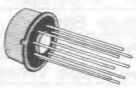
SGS-THOMSON MICROELECTRONICS

LM111-LM211 LM311

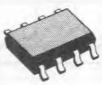
VOLTAGE COMPARATORS

- MAXIMUM INPUT CURRENT : 150 nA
- MAXIMUM OFFSET CURRENT : 20 nA
- DIFFERENTIAL INPUT VOLTAGE RANGE : ± 30 V
- POWER CONSUMPTION : 135 mW AT ± 15 V
- SUPPLY VOLTAGE : + 5 V TO ± 15 V
- OUTPUT CURRENT : 50 mA



H
TO-99
(Metal Can)

N
DIP8
(Plastic Package)
J
CERDIP8
(Cerdip Package)



D
SO8
(Plastic Micropackage)

GC
LCC20
(Tricecop (LCC))

DESCRIPTION

The LM111, LM211 and LM311 are voltage comparators that have low input currents.

They are also designed to operate over a wide range of supply voltages : from standard ± 15 V operational amplifier supplies down to the single + 5 V supply used for IC logic.

Their output is compatible with RTL-DTL and TTL as well as MOS circuits and can switch voltages up to + 50 V at output currents as high as 50 mA.

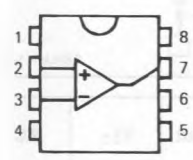
ORDER CODES

Part Number	Temperature Range	Package				
		H	N	J	D	GC
LM111	– 55 to + 125 °C	•		•		•
LM211	– 40 to + 105 °C	•	•		•	
LM311	0 to + 70 °C	•	•	•	•	

Note : Hi-Rel Versions Available
Examples LM111H. LM111J

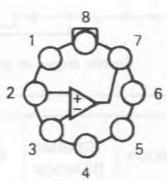
PIN CONNECTIONS (top views)

DIP8
CERDIP8
SO8



1 - Ground
2 - Non-inverting input
3 - Inverting input
4 - V_{CC}^-

TO-99



5 - Balance
6 - Strobe/balance
7 - Output
8 - V_{CC}^+

LCC20

1 - NC
2 - Ground
3 - NC
4 - NC
5 - Non-inverting input
6 - NC
7 - Inverting input
8 - NC
9 - NC
10 - V_{CC}^-
11 - NC
12 - Balance
13 - NC
14 - NC
15 - Balance/Strobe
16 - NC
17 - Output
18 - NC
19 - NC
20 - V_{CC}^+

