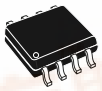
LM193W - LM293W LM393W

LOW POWER DUAL VOLTAGE COMPARATORS

- WIDE SINGLE SUPPLY VOLTAGE RANGE OR DUAL SUPPLIES : +2V TO +36V OR ±1V TO ±18V
- VERY LOW SUPPLY CURRENT (0.4mA) INDEPENDENT OF SUPPLY VOLTAGE (1mW/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
- ESD INTERNAL PROTECTION: 2kV

N
DIP8
(Plastic Package)



D
SO8
(Plastic Micropackage)

P
TSSOP8
(Thin Shrink Small Outline Package)

ORDER CODE

Part Number	Temperature Range	Package		
		N	D	P
LM193W	-55°C, +125°C	•	•	•
LM293W	-40°C, +105°C	•	•	•
LM393W	0°C, +70°C	•	•	•
Example : LM393WD				

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)

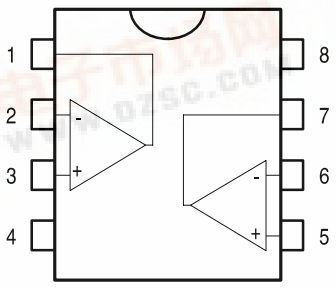
DESCRIPTION

These devices consist of two independent low voltage comparators designed specifically to operate from a single 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.

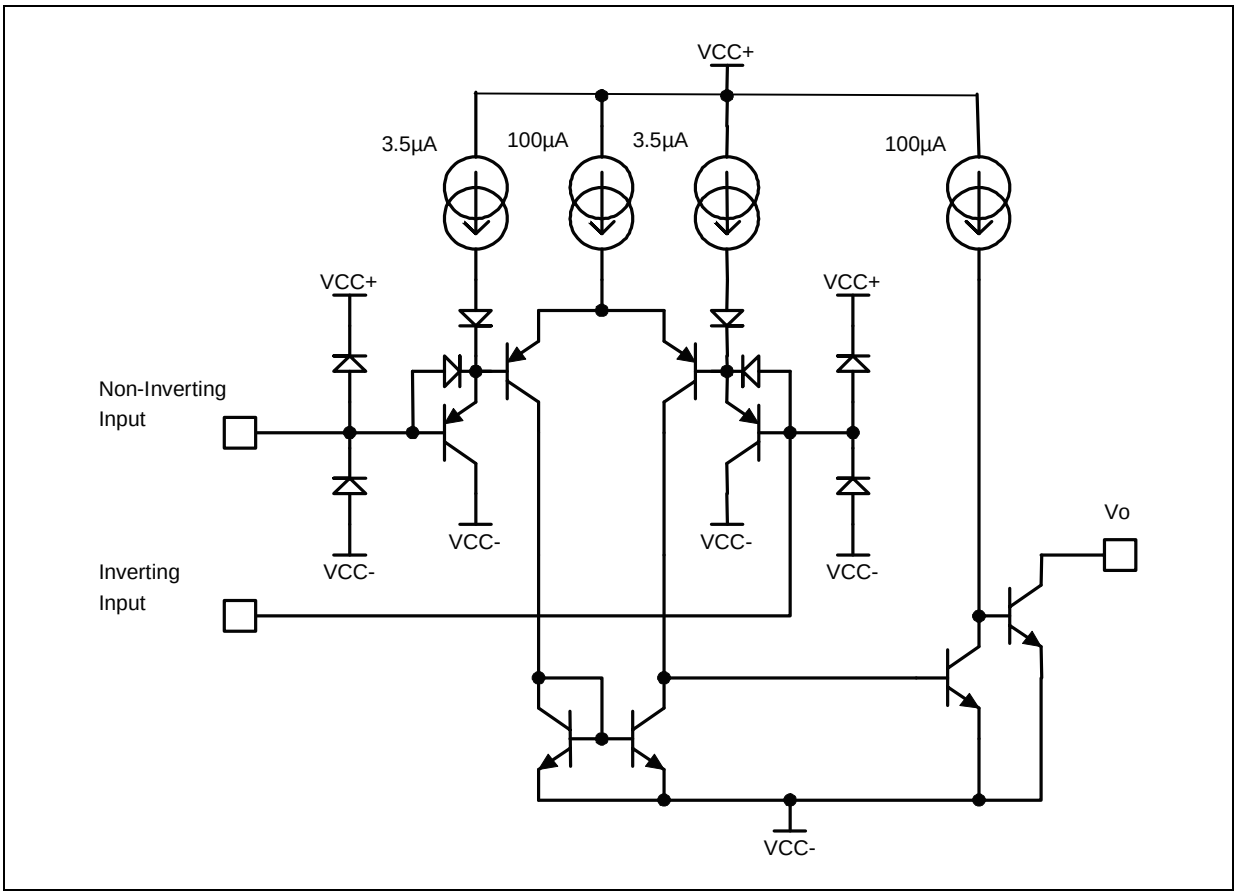
All the pins are protected against electrostatic discharge up to 2kV. As a consequence, the input voltages must not exceed the magnitude of Vcc+ or Vcc-.

