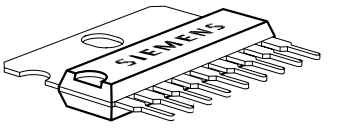
SIEMENS

Dual Power Operational Amplifier — TCA 2465

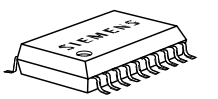
Overview — Bipolar IC

Features

- High output peak current of twice 2.5 A
- Twice 2.0 A output peak current for TCA 2465 G
- Large supply voltage range up to 42 V
- High slew rate of 2 V/µs
- Outputs fully protected (DC short-circuit proof for P-SIP-9-1 V_S up to 18 V; for P-DSO-20-6 V_S up to 14 V)
- Thermal overload protection
- Inhibit input enables “tristate” outputs
- Integrated clamp diodes



P-SIP-9-1



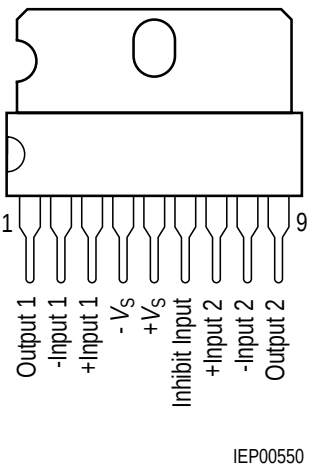
P-DSO-20-6

Type	Ordering Code	Package
TCA 2465	Q67000-A8109	P-SIP-9-1
TCA 2465 G	Q67000-A8334	P-DSO-20-6

Description

The IC contains two identical op amps, each supplying a high output current of 2.5 A at supply voltages between ± 3 V and ± 20 V. Internal compensation permits negative feedback of the amplifiers up to a min. of 20 dB. Both amplifiers can be disconnected at $V_8 \geq 2$ V via an inhibit input. Integrated protective circuits protect the outputs against short-circuit to + V_S and – V_S and prevent thermal overloading of the IC. TCA 2465 G comes in a special surface-mounted power package similar to P-DSO-20 and delivers twice 2.0 A output peak current.

TCA 2465



TCA 2465 G

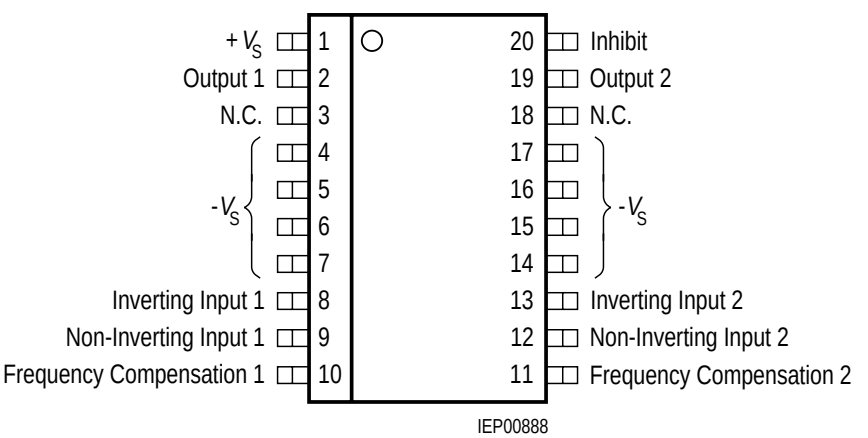


Figure 1 Pin Configuration (top view)

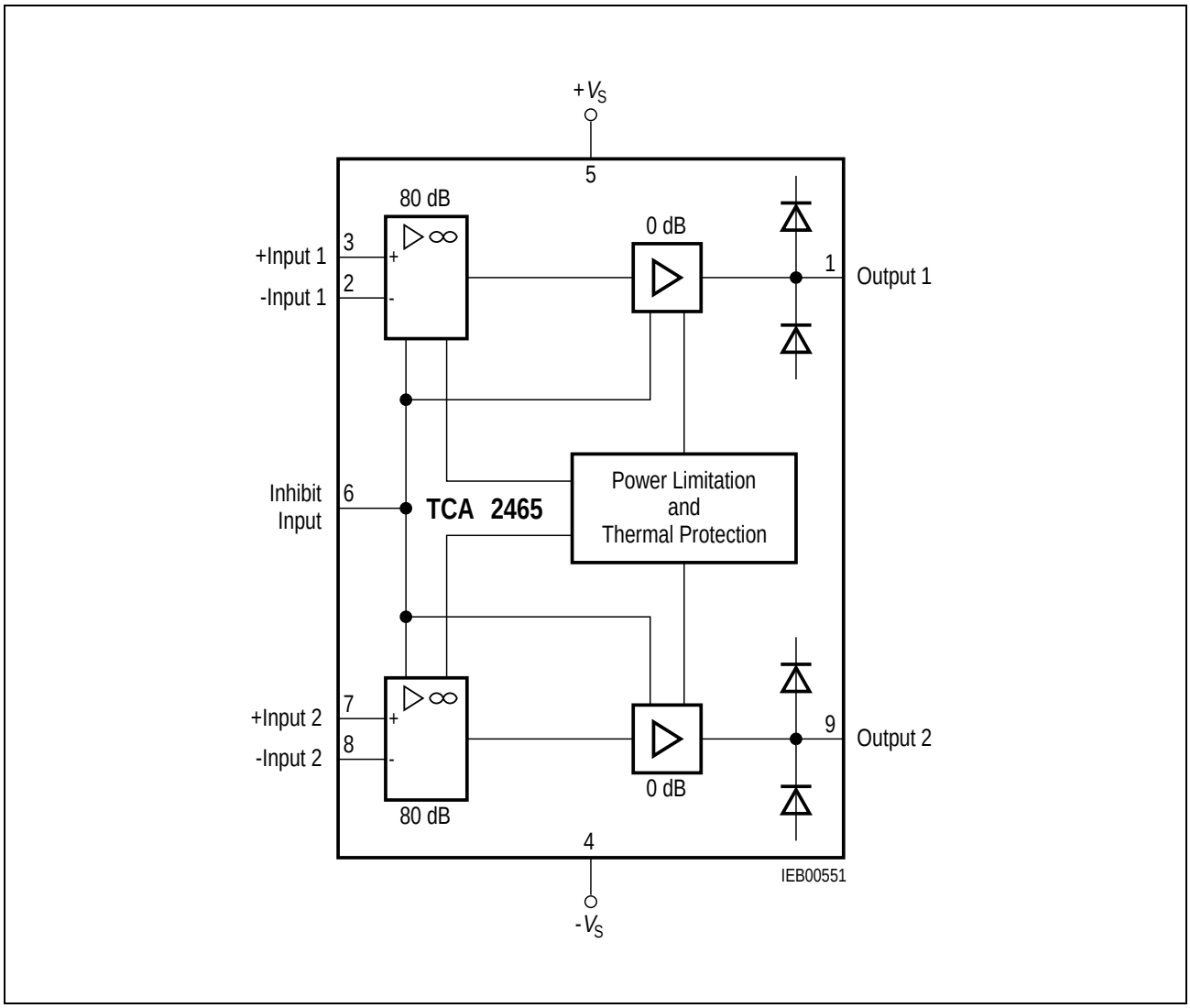


Figure 2 Block Diagram TCA 2465

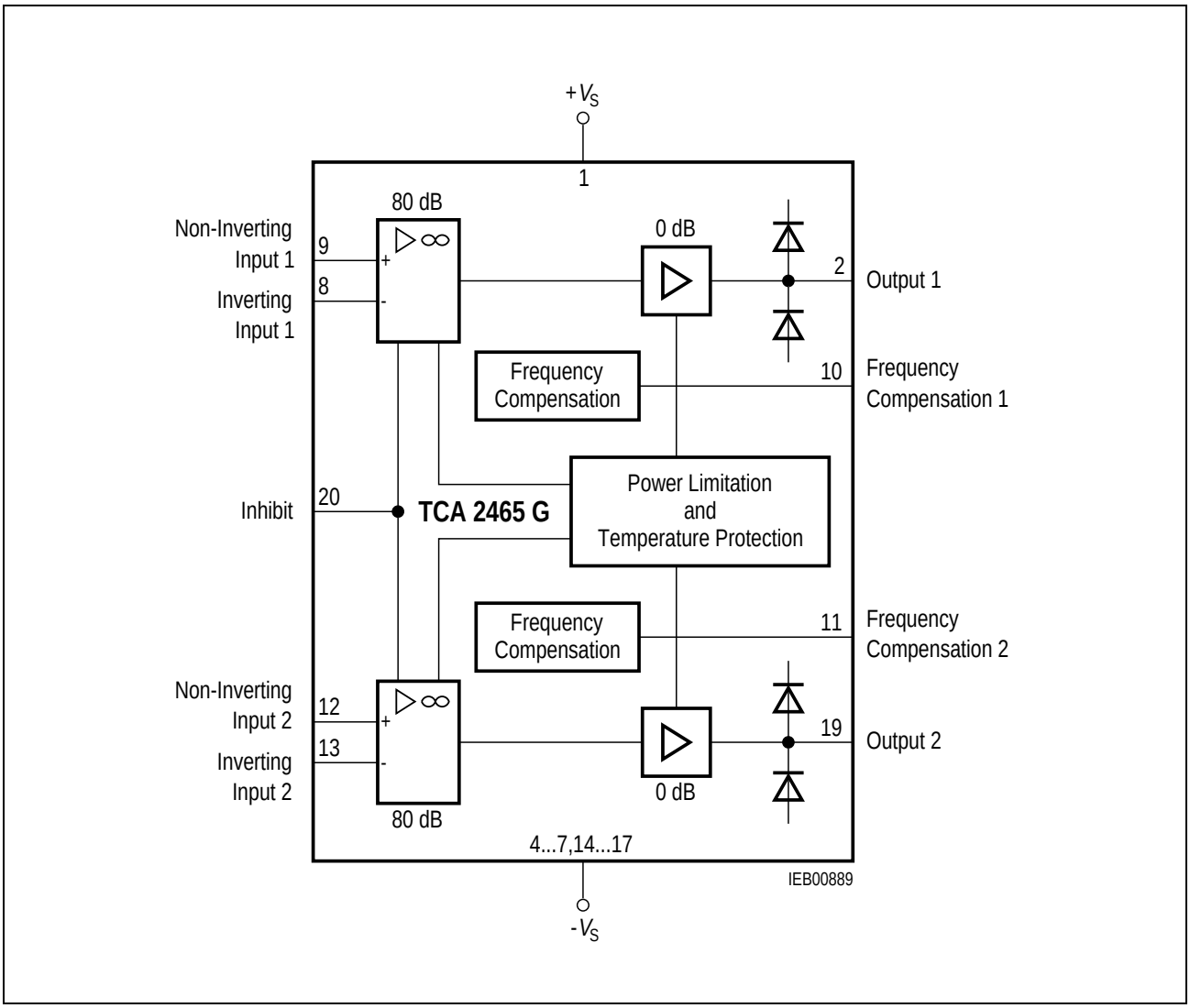


Figure 3 Block Diagram TCA 2465 G

Absolute Maximum Ratings

T_C = – 40 to 85 °C

Note: Values in brackets refer to TCA 2465 G

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Supply voltage	V_S	–	± 21	V	$\Delta V_{2\text{-}3}$ or $\Delta V_{8\text{-}7}$
Differential input voltage	V_{ID}	–	(– V_S) + (V_S)	V	
Output current	I_Q	– 2.5 (– 2)[1]	2.5 (2)[1]	A	I_1 or I_9
Output current	I_Q	– 1.5	–	A	$V_S \geq \pm$ 15 V; $V_Q <$ – V_S
Supply current	I_S	– 5 (– 2)[1]	5.5 (2)[1]	A	I_S
Ground current	I_{GND}	– 5.5 (– 2)[1]	5 (2)[1]	A	I_4
Input voltage	V_I	– V_S	V_S	V	V_2, V_3, V_7, V_8
Inhibit input	V_6	– V_S	V_S	V	
Junction temperature	T_j	–	150	°C	–
Storage temperature range	T_{stg}	– 50	150	°C	

[1] t < 1 ms, f ≤ 400 Hz

Operating Range

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Supply voltage	V_S	± 3	± 20	V	–
Output current	I_Q	(– 1.3)	(1.3)	A	–
Case temperature	T_C	– 40	85	°C	1)
Voltage gain	G_{Vmin}	20	–	dB	–
Forward current I_F of free wheeling diodes	I_F	–	(1.3)	A	–
Thermal resistance junction - ambient junction - case	 $R_{th\ jA}$ $R_{th\ jC}$	 – –	 60 5	 K/W K/W	 P-SIP-9-1 P-SIP-9-1
Thermal resistance junction - ambient junction - case	 $R_{th\ jA}$ $R_{th\ jC}$	 – –	 60 12	 K/W K/W	 P-DIP-16-2 P-DIP-16-2
Thermal resistance junction - ambient junction - case	 $R_{th\ jA}$ $R_{th\ jC}$	 – –	 (70) (22)	 K/W K/W	 (soldered) P-DSO-20-6 P-DSO-20-6