ABSOLUTE MAXIMUM RATINGS

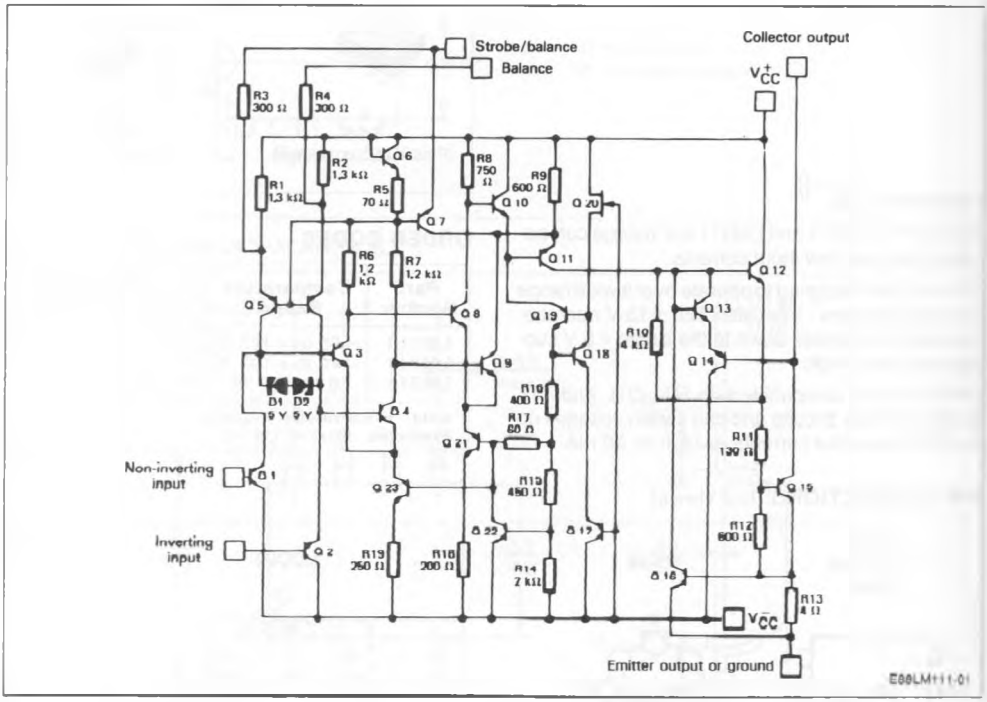
Symbol	Parameter	LM111	LM211	LM311	Unit
V_{CC}	Supply Voltage	36	36	36	V
V_{ID}	Differential Input Voltage	± 30	± 30	± 30	V
V_I	Input Voltage – (note 1)	± 15	± 15	± 15	V
P_{tot}	Power Dissipation LM311D-LM211D Other Versions	 500	 500	 300 500	mW
T_{oper}	Operating Free-air Temperature Range	– 55 to + 125	– 40 to + 105	0 to + 70	°C
T_{stg}	Storage Temperature Range	– 65 to + 150	– 65 to + 150	– 65 to + 150	°C
$V_{(1-4)}$	Ground to Negative Supply Voltage	30	30	30	V
$V_{(7-4)}$	Output to Negative Supply Voltage	50	50	40	V

Output short-circuit duration : 10 s
Voltage at strobe pin : V_{CC} – 5 V

Maximum junction temperature **LM111** : + 150 °C
LM211 : + 150 °C
LM311 : + 150 °C

Note : 1. This rating applies for ± 15 V supplies. The positive input voltage limit is 30 V above the negative. The negative input voltage limit is equal to the negative supply voltage or 30 V below the positive supply, whichever is less.

SCHEMATIC DIAGRAM



Case	GND	Non-Inverting Input	Inverting Input	V_{CC}^-	Balance	Strobe/ Balance	Output	V_{CC}^+	N.C.
TO–99 / DIP8 CERDIP8 / SO8	1	2	3	4	5	6	7	8	
LCC20	2	5	7	10	12	15	17	20	*

* LCC20 : Other pins are not connected.

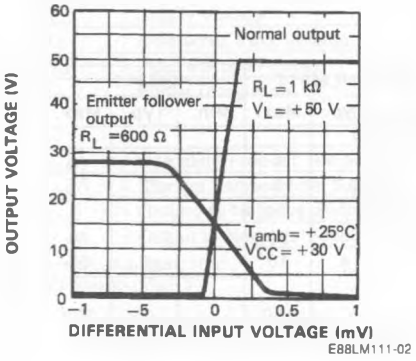
ELECTRICAL CHARACTERISTICS

LM111: $-55\ °C \le T_{amb} \le +125\ °C$, $V_{CC} = \pm 15\ V$
LM211: $-40\ °C \le T_{amb} \le +105\ °C$, $V_{CC} = \pm 15\ V$
LM311: $0\ °C \le T_{amb} \le +70\ °C$, $V_{CC} = \pm 15\ V$
(unless otherwise specified)

