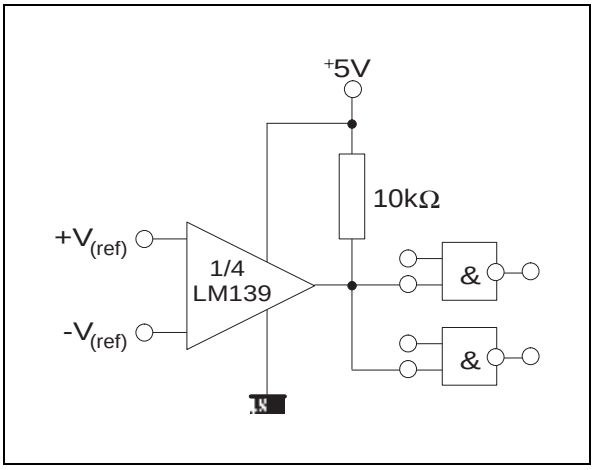
BASIC COMPARATOR



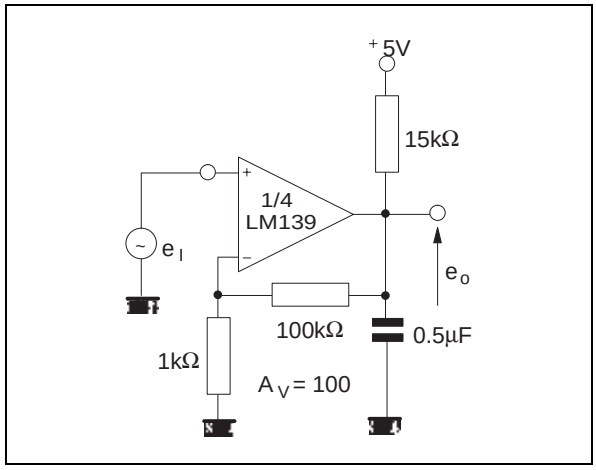
DRIVING CMOS



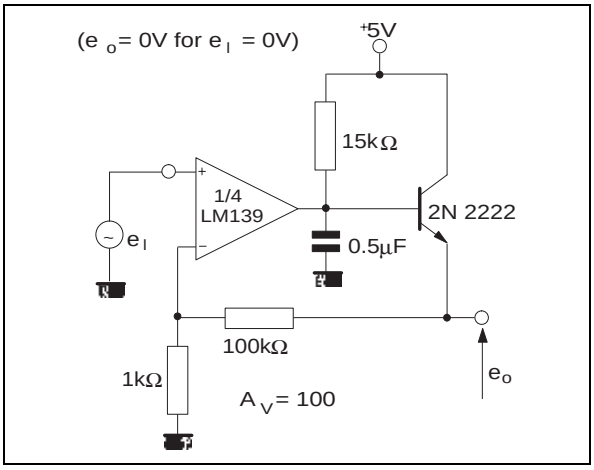
DRIVING TTL



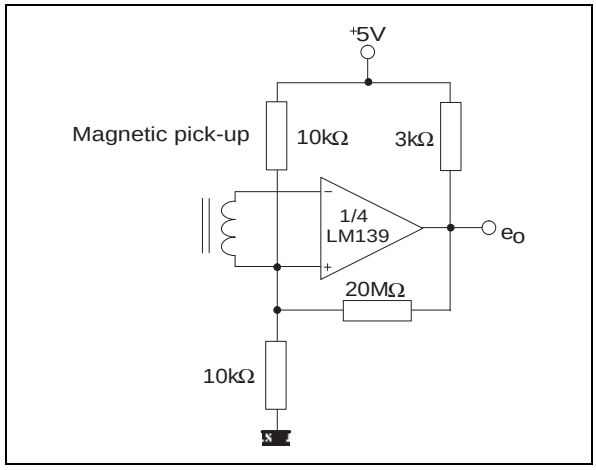
