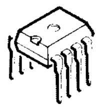
Single Operational Amplifiers

TBA 221; TBB 741
TBA 222; TBB 742

Bipolar IC

Features

- NPN input
- High differential input voltage
- Short-circuit proof
- High voltage gain
- High supply voltage 44 V
- Wide temperature range (TBA 222, TBB 742)
- Push-pull output
- B S1-version for high quality



P-DIP-8

Applications

- Amplifier
- Comparator

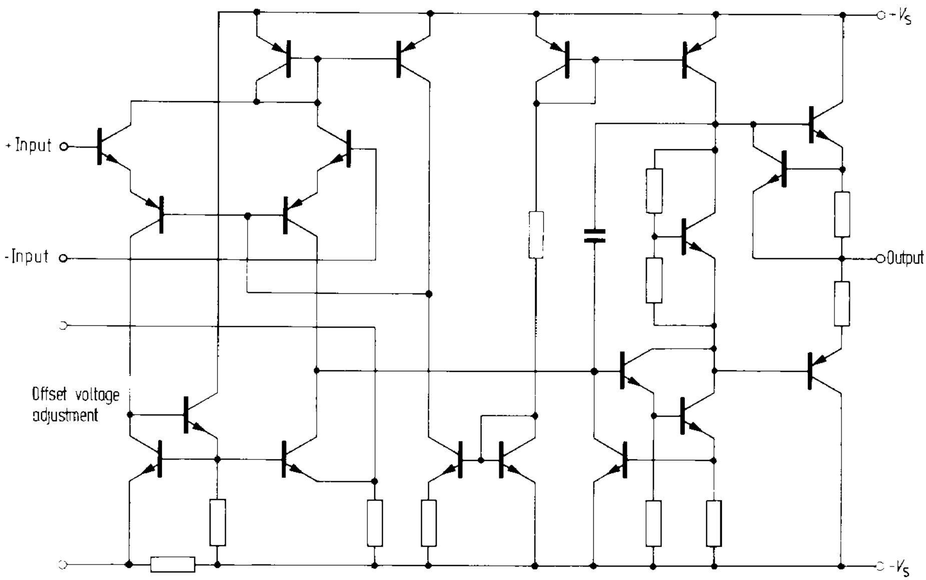
P-DSO-8

Type	Ordering Code	Package	Color Code
S TBA 221 B	Q67000-A281	P-DIP-8	–
S TBA 222 B	Q67000-A2280	P-DIP-8	–
TBA 222 B S1	Q67000-A8057	P-DIP-8	–
■ S TBB 741 G	Q67000-A1498	P-DSO-8 (SMD)	blue/brown
■ S TBB 742 G	Q67000-A2395-G403	P-DSO-8 (SMD)	red/green

■ = Not for new design

These op amps are short-circuit proof to $+V_S$, $-V_S$. The input offset voltage can be very easily compensated. Very few external components are required due to the internal frequency compensation. The gain reduction by 6 dB/octave yields a very good stability.

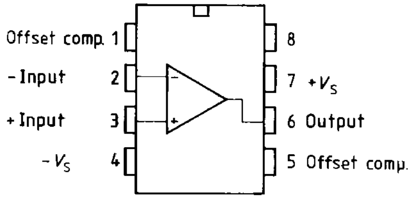
Circuit Diagram



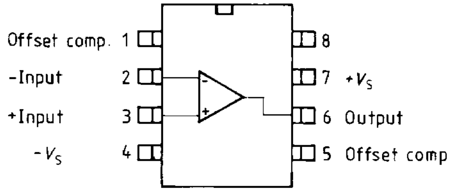
Pin Configurations

(top view)

TBA 221 B
TBA 222 B
TBA 222 B S1



TBB 741 G
TBB 742 G



1

Absolute Maximum Ratings

Parameter	Symbol	Limit Values TBA 221 TBB 741	Limit Values TBA 222 TBB 742	Unit
Supply voltage	V_S	± 18	± 22	V
Input voltage: $V_S = \pm 4$ to ± 15 V	V_I	$\pm V_S$	$\pm V_S$	V
$V_S \geq 15$ V	V_I	± 15	± 15	V
Differential input voltage	V_{ID}	± 30	± 30	V
Output short-circuit duration[1]	t_{QSC}	∞	∞	
Junction temperature	T_j	150	150	°C
Storage temperature range	T_{stg}	–55 to 125	–65 to 125	°C
Thermal resistance system - air TBA 221B/222B; BS1	$R_{th\,SA}$	100	100	K/W
TBB 741 G/742 G	$R_{th\,SA}$	200	200	K/W

[1]) Short circuit may be to $+V_S$, $-V_S$, or 0, whereby maximum ratings like T_j must not be exceeded.

