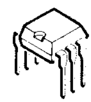
Single Operational Amplifier with Darlington Input

TCA 332
TCA 335

Bipolar IC

Features

- High input impedance
- Wide common-mode range
- Large supply-voltage range
- Large control range
- High output current
- Simple frequency compensation
- Wide temperature range (TCA 332)
- NPN Darlington input
- Open collector output



P-DIP-6

Applications

- Amplifier
- Comparator
- Level converter
- Impedance converter
- Driver

P-DSO-6

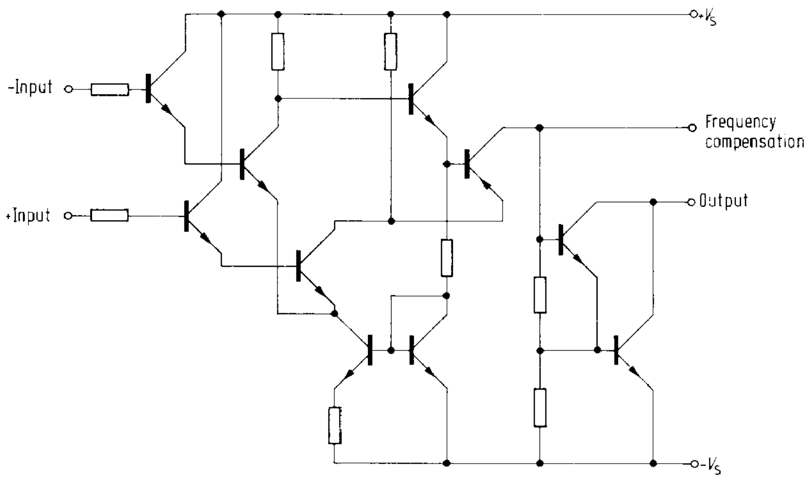
	Type	Ordering Code	Package	Color Code
■ S	TCA 332 A	Q67000-A2272	P-DIP-6	–
■	TCA 332 G	Q67000-A2270	P-DSO 6 (SMD)	orange/yellow
■ S	TCA 335 A	Q67000-A563	P-DIP-6	–
■ S	TCA 335 G	Q67000-A1018-G403	P-DSO-6	blue/yellow

■ = Not for new design

For TCA 315 and TCA 325 see **chapter "Comparators"**.

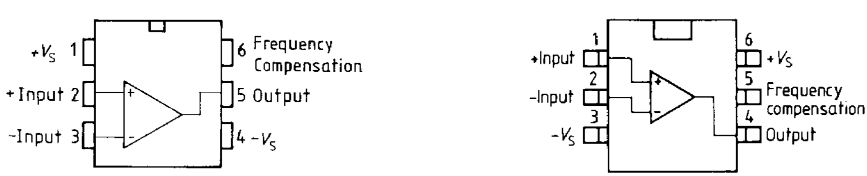
These op amps are particularly economic and versatile. Owing to their excellent performance characteristics they are well suited for a wide scope of applications, such as measuring and control engineering, automotive electronics, AF circuits, analog computers, etc. The low input current of these amplifiers is particularly advantageous for application in measuring and control systems.

Circuit Diagram

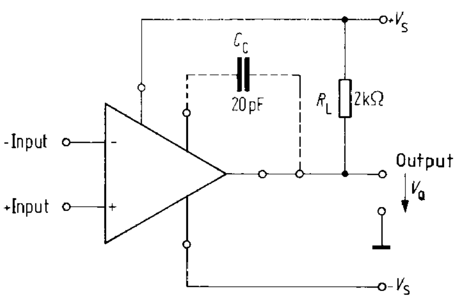


Pin Configurations

(top view)



Connection Diagram



C_C = output frequency compensation

R_L = load resistance (collector resistance)

Absolute Maximum Ratings

Parameter	Symbol	Limit Values	Unit
Supply voltage	V_S	± 15	V
Output current	I_Q	70	mA
Differential input voltage: V_S = 13 to 15 V Differential input voltage: V_S = 2 to 13 V	V_{ID} V_{ID}	± 13 ± V_S	V V
Junction temperature Storage temperature range	T_j T_{stg}	150 –55 to 125	°C °C
Thermal resistance system - air TCA 332 A TCA 332 G	 $R_{th\,SA}$ $R_{th\,SA}$	 115 200	 K/W K/W