LOW FREQUENCY OP AMP



LOW FREQUENCY OP AMP

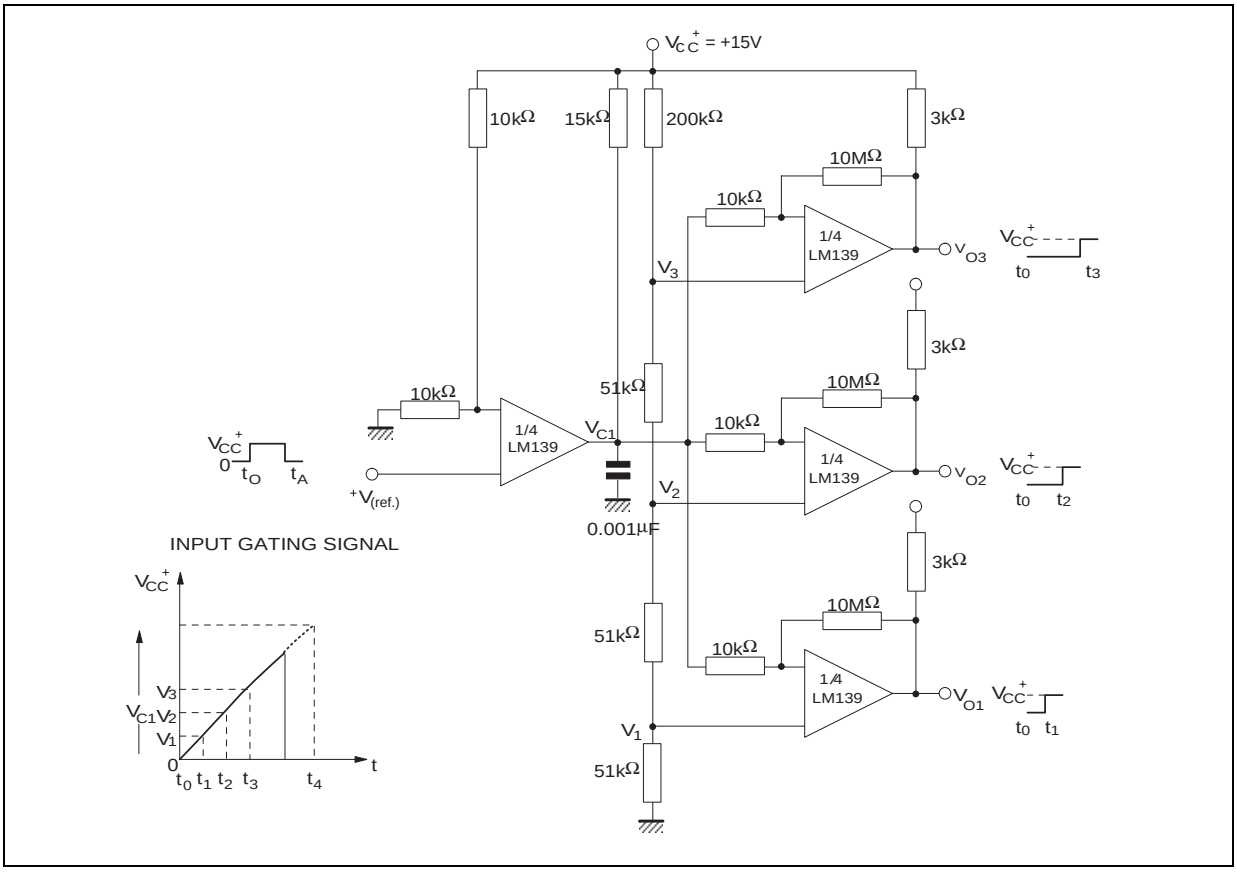


TRANSDUCER AMPLIFIER

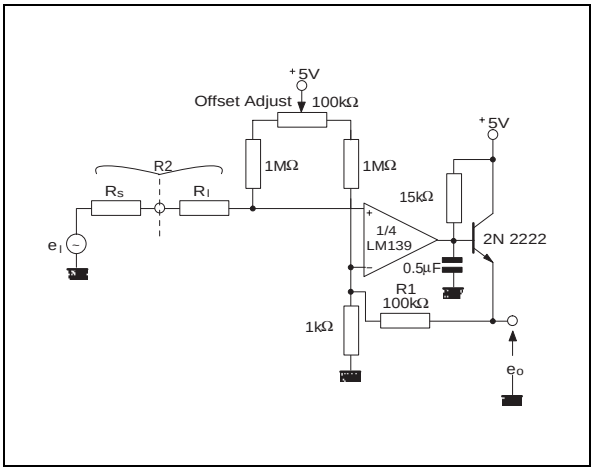


TYPICAL SINGLE (continued)