1) P_D = 12 W P-SIP-9-1
P_D = 3.5 W P-DSO-20-6

Characteristics

V_S = ± 10 V; T_j = 25 °C, unless otherwise specified

Note: Values in brackets refer to TCA 2465; G

Parameter	Symbol	Limit Values			Unit	Test Circuit
		min.	typ.	max.		
Open-loop supply current consumption S1 in position 1	I_S	–	–	5	mA	1; 12
S1 in position 2	I_S	–	30	50	mA	1; 12
Input offset voltage	V_{IO}	– 10	–	10	mV	2; 13
Input offset current	I_{IO}	– 100	–	100	nA	3; 14
Input current	I_I	–	0.25	1	µA	3; 14
Output voltage						
R_L = 12 Ω; f = 1 kHz	$V_{Q\ pp}$	± 8.5	± 9	–	V	4; 15
R_L = 4 Ω; f = 1 kHz[1)]	$V_{Q\ pp}$	± 8	± 8.5	–	V	4; 15
R_L = 470 Ω; f = 40 kHz	$V_{Q\ pp}$	–	± 8	–	V	4; 15
Input resistance f = 1 kHz	R_I	1	5	–	MΩ	4; 15
Open-loop voltage gain f = 100 kHz	G_{VO}	70	80	–	dB	5; 16
Common-mode input voltage range	V_{IC}	7/– 10	± 7.5/– 10.5	–	V	6; 17
Common-mode rejection	k_{CMR}	70	80	–	dB	6; 17
Supply voltage rejection	k_{SVR}	– 70	– 80	–	dB	7; 18
Temperature coefficient of V_{IO} – 40 °C ≤ T_j ≤ + 85 °C	α_{VIO}	–	50	–	µV/K	2; 13
Temperature coefficient of I_{IO} – 40 °C ≤ T_j ≤ + 85 °C	α_{IIO}	–	0.4	–	nA/K	3; 14
Slew rate of V_Q for non-inverting operation	SR	–	2 (0.5)	–	V/µs	8; 19
Slew rate of V_Q for inverting operation	SR	–	2 (0.5)	–	V/µs	9; 20
Noise voltage (DIN 45405, referred to input)	V_n	–	3	–	µV	1; 12
Inhibit input (referred to – V_S)						
V_6 for IC turned OFF	$V_{6\ OFF}$	2	–	–	V	1; 12
V_6 for IC turned ON	$V_{6\ ON}$	–	–	0.8	V	1; 12

Characteristics (cont'd)
V_S = ± 10 V; T_j = 25 °C, unless otherwise specified

Note: Values in brackets refer to TCA 2465; G

Parameter	Symbol	Limit Values			Unit	Test Circuit
		min.	typ.	max.		
H-input current, V_6 = 5 V[2]	I_{6H}	–	0.1	0.5	µA	1; 12
L-input current, V_6 = 0 V[2]	I_6	–	0.5	3	µA	1; 12
Turn-ON dead time I $I_{1;9}$ I > A[3] referred to $V_{6\ OFF/ON}$	$t_{D\ ON}$	–	10	20	µs	1; 12
Turn-OFF dead time I $I_{1;9}$ I < 1 A[3] referred to $V_{6\ OFF/ON}$	$t_{D\ OFF}$	–	10	20	µs	1; 12
Short-circuit current[4] (switch S3 closed)	I_{SC}	–	1	–	A	1; 12
Short-circuit current[4] (switch S4 closed)	I_{SC}	–	1	–	A	1; 12

1) Only for P-SIP-9-1
2) Referred to – V_S
3) Switch S2 closed
4) Only for P-SIP-9-1, for P-DSO-20-6 $V_S \leq \pm$ 7 V

Test Circuits

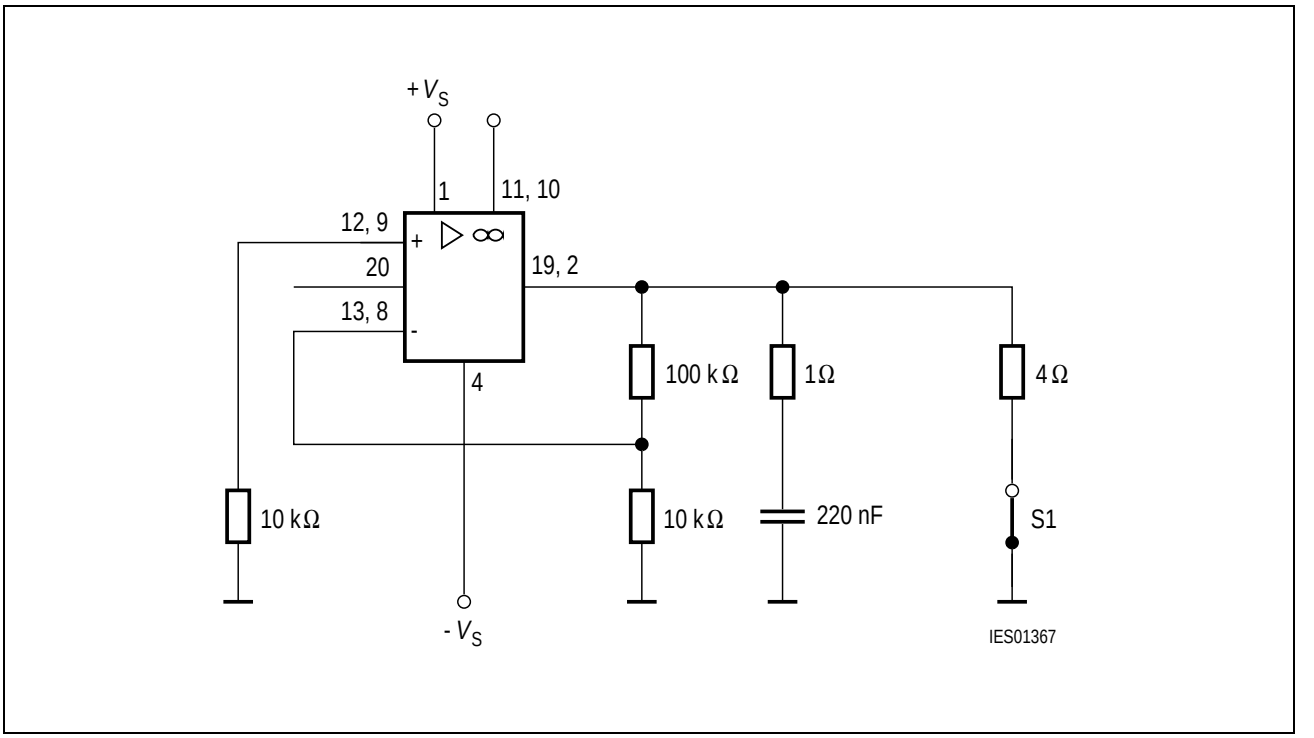


Figure 4 Open-Loop Supply Current Consumption; Noise Voltage (TCA 2465 G)

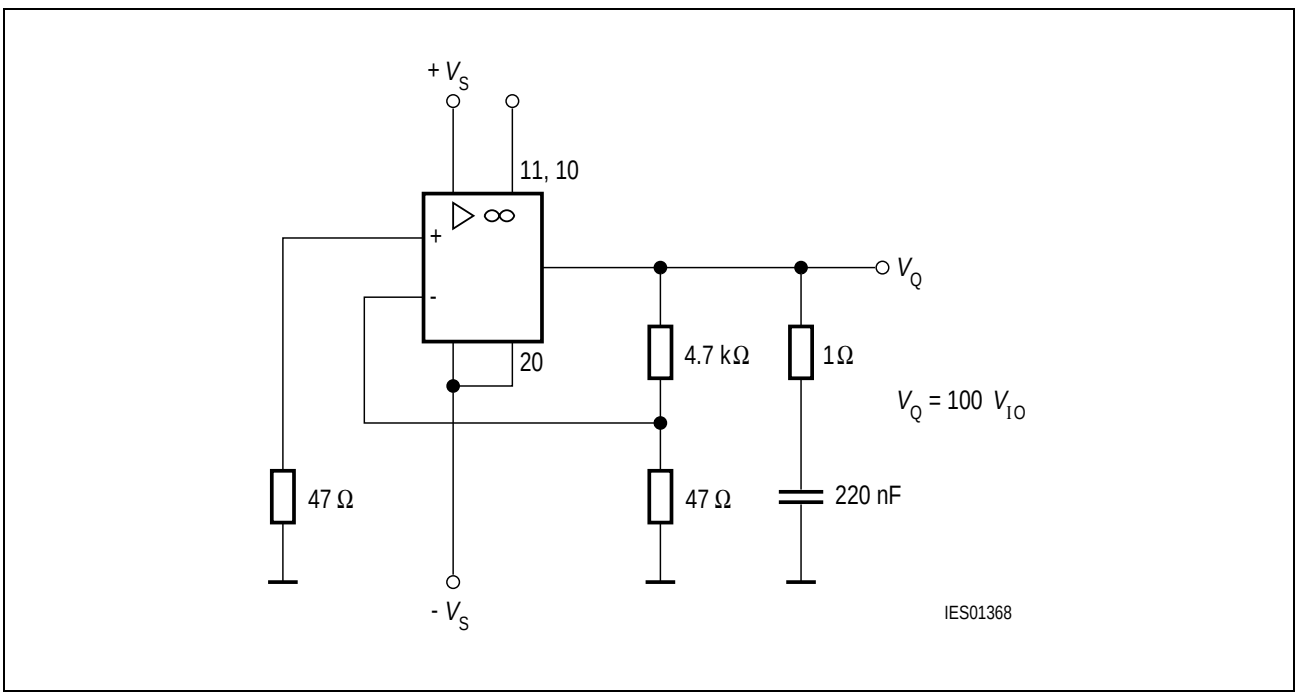


Figure 5 Input Offset Voltage; Temperature Coefficient of V_{IO} (TCA 2465 G)

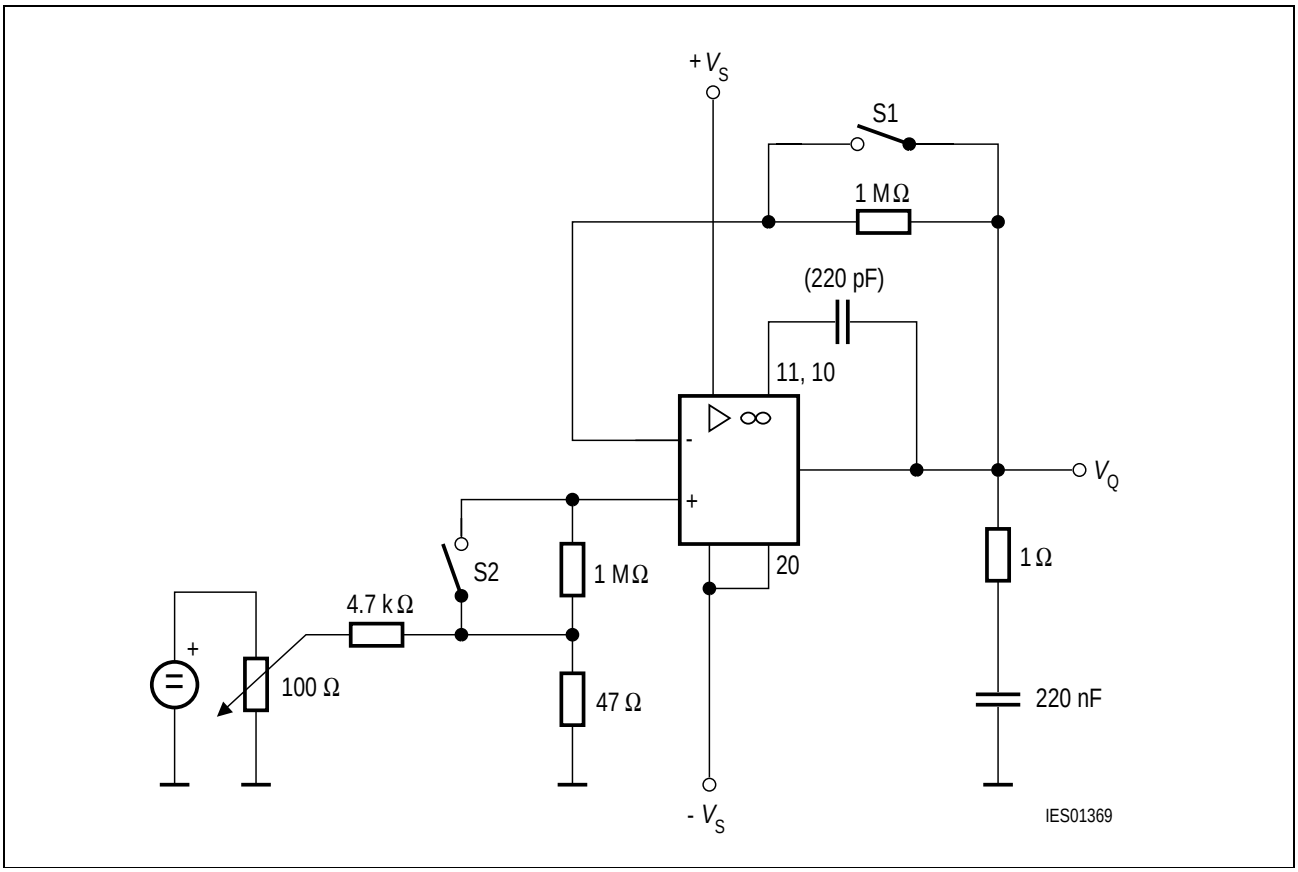


Figure 6 Input Offset Current; Input Current; Temperature Coefficient of I_{IO} (TCA 2465 G)

