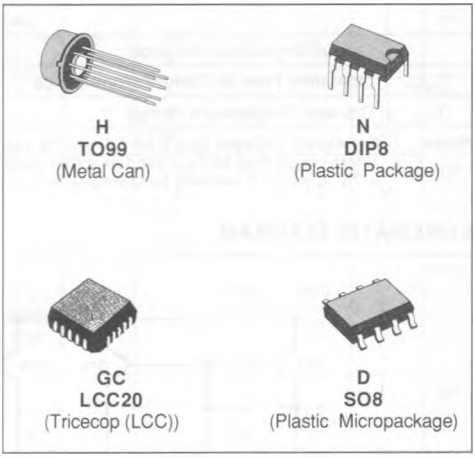
SGS-THOMSON MICROELECTRONICS

UA776

PROGRAMMABLE SINGLE OP-AMPs

- MICROPOWER OPERATION
- NO FREQUENCY COMPENSATION REQUIRED
- WIDE PROGRAMMING RANGE
- HIGH SLEW RATE
- SHORT-CIRCUIT PROTECTION
- PROGRAMMABLE SINGLE OP-AMPs



H
TO99
(Metal Can)

N
DIP8
(Plastic Package)

GC
LCC20
(Tricecop (LCC))

D
SO8
(Plastic Micropackage)

DESCRIPTION

The UA776 programmable operational amplifier is characterized by high input impedance, low supply currents and low input noise over a wide range of operating supply voltages.

Coupled with programmable electrical characteristics it is an extremely versatile amplifier for use in high accuracy, low power consumption analog applications.

Input noise voltage and current, power consumption, and input current can be optimized by a single resistor or current source that sets the chip quiescent current for nano-watt power consumption or for characteristics similar to the UA741.

Internal frequency compensation, absence of latch up, high slew rate and short-circuit protection assure ease of use in long time integrators, active filters, and sample and hold circuits.

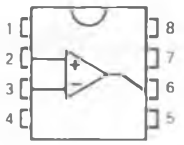
ORDER CODES

Part Number	Temperature Range	Package			
		H	N	GC	D
UA776C	0 to + 70 °C	•	•		•
UA776I	– 40 to + 105°C	•	•		•
UA776M	– 55 to + 125 °C	•		•	

Note : Hi-Rel Versions Available.
Examples : UA776CH, UA776CN, UA776CD

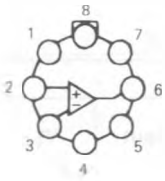
PIN CONNECTIONS (top views)

TO99



1 - Offset null
2 - Inverting input
3 - Non-inverting input
4 - V_{CC}

DIP8
SO8



5 - Offset null
6 - Output
7 - V_{CC}
8 - I_{set}

LCC20

1 - NC
2 - Offset null
3 - NC
4 - NC
5 - Inverting input
6 - NC
7 - Non-inverting input
8 - NC
9 - NC
10 - V_{CC}
11 - NC
12 - Offset null
13 - NC
14 - NC
15 - Output
16 - NC
17 - V_{CC}
18 - NC
19 - NC
20 - I_{set}