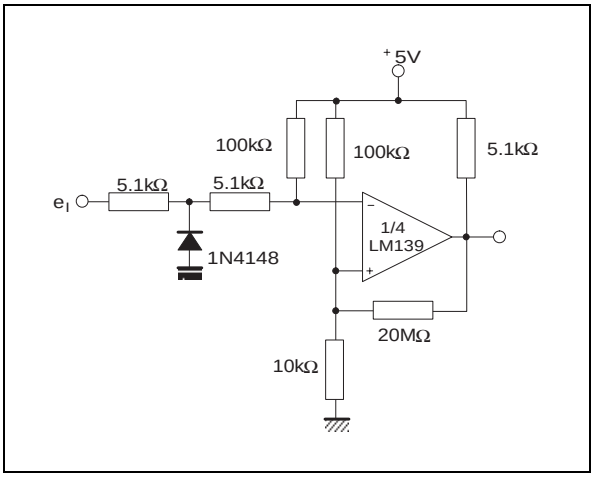
TIME DEALY GENERATOR



LOW FREQUANCY OP AMP WITH OFFSET ADJUST

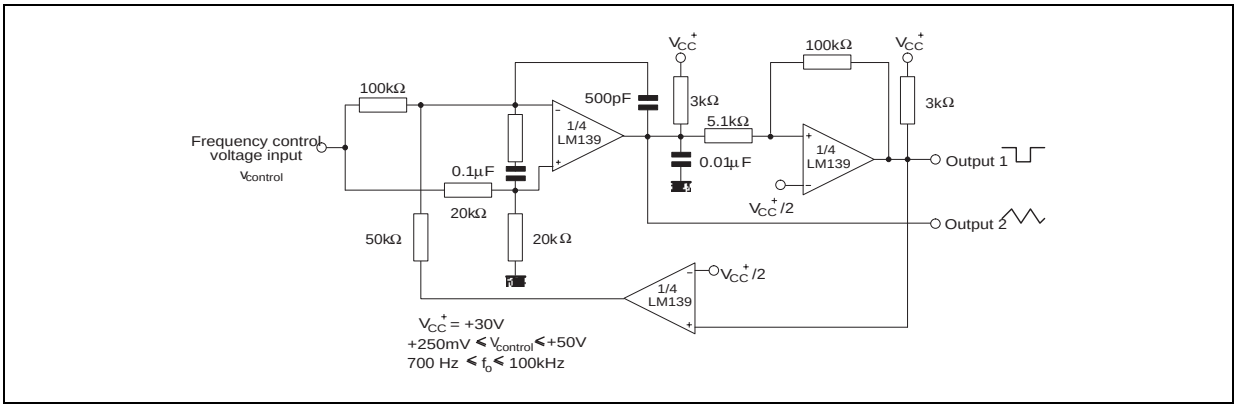


ZERO CROSSING DETECTOR (single power supply)

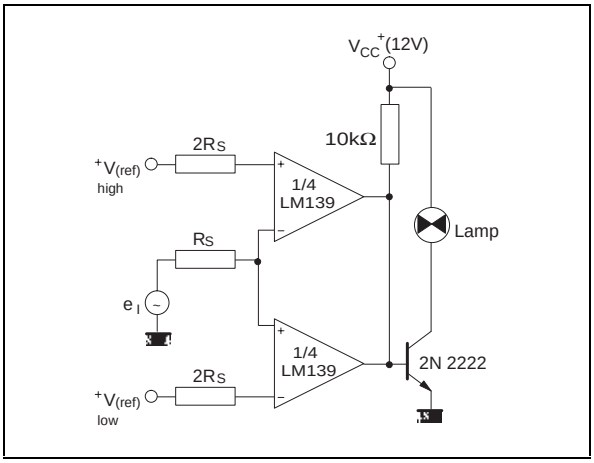


TYPICAL SINGLE (continued)