Operating Range

Parameter	Symbol	TBA 221 TBB 741	TBA 222 TBB 742	Unit
Supply voltage	V_S	± 4 to ± 18	± 4 to ± 22	V
Ambient temperature	T_A	0 to 70	–55 to 125	°C

Characteristics

$V_S = \pm 15$ V

Parameter	Symbol	Limit Values $T_A = 25\,°C$ min.	typ.	max.	Limit Values $T_A = 0\,°C$ to $70\,°C$ min.	max.	Unit
Input offset voltage $R_G \leq 10$ kΩ	V_{IO}	–6		6	–7.5	7.5	mV
Setting range of V_{IO}	V_{IO}	6	± 15	–6			mV
Input offset current	I_{IO}	–200	± 20	200	–300	300	nA
Input current	I_I		80	500		800	nA
Supply current	I_S		1.7	2.8		2.8	mA
Pos. output short-circuit current	I_{QSC+}	15	20	25			mA
Neg. output short-circuit current	I_{QSC}	–25	–20	–15			mA
Input resistance	R_I	300	2000				kΩ
Input capacitance	C_I		1.4				pF
Output resistance	R_Q		75				Ω
Control range $R_G \geq 10$ kΩ	$V_{Q\,pp}$	13	± 14	–12.5			V
$R_L \geq 2$ kΩ	$V_{Q\,pp}$	11	± 13	–11			V
Common-mode input voltage range	V_{IC}	$-V_S+3$		V_S-3			V

Characteristics

$V_S = \pm 15$ V

Parameter	Symbol	Limit Values $T_A = 25\,°C$ min.	typ.	max.	Limit Values $T_A = 0\,°C$ to $70\,°C$ min.	max.	Unit
Open-loop voltage gain $V_{Q\,pp} = \pm 10$ V, $R_L \geq 2$ kΩ	G_{V0}	86	100		84		dB
Common-mode rejection ($R_G \leq 10$ kΩ)	k_{CMR}	70	90				dB
Supply voltage rejection	k_{SVR}		30	150			µV/V
Transient response of output voltage at $G_V = 1$: Rise time, $V_I = 20$ mV, $R_L = 2$ kΩ; $C_L \leq 100$ pF	t_r		0.3				µs
Overshoot			5				%
Slew rate[1] $R_L \leq 2$ kΩ	SR		0.5				V/µs
Temperature coefficient of V_{IO} Temperature coefficient of I_{IO}	α_{VIO} α_{IIO}		3 0.4				µV/K nA/K

Characteristics (TBA 222, TBB 742)

$V_S = \pm 15$ V

Parameter	Symbol	min.	typ.	max.	min.	max.	Unit
Input offset voltage $R_G \leq 10$ kΩ	V_{IO}	–4		4	–5.5	5.5	mV
Setting range of V_{IO}	V_{IO}	6	±15	–6			mV
Input offset current	I_{IO}	–100	±20	100	–400	400	nA
Input current	I_I		80	350		1200	nA
Supply current	I_S		1.7	2.8		2.8	mA
Pos. output short-circuit current	I_{QSC+}	15	20	25			mA
Neg. output short-circuit current	I_{QSC-}	–25	–20	–15			mA
Input resistance	R_I	300	2000				kΩ
Input capacitance	C_I		1.4				pF
Output resistance	R_Q		75				Ω
Control range $R_L \geq 10$ kΩ	$V_{Q\,pp}$	13	±14	–12.5			V
$R_L \geq 2$ kΩ	$V_{Q\,pp}$	11	±13	–11			V
Common-mode input voltage range	V_{IC}	$-V_S+3$		V_S-3			V
Open-loop voltage gain $V_{Q\,pp} = \pm 10$ V, $R_L \geq 2$ kΩ	G_{V0}	94	106		88		dB
Common-mode rejection $R_G \leq 10$ kΩ	k_{CMR}	80	90				dB
Supply voltage rejection	k_{SVR}		30	100			µV/V

[1] For the relationship between power bandwidth and slew rate refer to **"Introduction – Operational Amplifiers"**

