THOMSON SEMICONDUCTORS

UA776

PROGRAMMABLE SINGLE OP-AMPs

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.

- Micropower operation.
- No frequency compensation required.
- Wide programming range.
- High slew rate.
- Short-circuit protection.

ORDERING INFORMATION

Hi-Rel versions available - See chapter 14

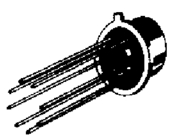
PART NUMBER	TEMPERATURE RANGE	PACKAGE			
		H	DP	GC	FP
UA776C	0°C to + 70°C	•	•		•
UA776M	– 55°C to + 125°C	•		•	

Examples : UA776CH, UA776CDP, UA776CFP

PROGRAMMABLE SINGLE OP-AMPs

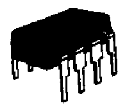
CASES

CB-11 (TO-99)



H SUFFIX METAL CAN

CB-98



DP SUFFIX PLASTIC PACKAGE

CB-705

GC SUFFIX TRICECOP (LCC)

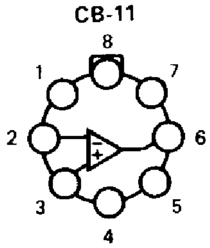
CB-342

FP SUFFIX PLASTIC MICROPACKAGE

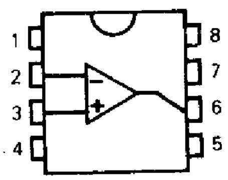
PIN ASSIGNMENTS

(Top views)

CB-11

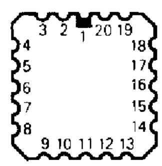


CB-98
CB-342



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

CB-705



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

Réf. 00290

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THOMSON COMPONENTS

ELECTRICAL CHARACTERISTICS

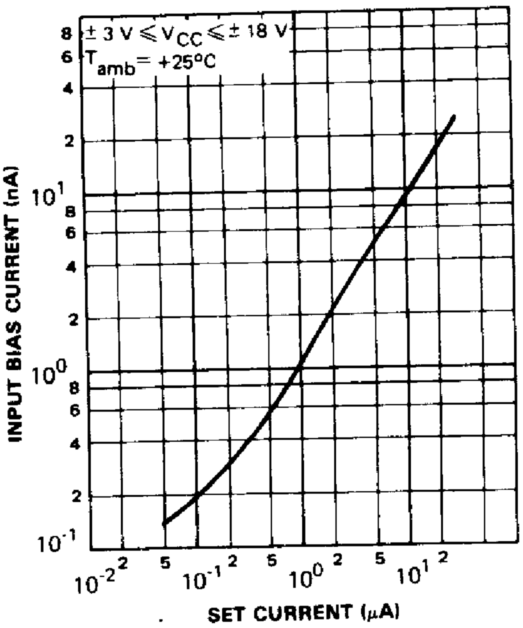
UA776M : $-55°C \leq T_{amb} \leq +125°C$, $V_{CC} = \pm 15$ V
UA776C : $- 0°C \leq T_{amb} \leq + 70°C$, $V_{CC} = \pm 15$ V
(Unless otherwise specified)