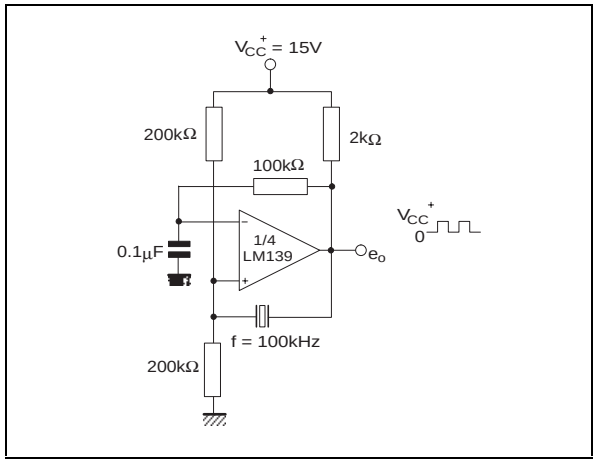
TWO-DECADE HIGH-FREQUENCY VCO



LIMIT COMPARATOR

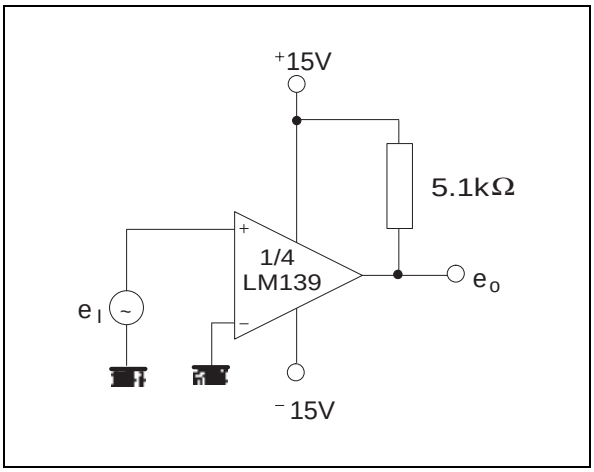


CRYSTAL CONTROLLED OSCILLATOR

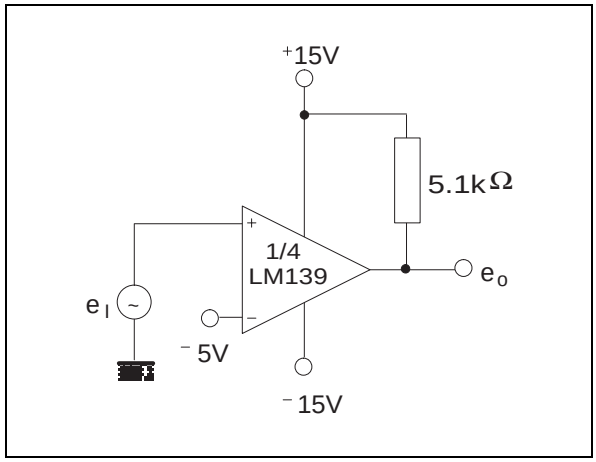


SPLIT-SUPPLY APPLICATIONS

ZERO CROSSING DETECTOR

