

## Operational Amplifier with Darlington Input

**TCA 331; A; W**  
**TCA 332**  
**TCA 335; A; W**

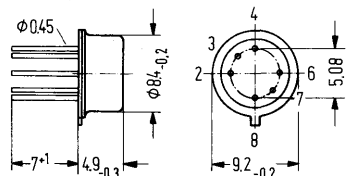
An economical and universal operational amplifier which by its excellent performance qualities is well suited for a wide range of applications such as measurement- and servo-systems, automobile electronics, AF-circuits, analog computers etc. The low input current of this amplifier is particularly advantageous in measurement- and servo system applications. In addition to a high gain, low offset voltage, small temperature- and supply voltage-dependence, the amplifier features

- High input resistance
- Wide common-mode range
- Large supply voltage range
- Large control range
- High output current
- Simple frequency compensation

Type	Ordering code
TCA 331	Q67000-A1013
TCA 331 A	Q67000-A1014
TCA 331 W	Q67000-A1015
TCA 332	Q67000-A1016
TCA 335	Q67000-A1017
TCA 335 A	Q67000-A563
TCA 335 W	Q67000-A1018

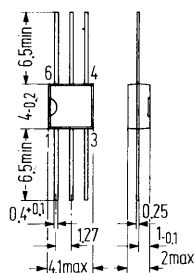
### Package outlines

TCA 331, TCA 332, TCA 335



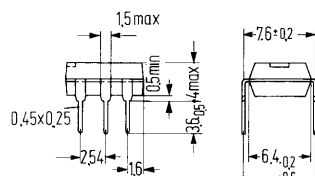
Package 5 H 6 DIN 41873  
(similar TO-78)  
Weight approx. 1 g

TCA 331 W, TCA 335 W



Miniature plastic package  
6 pins  
Weight approx. .1 g  
Colour code  
TCA 331 W blue/white  
TCA 335 W blue/yellow

TCA 331 A, TCA 335 A



Plastic plug-in package  
6 pins  
20 A 6 DIN 41866  
Weight approx. .7 g

Dimensions in mm

### Maximum ratings

Supply voltage  
Output current  
Differential input voltage  $V_{CC} = \pm 13$  to  $\pm 15$  V  
Differential input voltage  $V_{CC} = \pm 2$  to  $\pm 13$  V  
Junction temperature  
Storage temperature  
Thermal resistance:  
System-case (TCA 331, 332, 335)  
System-ambient air (TCA 331, 332, 335)  
System-ambient air (TCA 331 A, TCA 335 A)  
System-ambient air (TCA 331 W, TCA 335 W)

	TCA 331/A/W	TCA 332	TCA 335/A/W
$V_{CC}$	$\pm 15$		V
$I_g$	70		mA
$V_{ID}$	$\pm 13$		V
$V_{ID}$	$\pm V_{CC}$		
$T_j$	150		°C
$T_s$	-55 to +150		°C
$R_{thScase}$	80		K/W
$R_{thSamb}$	190		K/W
$R_{thSamb}$	140		K/W
$R_{thSamb}$	200		K/W

### Range of operation

Supply voltage  
Ambient temperature in operation  
TCA 331/A/W  
TCA 335/A/W  
TCA 332

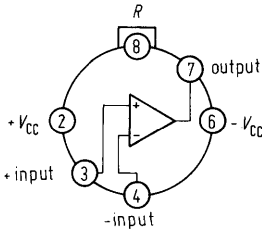
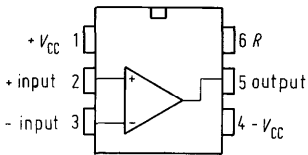
$V_{CC}$	$\pm 2$ to $\pm 15$	V
$T_{amb}$	0 to +70	°C
$T_{amb}$	-25 to +85	°C
$T_{amb}$	-55 to +125	°C