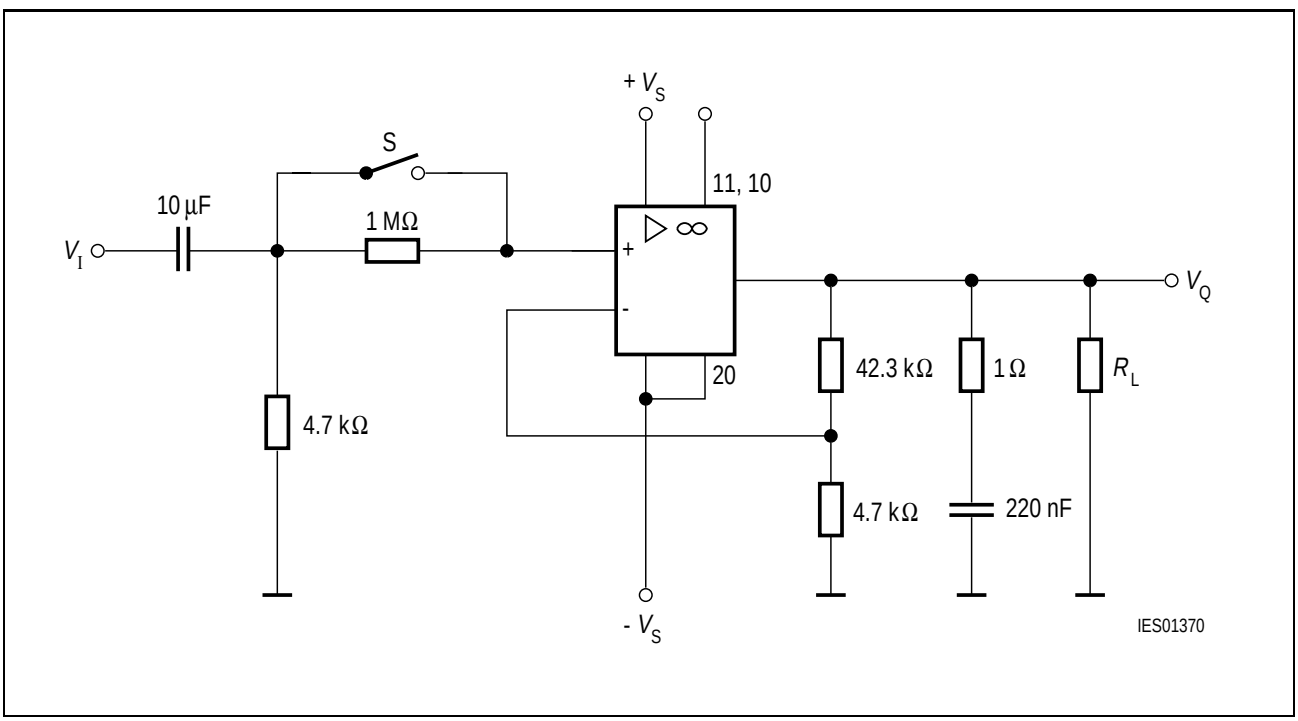


Figure 7 Output Voltage; Input Resistance (TCA 2465 G)

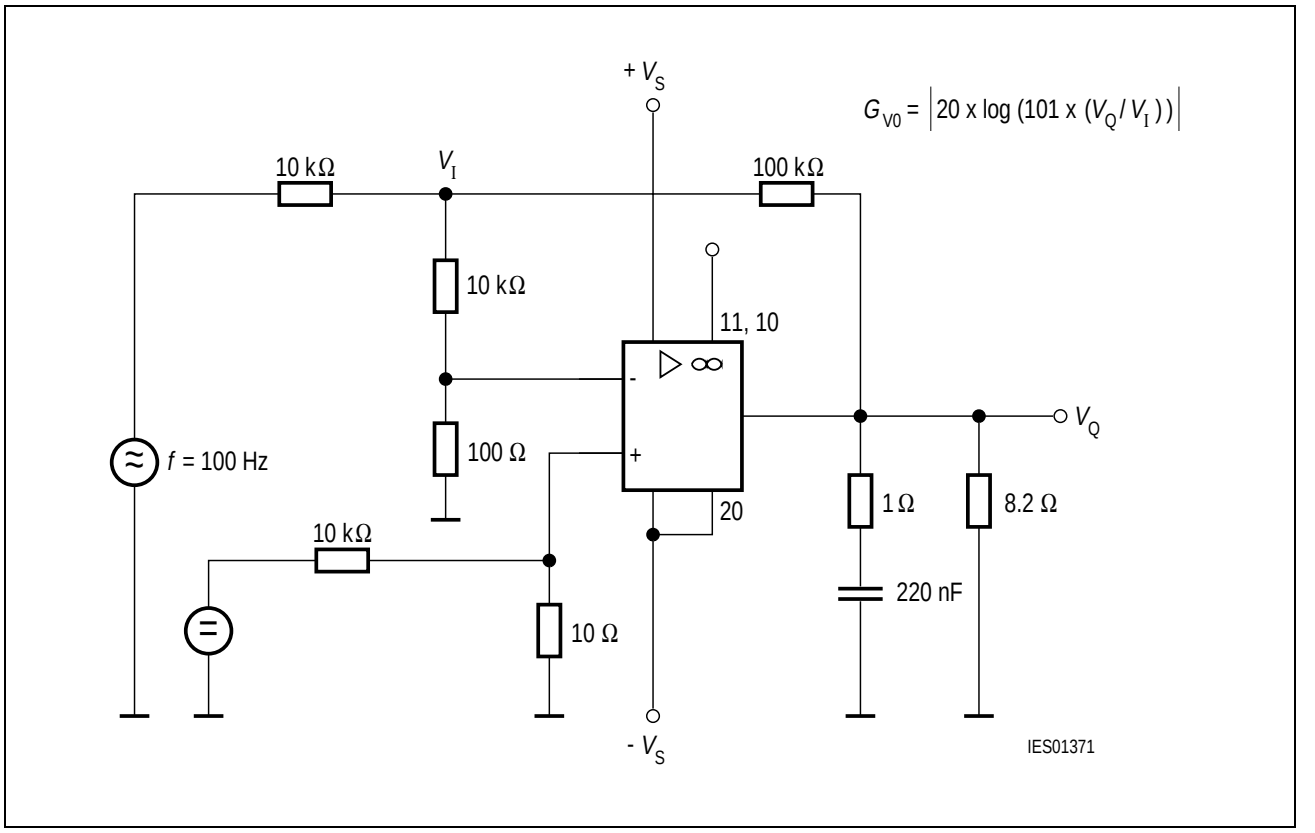


Figure 8 Open-Loop Voltage Gain G_{VO} (TCA 2465 G)

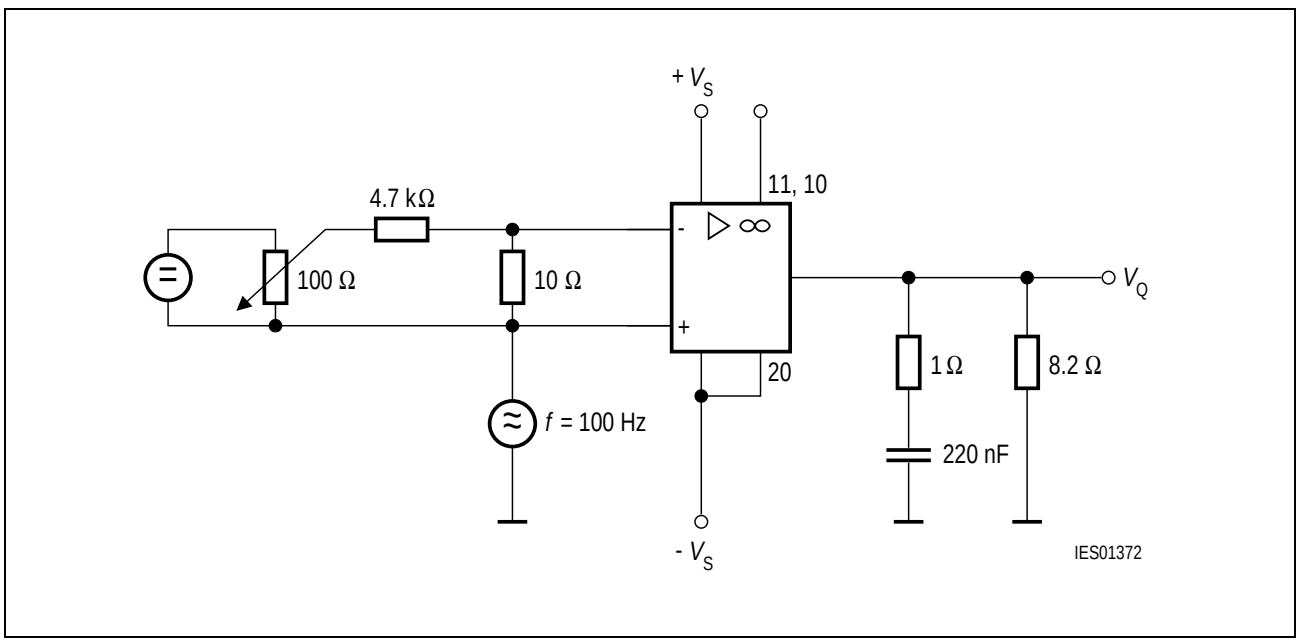


Figure 9 Common Mode Voltage Gain G_{VC}
Common-Mode Rejection
k_{CMR} (dB) = G_{VO} (dB) – G_{VC} (dB) (TCA 2465 G)

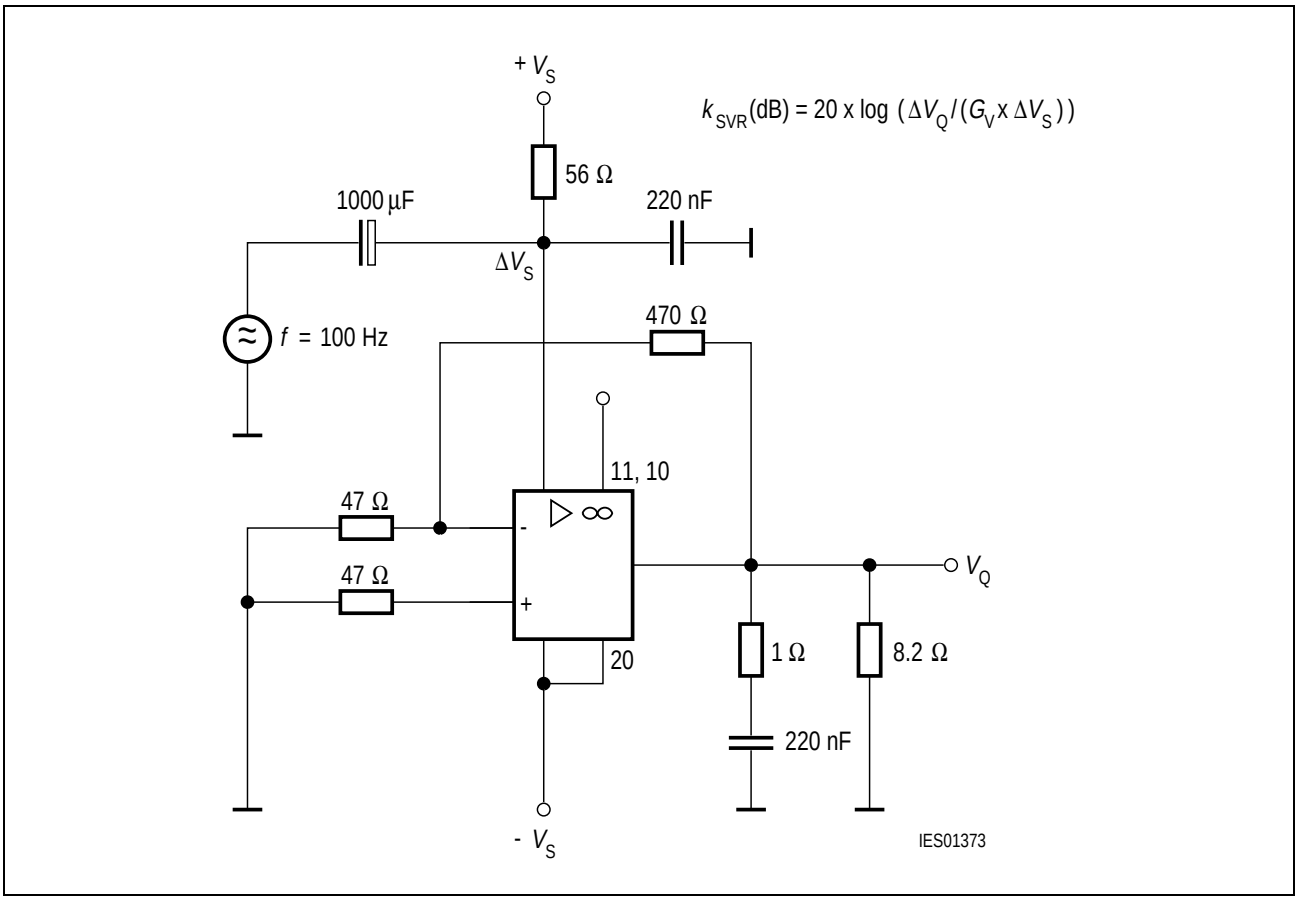


Figure 10 Supply Voltage Rejection k_{SVR} (TCA 2465 G)