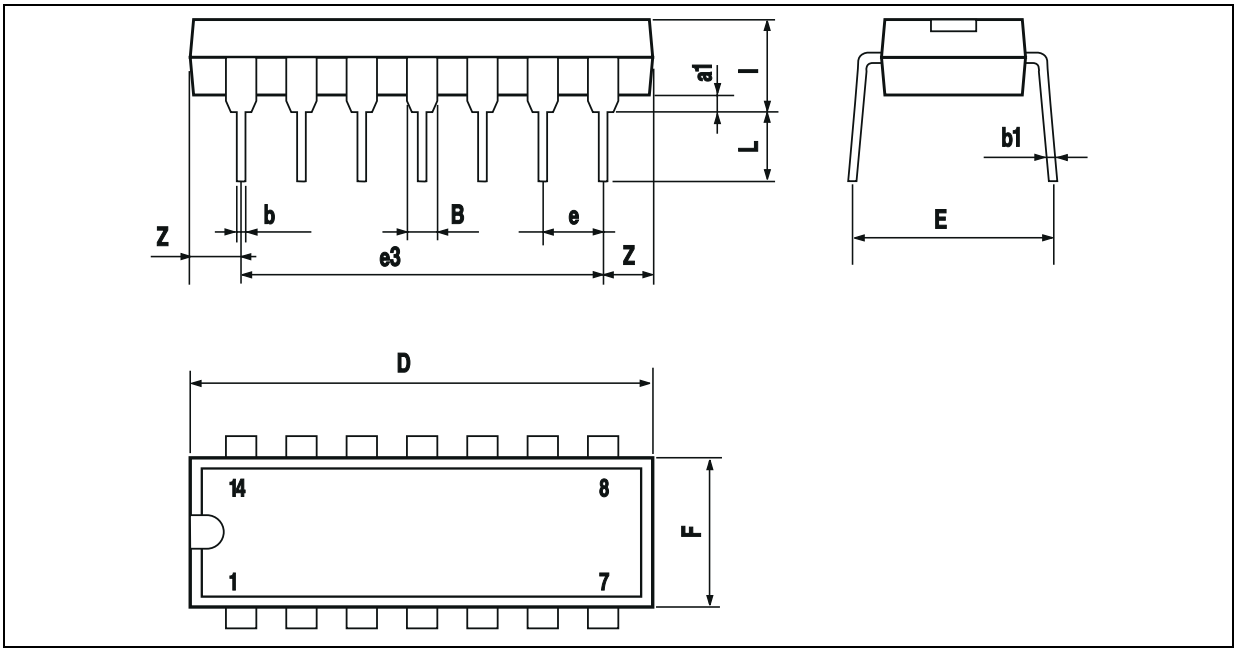


COMPARATOR WITH A NEGATIVE REFERENCE



PACKAGE MECHANICAL DATA

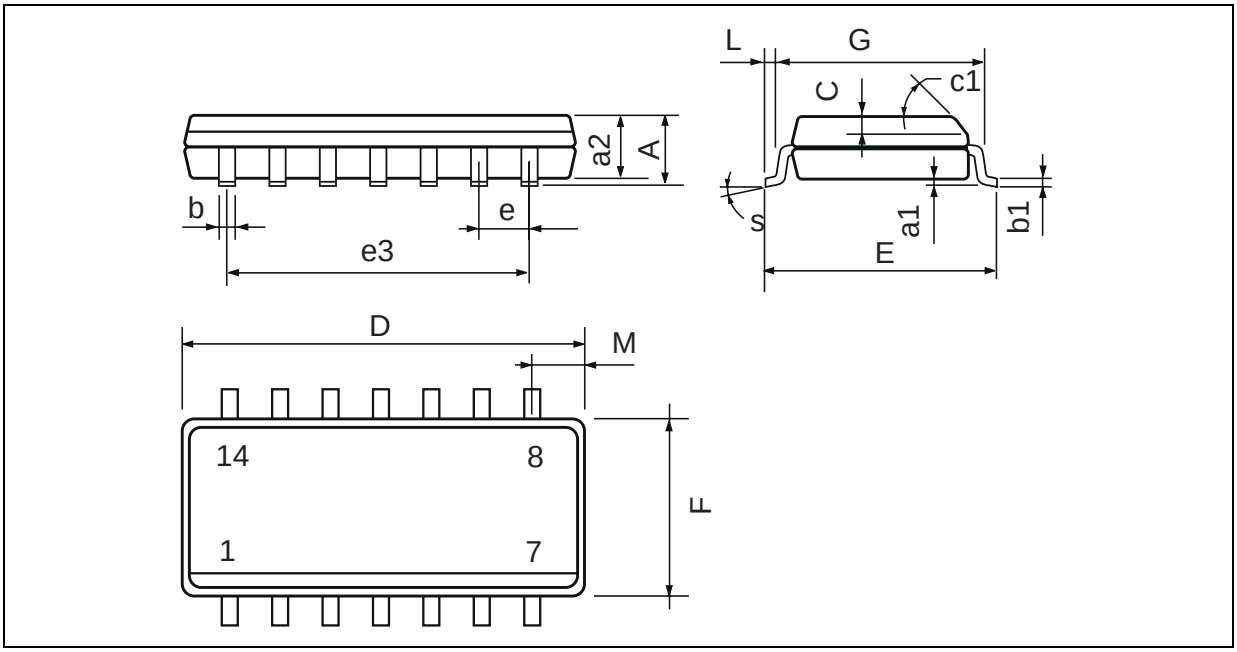
14 PINS - PLASTIC DIP



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
i			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100