PIN CONNECTIONS (top view)



1 - Output 1
2 - Inverting input 1
3 - Non-inverting input 1
4 - V_{CC}^-
5 - Non-inverting input 2
6 - Inverting input 2
7 - Output 2
8 - V_{CC}^+

SCHEMATIC DIAGRAM (1/2 LM193)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	LM193W	LM293W	LM393W	Unit
V_{CC}	Supply voltage	±18 or 36			V
V_{id}	Differential Input Voltage	V_{CC}^- -0.3 to V_{CC}^+ +0.3			V
V_i	Input Voltage				V
	Output Short-circuit to Ground - note 1)	Infinite			
P_{tot}	Power Dissipation	830			mW
T_{oper}	Opearting Free-air Temperature Range	-55 to +125	-40 to +105	0 to +70	°C
T_{stg}	Storage Temperature Range	-65 to +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}^+.

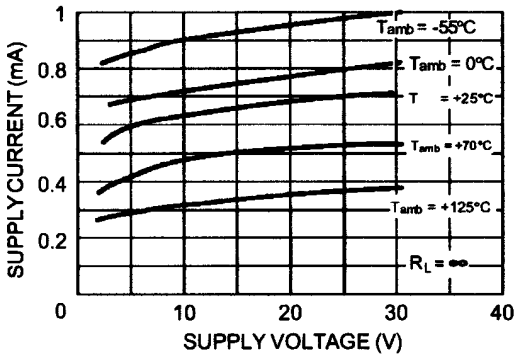
ELECTRICAL CHARACTERISTICS

V_{CC}^+ = +5V, V_{CC}^-= 0V, T_{amb} = +25°C (unless otherwise specified)