Characteristic		Symbol	$I_{set} = 1.5\ \mu A$ Min	$I_{set} = 1.5\ \mu A$ Typ	$I_{set} = 1.5\ \mu A$ Max	$I_{set} = 15\ \mu A$ Min	$I_{set} = 15\ \mu A$ Typ	$I_{set} = 15\ \mu A$ Max	Unit
Input offset voltage $T_{amb} = +25°C$	UA776M	V_{IO}	–	2	5	–	2	5	mV
	UA776C		–	2	6	–	2	6	
$T_{min} \leq T_{amb} \leq T_{max}$	UA776M		–	–	6	–	–	6	
	UA776C		–	–	7.5	–	–	7.5	
Input offset current $T_{amb} = +25°C$	UA776M	I_{IO}	–	0.7	3	–	2	15	nA
	UA776C		–	0.7	6	–	2	25	
$T_{amb} = T_{max}$	UA776M		–	–	5	–	–	15	
	UA776C		–	–	6	–	–	25	
$T_{amb} = T_{min}$			–	–	10	–	–	40	
Input bias current $T_{amb} = +25°C$	UA776M	I_{IB}	–	2	7.5	–	15	50	nA
	UA776C		–	2	10	–	15	50	
$T_{amb} = T_{max}$	UA776M		–	–	7.5	–	–	50	
	UA776C		–	–	10	–	–	50	
$T_{amb} = T_{min}$	UA776M		–	–	20	–	–	120	
	UA776C		–	–	20	–	–	100	
Large signal voltage gain ($V_O = \pm 10$ V) $T_{amb} = +25°C$, $R_L \geq 5$ kΩ	UA776M	A_{VD}	–	–	–	10^5	4.10^5	–	V/V
	UA776C		–	–	–	5.10^4	4.10^5	–	
$T_{amb} = +25°C$, $R_L \geq 75$ kΩ	UA776M		2.10^5	4.10^5	–	–	–	–	
	UA776C		5.10^4	4.10^5	–	–	–	–	
$T_{min} \leq T_{amb} \leq T_{max}$, $R_L \geq 75$ kΩ	UA776M		10^5	–	–	$7.5.10^4$	–	–	
	UA776C		5.10^4	–	–	5.10^4	–	–	
Supply voltage rejection ratio ($R_S \leq 10$ kΩ)	UA776M	SVR	–	25	150	–	25	150	µV/V
	UA776C		–	25	200	–	25	200	
Supply current $T_{amb} = +25°C$	UA776M	I_{CC}	–	20	25	–	160	180	µA
	UA776C		–	20	30	–	160	190	
$T_{min} \leq T_{amb} \leq T_{max}$	UA776M		–	–	30	–	–	200	
	UA776C		–	–	35	–	–	200	
Power consumption $T_{amb} = +25°C$	UA776M	P_D	–	–	0.75	–	–	5.4	mW
	UA776C		–	–	0.9	–	–	5.7	
$T_{min} \leq T_{amb} \leq T_{max}$	UA776M		–	–	30	–	–	200	
	UA776C		–	–	35	–	–	200	
Input voltage range		V_I	±10	–	–	±10	–	–	V
Common-mode rejection ratio ($R_S \leq 10$ kΩ)		CMR	70	90	–	70	90	–	dB
Output short-circuit current		I_{OS}	–	3	–	–	12	–	mA
Output voltage swing $T_{amb} = +25°C$, $R_L \geq 5$ kΩ		V_{OPP}	–	–	–	±10	±13	–	V
$R_L \geq 75$ kΩ			±12	±14	–	–	–	–	
$T_{min} \leq T_{amb} \leq T_{max}$, $R_L \geq 75$ kΩ			±10	–	–	±10	–	–	
Offset voltage adjustement range ($T_{amb} = +25°C$)		V_{IOR}	–	9	–	–	18	–	mV
Slew rate ($R_L \geq 5$ kΩ, $T_{amb} = +25°C$)		S_{VO}	–	0.1	–	–	0.8	–	V/µs
Rise time ($V_I = +20$ mV, $C_L = 100$ pF, $R_L \geq 5$ kΩ, $T_{amb} = +25°C$)		t_r	–	1.6	–	–	0.35	–	µs
Input resistance ($T_{amb} = +25°C$)		R_I	–	50	–	–	5	–	MΩ
Output resistance ($T_{amb} = +25°C$)		R_O	–	5	–	–	1	–	kΩ
Overshoot factor ($V_I = +20$ mV, $C_L = 100$ pF, $R_L \geq 5$ kΩ, $T_{amb} = +25°C$)		K_{OV}	–	0	–	–	10	–	%
Differential input capacitance ($T_{amb} = +25°C$)		C_{ID}	–	2	–	–	2	–	pF

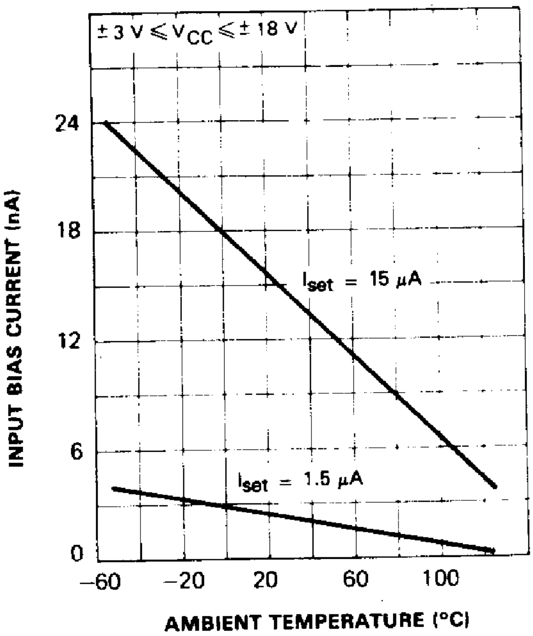
ELECTRICAL CHARACTERISTICS (continued)
UA776M : $-55°C \leq T_{amb} \leq +125°C$, $V_{CC} = \pm 3$ V
UA776C : $-\ 0°C \leq T_{amb} \leq +\ 70°C$, $V_{CC} = \pm 3$ V
(Unless otherwise specified)