1

Characteristics (TBA 222, TBA 742)
$V_S = \pm 15$ V

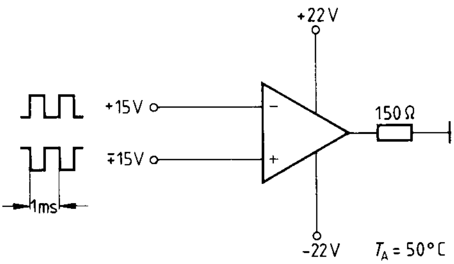
Parameter	Symbol	Limit Values $T_A = 25$ °C			Limit Values $T_A = 0$ °C to 70 °C		Unit
		min.	typ.	max.	min.	max.	
Transient response of output voltage at $G_V = 1$: Rise time, $V_I = 20$ mV, $R_L = 2$ kΩ, $C_L \leq 100$ pF	t_r		0.3				µs
Overshoot			5				%
Slew rate[1] $R_L \leq 2$ kΩ	*SR*		0.5				V/µs
Temperature coefficient of V_{IO}	α_{VIO}		3				µV/K
Temperature coefficient of I_{IO}	α_{IIO}		0.4				nA/K

TBA 222 B S1

The TBA 222 B S1 is similar to TBA 222 B, however, with special quality features.

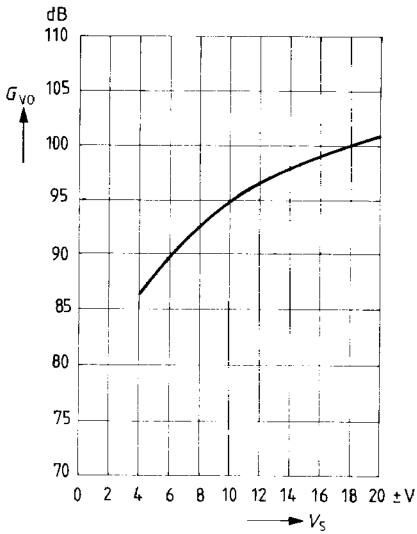
1. 72 hours electrically preaged at $T_A = 50$ °C, $V_S \pm 22$ V corresponding to the circuit shown below
2. Noise < 5 µVs in accordance with DIN 45405

Circuit, Preageing for TBA 222 B S1

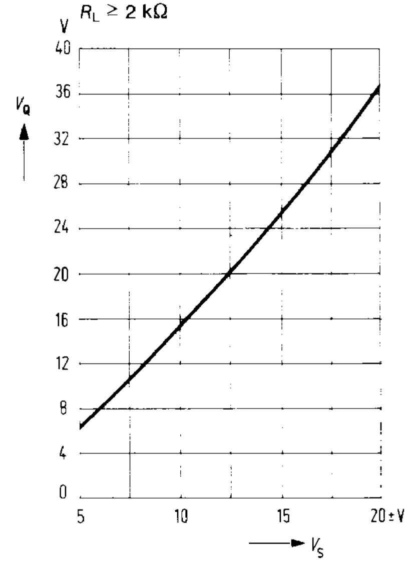


[1]) For the relationship between power bandwidth and slew rate refer to **"Introduction – Operational Amplifier"**

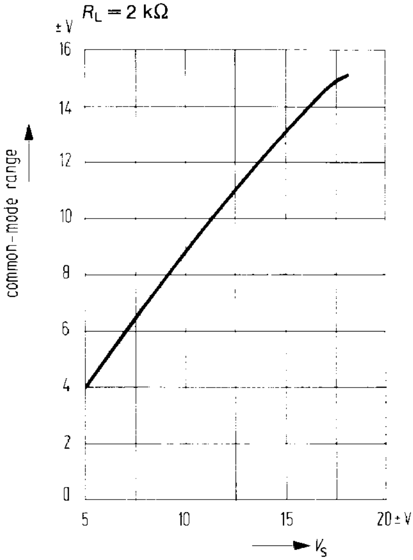
Open-loop voltage gain versus supply voltage



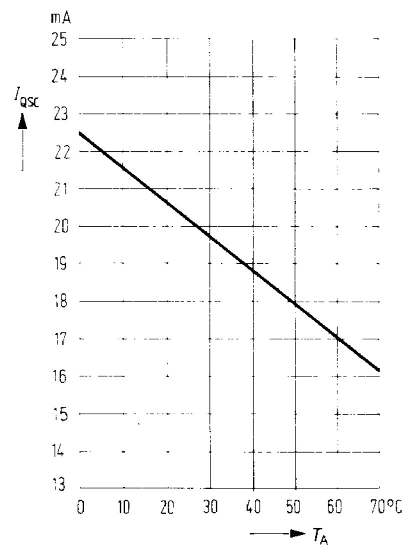
Output voltage versus supply voltage
$R_L \geq 2\ k\Omega$