Symbol	Parameter	LM111/LM211			LM311			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{IO}	Input Offset Voltage ($R_S \le 50\ k\Omega$) – (note 2) $T_{min} \le T_{amb} \le T_{max}$ $T_{amb} = +25\ °C$		 0.7	 4 3		 2	 10 7.5	mV
I_{IO}	Input Offset Current – (note 2) $T_{min} \le T_{amb} \le T_{max}$ $T_{amb} = +25\ °C$		 4	 20 10		 6	 70 50	nA
I_{IB}	Input Bias Current – (note 2) $T_{min} \le T_{amb} \le T_{max}$ $T_{amb} = +25\ °C$		 60	 150 100		 100	 300 250	nA
A_{VD}	Large Signal Voltage Gain ($T_{amb} = +25\ °C$)	40	200		40	200		V/mV
	Supply Currents ($T_{amb} = 25\ °C$)							mA
I_{CC}	Positive		5.1	6		5.1	7.5	
I_{CC}	Negative		4.1	5		4.1	5	
V_I	Input Voltage Range		± 14			± 14		V
V_{OL}	Low Level Output Voltage $T_{min} \le T_{amb} \le T_{max}$ $V_{CC} \ge +4.5\ V$, $V_{CC} = 0$, $I_{sink} = 8\ mA$, $V_I \le -6\ mV$ $V_I \le -10\ mV$ $T_{amb} = +25\ °C$, $I_O = 50\ mA$, $V_I \le -5\ mV$ $V_I \le -10\ mV$		 0.23 0.75	 0.4 1.5		 0.23 0.75	 0.4 1.5	V
I_{OH}	High Level Output Current $T_{min} \le T_{amb} \le T_{max}$, $V_I \ge +5\ mV$, $V_O = +35\ V$ $T_{amb} = +25\ °C$, $V_I \ge +5\ mV$, $V_O = +35\ V$ $V_I \ge +10\ mV$, $V_O = +35\ V$		 0.1 0.2	 0.5 10		 0.2	 50	µA nA nA
I_{strobe}	Strobe Current ($T_{amb} = +25\ °C$)		3			3		mA
t_{rs}	Response Time ($T_{amb} = +25\ °C$) – (note 3)		200			200		ns

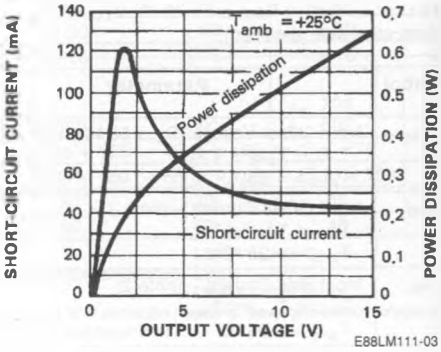
Notes: 2. The offset voltage, offset current and bias current specifications apply for any supply voltage from a single +5 V supply up to ±15 V supplies.
The offset voltages and offset currents given are the maximum values required to drive the output down to +1 V or up to +14 V with a 1 mA load current. Thus, these parameters define an error band and take into account the worst case of voltage gain and input impedance.
3. The response time specified (see definitions) is for a 100 mV input step with 5 mV overdrive.