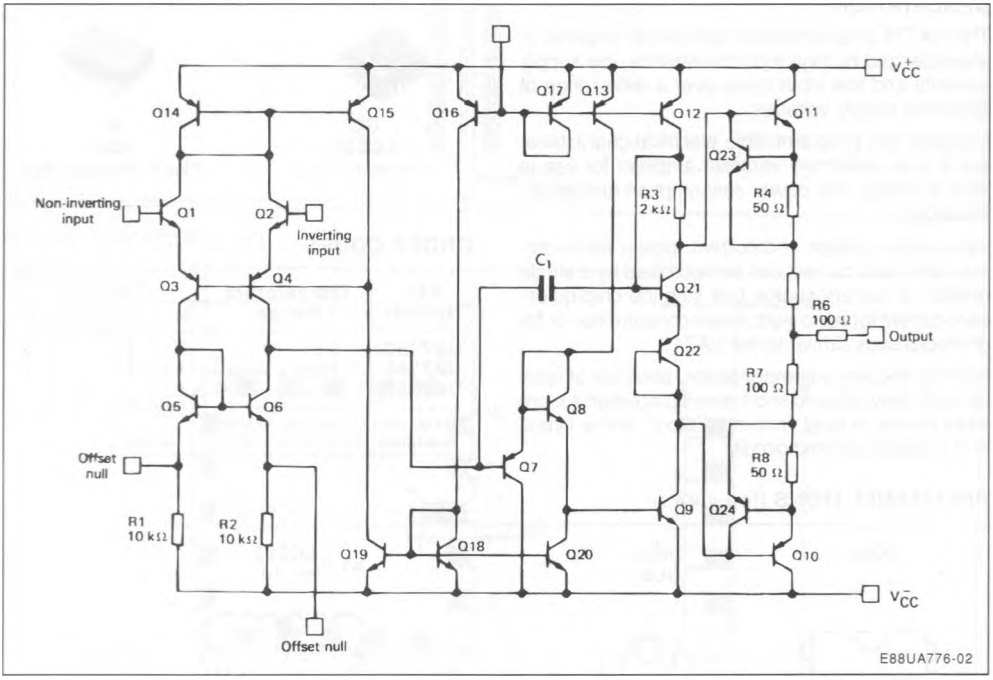
E88UA776-01

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	UA776M	UA776I	UA776C	Unit
V_{CC}	Supply Voltage	± 18	± 18	± 18	V
V_I	Input voltage	± 15	± 15	± 15	V
V_{ID}	Differential Input Voltage	± 30	± 30	± 30	V
P_{tot}	Power Dissipation UA776GC UA776CH	500 665	310 500	310 500	mW
	Output Short-circuit Duration	Indefinite			
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

Notes : 1. For supply voltages less than ± 15 V, the absolute maximum input voltage is equal to the supply voltage.
2. Short-circuit may be to ground or either supply. Rating applies to + 125 °C package temperature serial M or + 75 °C serial C ambient temperature for $I_{set} \leq 30$ µA.

SCHEMATIC DIAGRAM



Case	Offset Null	Inverting Input	Non-inverting Input	Output	V_{CC}^-	V_{CC}^+	I_{set}
TO99/SO8 DIP8	1, 5	2	3	6	4	7	8
LCC20	2, 12	5	7	15	10	17	20

* **LCC20** : Other pins are not connected.

ELECTRICAL CHARACTERISTICS

V_{CC} * = ± 15 V (unless otherwise specified)

UA776C: $0 \leq T_{amb} \leq +70$ °C
UA776I : $-40 \leq T_{amb} \leq +105$ °C
UA776M: $-55 \leq T_{amb} \leq +125$ °C

Symbol	Parameter		I_{set} = 1.5 µA			I_{set} = 15 µA			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{IO}	Input Offset Voltage								mV
	T_{amb} = 25 °C			2	5		2	5	
	$T_{min} \leq T_{amb} \leq T_{max}$				6			6	
I_{IO}	Input Offset Current								nA
	T_{amb} = 25 °C			0.7	3		2	15	
	$T_{min} \leq T_{amb} \leq T_{max}$				10			40	
I_{IB}	Input Bias Current								nA
	T_{amb} = 25 °C	UA776M		2	7.5		15	50	
		UA776I, C		2	10		15	50	
	$T_{min} \leq T_{amb} \leq T_{max}$				20			100	
A_{VD}	Large Signal Voltage Gain (V_O = ± 10 V)								V/mV
	T_{amb} = 25 °C	R_L = 5 kΩ				100	400		
		R_L = 75 kΩ	200	400					
	$T_{min} \leq T_{amb} \leq T_{max}$	R_L = 75 kΩ	100						
		R_L = 5 kΩ				75			
SVR	Supply Voltage Rejection Ratio ($R_S \leq 10$ kΩ)								dB
	T_{amb} = 25 °C		77	92		77	92		
	$T_{min} \leq T_{amb} \leq T_{max}$		77			77			
I_{CC}	Supply Current, no Load								µA
	T_{amb} = 25 °C			20	25		160	180	
	$T_{min} \leq T_{amb} \leq T_{max}$				30			200	
V_I	Input Voltage Range								V
	T_{amb} = 25 °C		− 10		+ 10	− 10		+ 10	
CMR	Common Mode Rejection Ratio ($R_S \leq 10$ kΩ)								dB
	T_{amb} = 25 °C		70	90		70	90		
	$T_{min} \leq T_{amb} \leq T_{max}$		70			70			
I_{OS}	Output Short-circuit Current		0.5	3	15	6	12	30	mA
± V_{OPP}	Output Voltage Swing								V
	T_{amb} = 25 °C	RL ≥ 5 kΩ				10	13		
		$R_L \geq$ 75 kΩ	12	14					
	$T_{min} \leq T_{amb} \leq T_{max}$	$R_L \geq$ 75 kΩ	10			10			
V_{IOR}	Offset Voltage Adjustement Range			9			18		mV
S_{VO}	Slew-rate	(V_I = ± 10 V							V/µs
	$C_L \leq$ 100pF, T_{amb} = 25 °C, unity gain)								
		R_L = 5 kΩ				0.2	0.8	2	
		R_L = 75 kΩ	0.01	0.1	1				