Operating Range

Supply voltage	V_S	± 2 to ± 15	V
Ambient temperature	T_A	–55 to 125	°C

Characteristics

V_S = ± 5 V to ± 15 V
R_L = 2 kΩ, unless otherwise specified

Parameter	Symbol	Limit Values T_A = 25 °C min.	typ.	max.	Limit Values T_A = –55 to 125 °C min.	max.	Unit
Open-loop supply current consumption	I_S		1.5	2.5		2.5	mA
Input offset voltage R_G = 50 Ω	V_{IO}	–10		10	–15	15	mV
Input offset current	I_{IO}	–5		5	–10	10	nA
Input current	I_I		5	15		25	nA
Input current V_{ID} = ± 13 V	I_I			200			nA
Control range V_S = ± 15 V	$V_{Q\,pp}$	14.9		–14.0	14.8	–14.0	V
R_L = 620 Ω, V_S = ± 15 V	$V_{Q\,pp}$	14.9		–12.5	14.8	–12.0	V
V_S = ± 15 V, f = 100 kHz	$V_{Q\,pp}$		± 10				V

Characteristics
$V_S = \pm 5$ V to ± 15 V; $R_L = 2$ kΩ, unless otherwise specified

Parameter	Symbol	Limit Values $T_A = 25$ °C			Limit Values $T_A = -55$ to 125 °C		Unit
		min.	typ.	max.	min.	max.	
Input impedance $f = 1$ kHz	Z_I		3				MΩ
Open-loop voltage gain $f = 1$ kHz $R_L = 10$ kΩ, $f = 1$ kHz $f = 1$ MHz	 G_{V0} G_{V0} G_{V0}	 80	 83 88 43		 75		 dB dB dB
Common-mode input voltage range	V_{IC}	$-V_S+2$		V_S-2	$-V_S+3$	V_S-3	V
Common-mode rejection $R_L = 2$ kΩ	k_{CMR}	75	80		70		dB
Supply voltage rejection $G_V = 100$	k_{SVR}		25	200		200	µV/V
Temperature coefficient of V_{IO} $R_G = 50$ Ω Temperature coefficient of I_{IO} $R_G = 50$ Ω	α_{VIO} α_{IIO}		12 50	50		50	µV/K pA/K
Slew rate of V_Q for non-inverting operation[1]) (see TAA 765, test circuit 1) Slew rate of V_Q for inverting operation[1]) (see TAA 765, test circuit 2)	SR SR		9 18				V/µs V/µs
Output saturation voltage $I_Q = 10$ mA	V_{Qsat}			1			V
Output reverse current	I_{QR}			1		5	µA

Characteristics
$V_S = \pm 2$ V, $R_L = 2$ kΩ

Parameter	Symbol	min.	typ.	max.	min.	max.	Unit
Input offset voltage $R_G = 50$ Ω	V_{IO}	−10		10	−15	15	mV
Input offset current Input current	I_{IO} I_I	−5	 5	5 15	−10	10 25	nA nA
Open-loop voltage gain $f = 1$ kHz	G_{V0}	75			70		dB

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

Absolute Maximum Ratings

Parameter	Symbol	Limit Values	Unit
Supply voltage	V_S	± 15	V
Output current	I_Q	70	mA
Differential input voltage: V_S = 13 to 15 V Differential input voltage: V_S = 2 to 13 V	V_{ID} V_{ID}	± 13 ± V_S	V V
Junction temperature Storage temperature range	T_j T_{stg}	150 −55 to 125	°C °C
Thermal resistance system – air TCA 335 A TCA 335 G	 $R_{th\ SA}$ $R_{th\ SA}$	 115 200	 K/W K/W

Operating Range

Parameter	Symbol	Limit Values	Unit
Supply voltage	V_S	± 2 to ± 15	V
Ambient temperature	T_A	−25 to 85	°C