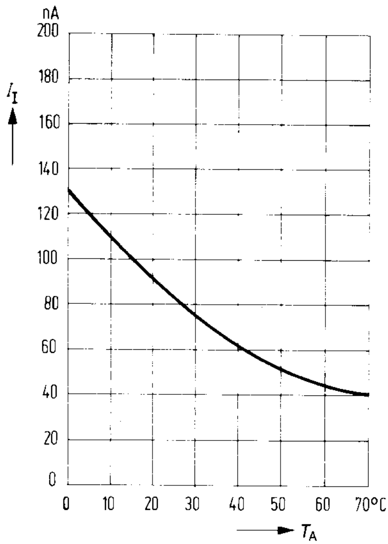
Common-mode range versus supply voltage
$R_L = 2\ k\Omega$



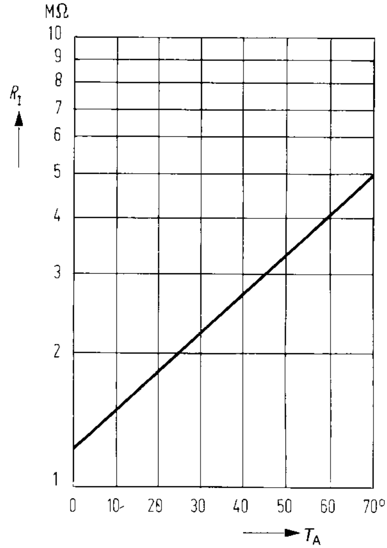
Output short-circuit current versus ambient temperature



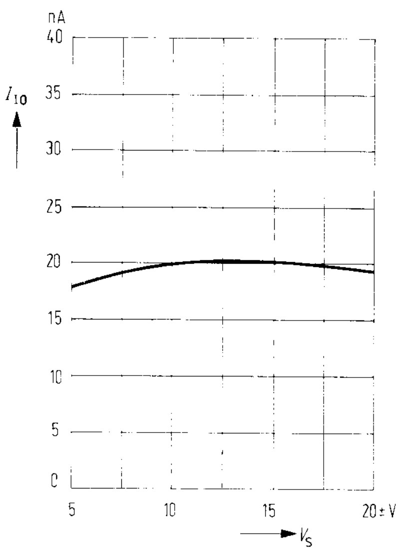
Input current versus ambient temperature
$V_S = \pm$ 15 V



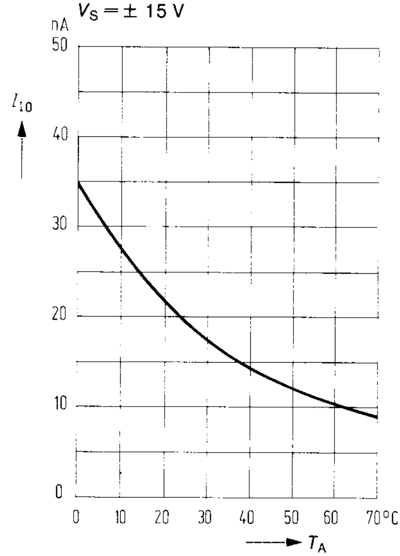
Input resistance versus ambient temperature
$V_S = \pm$ 15 V



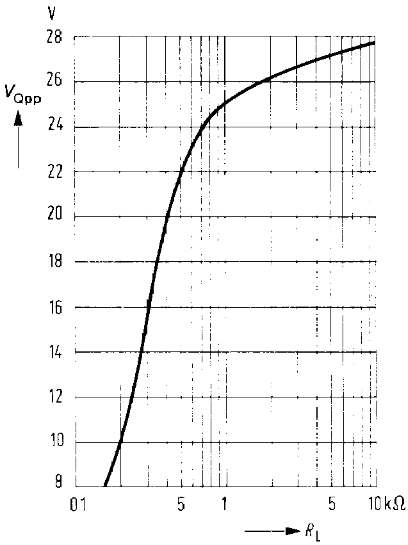
Input offset current versus supply voltage



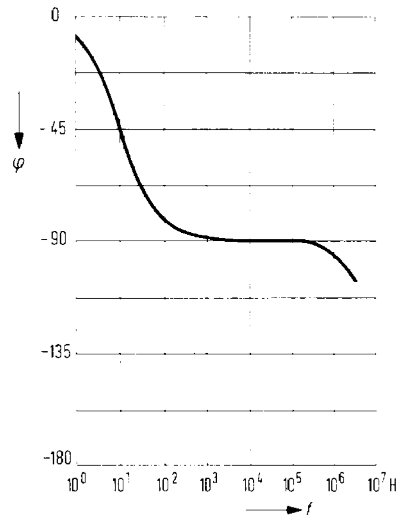
Input offset current versus ambient temperature
$V_S = \pm$ 15 V