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	I_{set} = 1.5 µA			I_{set} = 15 µA			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
t_r	Rise Time (V_I = + 20 mV, $C_L \leq$ 100pF, T_{amb} = 25 °C, unity gain) R_L = 5 kΩ R_L = 75 kΩ		 1.6			 0.35		µs
K_{OV}	Overshoot Factor (V_I = ± 20 mV, C_L < 100 pF, T_{amb} = 25 °C, unity gain) R_L = 5 kΩ R_L = 75 kΩ		 0			 10		%
R_I	Input Resistance , T_{amb} = 25 °C		50			5		MΩ
C_{ID}	Differential Input Capacitance		2			2		pF
R_O	Output Resistance, T_{amb} = 25 °C		5			1		kΩ
GBP	Gain Bandwidth Product (T_{amb} = 25 °C, C_L = 100 pF) f = 100 kHz R_L = 5 kΩ f = 10 kHz R_L = 75 kΩ	 0.03	 0.1	 0.5	 0.4	 0.7	 1.2	MHz
THD	Total Harmonic distorsion (f = 1 kHz, A_v = 20 dB, V_{opp} = 2 V_{pp} $C_L \leq$ 100 pF, T_{amb} = 25 °C R_L = 5 kΩ R_L = 75 kΩ		 0.8			 0.025		%
V_n	Equivalent Input Noise Voltage (f = 1 kHz)		20			20		$nV/\sqrt{Hz}$

ELECTRICAL CHARACTERISTICS

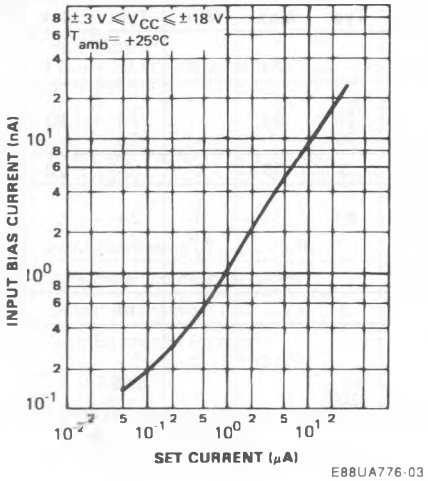
V_{CC}^+ = ± 3 V (unless otherwise specified)

Symbol	Parameter		I_{set} = 1.5 µA			I_{set} = 15 µA			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{IO}	Input Offset Voltage T_{amb} = 25 °C $T_{min} \leq T_{amb} \leq T_{max}$			2	5 6		2	5 6	mV
I_{IO}	Input Offset Current T_{amb} = 25 °C $T_{min} \leq T_{amb} \leq T_{max}$			0.7	3 10		2	15 40	nA
I_{IB}	Input Bias Current T_{amb} = 25 °C $T_{min} \leq T_{amb} \leq T_{max}$	UA776M UA776I, C		2 2	7 10 20		15 15	50 50 100	nA
A_{VD}	Large Signal Voltage Gain (V_O = ± 10 V) T_{amb} = 25 °C $T_{min} \leq T_{amb} \leq T_{max}$	R_L = 5 kΩ R_L = 75 kΩ R_L = 5 kΩ R_L = 75 kΩ	 50 25	 200		 50 25	 200		V/mV
SVR	Supply Voltage Rejection Ratio ($R_S \leq$ 10 kΩ) T_{amb} = 25 °C $T_{min} \leq T_{amb} \leq T_{max}$		77 77	92		77 77	92		dB
I_{CC}	Supply Current, no Load T_{amb} = 25 °C $T_{min} \leq T_{amb} \leq T_{max}$			13	20 25		130	160 180	uA

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	I_{set} = 1.5 µA			I_{set} = 15 µA			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_I	Input Voltage Range T_{amb} = 25 °C	− 1		+ 1	− 1		+ 1	V
CMR	Common Mode Rejection Ratio ($R_S \leq 10$ kΩ) T_{amb} = 25 °C $T_{min} \leq T_{amb} \leq T_{max}$		70 70	90		70 70	90	dB
I_{OS}	Output Short-circuit Current	0.5	3	15	2	5	20	mA
V_{OPP}	Output Voltage Swing T_{amb} = 25 °C $R_L \geq 75$ kΩ $R_L \geq 5$ kΩ $T_{min} \leq T_{amb} \leq T_{max}$ $R_L \geq 75$ kΩ $R_L \geq 5$ kΩ	2 2	2.4		2 1.9 2 1.9	2.4 2.1		V
V_{IOR}	Offset Voltage Adjustement Range		9			18		mV
S_{VO}	Slew Rate (V_I = ± 10 V $C_L \leq 100$pF, T_{amb} = 25 °C, unity gain) R_L = 5 kΩ R_L = 75 kΩ		 0.03			0.35		V/µs
t_r	Rise Time (V_I = + 20 mV, $C_L \leq 100$pF, T_{amb} = 25 °C, unity gain) R_L = 5 kΩ R_L = 75 kΩ		 3			0.6		µs
K_{OV}	Overshoot (V_I = ± 20 mV, R_L = 2 kΩ $C_L \leq 100$ pF, T_{amb} = 25 °C, unity gain) $R_L \geq 5$ kΩ $R_L \geq 75$ kΩ		 0			5		%
R_I	Input Resistance ,T_{amb} = 25 °C		50			5		MΩ
C_{ID}	Differential Input Capacitance		2			2		pF
R_O	Output Resistance, T_{amb} = 25 °C		5			1		kΩ
GBP	Gain Bandwidth Product (T_{amb} = 25 °C, C_L = 100 pF) f = 100 kHz R_L = 5 kΩ f = 10 kHz R_L = 75 kΩ		 0.075			0.5		MHz
THD	Total Harmonic distortion (f = 1 kHz, A_v = 20 dB , R_L = 2 kΩ C_L < 100 pF, T_{amb} = 25 °C, V_{opp} = 1 V_{pp} R_L = 5 kΩ R_L = 75 kΩ		 1			0.03		%
V_n	Equivalent Input Noise Voltage (f = 1 kHz)		20			20		nV/√Hz