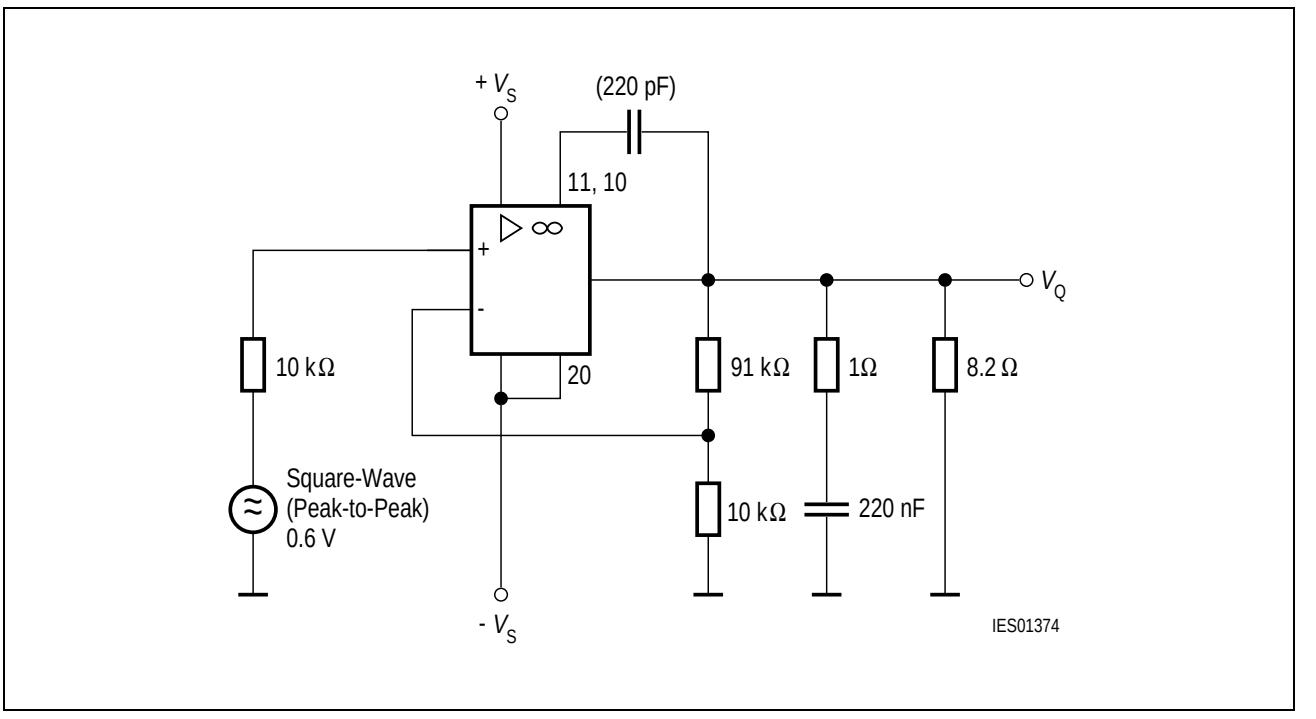


Figure 11 Slew Rate for Non-Inverting Operation (TCA 2465 G)

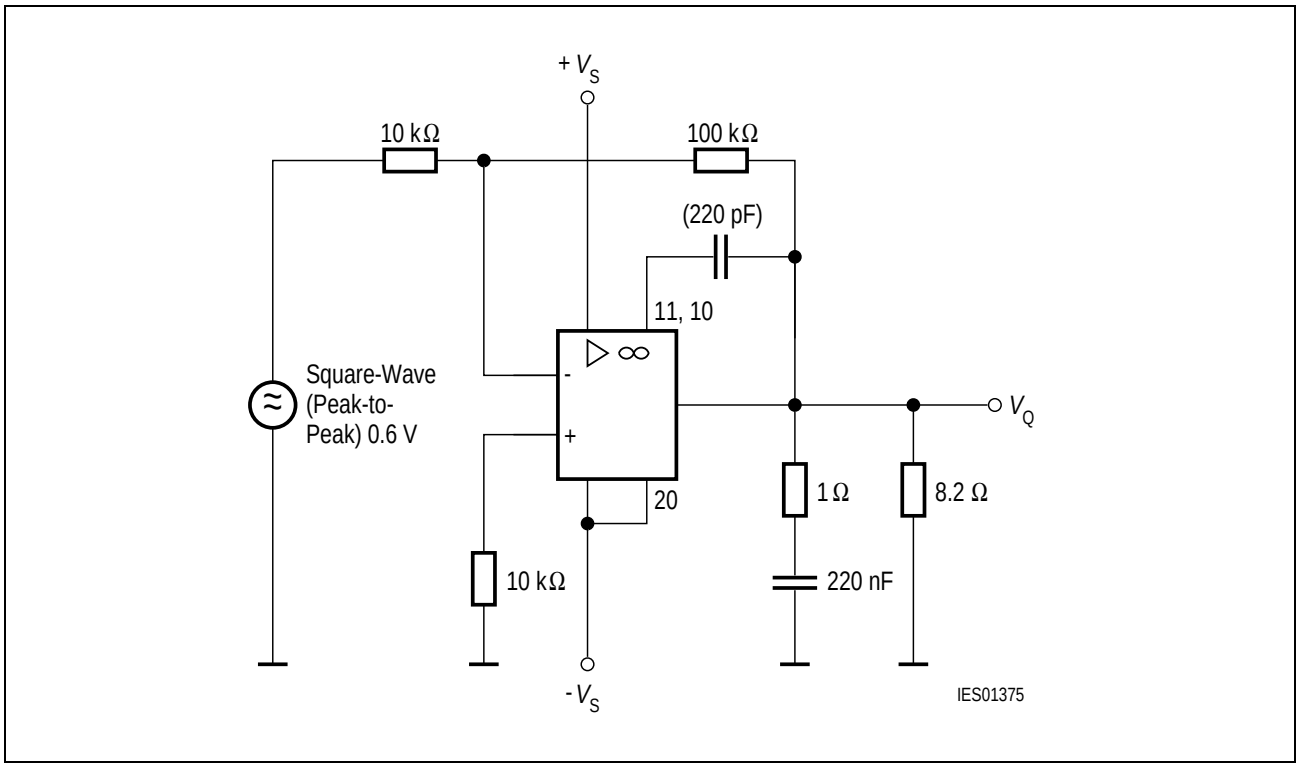
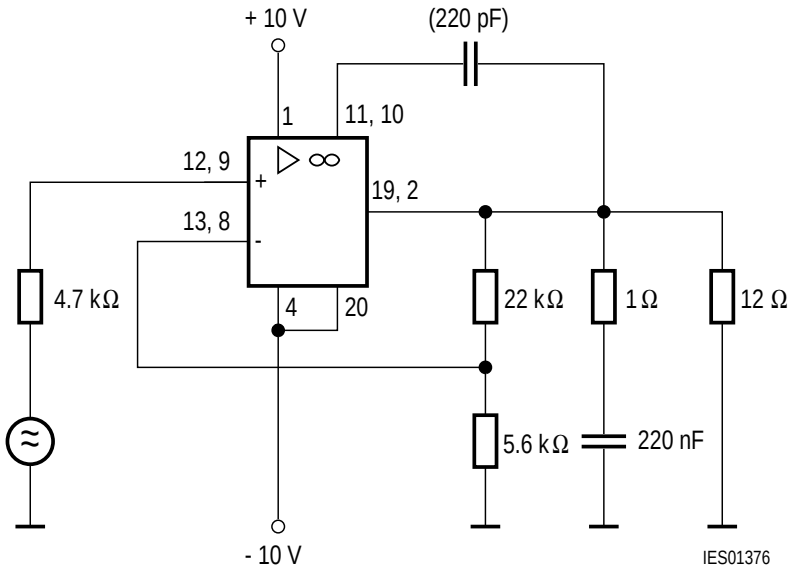


Figure 12 Slew Rate for Inverting Operation (TCA 2465 G)

a) Amplifier; G_V = 5



b) Voltage follower TCA 2465 G

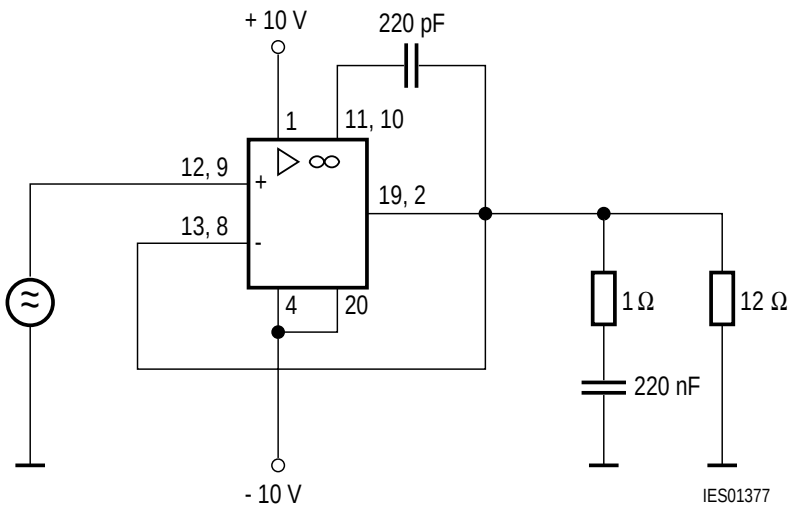
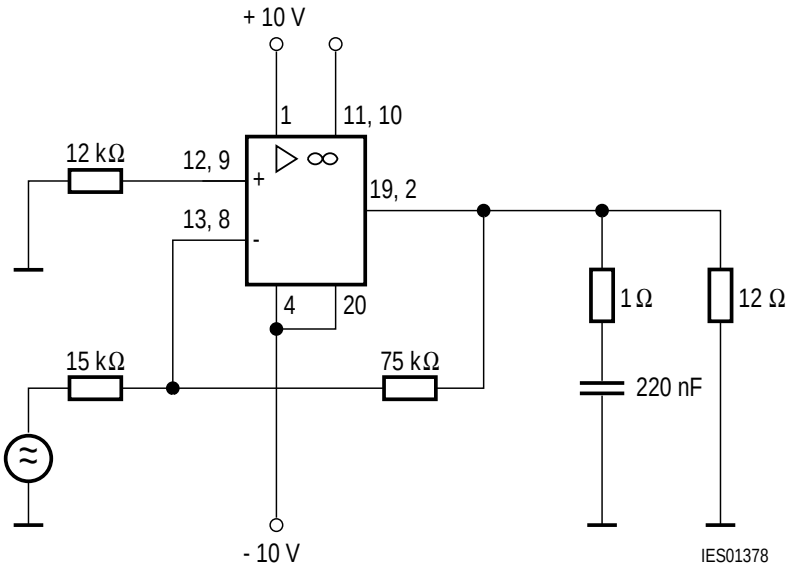


Figure 13 Non-Inverting Operation (TCA 2465 G)

a) Amplifier; $G_V = -5$



b) Inverter TCA 2465 G

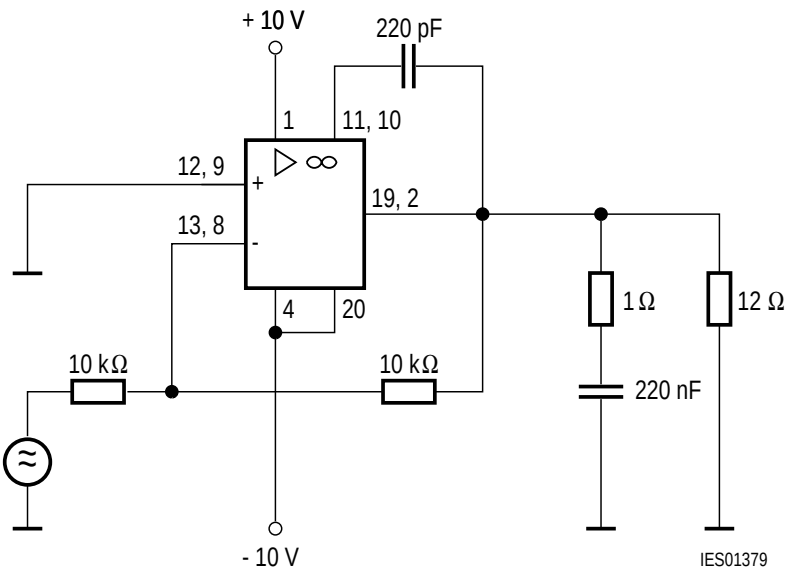


Figure 14 Inverting Operation (TCA 2465 G)