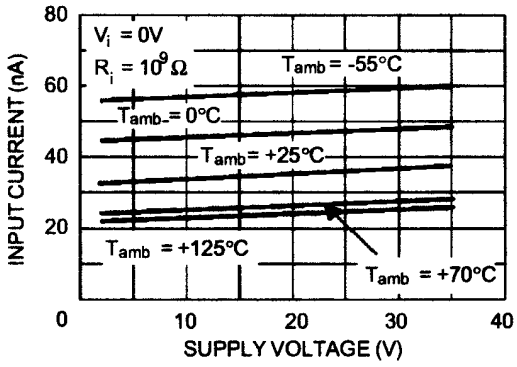
Symbol	Parameter	Min	Typ.	Max.	Unit
V_{io}	Input Offset Voltage - note 1) T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$		1	5 9	mV
I_{ib}	Input Bias Current - note 2) T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$		25	250 400	nA
I_{io}	Input Offset Current T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$		5	50 150	nA
A_{vd}	Large Signal Voltage Gain V_{CC} = 15V, R_L = 15kΩ, V_o = 1V to 11V	50	200		V/mV
I_{CC}	Supply Current (all comparators) V_{CC} = 5V, no load V_{CC} = 30V, no load		0.4 1	1 2.5	mA
V_{icm}	Input Common Mode Voltage Range - note 3) T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$	0 0		V_{CC}^+ -1.5 V_{CC}^+ -2	V
V_{id}	Differential Input Voltage -note 4)			V_{CC}^+	V
Isink	Output Sink Currrent V_{id}= 1V, V_o = 1.5V	6	16		mA
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	mV
I_{OH}	High Level Output Current (V_{id} = 1V) V_{id} = 1V, V_{CC} = V_o = 30V T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$		0.1	 1	nA µA
t_{re}	Response Time - note 5) R_L= 5.1kΩ to V_{CC}^+		1.3		µs
t_{rel}	Large Signal Response Time V_i = TTL, $V_{(ref)}$ = +1.4V, R_L= 5.1kΩ to V_{CC}^+		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. 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).
5. The response time specified is for a 100mV input step with 5mV overdrive. For larger overdrive signals 300ns can be obtained

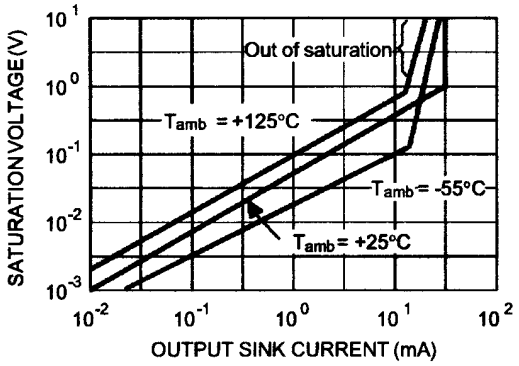
SUPPLY CURRENT versus SUPPLY VOLTAGE



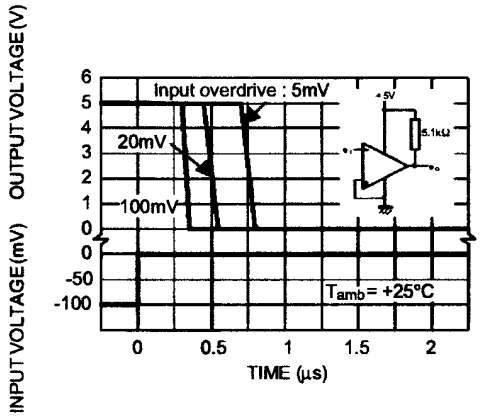
INPUT CURRENT versus SUPPLY VOLTAGE



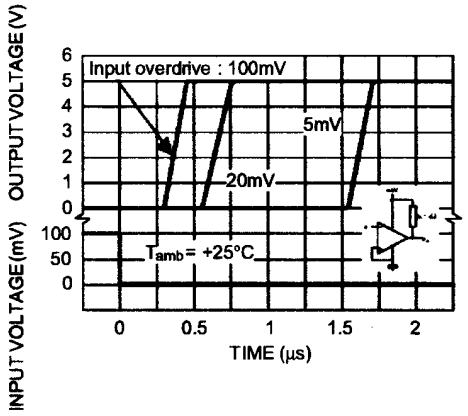
OUTPUT SATURATION VOLTAGE versus OUTPUT CURRENT



RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - NEGATIVE TRANSITION

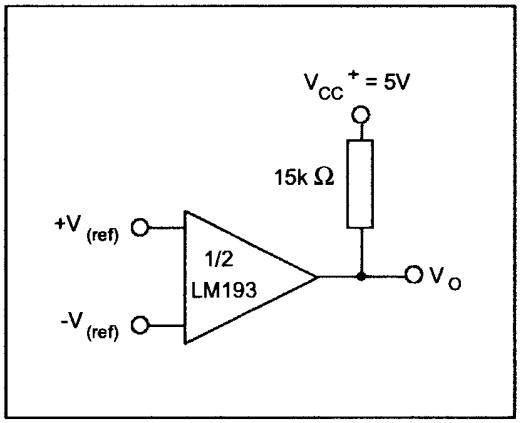


RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - POSITIVE TRANSITION

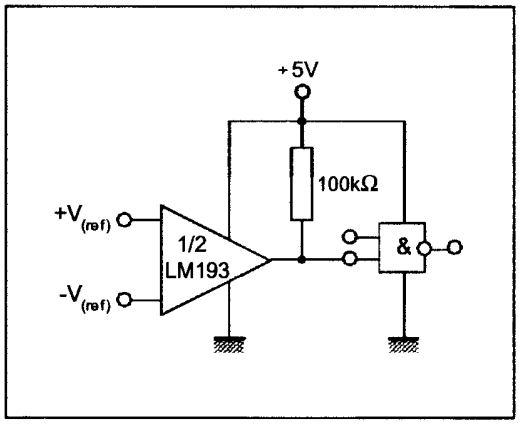


TYPICAL APPLICATIONS

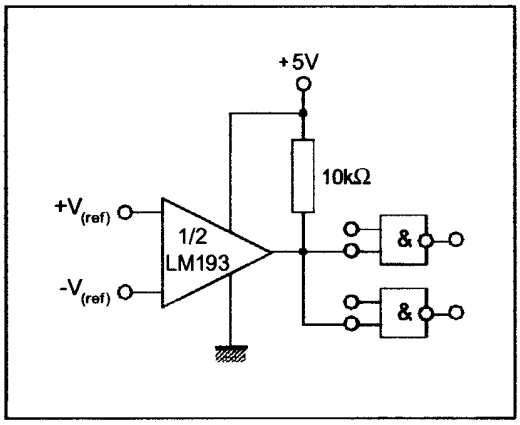
BASIC COMPARATOR



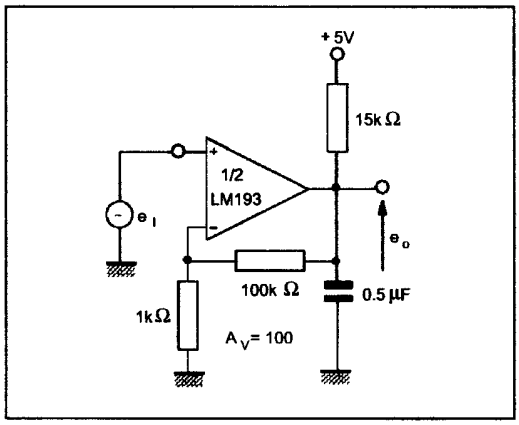
DRIVING CMOS



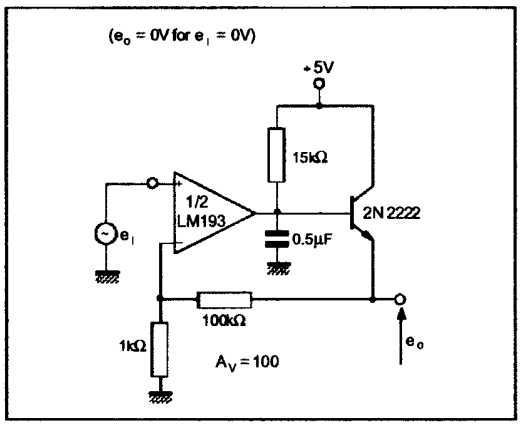