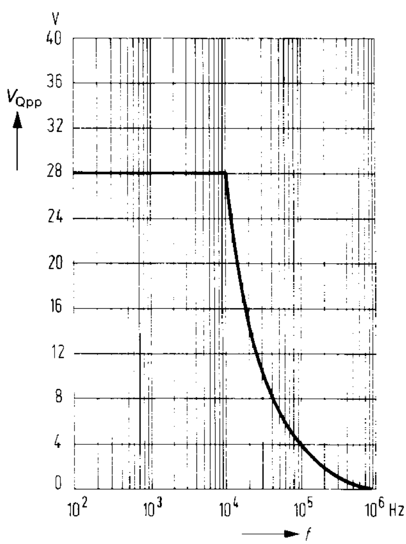
Output voltage versus load resistance
$V_S = \pm\ 15$ V



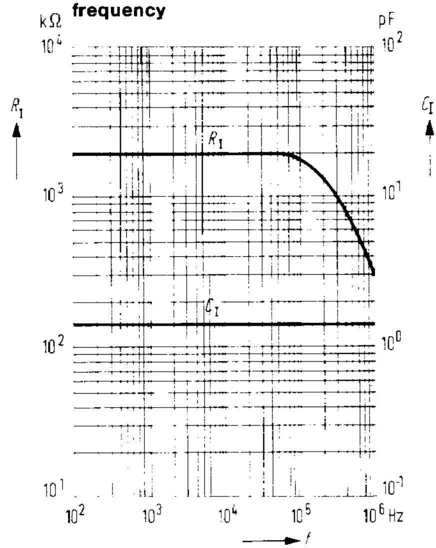
Phase response of open-loop voltage gain
Phase versus frequency
$V_S = \pm\ 15$ V



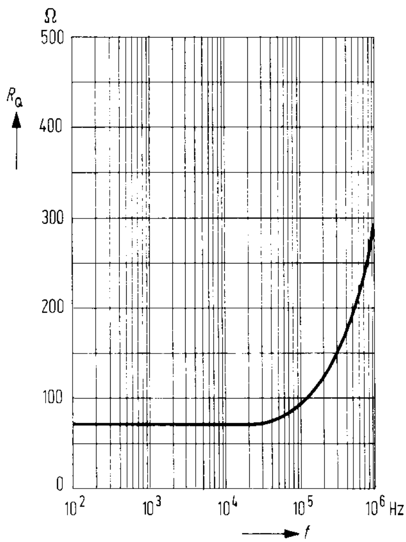
Output voltage versus frequency
$V_S = \pm\ 15$ V; $R_L = 10$ kΩ



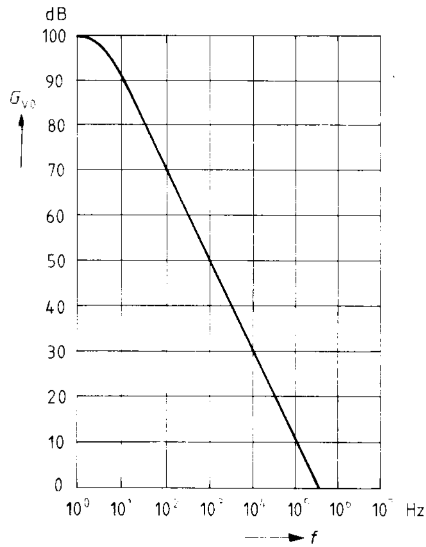
Input resistance and input capacitance versus frequency



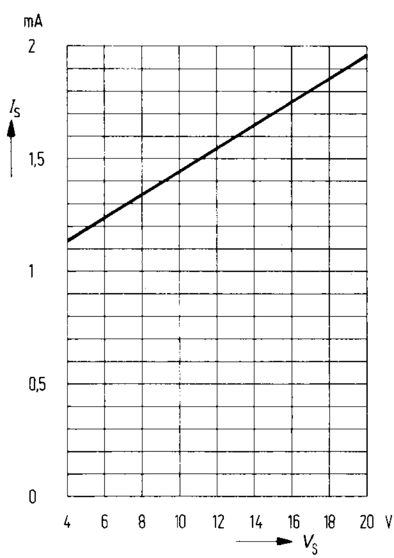
Output resistance versus frequency



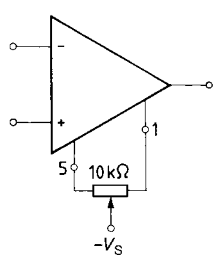
Open-loop voltage gain versus frequency



Supply current versus supply voltage



Offset voltage adjustment circuit



Transient response