

Comparators with Darlington Input
TTL-Compatible

TCA 312
TCA 315

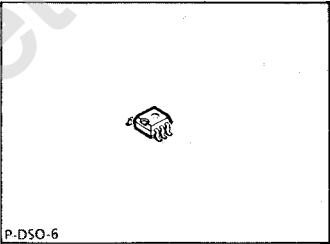
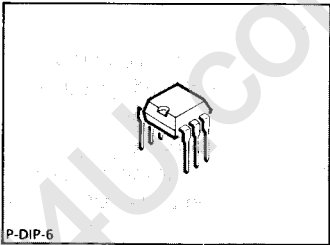
Bipolar IC

Features

- Very high input resistance
- Large control range
- High output current
- Low output saturation voltage
- Wide temperature range (TCA 312 A; G)
- NPN input
- Open collector output
- High slew rate

Applications

- Comparator
- Level converter
- Driver



Type	Ordering Code	Package	Color Code
☐ TCA 312 A	Q67000-A2048	P-DIP-6	—
TCA 312 G	Q67000-A2509	P-DSO-6 (SMD)	red
☐ TCA 315 A	Q67000-A561	P-DIP-6	—
☐ TCA 315 G	Q67000-A1005	P-DSO-6 (SMD)	red/yellow

TCA 312 abd TCA 315 are suitable for use as Schmitt trigger or comparator in control engineering and automotive electronics. The output has been designed to control TTL circuits directly.

Comparators, TTL-Compatible

TCA 322
TCA 325

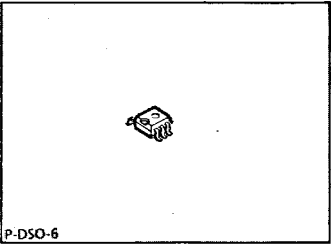
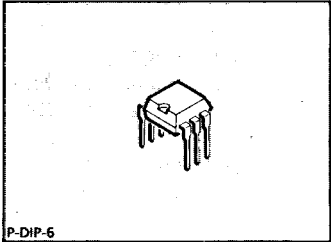
Bipolar IC

Features

- Wide common-mode range
- Large supply voltage range
- Large control range
- High output current
- Low output saturation voltage
- Wide temperature range (TCA 322)
- NPN input
- Open collector output
- High slew rate

Applications

- Comparator
- Level converter
- Impedance converter
- Driver

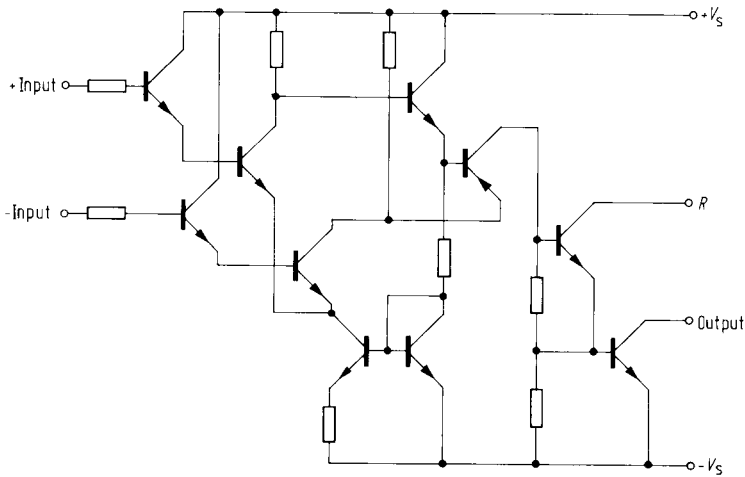


Type	Ordering Code	Package	Color Code
■ □ TCA 322 A	Q67000-A2501	P-DIP-6	—
■ TCA 322 G	Q67000-A2508	P-DSO-6 (SMD)	brown
■ □ TCA 325 A	Q67000-A562	P-DIP-6	—
■ □ TCA 325 G	Q67000-A1012	P-DSO-6 (SMD)	green/yellow