TRANSFER CHARACTERISTICS



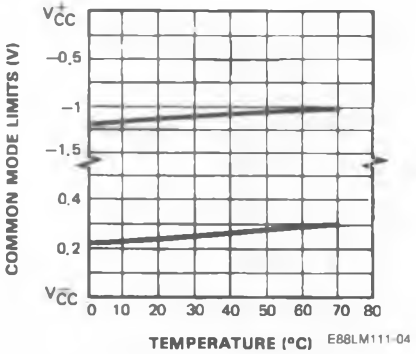
E88LM111-02

OUTPUT LIMITING CHARACTERISTICS



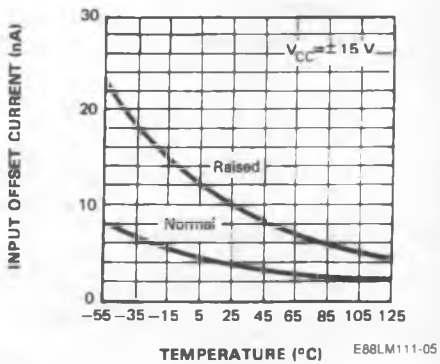
E88LM111-03

COMMON MODE LIMITS



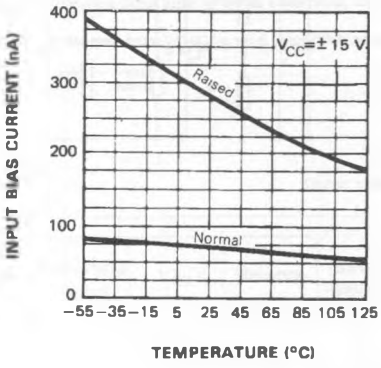
E88LM111-04

INPUT OFFSET CURRENT



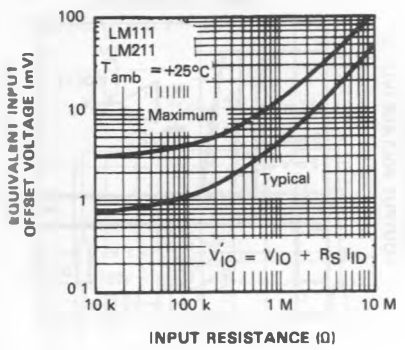
E88LM111-05

INPUT BIAS CURRENT



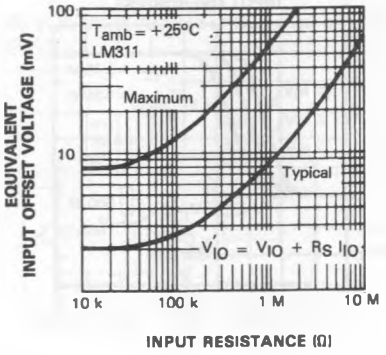
E88LM111-06

EQUIVALENT INPUT OFFSET ERROR



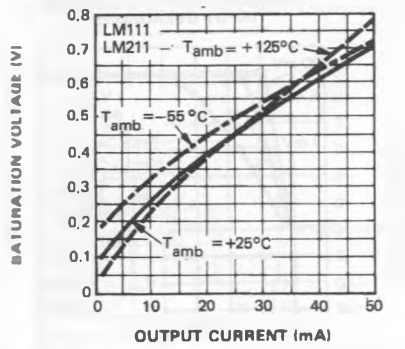
E88LM111-07

EQUIVALENT INPUT OFFSET ERROR



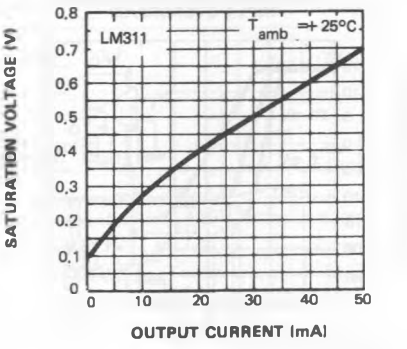
E88LM111-08

LOW LEVEL OUTPUT SATURATION VOLTAGE