Characteristic		Symbol	$I_{set} = 1.5\ \mu A$			$I_{set} = 15\ \mu A$			Unit
			Min	Typ	Max	Min	Typ	Max	
Input offset voltage		V_{IO}							mV
$T_{amb} = +25°C$	UA776M		–	2	5	–	2	5	
	UA776C		–	2	6	–	2	6	
$T_{min} \leq T_{amb} \leq T_{max}$	UA776M		–	–	6	–	–	6	
	UA776C		–	–	7.5	–	–	7.5	
Input offset current		I_{IO}							nA
$T_{amb} = +25°C$	UA776M		–	0.7	3	–	2	15	
	UA776C		–	0.7	6	–	2	25	
$T_{amb} = T_{max}$	UA776M		–	–	5	–	–	15	
	UA776C		–	–	6	–	–	25	
$T_{amb} = T_{min}$			–	–	10	–	–	40	
Input bias current		I_{IB}							nA
$T_{amb} = +25°C$	UA776M		–	2	7.5	–	15	50	
	UA776C		–	2	10	–	15	50	
$T_{amb} = T_{max}$	UA776M		–	–	7.5	–	–	50	
	UA776C		–	–	10	–	–	50	
$T_{amb} = T_{min}$	UA776M		–	–	20	–	–	120	
	UA776C		–	–	20	–	–	100	
Large signal voltage gain ($V_O = \pm 1$ V)		A_{VD}							V/V
$T_{amb} = +25°C$, $R_L \geq 5$ kΩ	UA776M		–	–	–	5.10^4	2.10^5	–	
	UA776C		–	–	–	$2.5.10^4$	2.10^5	–	
$R_L \geq 75$ kΩ	UA776M		5.10^4	2.10^5	–	–	–	–	
	UA776C		$2.5.10^4$	2.10^5	–	–	–	–	
$T_{min} \leq T_{amb} \leq T_{max}$, $R_L \geq 5$ kΩ			–	–	–	$2.5.10^4$	–	–	
$R_L \geq 75$ kΩ			$2.5.10^4$	–	–	–	–	–	
Supply voltage rejection ratio ($R_S \leq 10$ kΩ)		SVR							µV/V
	UA776M		–	25	150	–	25	150	
	UA776C		–	25	200	–	25	200	
Supply current		I_{CC}							µA
$T_{amb} = +25°C$	UA776M		–	13	20	–	130	160	
	UA776C		–	13	20	–	130	170	
$T_{min} \leq T_{amb} \leq T_{max}$			–	–	25	–	–	180	
Power consumption		P_D							µW
$T_{amb} = +25°C$	UA776M		–	78	120	–	780	960	
	UA776C		–	78	120	–	780	1020	
$T_{min} \leq T_{amb} \leq T_{max}$	UA776M		–	–	150	–	–	1080	
	UA776C		–	–	150	–	–	1080	
Input voltage range		V_I	±1	–	–	±1	–	–	V
Common-mode rejection ratio ($R_S \leq 10$ kΩ)		CMR	70	86	–	70	86	–	dB
Output short-circuit current ($T_{amb} = +25°C$)		I_{OS}	–	3	–	–	5	–	mA
Output voltage swing		V_{OPP}							V
$R_L \geq 5$ kΩ	UA776C		–	–	–	±2	+2.1	–	
	UA776M		–	–	–	±1.9	±2.1	–	
$R_L \geq 75$ kΩ			±2	±2.4	–	±2	±2.4	–	
Offset voltage adjustement range ($T_{amb} = +25°C$)		V_{IOR}	–	9	–	–	18	–	mV
Slew rate ($R_L \geq 5$ kΩ, $T_{amb} = +25°C$)		S_{VO}	–	0.03	–	–	0.35	–	V/µs
Rise time ($V_I = +20$ mV, $C_L = 100$ pF, $R_L \geq 5$ kΩ, $T_{amb} = +25°C$)		t_r	–	3	–	–	0.6	–	µs
Input resistance ($T_{amb} = +25°C$)		R_I	–	50	–	–	5	–	MΩ
Output resistance ($T_{amb} = +25°C$)		R_O	–	5	–	–	1	–	kΩ
Overshoot factor ($V_I = +20$ mV, $C_L = 100$ pF, $R_L \geq 5$ kΩ, $T_{amb} = +25°C$)		K_{OV}	–	0	–	–	5	–	%
Differential input capacitance ($T_{amb} = +25°C$)		C_{ID}	–	2	–	–	2	–	pF