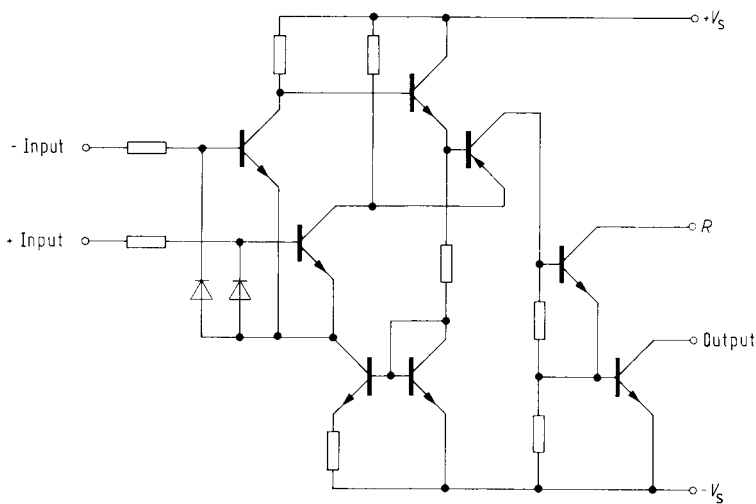
■ = Not for new design

TCA 322 and TCA 325 are suitable for use as Schmitt trigger or comparator in control engineering and automotive electronics. The output has been designed to control TTL circuits directly.

Circuit Diagram TCA 312/315



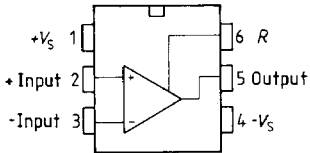
Circuit Diagram TCA 322/325



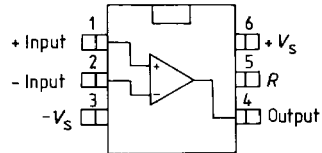
Pin Configurations

(top view)

TCA 312 A; TCA 322 A
TCA 315 A; TCA 325 A

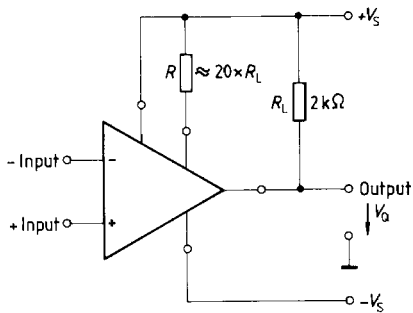


TCA 312 G; TCA 322 G
TCA 315 G; TCA 325 G



Connection Diagram

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
Driver current	I_{dr}	10	mA
Differential input voltage $V_S = 13$ to 15 V	V_{ID}	± 13	V
Differential input voltage $V_S = 2$ to 13 V	V_{ID}	$\pm V_S$	V
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	–55 to 125	°C
Thermal resistance system – air	$R_{th SA}$	115	K/W
system – air	$R_{th SA}$	200	K/W

Operating Range

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

Characteristics

$V_S = \pm 5$ V to ± 15 V; $R = 6.8$ k Ω

$R_L = 2$ k Ω

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.	
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	5	–10	10	nA
Input current	I_i			15		25	nA
Input current	I_i			200			nA
$V_{ID} = \pm 13$ V							
Control range							
$V_S = \pm 15$ V	$V_{Q pp}$	14.9		–14.8	14.8	–14.6	V
$R_L = 620$ Ω , $V_S = \pm 15$ V	$V_{Q pp}$	14.9		–14.0	14.8	–13.5	V
$V_S = \pm 15$ V, $f = 100$ kHz	$V_{Q pp}$		± 10				V

Characteristics
 $V_S = \pm 5 \text{ V}$ to $\pm 15 \text{ V}$; $R = 6.8 \text{ k}\Omega$,