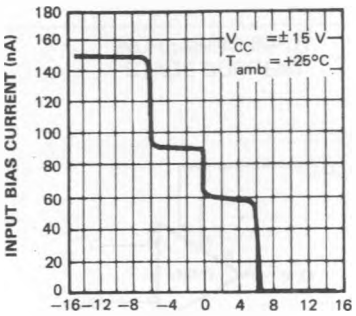
E88LM111-09

LOW LEVEL OUTPUT SATURATION VOLTAGE



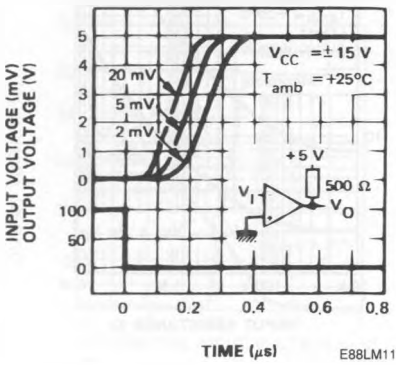
E88LM111-10

INPUT CHARACTERISTICS



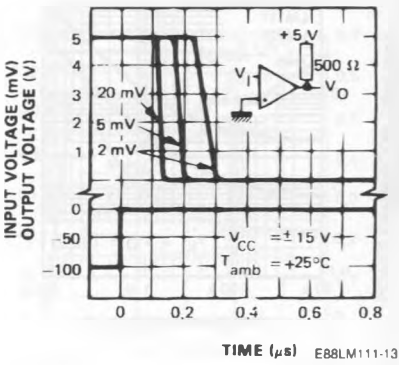
E88LM111-11

RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



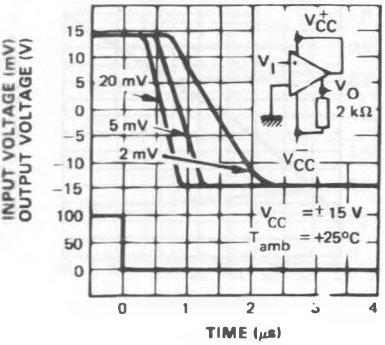
E88LM111-12

RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



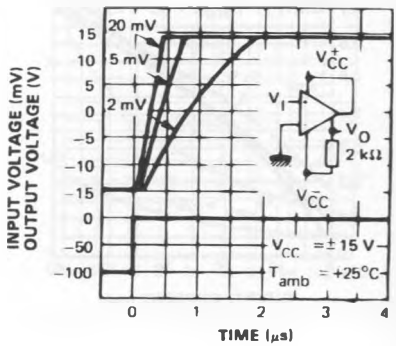
E88LM111-13

RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



E88LM111-14

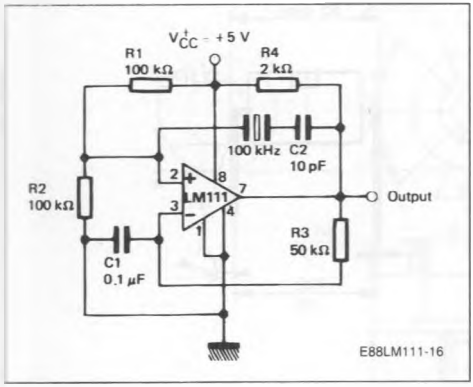
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