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**Pin connection**

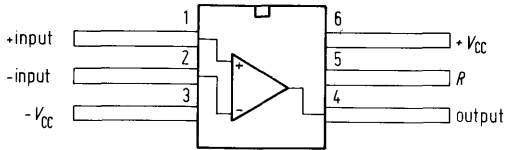
TCA 331 A  
TCA 335 A

TCA 331  
TCA 332  
TCA 335



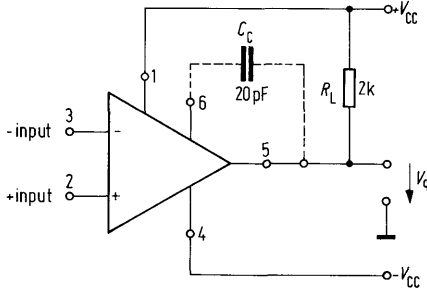
TCA 331 W  
TCA 335 W

*R* = frequency compensation



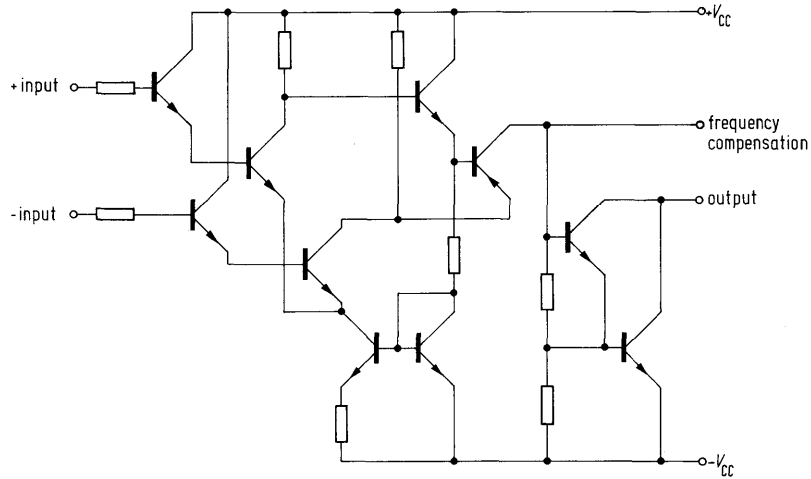
**Connection diagram**

$C_C$  = Output frequency compensation,  
 $R_L$  = load resistance



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**Circuit diagram**



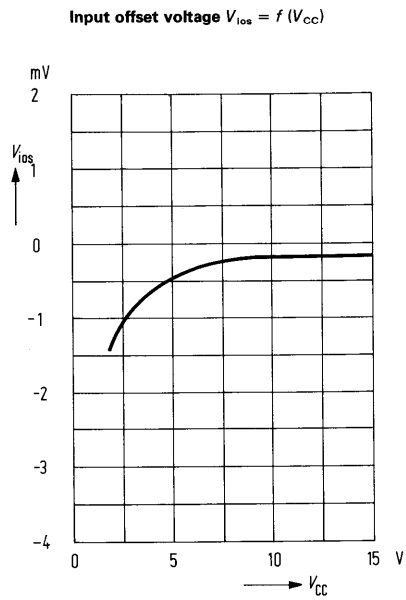
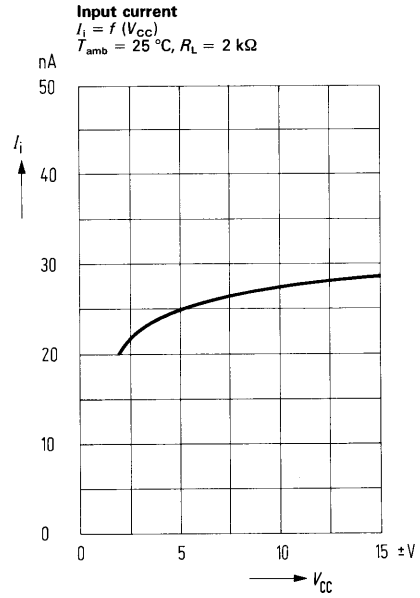
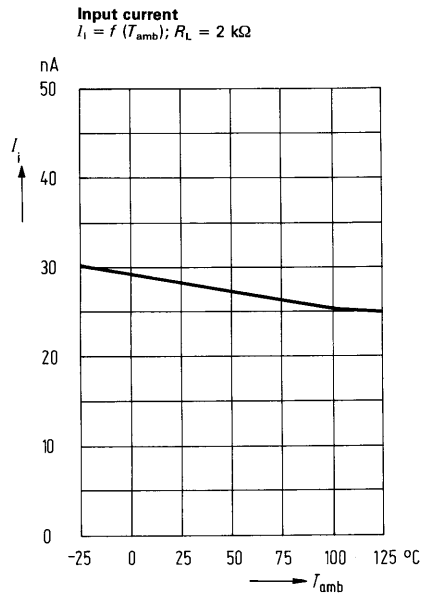
**Operating characteristics**  
 $(V_{CC} = \pm 15 \text{ V})$