 $R_L = 2 \text{ k}\Omega$,

unless otherwise specified

Parameter	Symbol	Limit Values $T_A = 25^\circ\text{C}$			Limit Values $T_A = -55$ to 125°C		
		min.	typ.	max.	min.	max.	
Input impedance $f = 1 \text{ kHz}$	Z_i		3				$\text{M}\Omega$
Open-loop voltage gain $f = 1 \text{ kHz}$ $R_L = 10 \text{ k}\Omega$, $f = 1 \text{ kHz}$ $f = 1 \text{ MHz}$	G_{V0} G_{V0} G_{V0}	80	83 88 60		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	K_{CMR}	75	80		70		dB
Supply voltage rejection $G_V = 100$	K_{SVR}		25	200		200	$\mu\text{V/V}$
Temperature coefficient of V_{IO} $R_G = 50 \Omega$	α_{VIO}		12	50			$\mu\text{V/K}$
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		30				$\text{V}/\mu\text{s}$
Output saturation voltage $I_Q = 10 \text{ mA}$	V_{Qsat}			200		400	mV
Output reverse current	I_{QR}			1		5	μA

Characteristics
 $V_S = \pm 2 \text{ V}$; $R = 6.8 \text{ k}\Omega$, $R_L = 2 \text{ k}\Omega$

Input offset voltage $R_G = 50 \Omega$	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 $f = 1 \text{ kHz}$	G_{V0}	75			70		dB

¹⁾ For the relationship between power bandwidth and slew rate refer to "General Technical Information"

Absolute Maximum Ratings

Parameter	Symbol	Limit Values	Unit
Supply voltage	V_S	± 15	V
Output current	I_Q	70	mA
Driver current	I_{dr}	10	mA
Differential input voltage $V_S = 13$ to 15 V	V_{ID}	± 13	V
Differential input voltage $V_S = 2$ to 13 V	V_{ID}	$\pm V_S$	V
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−55 to 125	°C
Thermal resistance			
system – air TCA 315 A	$R_{th\ SA}$	115	K/W
system – air TCA 315 G	$R_{th\ SA}$	200	K/W

Operating Range

Supply voltage	V_S	± 2 to ± 15	V
Ambient temperature	T_A	-25 to 85	$^{\circ}\text{C}$

Characteristics

$V_S = \pm 5$ V to ± 15 V
 $R = 6.8\text{ k}\Omega$, $R_L = 2\text{ k}\Omega$,
unless otherwise specified

Parameter	Symbol	Limit Values $T_A = 25\text{ }^{\circ}\text{C}$			Limit Values $T_A = -25$ to $85\text{ }^{\circ}\text{C}$		Unit
		min.	typ.	max.	min.	max.	
Open-loop supply current consumption	I_S		1.5	2.5		2.5	mA
Input offset voltage $R_G = 50\text{ }\Omega$	V_{IO}	-15		15	-18	18	mV
Input offset current	I_{IO}	-10		10	-20	20	nA
Input current	I_I		5	25		35	nA
Input current $V_{ID} = \pm 13$ V	I_I			200			nA
Control range							
$V_S = \pm 15$ V	$V_{Q\ pp}$	14.9		-14.8	14.8	-14.6	V
$R_L = 620\text{ }\Omega$; $V_S = \pm 15$ V	$V_{Q\ pp}$	14.9		-14.0	14.8	-13.5	V
$V_S = \pm 15$ V, $f = 100\text{ kHz}$	$V_{Q\ pp}$		± 10				V

Characteristics
 $V_S = \pm 5 \text{ V to } \pm 15 \text{ V}; R = 6.8 \text{ k}\Omega,$
 $R_L = 2 \text{ k}\Omega,$