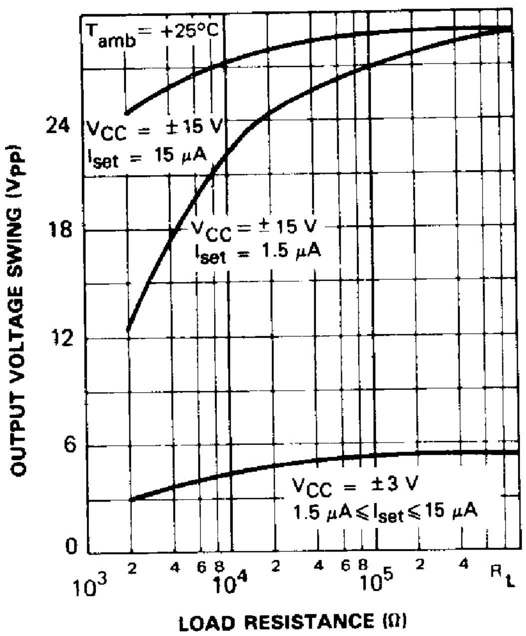
INPUT BIAS CURRENT



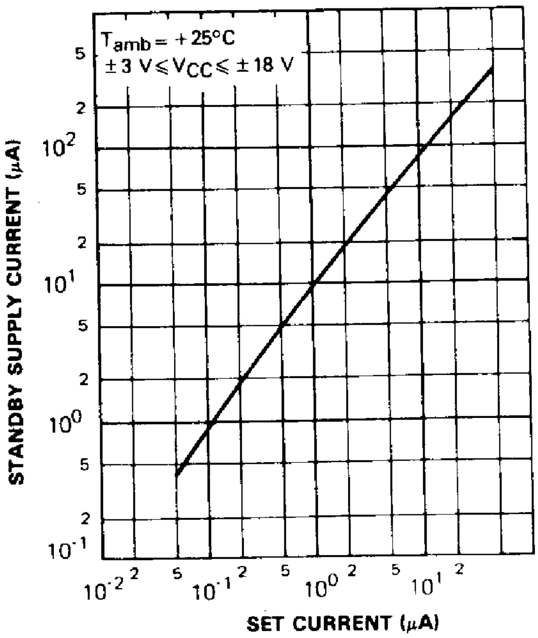
INPUT BIAS CURRENT



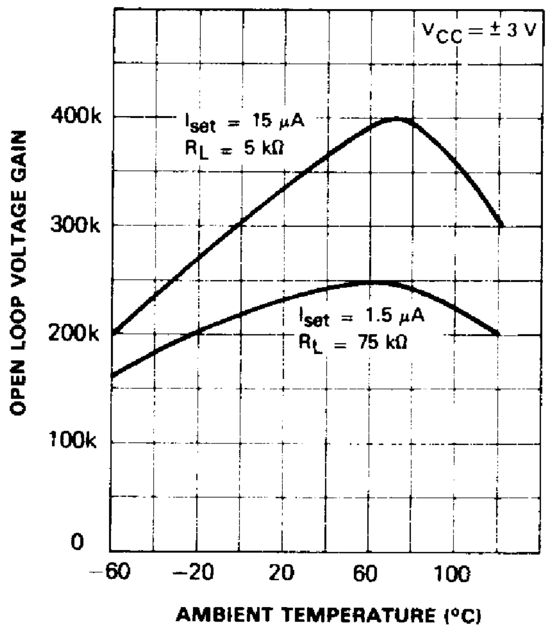
OUTPUT VOLTAGE SWING



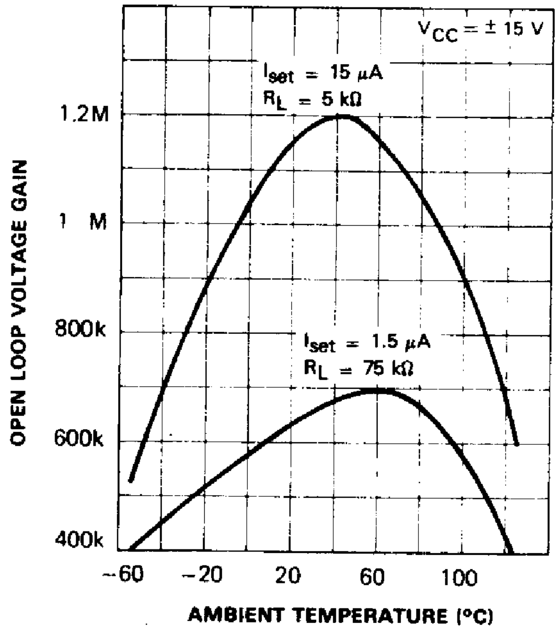
STANDBY SUPPLY CURRENT VERSUS SET CURRENT