INPUT BIAS CURRENT



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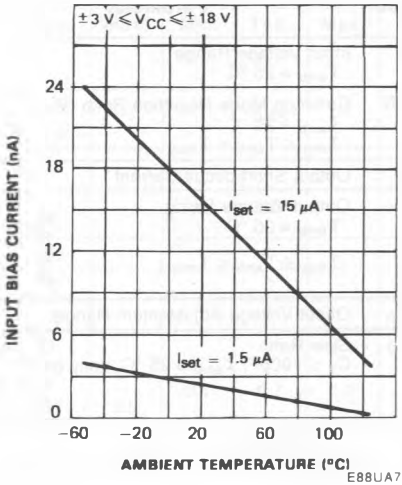
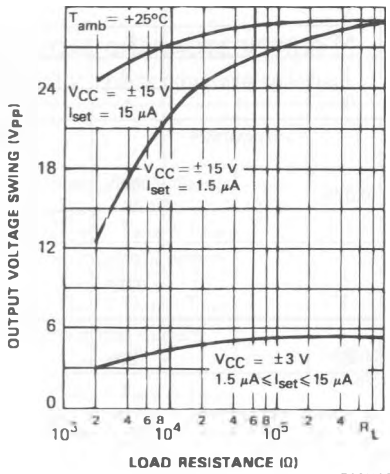
INPUT BIAS CURRENT



E88UA776-04

OUTPUT VOLTAGE SWING



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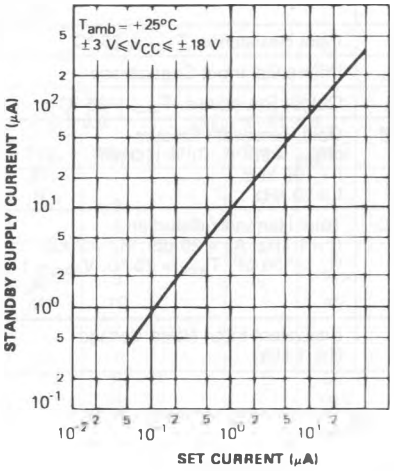
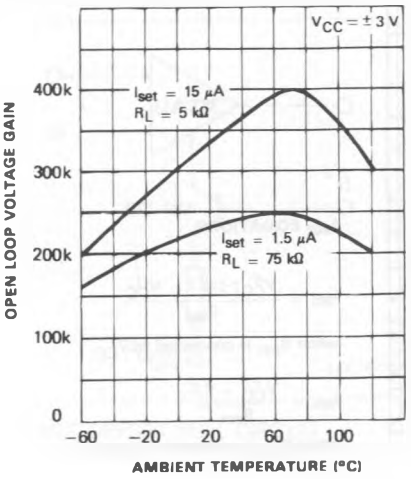
STANDBY SUPPLY CURRENT VERSUS SET CURRENT