unless otherwise specified

Parameter	Symbol	Limit Values $T_A = 25^\circ\text{C}$			Limit Values $T_A = -25$ to 85°C		Unit
		min.	typ.	max.	min.	max.	
Input impedance $f = 1 \text{ kHz}$	Z_i		3				$\text{M}\Omega$
Open-loop voltage gain $f = 1 \text{ kHz}$	G_{V0}	75	80		75		dB
$R_L = 10 \text{ k}\Omega, f = 1 \text{ kHz}$	G_{V0}		85				dB
$f = 1 \text{ MHz}$	G_{V0}		60				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	$\mu\text{V/V}$
Temperature coefficient of V_{IO} $R_G = 50 \text{ }\Omega$	α_{VIO}		12	50			$\mu\text{V/K}$
Temperature coefficient of I_{IO} $R_G = 50 \text{ }\Omega$	α_{IIO}		50				pA/K
Slew rate of V_q for non-inverting operation ¹⁾ (see TAA 765, test circuit 1)	SR		30				$\text{V}/\mu\text{s}$
Output saturation voltage $I_Q = 10 \text{ mA}$	V_{Qsat}			200		400	mV
Output reverse current	I_{QR}			10		20	μA

Characteristics
 $V_S = \pm 2 \text{ V}; R = 6.8 \text{ k}\Omega, R_L = 2 \text{ k}\Omega$

Input offset voltage $R_G = 50 \text{ }\Omega$	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 $f = 1 \text{ kHz}$	G_{V0}	70			70		dB

¹⁾ For the relationship between power bandwidth and slew rate refer to "General Technical Information"

Absolute Maximum Ratings

Parameter	Symbol	Limit Values	Unit
Supply voltage	V_S	± 15	V
Output current	I_Q	70	mA
Driver current at R	I_{dr}	10	mA
Differential input voltage	V_{ID}	$\pm V_S$	V
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	–55 to 125	°C
Thermal resistance			
system – air TCA 322 A	$R_{th SA}$	115	K/W
system – air TCA 322 G	$R_{th SA}$	200	K/W

Operating Range

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

Characteristics

$V_S = \pm 5$ V to ± 15 V

$R = 6.8$ k Ω , $R_L = 2$ k Ω ,

unless otherwise specified

Parameter	Symbol	Limit Values $T_A = 25^\circ\text{C}$			Limit Values $T_A = -55$ to 125°C		Unit
		min.	typ.	max.	min.	max.	
Open-loop supply current consumption	I_S		1.5	2.5		2.5	mA
Input offset voltage $R_G = 50 \Omega$	V_{IO}	–4		4	–6	6	mV
Input offset current	I_{IO}	–100	± 50	100	–300	300	nA
Input current	I_I		0.3	0.7		1.0	μA
Control range							
$V_S = \pm 15$ V	$V_{Q pp}$	14.9		–14.8	14.8	–14.6	V
$R_L = 620 \Omega$, $V_S = \pm 15$ V	$V_{Q pp}$	14.9		–14.0	14.8	–13.5	V
$V_S = \pm 15$ V, $f = 100$ kHz	$V_{Q pp}$		± 10				V

Characteristics $V_S = \pm 5 \text{ V}$ to $\pm 15 \text{ V}$ $R = 6.8 \text{ k}\Omega$, $R_L = 2 \text{ k}\Omega$,

unless otherwise specified

Parameter	Symbol	Limit Values $T_A = 25^\circ\text{C}$			Limit Values $T_A = -55$ to 125°C		Unit
		min.	typ.	max.	min.	max.	
Input impedance $f = 1 \text{ kHz}$	Z_i		200				$\text{k}\Omega$
Open-loop voltage gain $f = 1 \text{ kHz}$ $R_L = 10 \text{ k}\Omega$, $f = 1 \text{ kHz}$ $f = 1 \text{ MHz}$	G_{V0} G_{V0} G_{V0}	85	87 92 60		80		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	k_{CMR}	80	85		75		dB
Supply voltage rejection $G_V = 100$	k_{SVR}		25	200		200	$\mu\text{V/V}$
Temperature coefficient of V_{IO} $R_G = 50 \text{ }\Omega$	α_{VIO}		6	25			$\mu\text{V/K}$
Temperature coefficient of I_{IO} $R_G = 50 \text{ }\Omega$	α_{II0}		0.3	1.5			nA/K
Slew rate of V_o for non-inverting operation ¹⁾ (see TAA 765, test circuit 1)	SR		50				$\text{V}/\mu\text{s}$
Output saturation voltage $I_Q = 10 \text{ mA}$	$V_{Q \text{ sat}}$			200		400	mV
Output reverse current	I_{QR}			1		5	μA