		TCA 331/A/W TCA 335/A/W $T_{amb} = 25^\circ\text{C}$			TCA 332 $T_{amb} = 25^\circ\text{C}$					
								$T_{amb} = -55 \text{ to } 125^\circ\text{C}$		
		min	typ	max	min	typ	max	min	max	
Supply current	$I_{CC}$		1.5	2.5		1.5	2.5			mA
Input offset voltage ( $R_G = 50 \Omega$ )	$V_{io}$	-20		20	-14		14	-20	20	mV
Input offset current	$I_{io}$	-25	$\pm 10$	25	-15		15	-40	40	nA
Input current	$I_i$		30	50			30		80	nA
Input current ( $V_{ID} = \pm 13 \text{ V}$ )	$I_i$			200			200			nA
Output voltage ( $R_L = 2 \text{ k}\Omega$ )	$V_{qpp}$	14.9		-14.0	14.9		-14.0	14.8	-14.0	V
Output voltage ( $R_L = 620 \Omega$ )	$V_{qpp}$	14.9		-12.5	14.9		-12.5	14.8	-12.0	V
Output voltage ( $R_L = 2 \text{ k}\Omega, f = 100 \text{ kHz}$ )	$V_{qpp}$		$\pm 10$			$\pm 10$				V

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**TCA 335; A; W**

Operating characteristics (continued) $V_{CC} = \pm 15\text{ V}$		TCA 331/A/W TCA 335/A/W $T_{amb} = 25\text{ }^\circ\text{C}$			TCA 332					
					$T_{amb} = 25\text{ }^\circ\text{C}$			$T_{amb} = -55\text{ to }+125\text{ }^\circ\text{C}$		
		min	typ	max	min	typ	max	min	max	
Input impedance ( $f = 1\text{ kHz}$ )	$Z_i$		3			3				$M\Omega$
Open-loop voltage gain ( $R_L = 2\text{ k}\Omega$ , $f = 1\text{ kHz}$ )	$G_V$	75	80		80	83		75		dB
( $R_L = 10\text{ k}\Omega$ , $f = 1\text{ kHz}$ )	$G_V$		85			88				dB
( $R_L = 2\text{ k}\Omega$ , $f = 1\text{ MHz}$ )	$G_V$		43			43				dB
Input common-mode range ( $R_L = 2\text{ k}\Omega$ )	$V_{iCM}$	13		-13	13			-13		V
Common-mode rejection ratio ( $R_L = 2\text{ k}\Omega$ )	$CMRR$	60	74		65	77				dB
Sensitivity to supply voltage variations ( $C_c = 1\text{ pf}$ , $G_V = 100$ )	$\frac{\Delta V_{io}}{\Delta V_{CC}}$		25	200		25	200			$\mu\text{V/V}$
Temp. coefficient of $V_{io}$ ( $R_G = 50\text{ }\Omega$ )	$\alpha_{Vio}$		12			12	50			$\mu\text{V/K}$
Temp. coefficient of $I_{io}$ ( $R_G = 50\text{ }\Omega$ )	$\alpha_{Iio}$		50			50				pA/K
Rise time of $V_q$ for non-inverting operation (test circuit 1)	$\frac{dV_q}{dt_r}$		9			9				V/ $\mu\text{s}$
Rise time for $V_q$ for inverting operation (test circuit 2)	$\frac{dV_q}{dt_r}$		18			18				V/ $\mu\text{s}$
Output saturation voltage ( $I_q = 10\text{ mA}$ )	$V_{qsat}$			1				1		V
Output leakage current $V_{CC} = \pm 5\text{ V}$	$I_{qlik}$		1	10		1	10			$\mu\text{A}$
Input offset voltage ( $R_G = 50\text{ }\Omega$ )	$V_{io}$	-20		20	-14		14			mV
Input offset current	$I_{io}$	-25	$\pm 10$	25	-15		15			nA
Input current	$I_i$		30	50			30			nA
Open loop voltage gain ( $R_L = 2\text{ k}\Omega$ , $f = 1\text{ kHz}$ )	$G_V$	65			70					dB

**TCA 331; A; W**  
**TCA 332**  
**TCA 335; A; W**



For further performance curves  
 see TAA 761