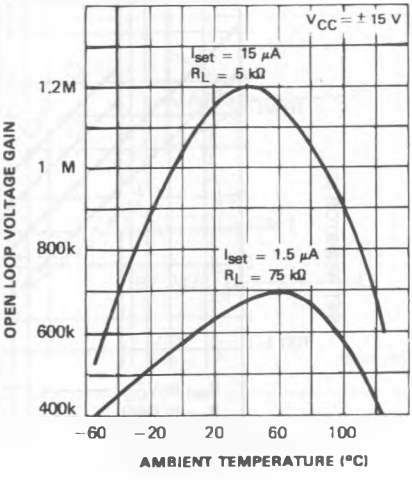
E88UA776-06

OPEN LOOP VOLTAGE GAIN



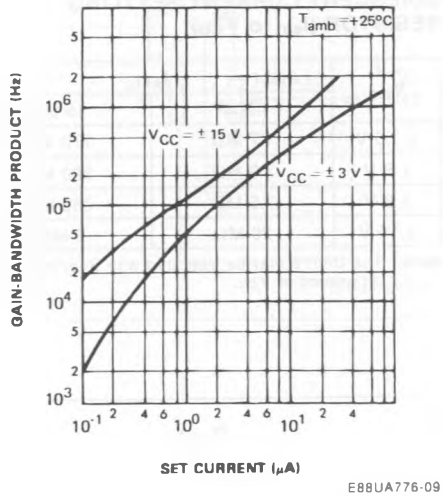
E88UA776-07

OPEN LOOP VOLTAGE GAIN



E88UA776-08

GAIN-BANDWIDTH



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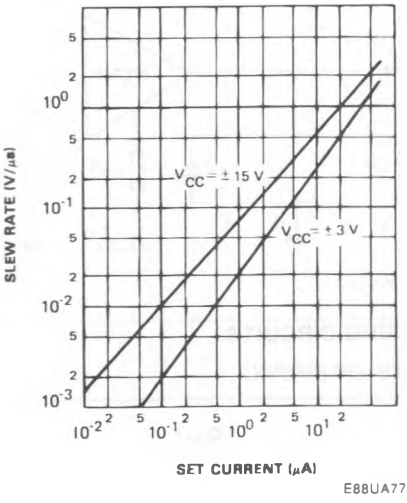
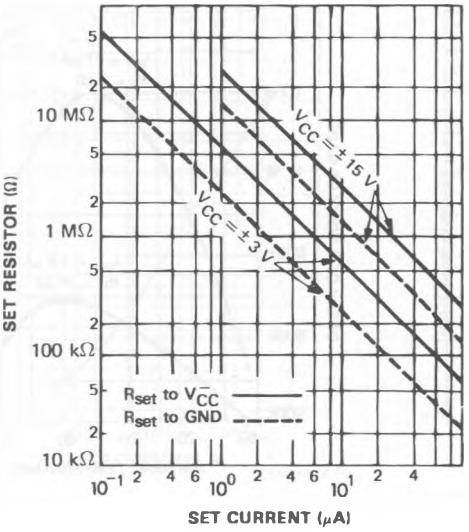
SLEW RATE



E88UA776-10

SET RESISTOR vs SET CURRENT



I_{set} EQUATIONS

$$I_{set} = \frac{V_{CC}^+ - 0.7 - V_{CC}^-}{R_{set}}$$

when R_{set} is connected to V_{CC}^-.

$$I_{set} = \frac{V_{CC}^+ - 0.7}{R_{set}}$$

when R_{set} is connected to ground.

E88UA776-11

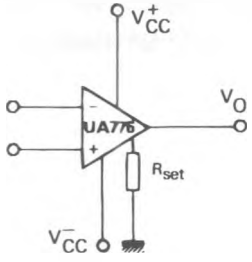
QUIESCENT CURRENT SETTLING RESISTOR (I_{set} to V_{CC}^-)

V_{CC}	I_{set}	
	1.5 μA	15 μA
± 1.5 V	1.7 MΩ	170 kΩ
± 3 V	3.6 MΩ	360 kΩ
± 6 V	7.5 MΩ	750 kΩ
± 15 V	20 MΩ	2 MΩ

Note : The UA776 may be operated with Rset connected to ground or V_{CC}^-.

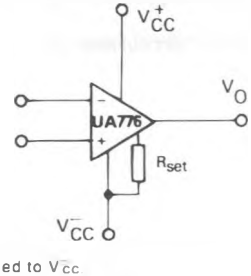
BIASING CIRCUITS

RESISTOR BIASING



R_{set} connected to ground.

E88UA776-12

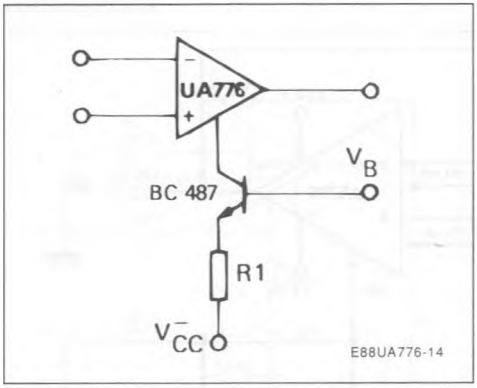


R_{set} connected to V_{CC}^-
Recommended for : $V_{CC} \leq \pm 6$ V

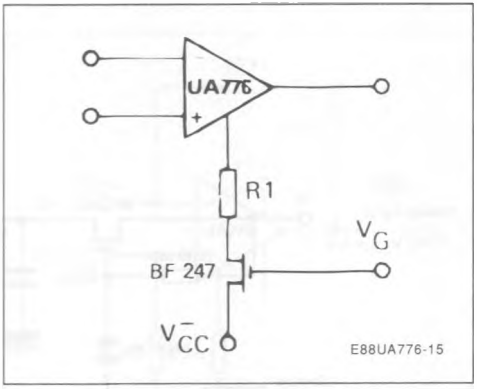
E88UA776-13

BIASING CIRCUITS (continued)