Characteristics $V_S = \pm 2 \text{ V}$; $R = 6.8 \text{ k}\Omega$, $R_L = 2 \text{ k}\Omega$,

unless otherwise specified

Input offset voltage $R_G = 50 \text{ }\Omega$	V_{IO}	-4		4	-6	6	mV
Input offset current Input current	I_{IO} I_I	-70	0.2	70 0.5	-200	200 0.8	nA μA
Open-loop voltage gain $f = 1 \text{ kHz}$	G_{V0}	80			75		dB

¹⁾ For the relationship between power bandwidth and slew rate refer to "General Technical Information"

Absolute Maximum Ratings

Parameter	Symbol	Limit Values	Unit
Supply voltage	V_S	± 15	V
Output current	I_Q	70	mA
Driver current at R	I_{dr}	10	mA
Differential input voltage	V_{ID}	$\pm V_S$	V
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−55 to 125	°C
Thermal resistance			
system – air TCA 325 A	$R_{th\ SA}$	115	K/W
system – air TCA 325 G	$R_{th\ SA}$	200	K/W

Operating Range

Supply voltage	V_S	± 2 to ± 15	V
Ambient temperature	T_A	−25 to 85	°C

Characteristics

$V_S = \pm 5\text{ V}$ to $\pm 15\text{ V}$
 $R = 6.8\text{ k}\Omega$, $R_L = 2\text{ k}\Omega$,
unless otherwise specified

Parameter	Symbol	Limit Values $T_A = 25^\circ\text{C}$			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 $R_G = 50\ \Omega$	V_{IO}	−5.5		5.5	−7	7	mV
Input offset current	I_{IO}	−200	± 80	200	−300	300	nA
Input current	I_I		0.5	0.8		1.0	μA
Control range							
$V_S = \pm 15\text{ V}$	$V_{Q\ pp}$	14.9		−14.8	14.8	−14.6	V
$R_L = 620\ \Omega$, $V_S = \pm 15\text{ V}$	$V_{Q\ pp}$	14.9		−14.0	14.8	−13.5	V
$V_S = \pm 15\text{ V}$, $f = 100\text{ kHz}$	$V_{Q\ pp}$		± 10				V

Characteristics

$V_S = \pm 5 \text{ V}$ to $\pm 15 \text{ V}$; $R = 6.8 \text{ k}\Omega$, $R_L = 2 \text{ k}\Omega$,
unless otherwise specified

Parameter	Symbol	Limit Values $T_A = 25^\circ\text{C}$			Limit Values $T_A = -25$ to 85°C		Unit
		min.	typ.	max.	min.	max.	
Input impedance $f = 1 \text{ kHz}$	Z_i		200				$\text{k}\Omega$
Open-loop voltage gain $f = 1 \text{ kHz}$ $R_L = 10 \text{ k}\Omega$, $f = 1 \text{ kHz}$ $f = 1 \text{ MHz}$	G_{V0} G_{V0} G_{V0}	80	85 90 60		80		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	k_{CMR}	75	83		75		dB
Supply voltage rejection $G_V = 100$	k_{SVR}		25	200		200	$\mu\text{V/V}$
Temperature coefficient of V_{IO} $R_G = 50 \Omega$	α_{VIO}		6				$\mu\text{V/K}$
Temperature coefficient of I_{IO} $R_G = 50 \Omega$	α_{IIIO}		0.3				nA/K
Slew rate of V_q for non-inverting operation ¹⁾ (see TAA 765, test circuit 1)	SR		50				$\text{V}/\mu\text{s}$
Output saturation voltage $I_Q = 10 \text{ mA}$	$V_{Q \text{ sat}}$			200		400	mV
Output reverse current	I_{QR}			10		20	μA

