

Dual Power Operational Amplifier

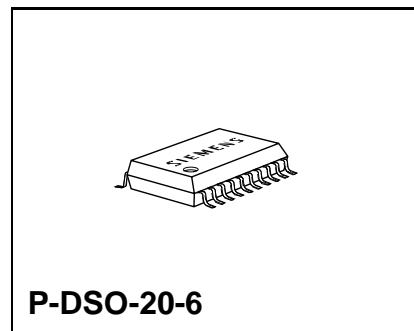
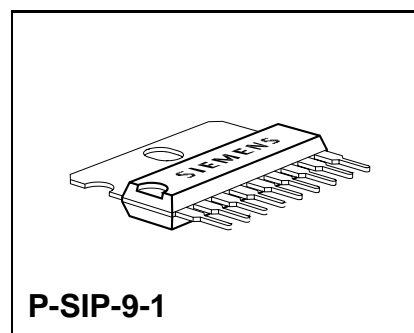
TCA 2465

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/ μ s
- 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



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 $V_g \geq 2$ 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.

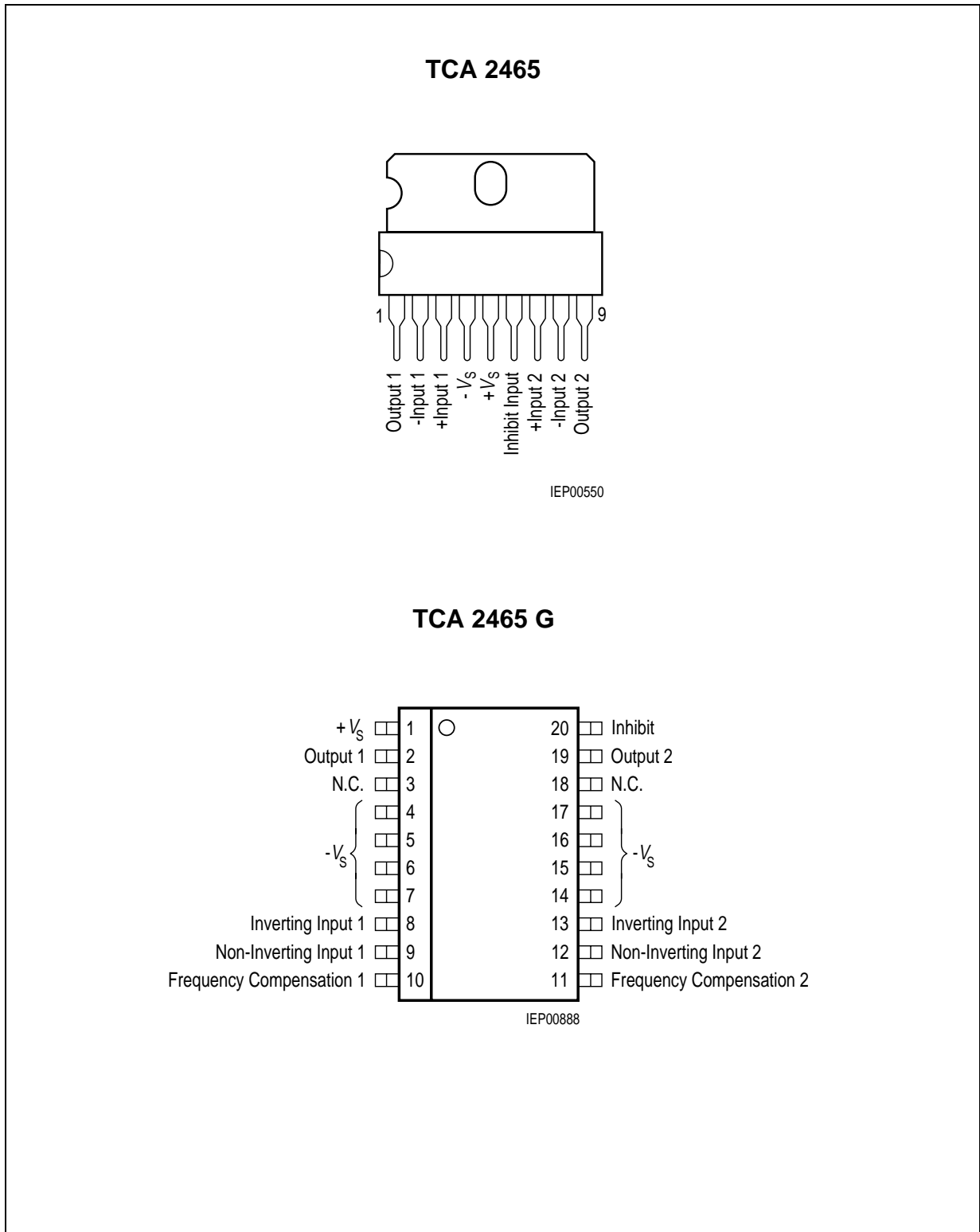


Figure 1 Pin Configuration (top view)