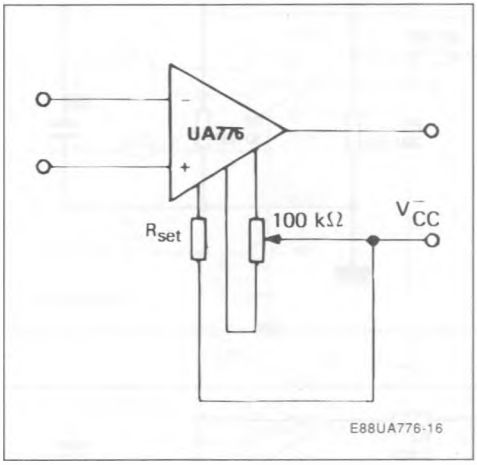
TRANSISTOR CURRENT SOURCE BIASING



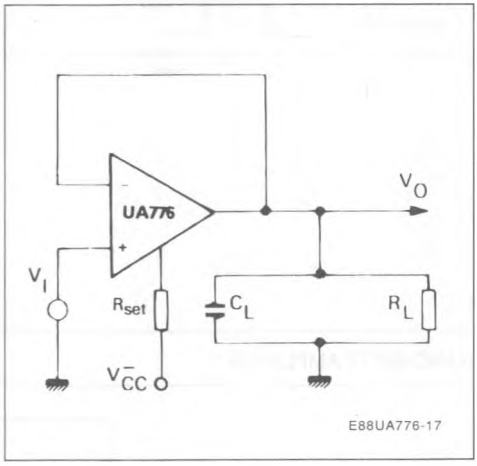
FET CURRENT SOURCE BIASING



VOLTAGE OFFSET NULL CIRCUIT

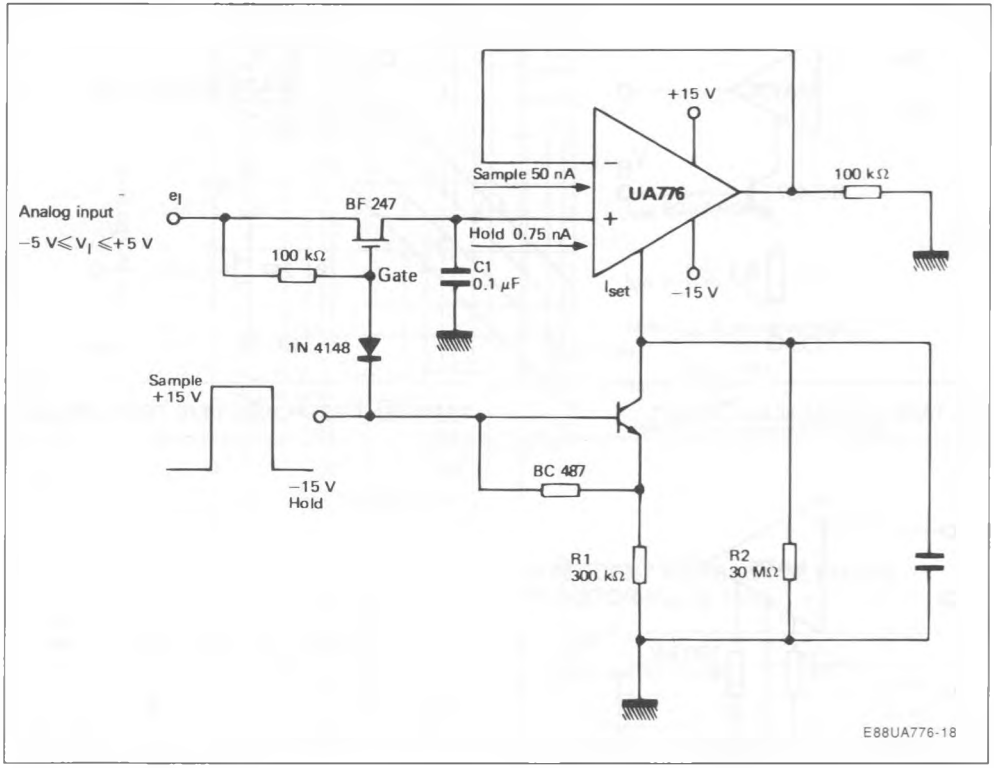


TRANSIENT RESPONSE TIME TEST CIRCUIT