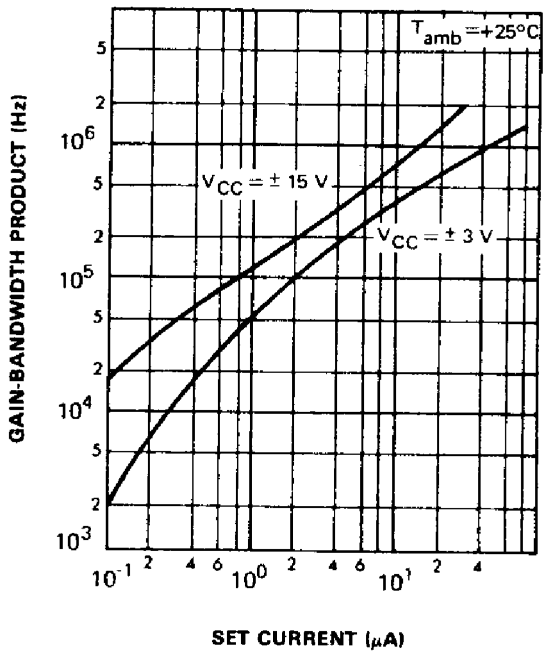
OPEN LOOP VOLTAGE GAIN



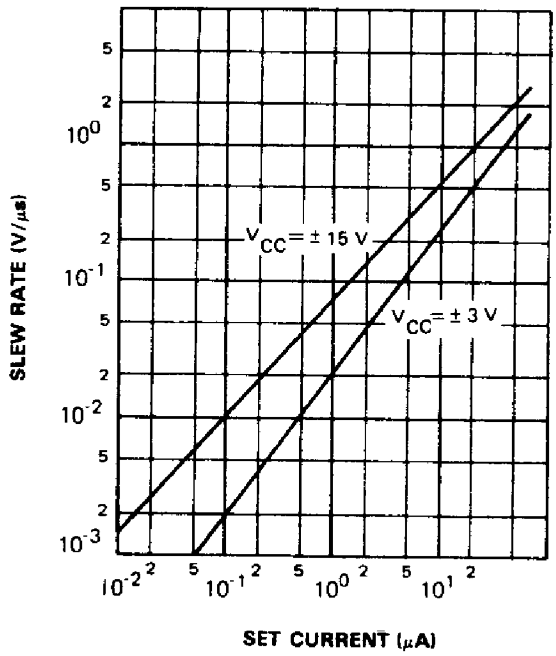
OPEN LOOP VOLTAGE GAIN



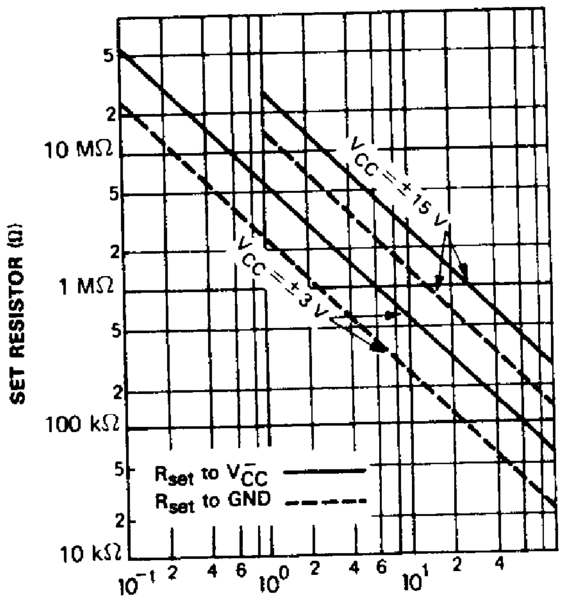
GAIN-BANDWIDTH



SLEW RATE



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.

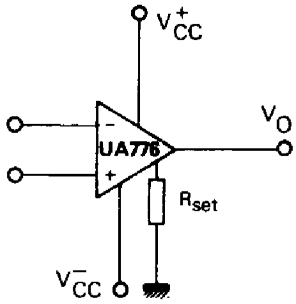
QUIESCENT CURRENT SETTING RESISTOR (I_{set} to V_{CC}^-)

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

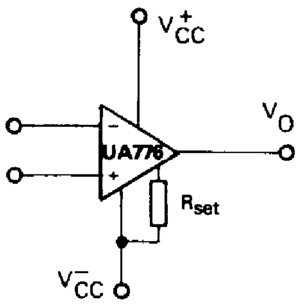
Note : The UA776 may be operated with R_{set} connected to ground or V_{CC}^-.

BIASING CIRCUITS

RESISTOR BIASING

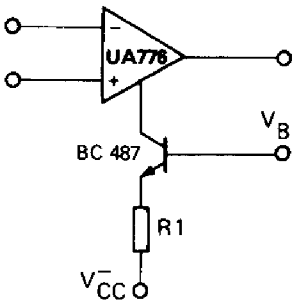


R_{set} connected to ground.