Characteristics

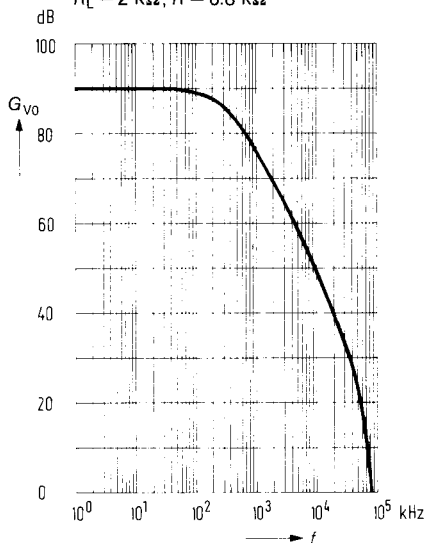
$V_S = \pm 2 \text{ V}$; $R = 6.8 \text{ k}\Omega$, $R_L = 2 \text{ k}\Omega$

Input offset voltage $R_G = 50 \Omega$	V_{IO}	-6		6	-7.5	7.5	mV
Input offset current	I_{IO}	-150		150	-200	200	nA
Input current	I_i		0.2	0.6		0.8	μA
Open-loop voltage gain $f = 1 \text{ kHz}$	G_{V0}	75			75		dB

¹⁾ For the relationship between power bandwidth and slew rate refer to "General Technical Information"

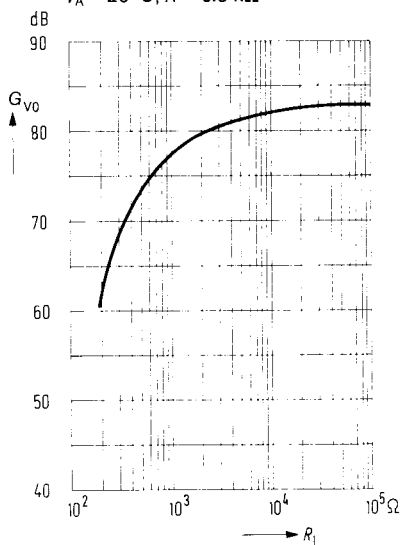
Open-loop voltage gain versus frequency

$R_L = 2 \text{ k}\Omega$; $R = 6.8 \text{ k}\Omega$



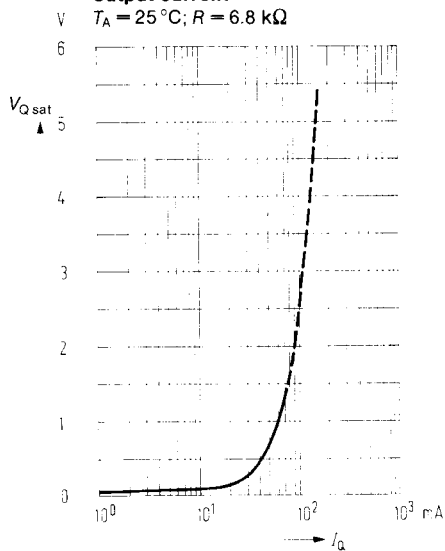
Open-loop voltage gain versus load resistance

$T_A = 25^\circ\text{C}$; $R = 6.8 \text{ k}\Omega$



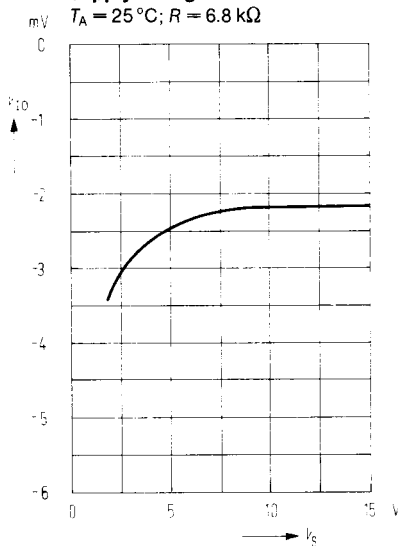
Output saturation voltage versus output current