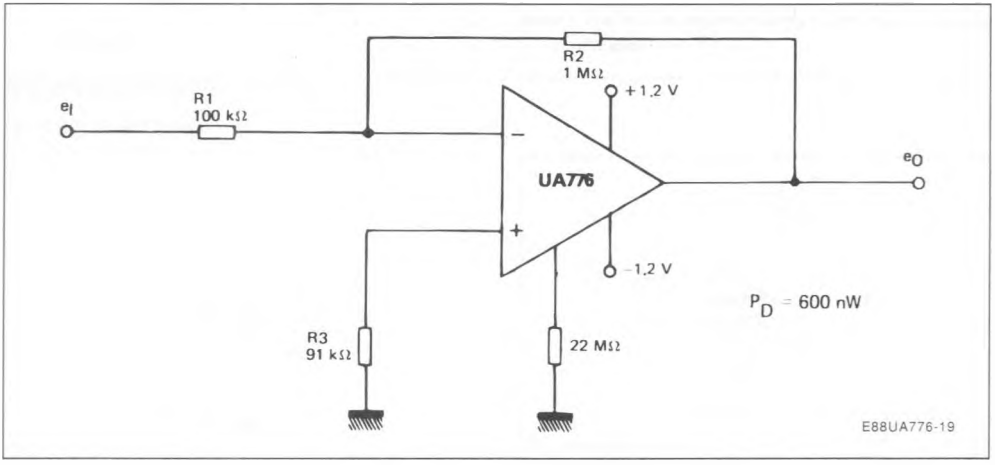


TYPICAL APPLICATIONS

HIGH ACCURACY SAMPLE AND HOLD

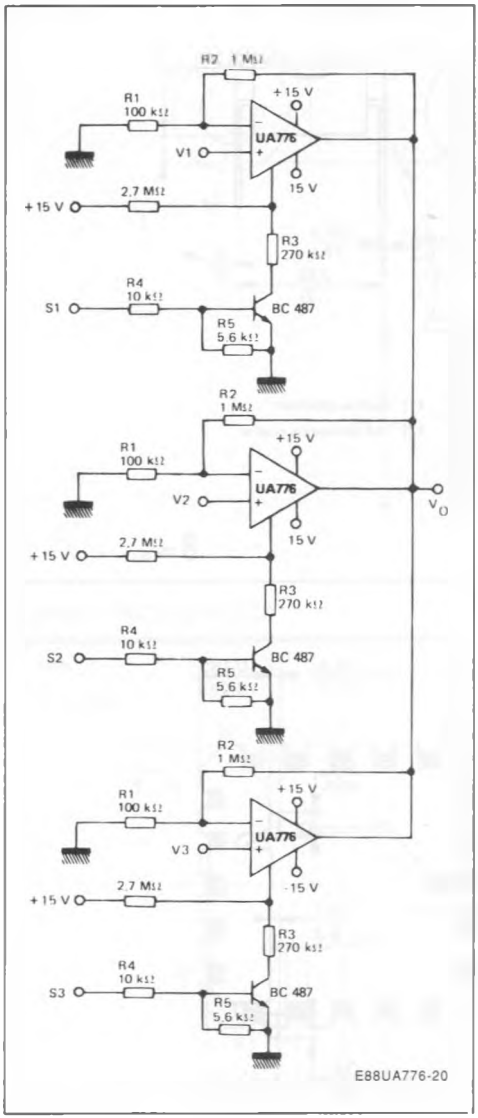


NANO-WATT AMPLIFIER

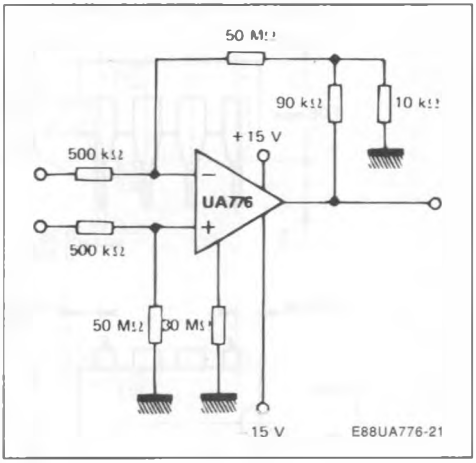


TYPICAL APPLICATIONS (continued)