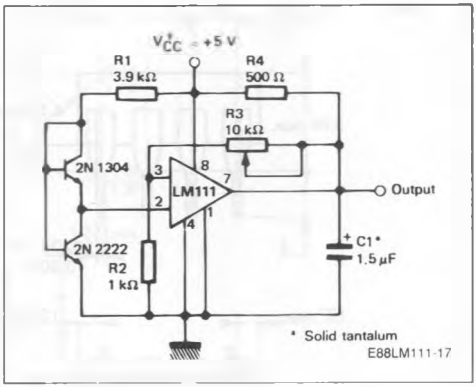
E88LM111-15

TYPICAL APPLICATIONS

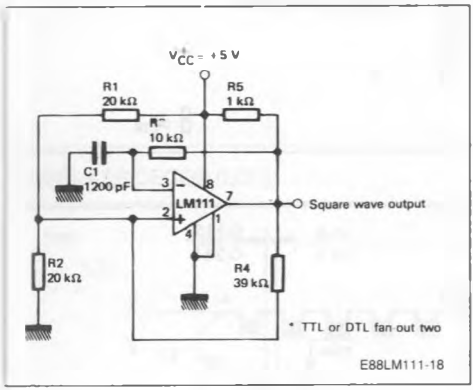
CRYSTAL OSCILLATOR



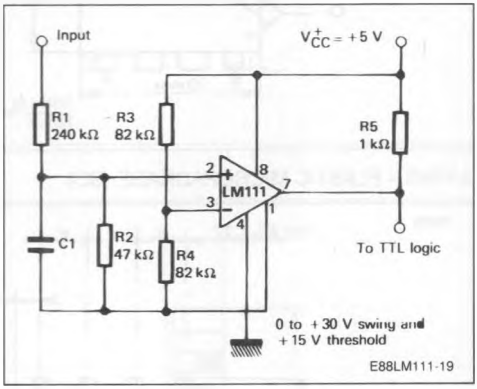
LOW VOLTAGE ADJUSTABLE REFERENCE SUPPLY



500 kHz FREE RUNNING MULTIVIBRATOR

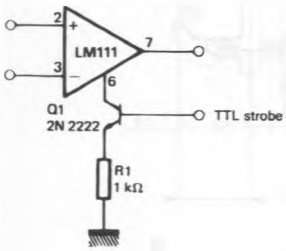


TTL INTERFACE WITH HIGH LEVEL LOGIC

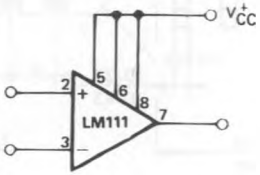


AUXILIARY CIRCUITS