DRIVING TTL



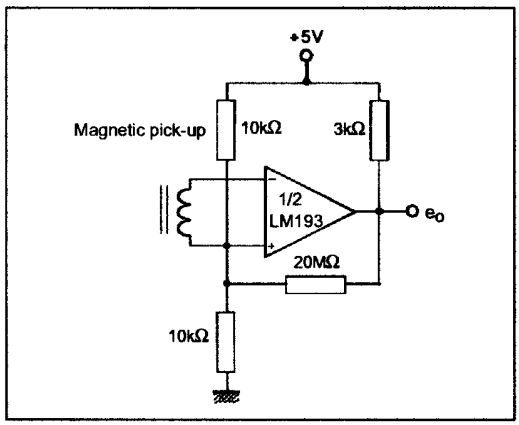
LOW FREQUENCY OP AMP



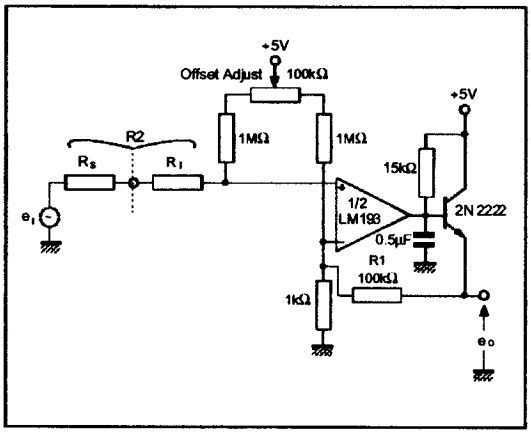
LOW FREQUENCY OP AMP



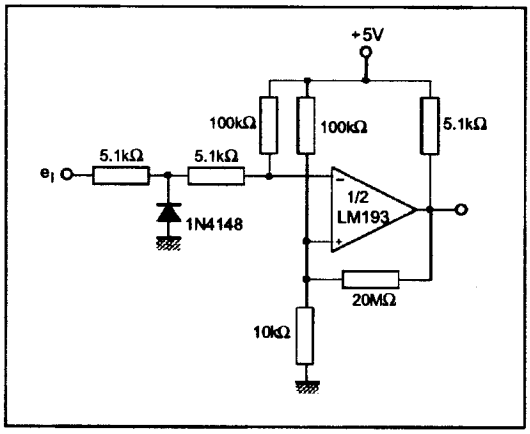
TRANSDUCER AMPLIFIER



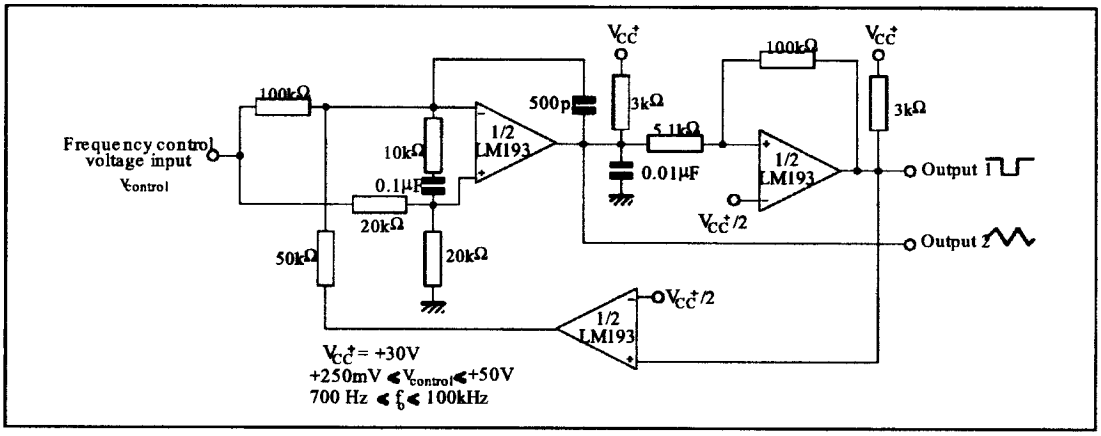
LOW FREQUENCY OP AMP WITH OFFSET ADJUST



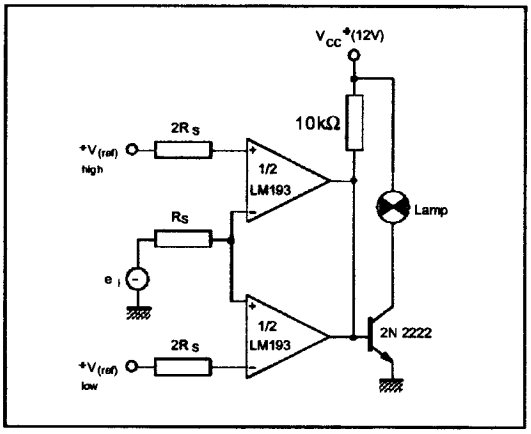
ZERO CROSSING DETECTOR (SINGLE POWER SUPPLY)