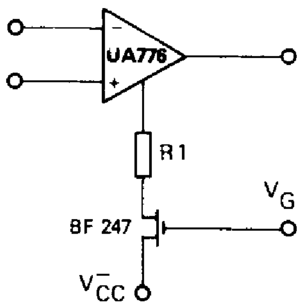


R_{set} connected to V_{CC}^-.
Recommended for : $V_{CC} \leq \pm 6$ V

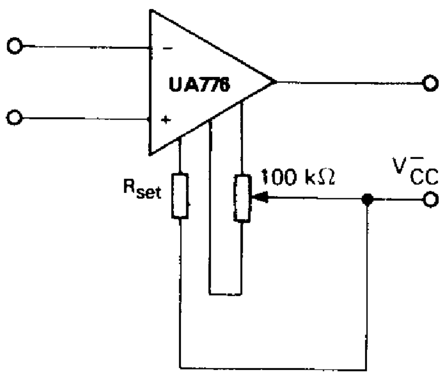
TRANSISTOR CURRENT SOURCE BIASING



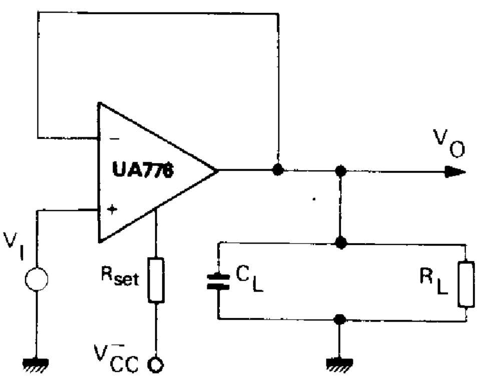
FET CURRENT SOURCE BIASING



VOLTAGE OFFSET NULL CIRCUIT

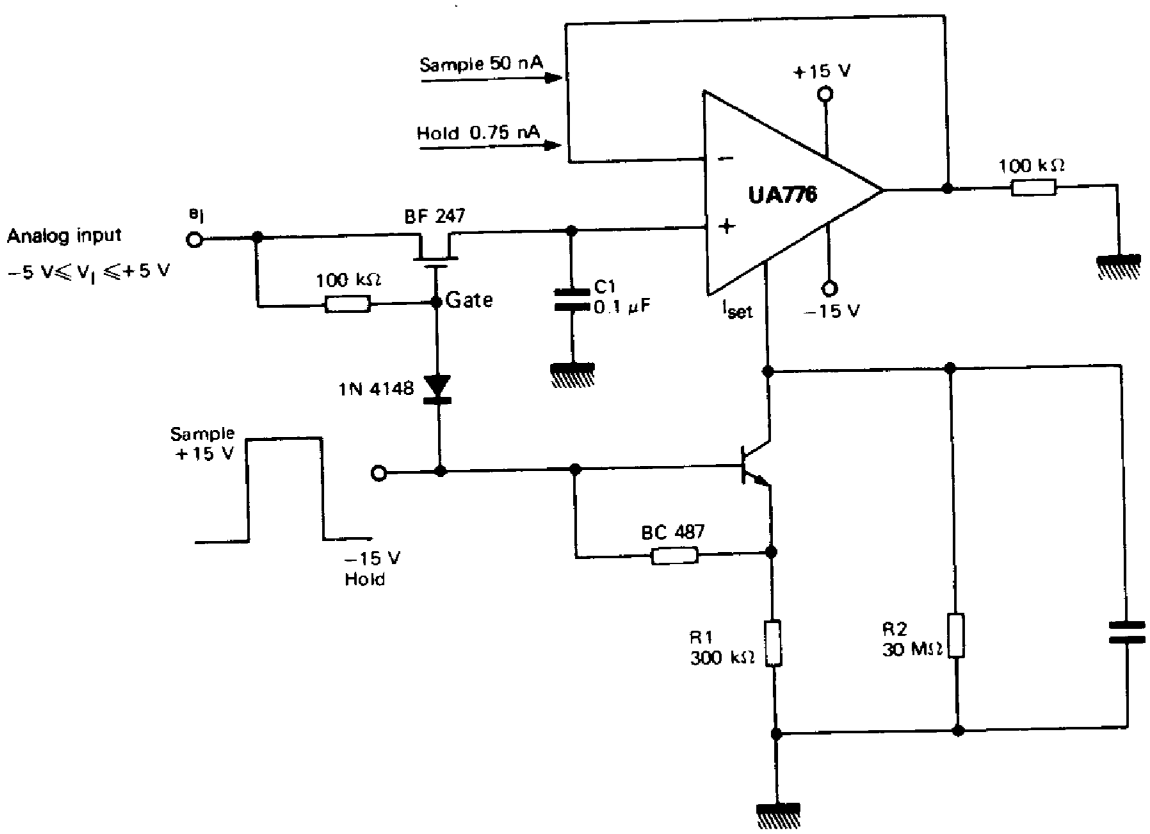


TRANSIENT RESPONSE TIME TEST CIRCUIT