MULTIPLEXING AND SIGNAL CONDITIONING WITHOUT FETs

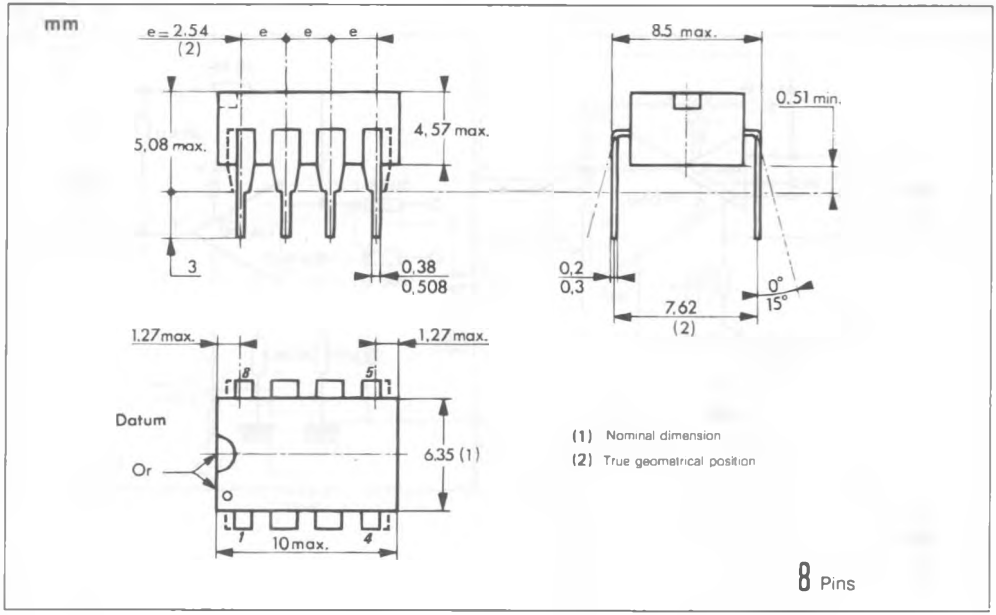


HIGH INPUT IMPEDANCE AMPLIFIER

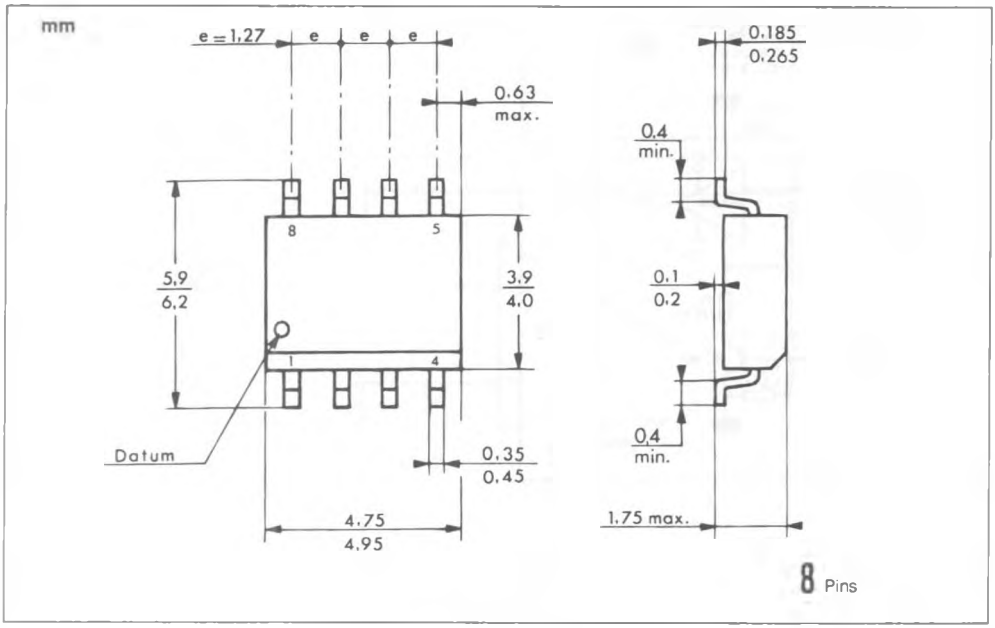


PACKAGE MECHANICAL DATA

8 PINS – PLASTIC DIP OR CERDIP

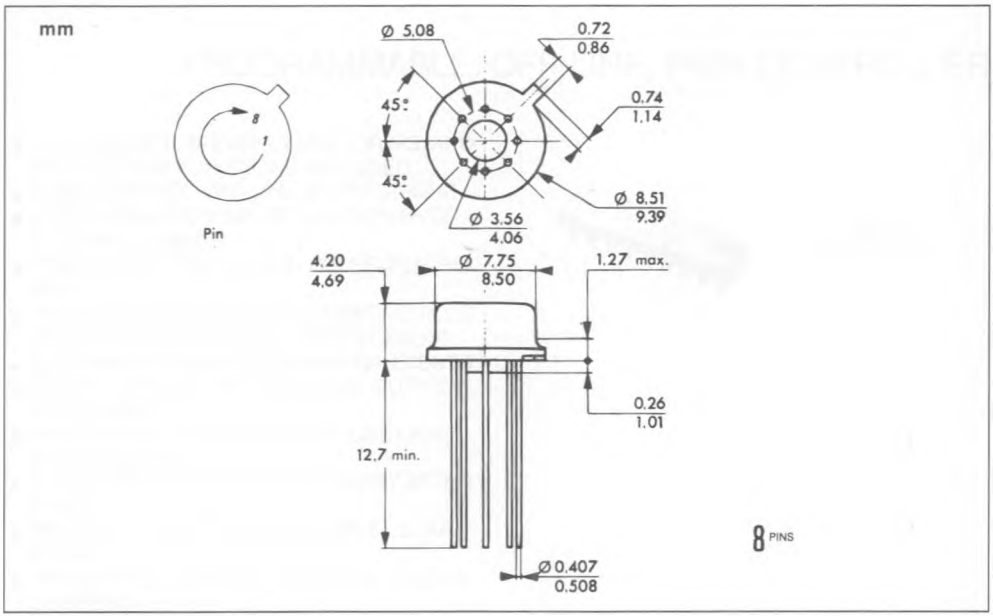


8 PINS – PLASTIC MICROPACKAGE (SO)



PACKAGE MECHANICAL DATA (continued)

8 PINS – METAL CAN TO99



20 PINS – TRICECOP (LCC)