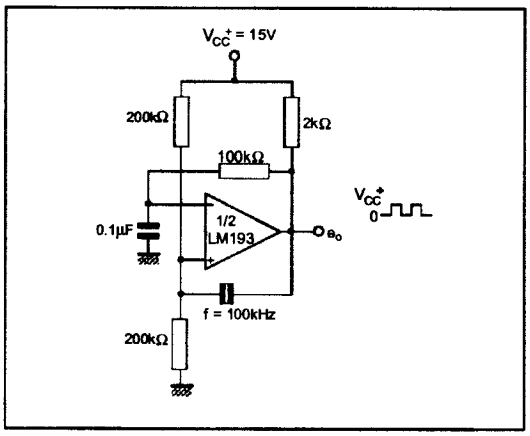
TWO DECADES HIGH FREQUENCY VCO



LIMIT COMPARATOR

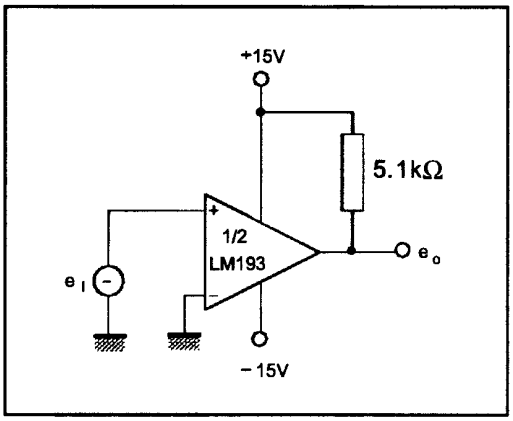


CRYSTAL CONTROLLED OSCILLATOR

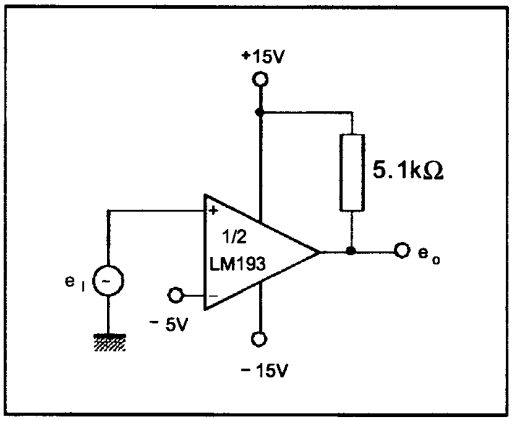


SPLIT-SUPPLY APPLICATIONS

ZERO CROSSING DETECTOR



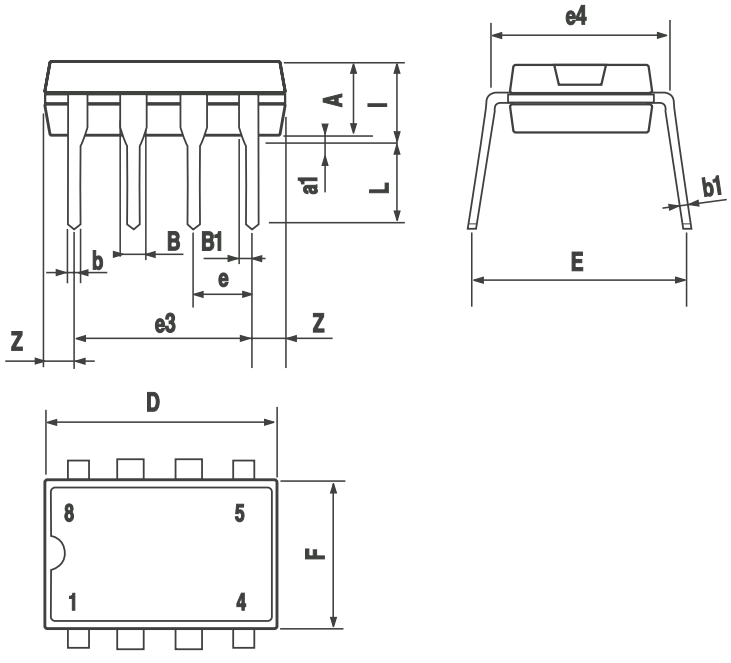
COMPARATOR WITH A NEGATIVE REFERENCE



PACKAGE MECHANICAL DATA

Plastic DIP-8 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A		3.3			0.130	
a1	0.7			0.028		
B	1.39		1.65	0.055		0.065
B1	0.91		1.04	0.036		0.041
b		0.5			0.020	
b1	0.38		0.5	0.015		0.020
D			9.8			0.386
E		8.8			0.346	