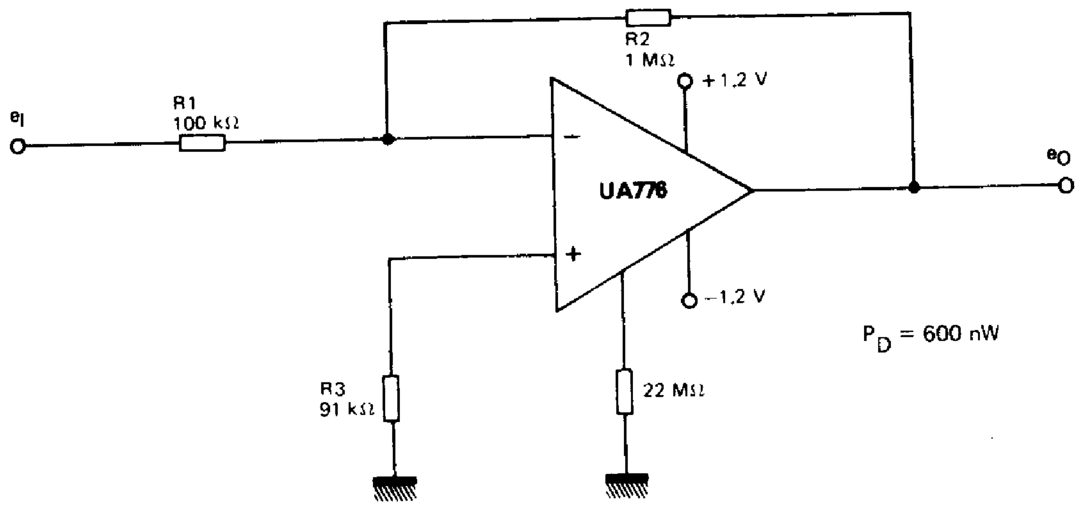


TYPICAL APPLICATIONS

HIGH ACCURACY SAMPLE AND HOLD



NANO-WATT AMPLIFIER



$P_D = 600$ nW

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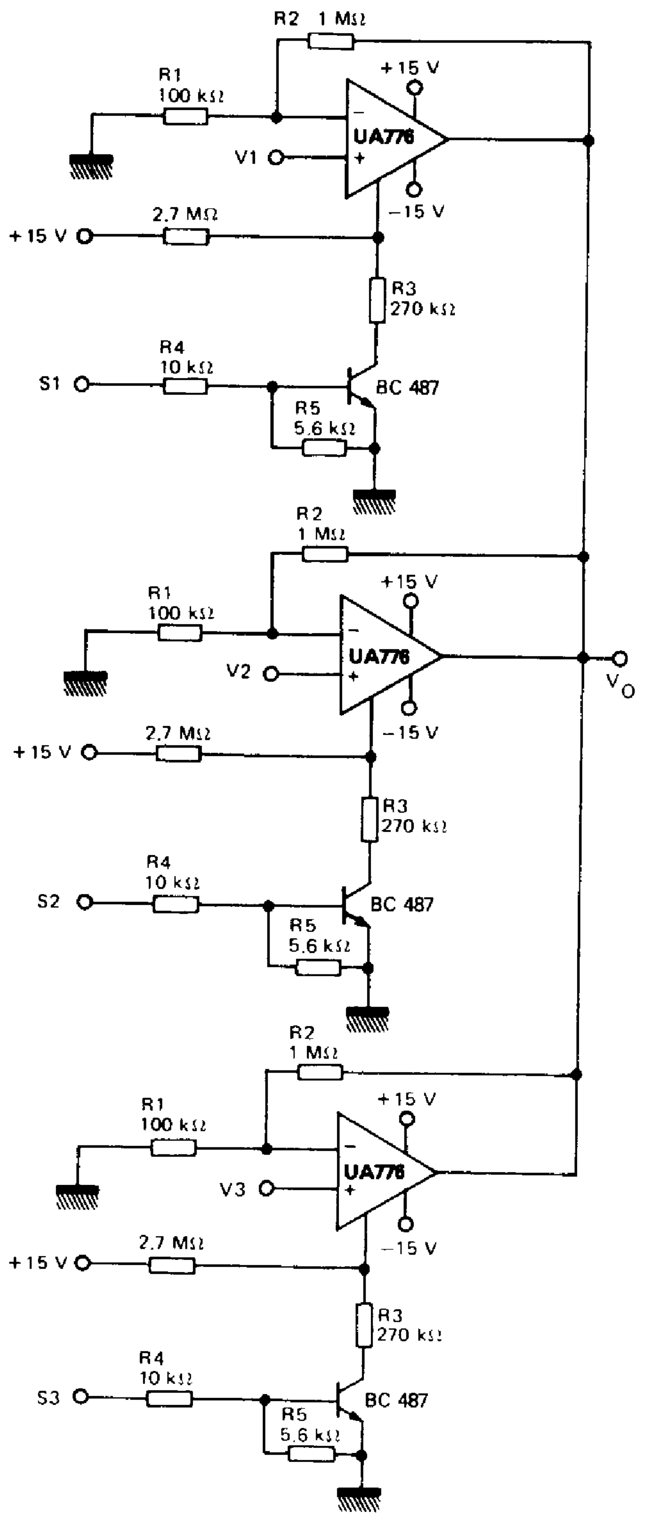
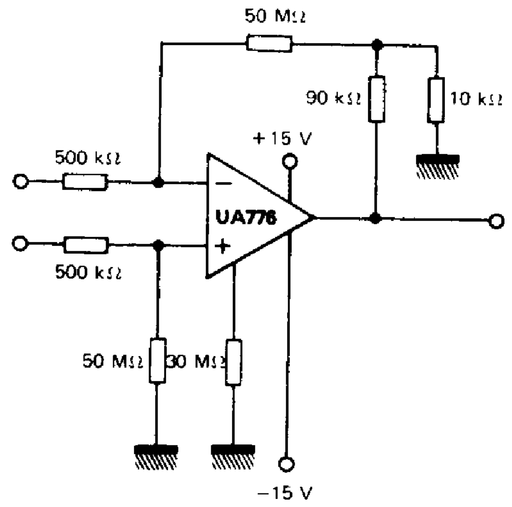
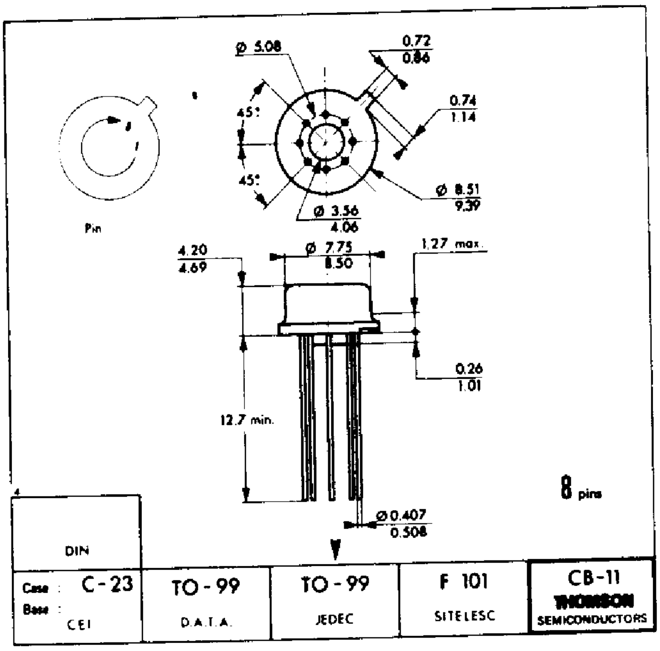
TYPICAL APPLICATIONS (continued)