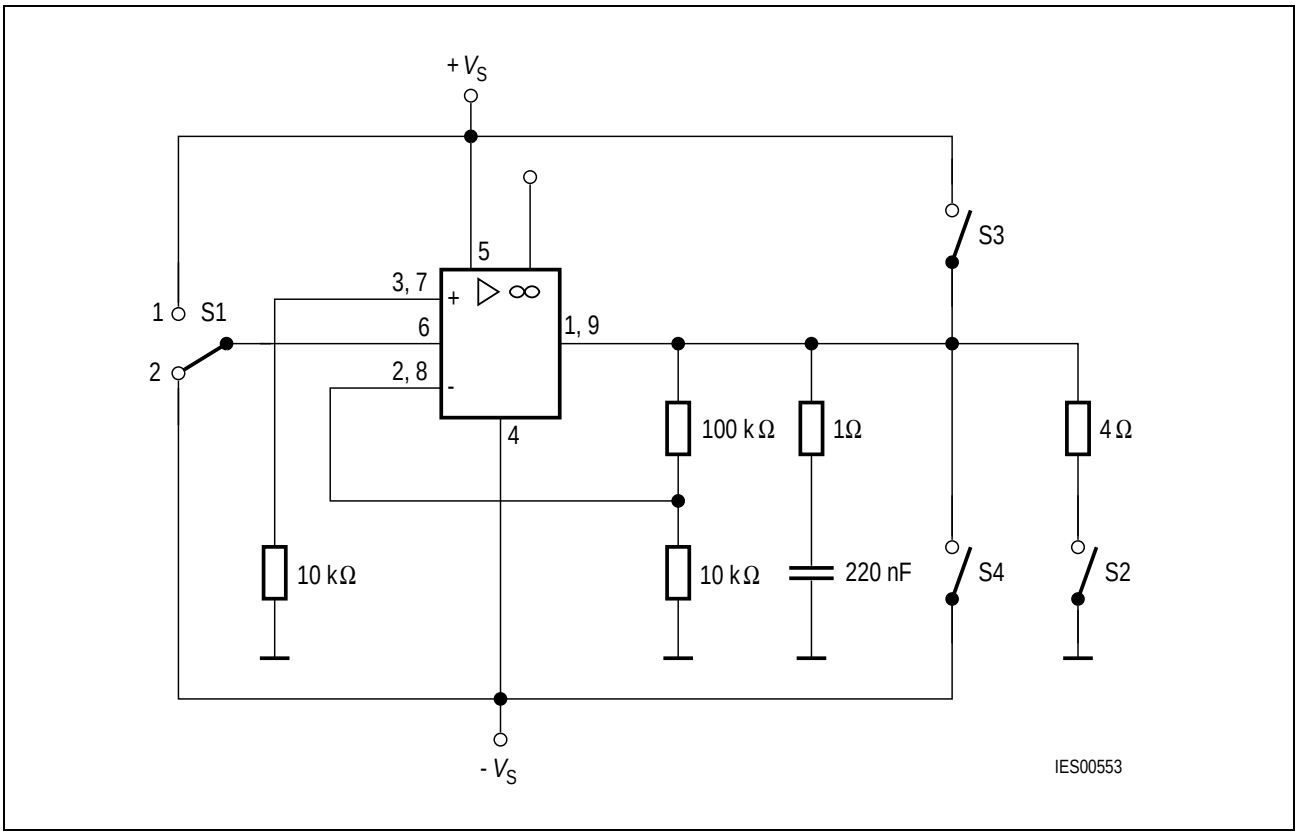


Figure 15 Open-Loop Supply Current Consumption; Noise Voltage (TCA 2465/A)

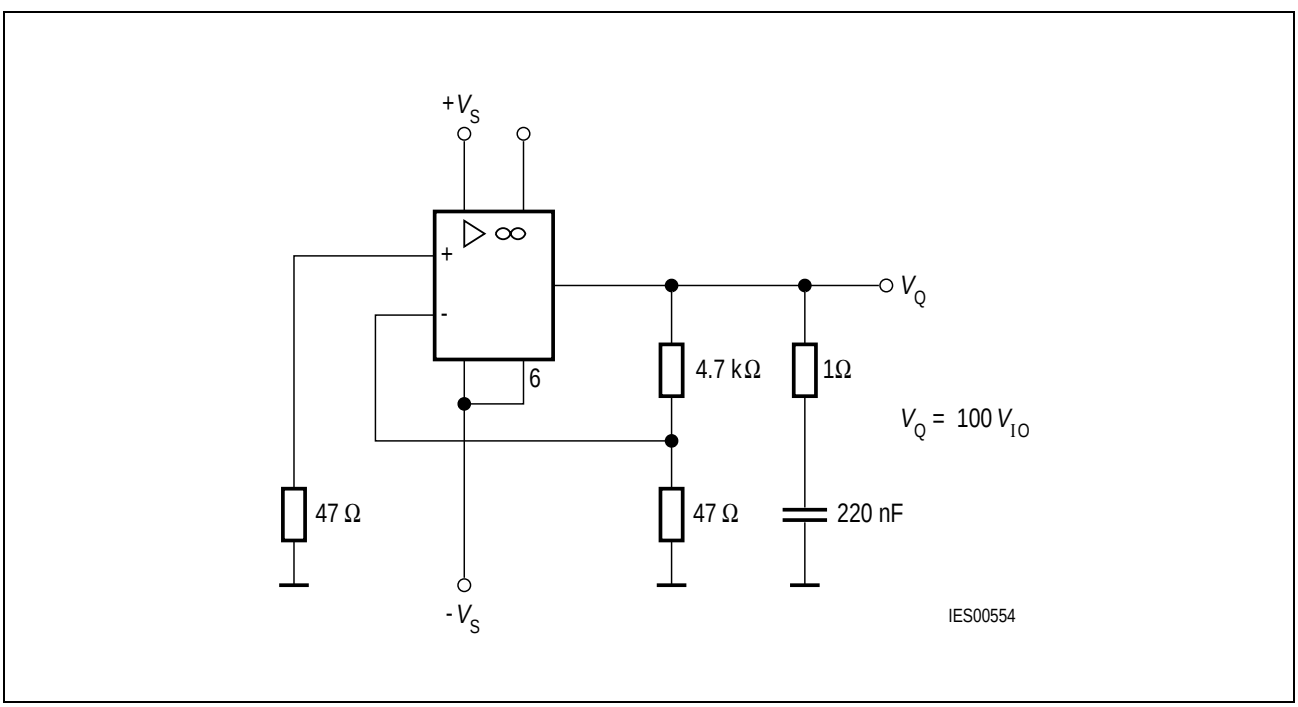


Figure 16 Input Offset Voltage; Temperature Coefficient of V_{IO} (TCA 2465/A)

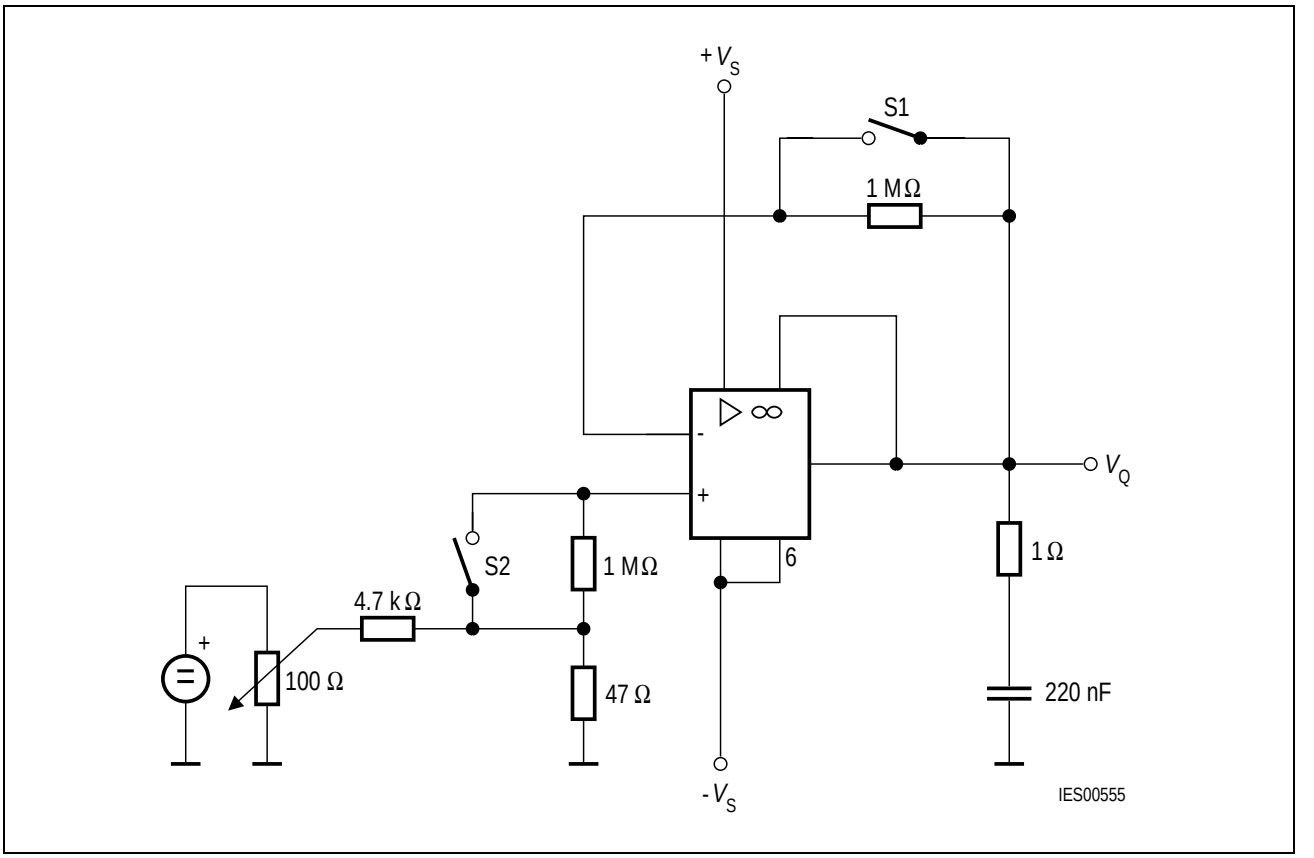


Figure 17 Input Offset Current; Input Current; Temperature Coefficient of I_{IO} (TCA 2465)

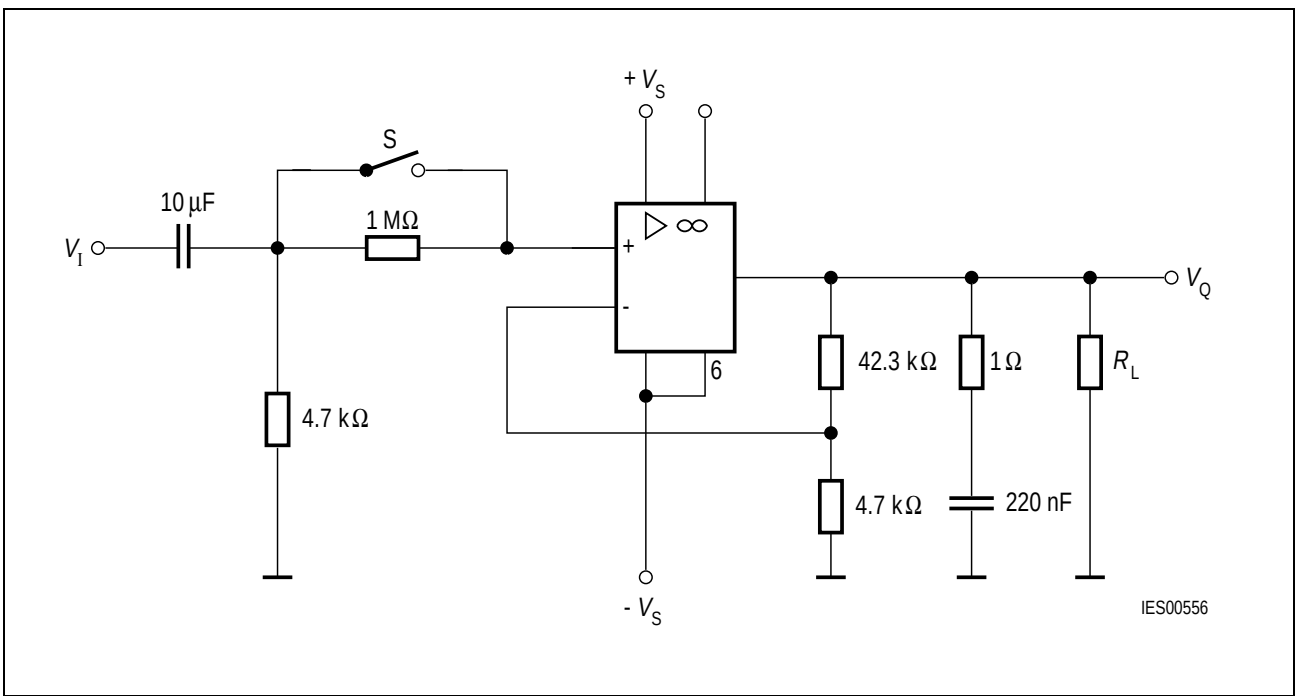


Figure 18 Output Voltage; Input Resistance (TCA 2465)