$T_A = 25^\circ\text{C}$; $R = 6.8 \text{ k}\Omega$

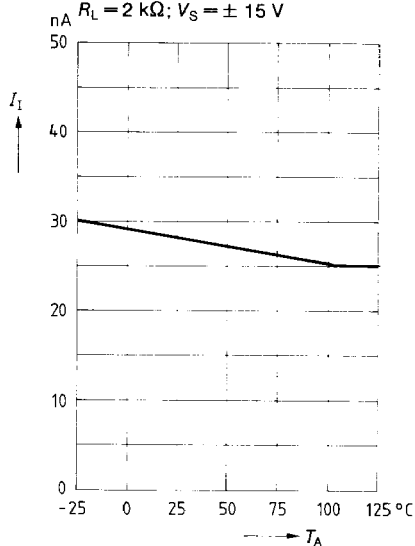


Input offset voltage versus supply voltage

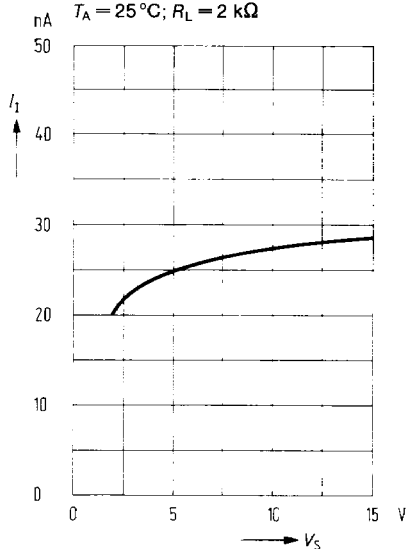
$T_A = 25^\circ\text{C}$; $R = 6.8 \text{ k}\Omega$



**Input current versus
ambient temperature**
 $R_L = 2 \text{ k}\Omega$; $V_S = \pm 15 \text{ V}$

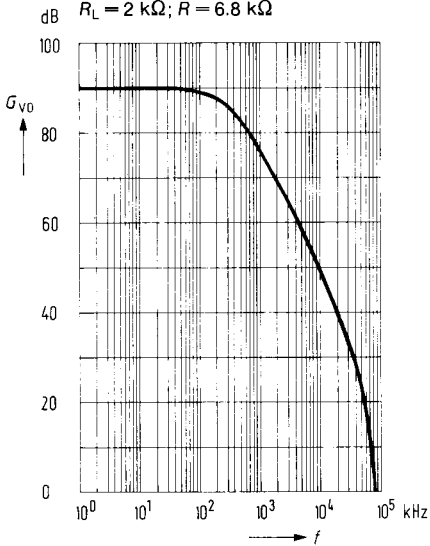


**Input current versus
supply voltage**
 $T_A = 25 \text{ °C}$; $R_L = 2 \text{ k}\Omega$



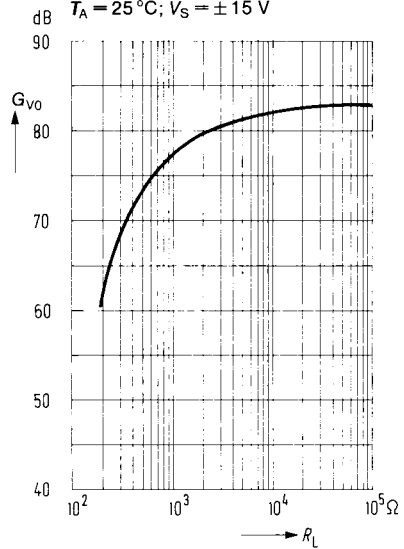
Open-loop voltage gain versus frequency

$R_L = 2 \text{ k}\Omega$; $R = 6.8 \text{ k}\Omega$



Open-loop voltage gain versus load resistance

$T_A = 25^\circ\text{C}$; $V_S = \pm 15 \text{ V}$



Output saturation voltage versus output current

$T_A = 25^\circ\text{C}$; $R = 6.8 \text{ k}\Omega$