MULTIPLEXING AND SIGNAL CONDITIONING WITHOUT FETs



HIGH INPUT IMPEDANCE AMPLIFIER





CB-11
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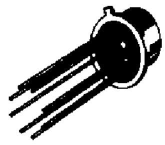
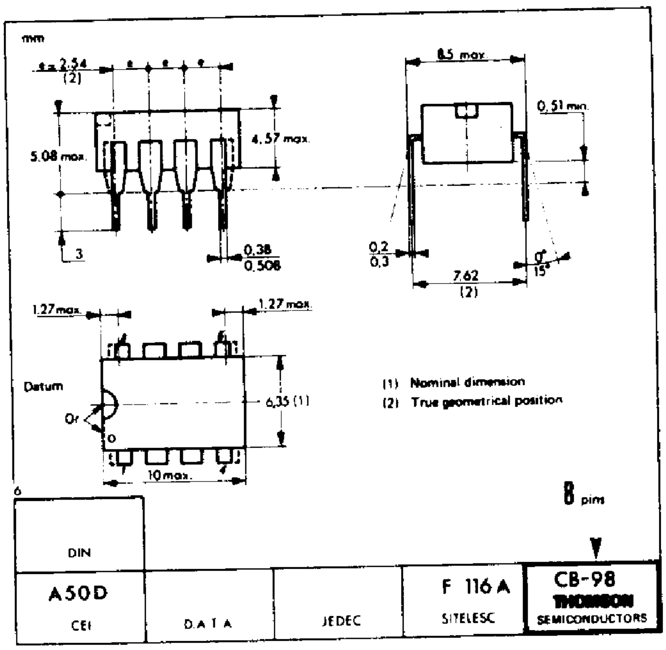
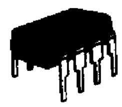


H SUFFIX
METAL CAN



CB-98



DP SUFFIX
PLASTIC PACKAGE
DG SUFFIX
CERDIP PACKAGE