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			7.1			0.280
I			4.8			0.189
L		3.3			0.130	
Z	0.44		1.6	0.017		0.063

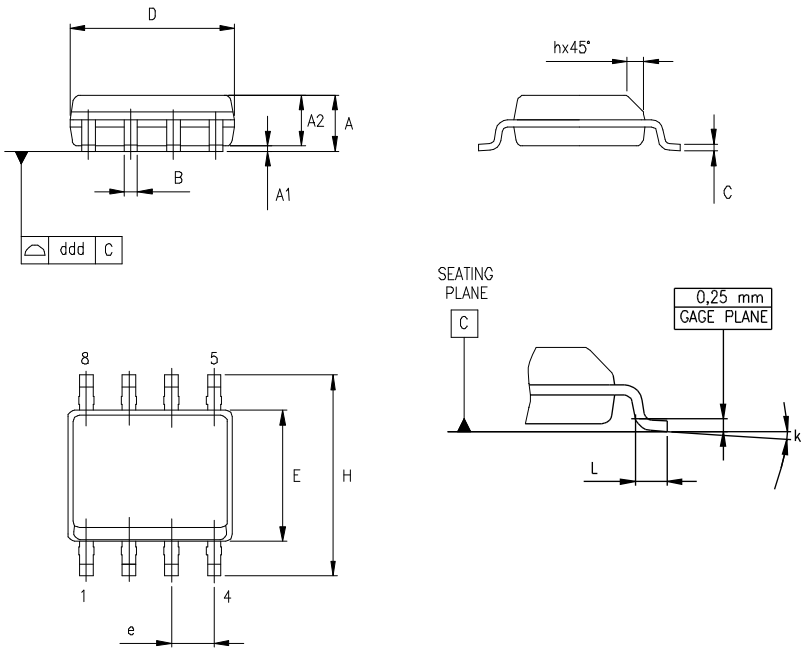


P001F

PACKAGE MECHANICAL DATA

SO-8 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	8° (max.)					
ddd			0.1			0.04



0016023/C

PACKAGE MECHANICAL DATA

TSSOP8 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.008
D	2.90	3.00	3.10	0.114	0.118	0.122
E	6.20	6.40	6.60	0.244	0.252	0.260
E1	4.30	4.40	4.50	0.169	0.173	0.177
e		0.65			0.0256	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030
L1		1			0.039