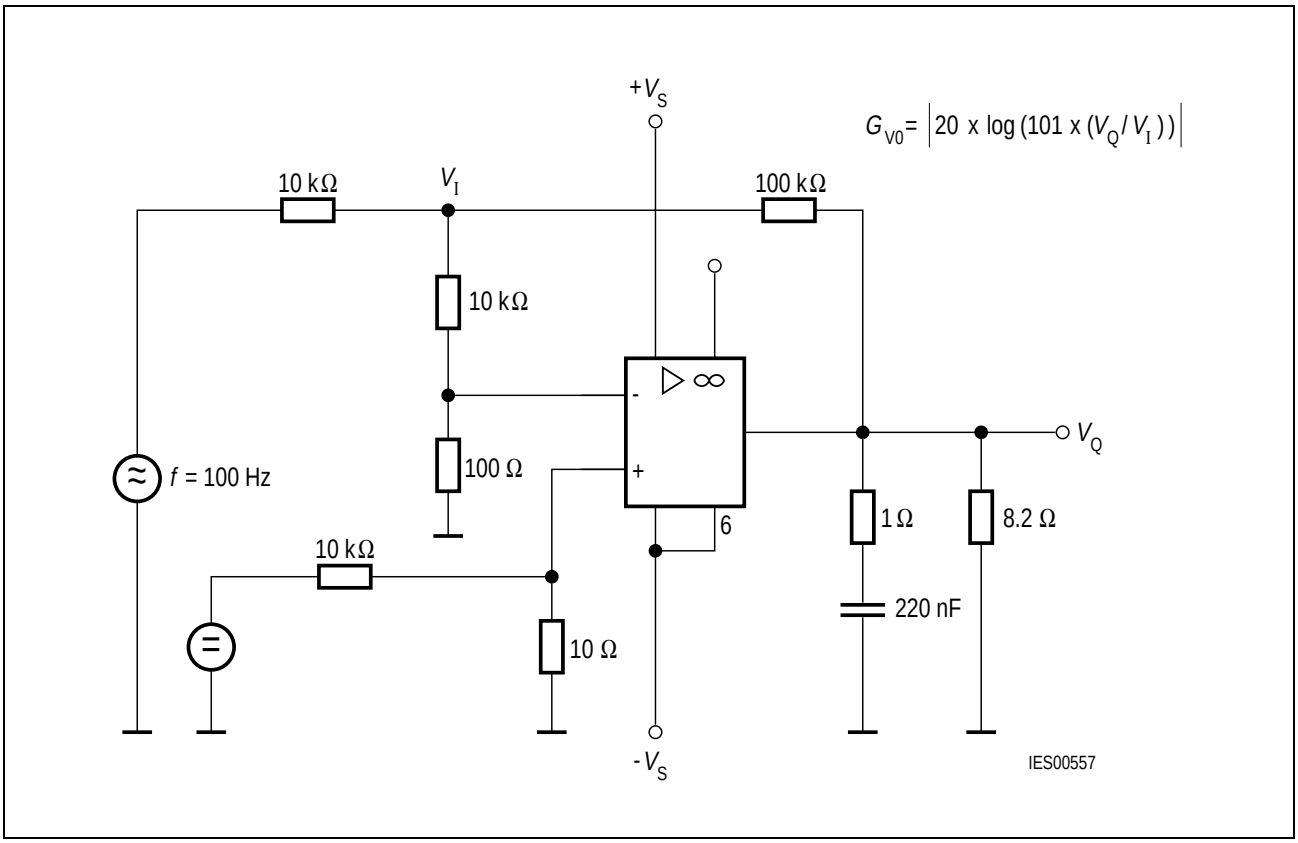


Figure 19 Open-Loop Voltage Gain G_{VO} (TCA 2465)

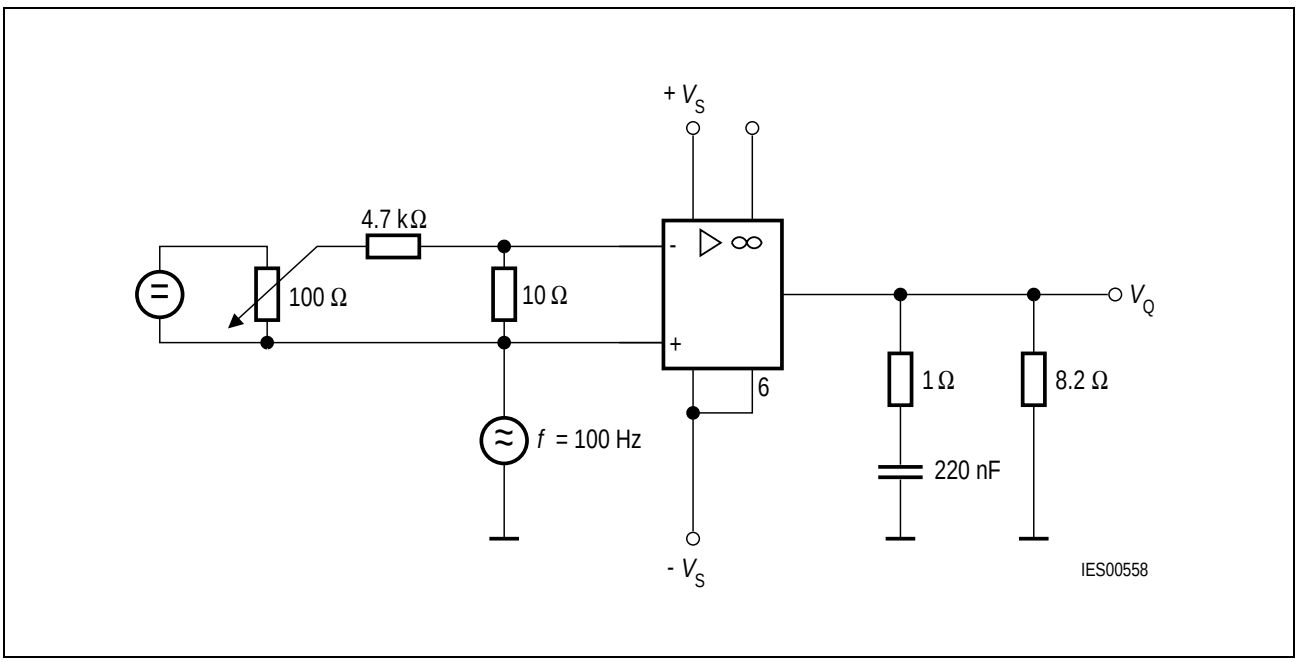


Figure 20 Common Mode Voltage Gain G_{VC}
Common-Mode Rejection k_{CMR} (dB) = G_{VO} (dB) – G_{VC} (dB) (TCA 2465/A)

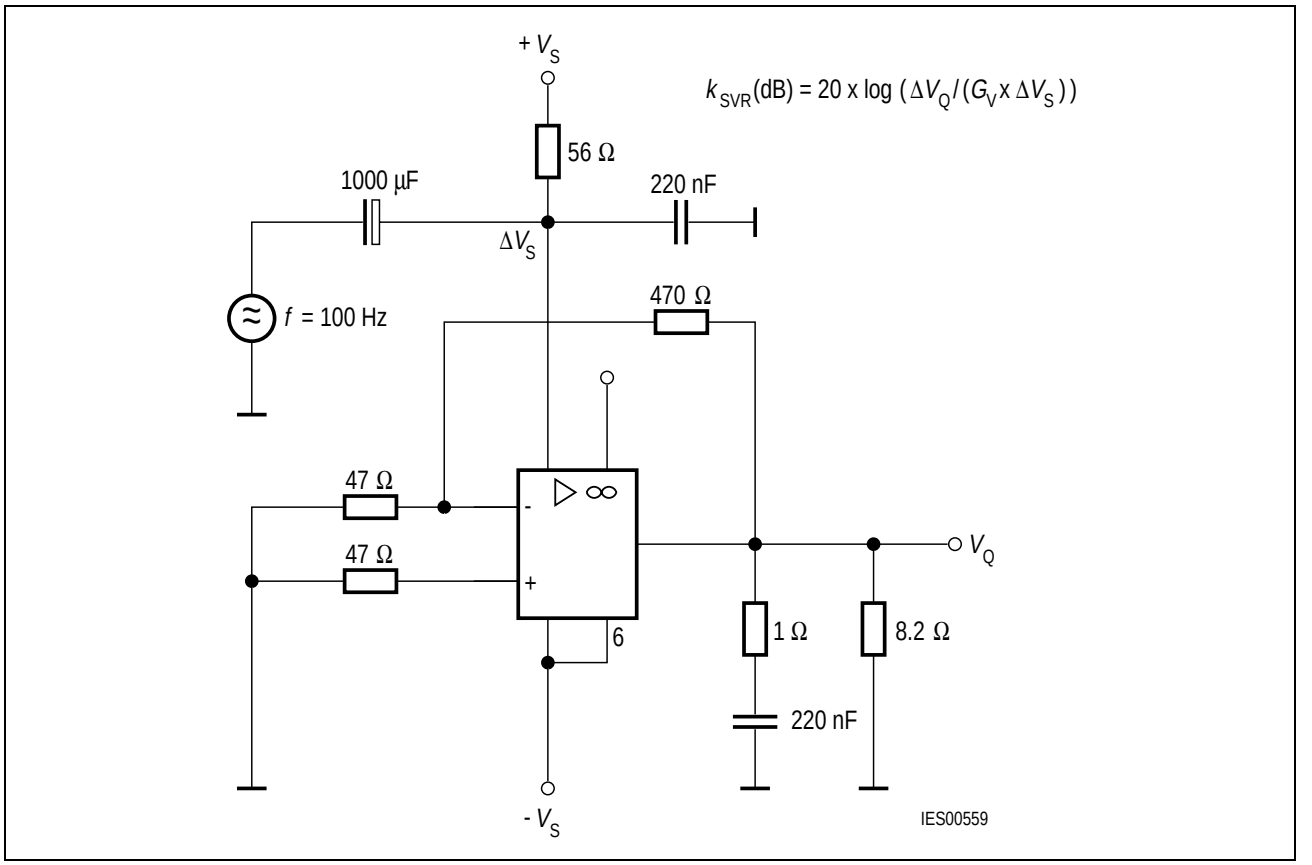


Figure 21 Supply Voltage Rejection k_{SVR} (TCA 2465)

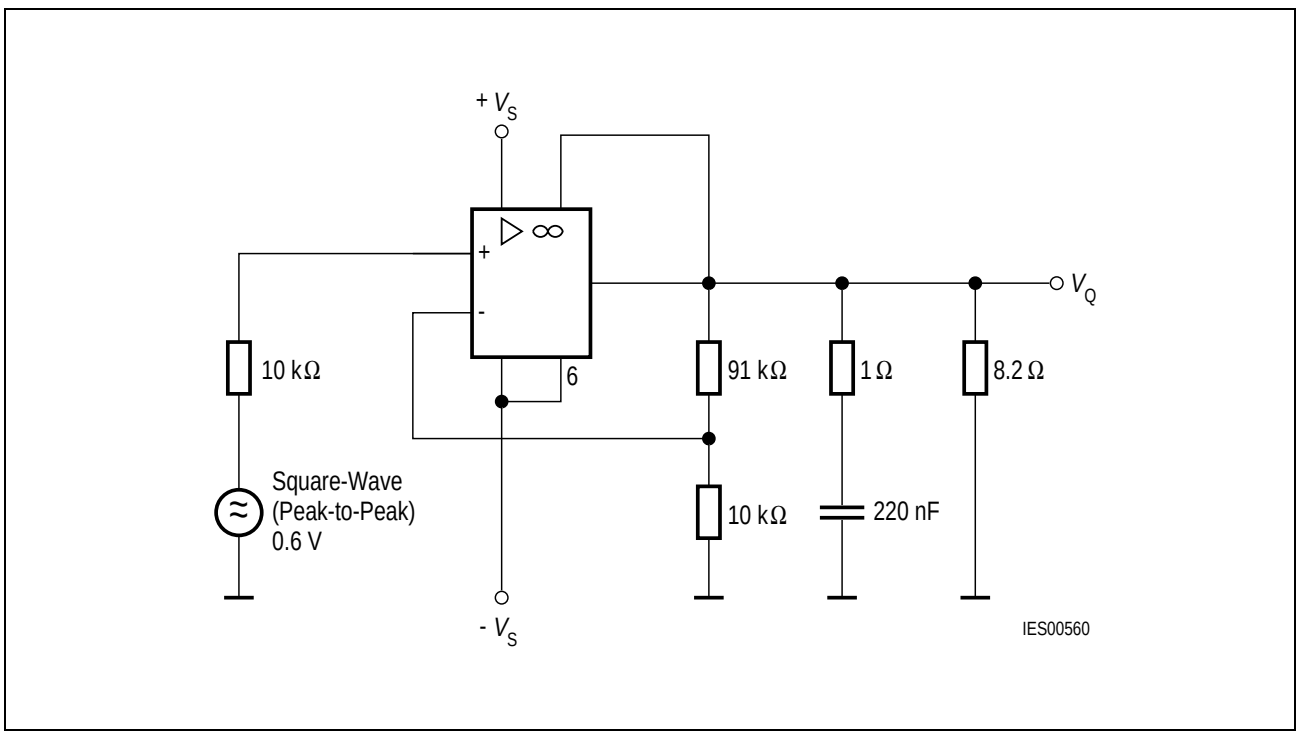


Figure 22 Slew Rate for Non-Inverting Operation (TCA 2465)