Characteristics

V_S = ± 5 V to ± 15 V; R_L = 2 kΩ,
unless otherwise specified

Parameter	Symbol	Limit Values T_A = 25 °C			Limit Values T_A = −25 to 85 °C		Unit
		min.	typ.	max.	min.	max.	
Open-loop supply current consumption	I_S		1.5	2.5		2.5	mA
Input offset voltage R_G = 50 Ω	V_{IO}	−15		15	−18	18	mV
Input offset current Input current Input current V_{ID} = ± 13 V	I_{IO} I_I I_I	−10	 5	10 25 200	−20	20 35	nA nA nA
Control range V_S = ± 15 V R_L = 620 Ω, V_S = ± 15 V V_S = ± 15 V, f = 100 kHz	 $V_{Q\ pp}$ $V_{Q\ pp}$ $V_{Q\ pp}$	 14.9 14.9	 ± 10	 −14.0 −12.5	 14.8 14.8	 −14.0 −12.0	 V V V

Characteristics

$V_S = \pm 5$ V to ± 15 V; $R_L = 2$ kΩ,
unless otherwise specified

Parameter	Symbol	Limit Values $T_A = 25\,°C$ min.	typ.	max.	Limit Values $T_A = -25$ to 85 °C min.	max.	Unit
Input impedance $f = 1$ kHz	Z_I		3				MΩ
Open-loop voltage gain							
$f = 1$ kHz	G_{V0}	75	80		75		dB
$R_L = 10$ kΩ, $f = 1$ kHz	G_{V0}		85				dB
$f = 1$ MHz	G_{V0}		43				dB
Common-mode input voltage range	V_{IC}	$-V_S+2$		V_S-2	$-V_S+3$	V_S-3	V
Common-mode rejection	k_{CMR}	70	78		70		dB
Supply voltage rejection $G_V = 100$	k_{SVR}		25	200		200	µV/V
Temperature coefficient of V_{IO} $R_G = 50\ \Omega$	α_{VIO}		12	50		50	µV/K
Temperature coefficient of I_{IO} $R_G = 50\ \Omega$	α_{IIO}		50				pA/K
Slew rate of V_Q for non-inverting operation[1]) (see TAA 765, test circuit 1)	SR		9				V/µs
Slew rate of V_Q for inverting operation[1]) (see TAA 765, test circuit 2)	SR		18				V/µs
Output saturation voltage $I_Q = 10$ mA	V_{Qsat}			1			V
Output reverse current	I_{QR}			10		20	µA

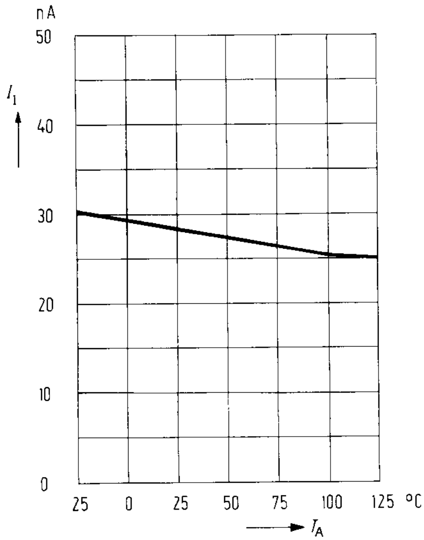
Characteristics

$V_S = \pm 2$ V, $R_L = 2$ kΩ

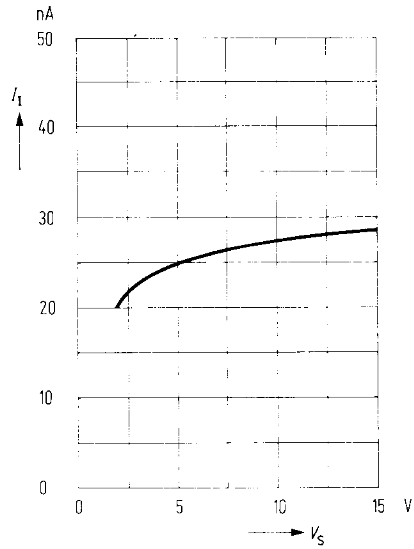
Parameter	Symbol	min.	typ.	max.	min.	max.	Unit
Input offset voltage $R_G = 50\ \Omega$	V_{IO}	−17		17	−20	20	mV
Input offset current	I_{IO}	−10		10	−20	20	nA
Input current	I_I		5	25		35	nA
Open-loop voltage gain $f = 1$ kHz	G_{V0}	70			70		dB

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

Input current versus ambient temperature
$R_L = 2\ k\Omega$



Input current versus supply voltage
$T_A = 25\ °C$; $R_L = 2\ k\Omega$



Input offset voltage versus supply voltage