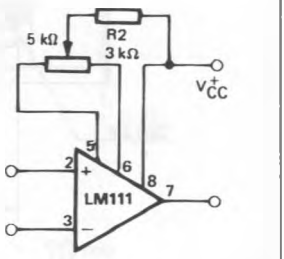
STROBE



INCREASING INPUT STAGE CURRENT

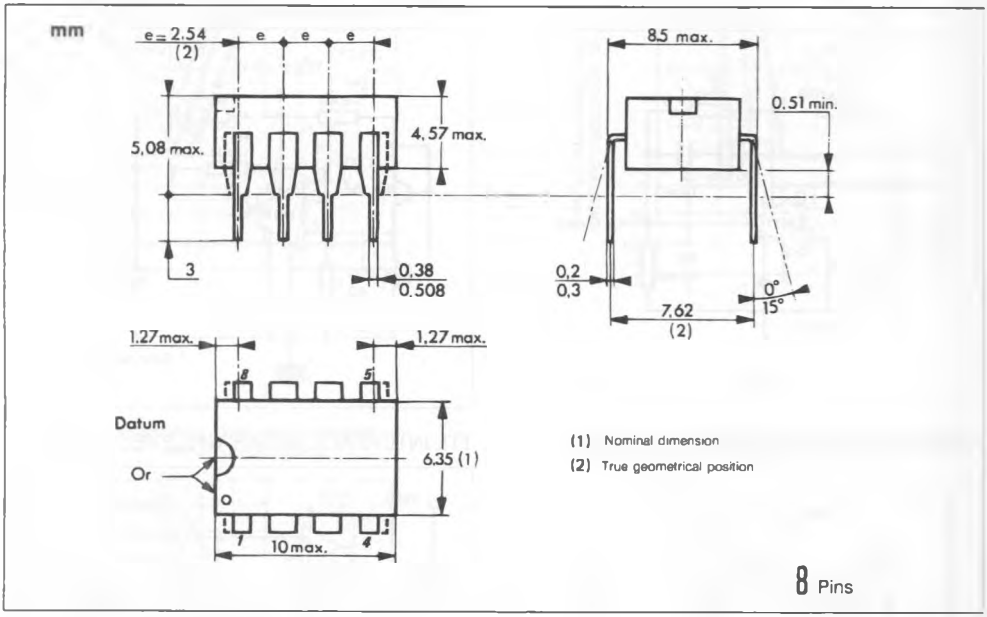


OFFSET BALANCING

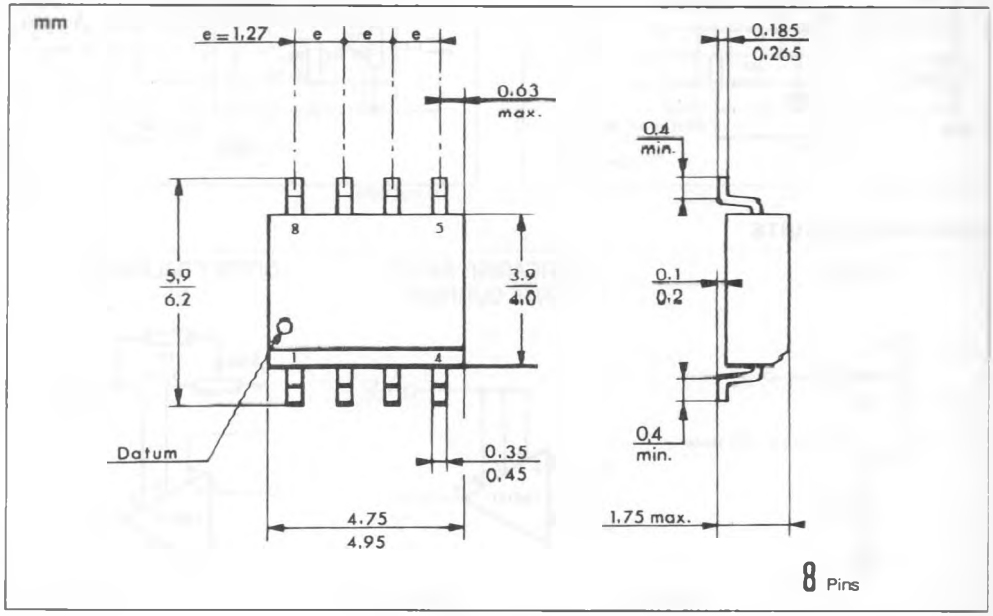


PACKAGE MECHANICAL DATA

8 PINS – PLASTIC DIP OR CERDIP

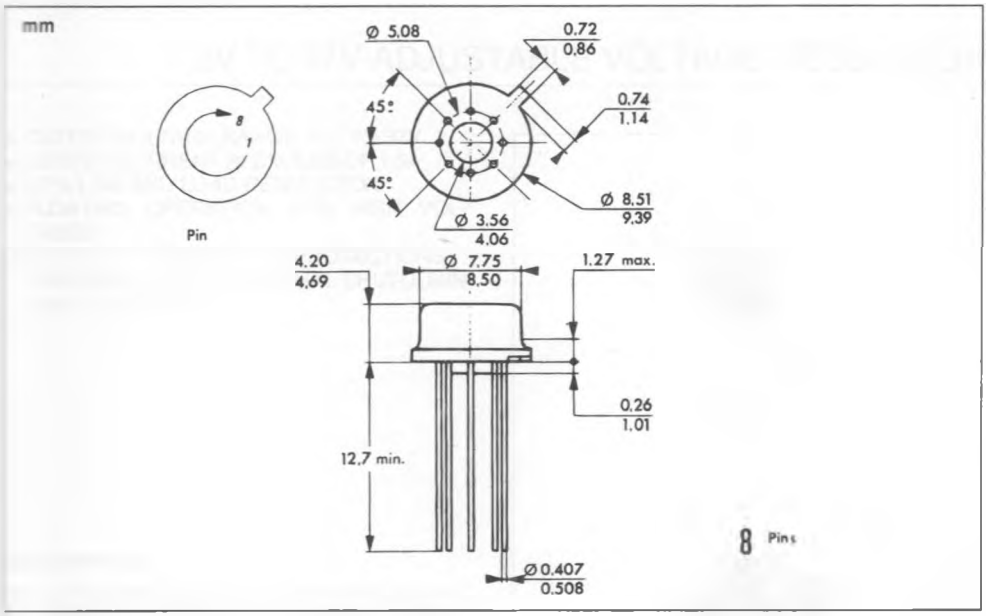


8 PINS – PLASTIC MICROPACKAGE (SO)



PACKAGE MECHANICAL DATA (continued)

PINS – METAL CAN TO99



PINS – TRICECOP (LCC)