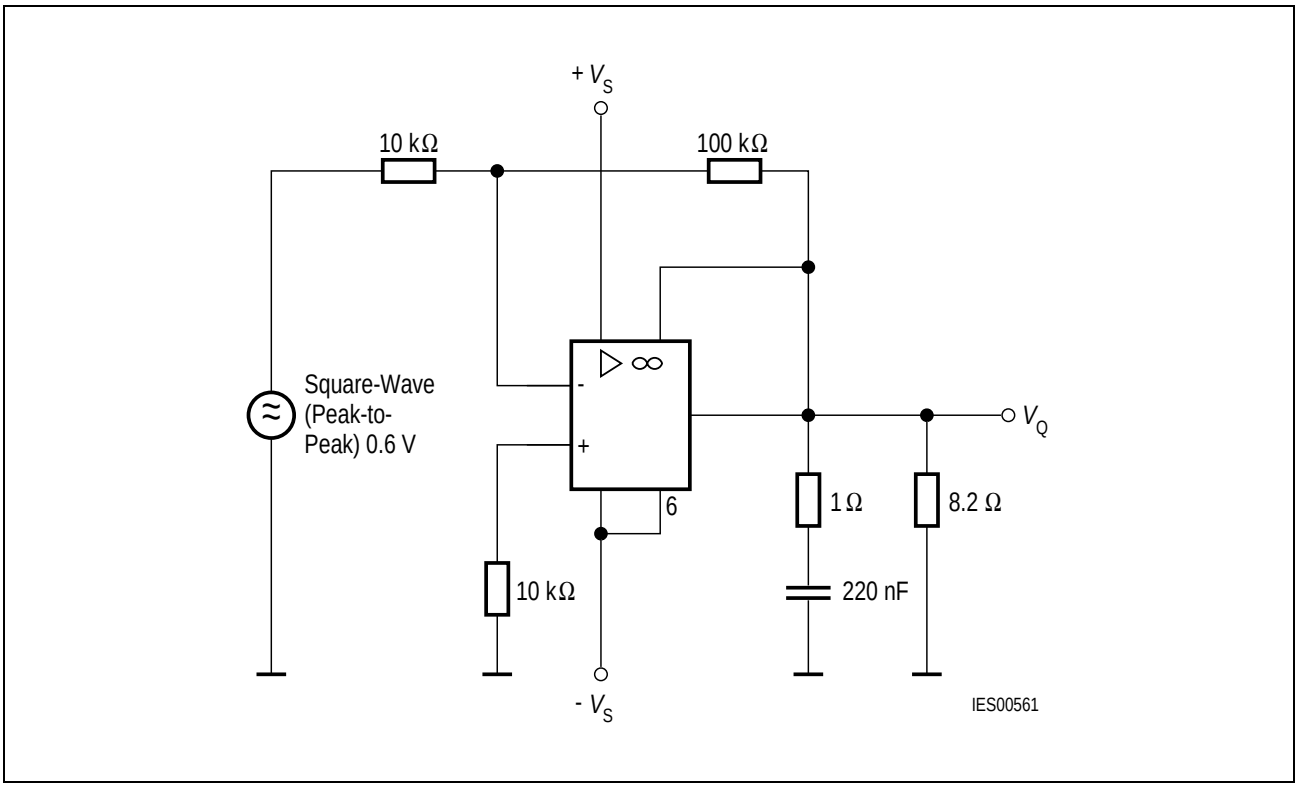


Figure 23 Slew Rate for Inverting Operation (TCA 2465)

Note: Values in brackets refer to TCA 2465 A

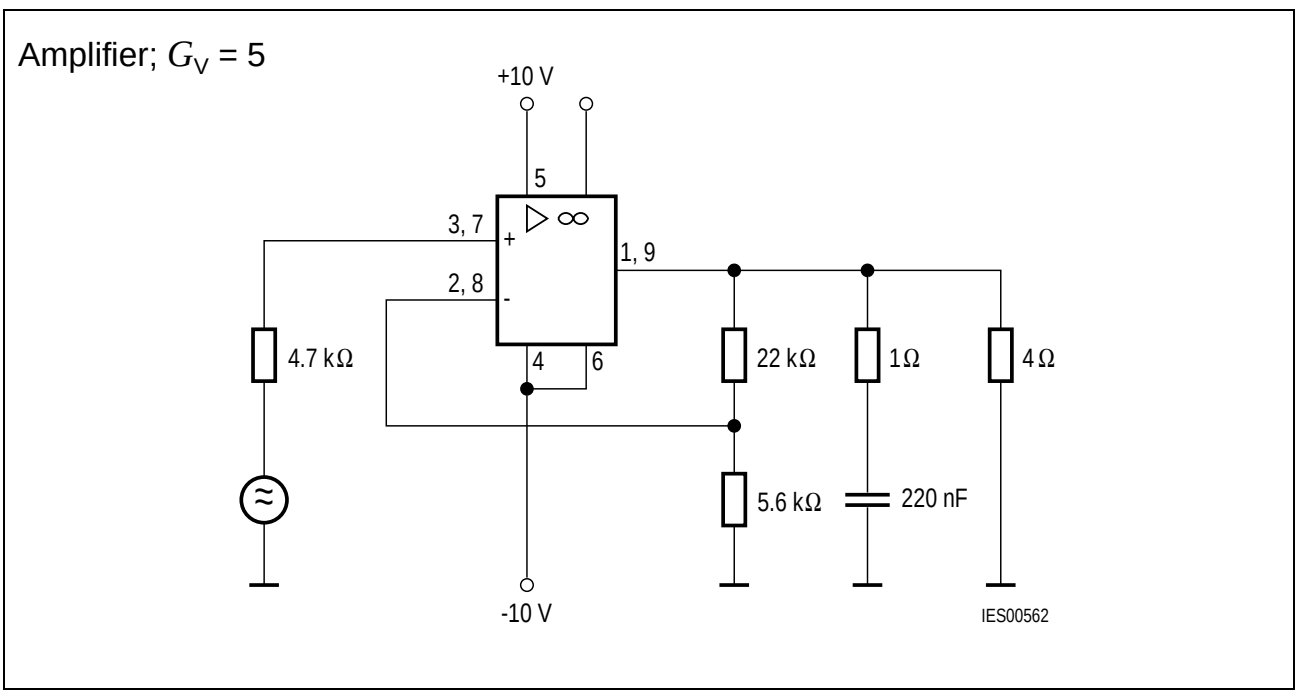


Figure 24 Non-Inverting Operation (TCA 2465)

Amplifier; $G_V = -5$

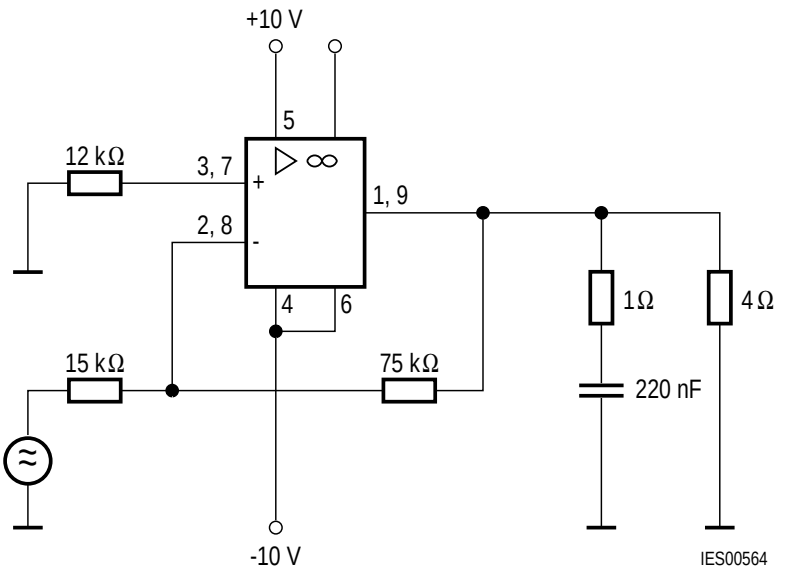
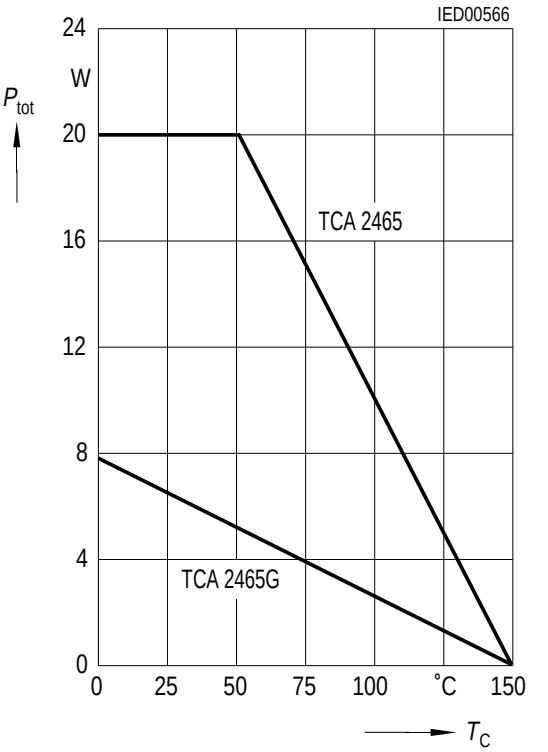


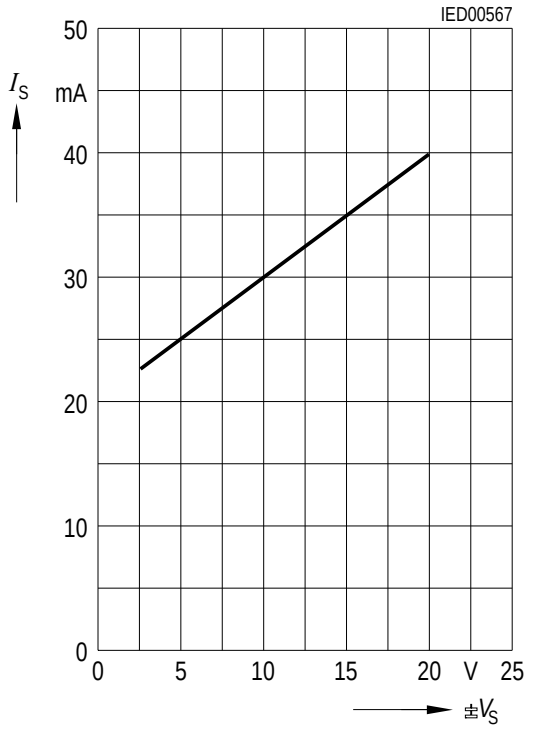
Figure 25 Inverting Operation (TCA 2465)

Safe Operating Area (SOA) Peak Output Current versus Collector-Emitter Voltage
T_j = 25 °C, $V_{CE} = + V_S - V_Q$ or $V_{CE} = - V_S - V_Q$

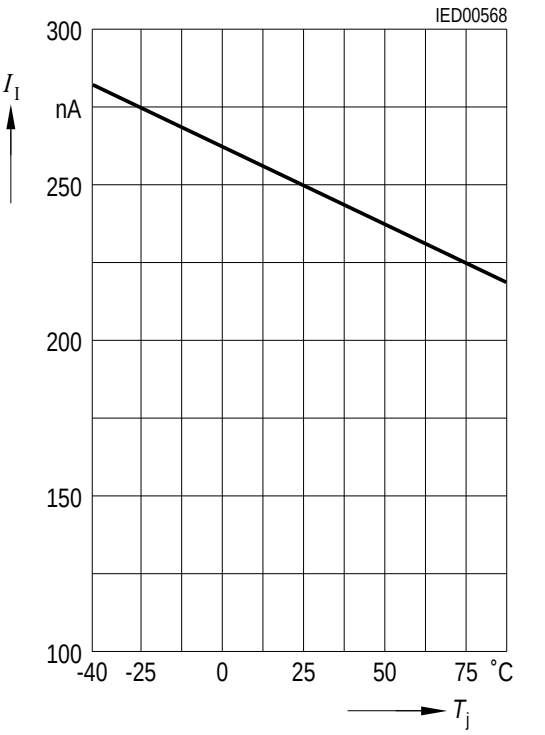
Max. Permissible Power Dissipation versus Case Temperature