PACKAGE MECHANICAL DATA

14 PINS - PLASTIC MICROPACKAGE (SO)

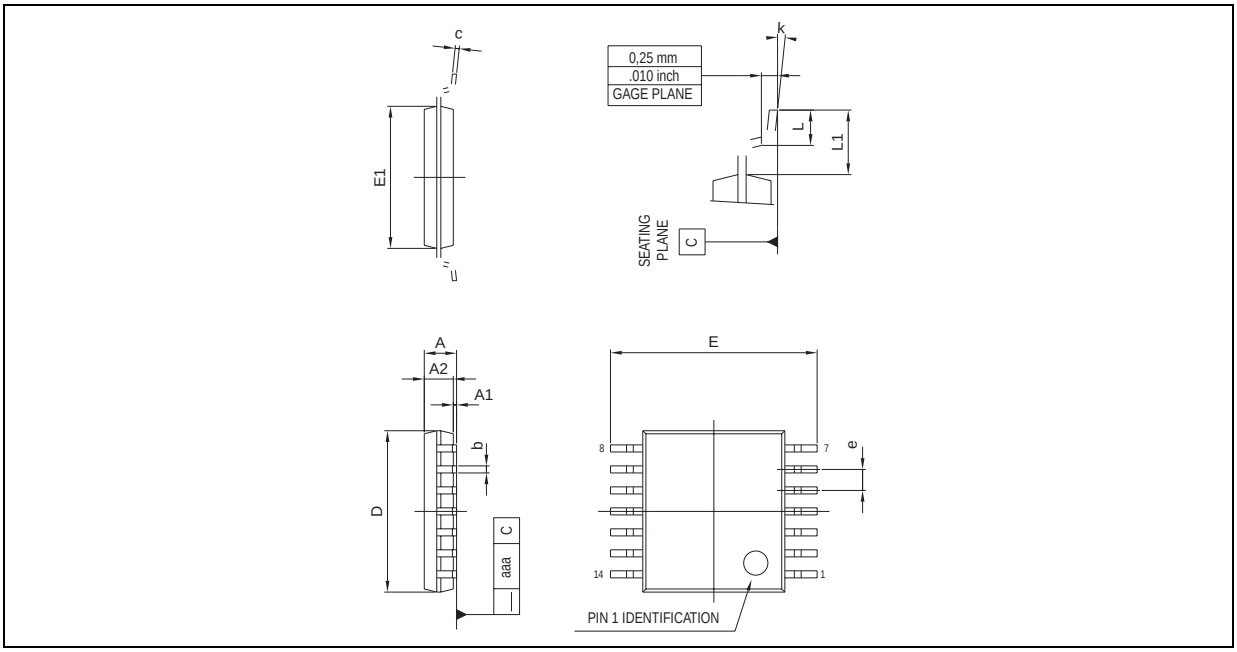


Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.2	0.004		0.008
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1	45° (typ.)					
D (1)	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F (1)	3.8		4.0	0.150		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.020		0.050
M			0.68			0.027
S	8° (max.)					

Note : (1) D and F do not include mold flash or protrusions - Mold flash or protrusions shall not exceed 0.15mm (.066 inc) ONLY FOR DATA BOOK.

PACKAGE MECHANICAL DATA

14 PINS - THIN SHRINK SMALL OUTLINE PACKAGE



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.20			0.05
A1	0.05		0.15	0.01		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.15
c	0.09		0.20	0.003		0.012
D	4.90	5.00	5.10	0.192	0.196	0.20
E		6.40			0.252	
E1	4.30	4.40	4.50	0.169	0.173	0.177
e		0.65			0.025	
k	0°		8°	0°		8°
L	0.450	0.600	0.750	0.018	0.024	0.030
L1		1.00			0.039	
aaa			0.100			0.004