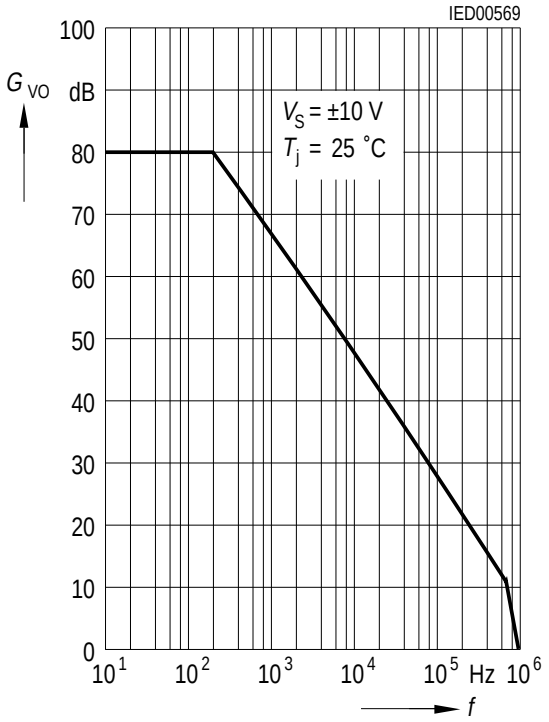
Supply Current versus Supply Voltage T_j = 25 °C



Input Current versus Junction Temperature V_S = ± 10 V

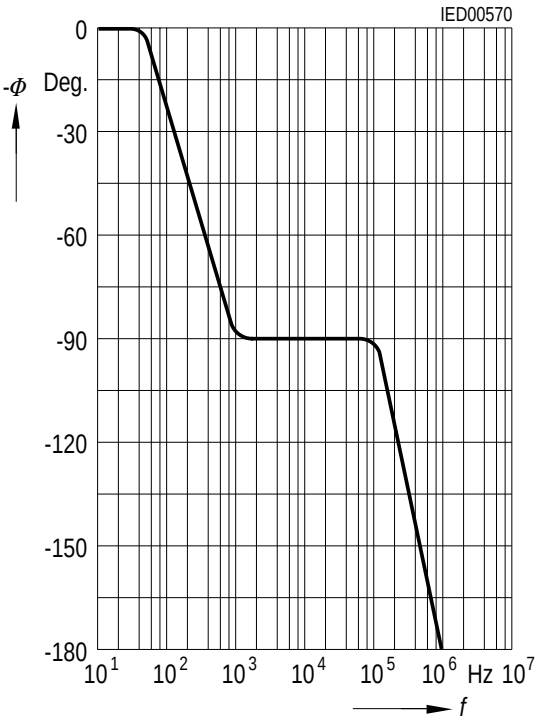


Open-Loop Voltage Gain versus Frequency



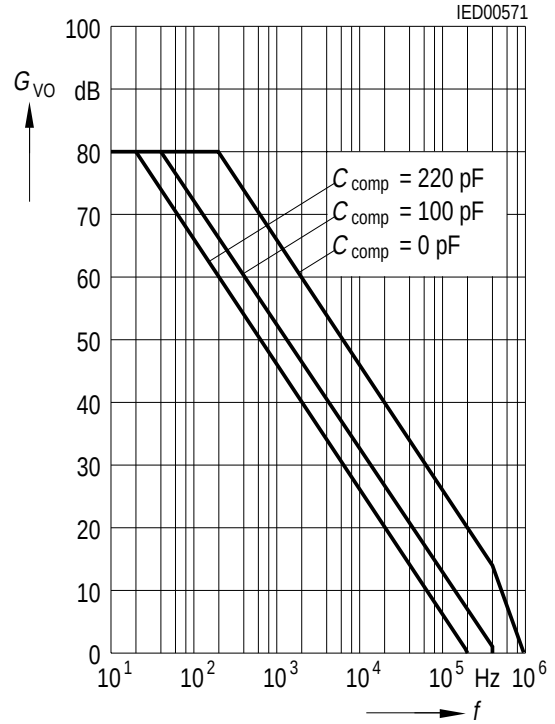
Phase Response versus Frequency

V_S = ± 10 V; T_j = 25 °C



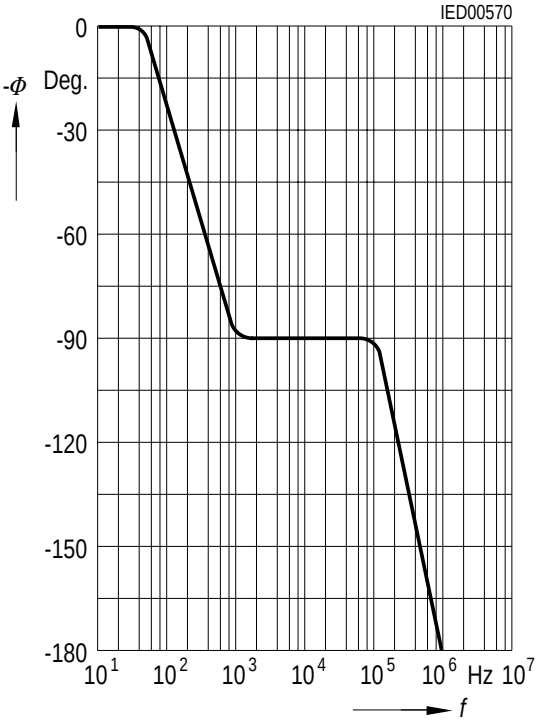
TCA 2465, G Open-Loop Voltage Gain versus Frequency

V_S = ± 10 V, T_j = 25 °C



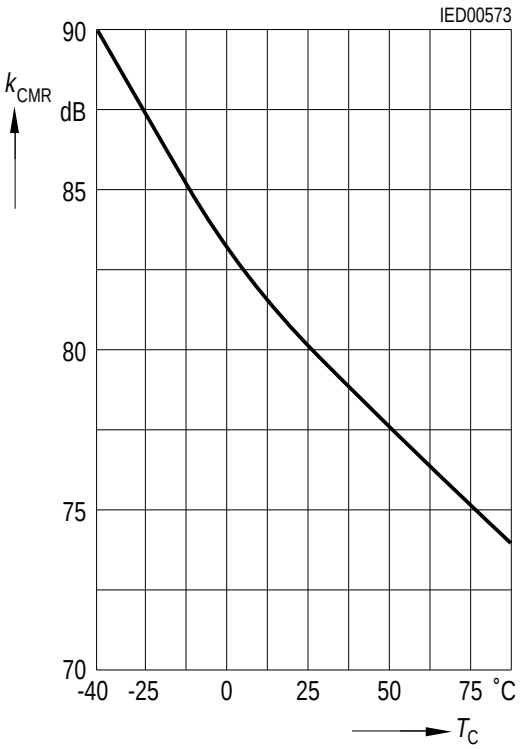
TCA 2465, G Phase Response versus Frequency

V_S = ± 10 V, T_j = 25 °C



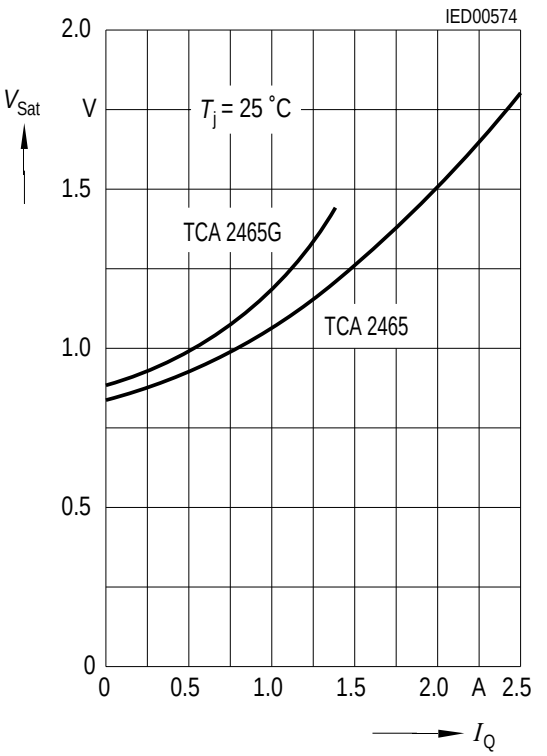
Common-Mode Rejection versus Case Temperature

$V_S = \pm 10$ V

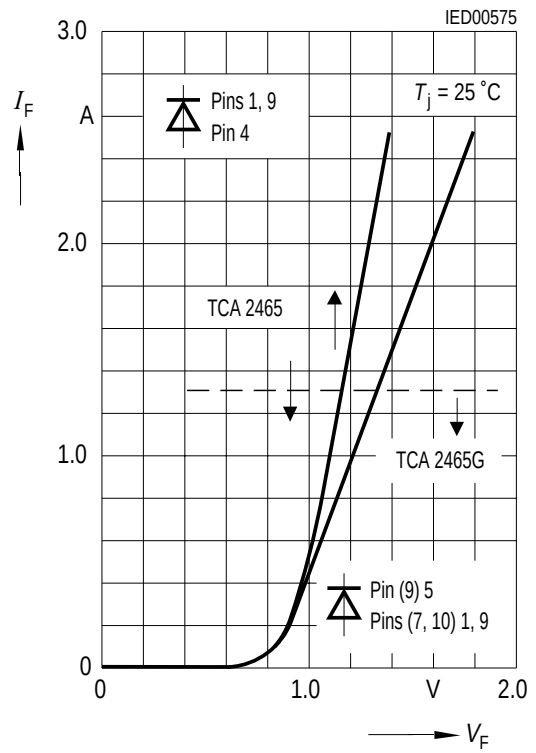


Saturation Voltage versus Peak Output Current

$T_j = 25$ °C

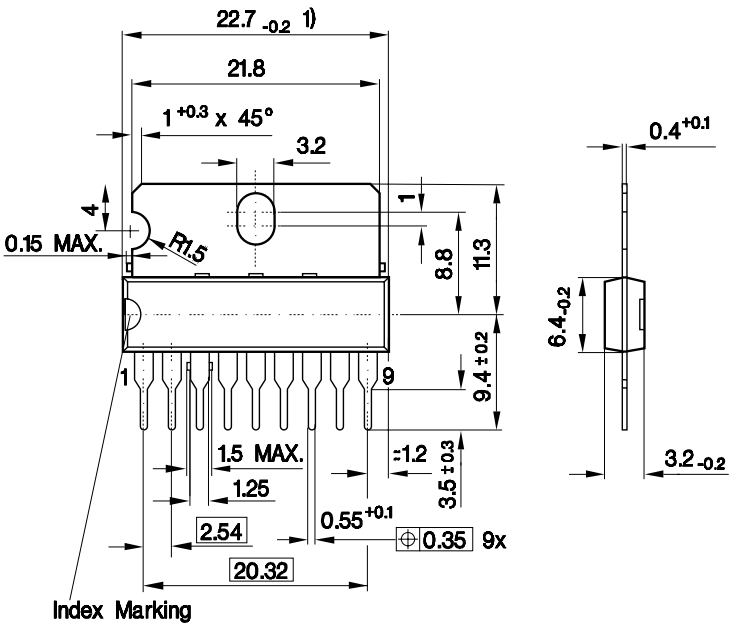


Forward Current versus Forward Voltage



Package Outlines

P-SIP-9-1
(Plastic Single In-line Package)



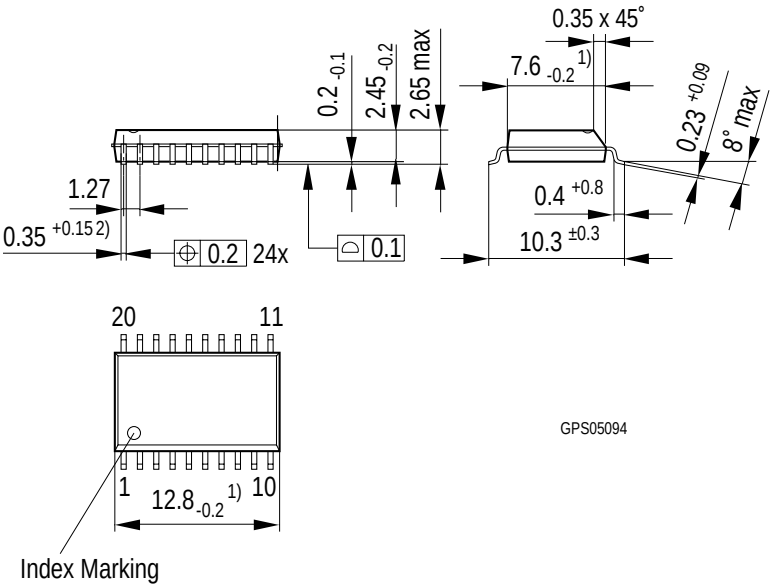
1) Does not include plastic or metal protrusion of 0.25 max.

GPI05038

Sorts of Packing
Package outlines for tubes, trays etc. are contained in our Data Book “Package Information”.

Dimensions in mm

P-DSO-20-6
(Plastic Dual Small Outline Package)



1) Does not include plastic or metal protrusions of 0.15 max per side
2) Does not include dambar protrusion of 0.05 max per side

Sorts of Packing
Package outlines for tubes, trays etc. are contained in our Data Book “Package Information”.

SMD = Surface Mounted Device

Dimensions in mm