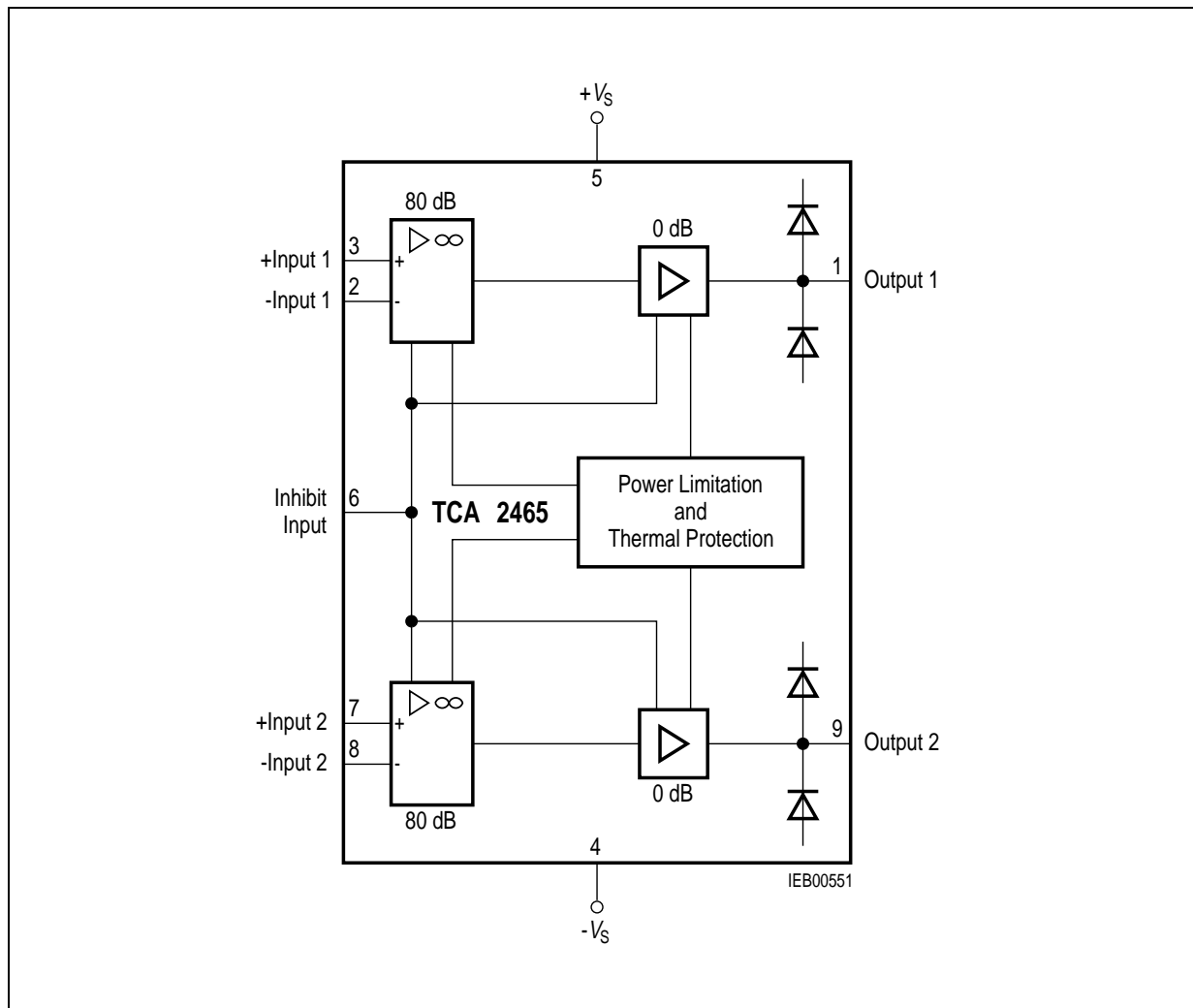


Figure 2 Block Diagram TCA 2465

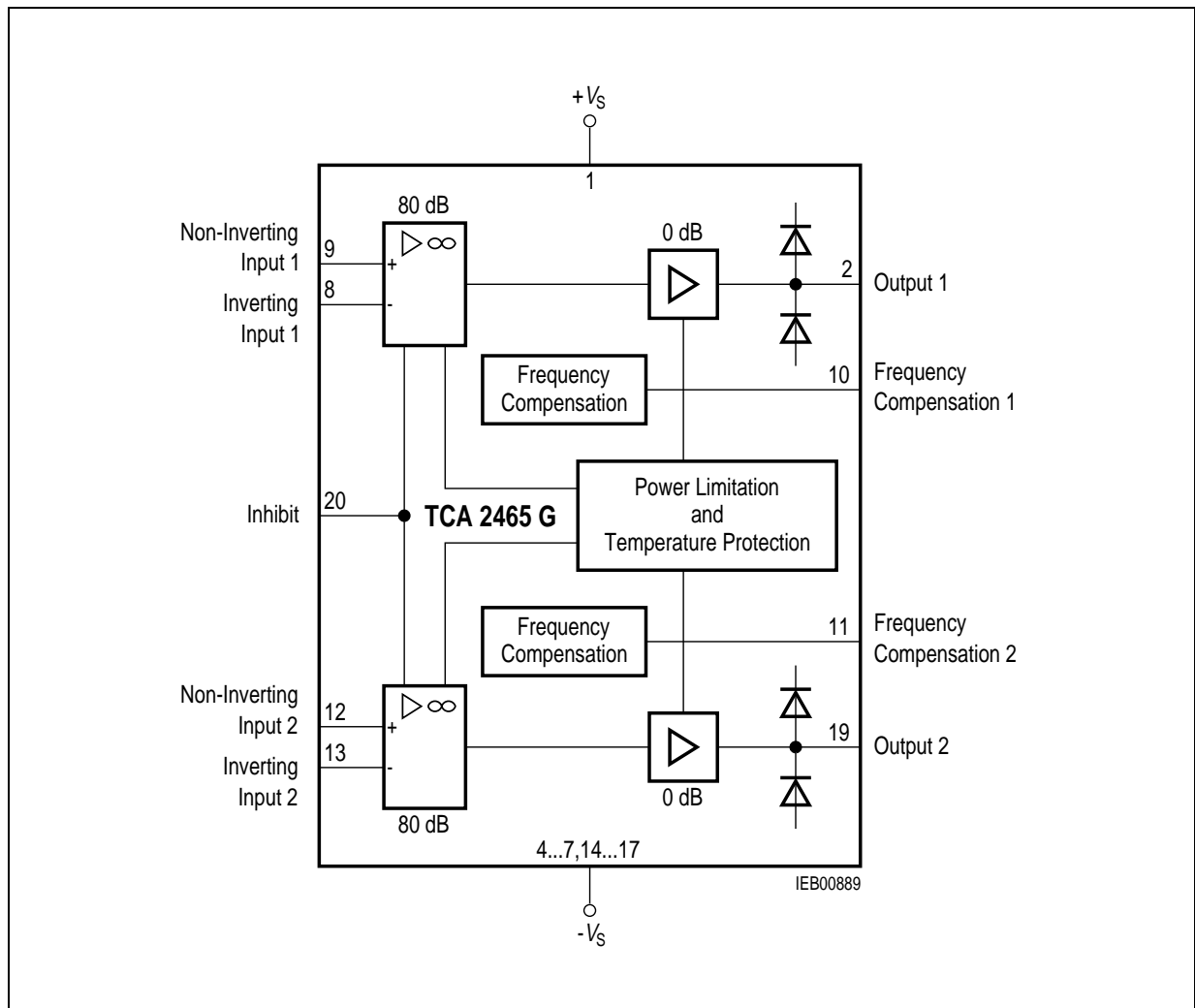


Figure 3 Block Diagram TCA 2465 G

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	ΔV_{2-3} or ΔV_{8-7}
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 $V_S \geq \pm 15$ V; $V_Q < -V_S$
Output current	I_Q	– 1.5	–	A	
Supply current	I_S	$-5 (-2)^{1)}$	$5.5 (2)^{1)}$	A	I_S I_4
Ground current	I_{GND}	$-5.5 (-2)^{1)}$	$5 (2)^{1)}$	A	
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, $f \leq 400$ 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	$R_{th jA}$	–	60	K/W	P-SIP-9-1
Thermal resistance junction - case	$R_{th jC}$	–	5	K/W	P-SIP-9-1
Thermal resistance junction - ambient	$R_{th jA}$	–	60	K/W	P-DIP-16-2
Thermal resistance junction - case	$R_{th jC}$	–	12	K/W	P-DIP-16-2
Thermal resistance junction - ambient	$R_{th jA}$	–	(70)	K/W	(soldered) P-DSO-20-6
Thermal resistance junction - case	$R_{th jC}$	–	(22)	K/W	P-DSO-20-6

1) $P_D = 12\text{ W}$ P-SIP-9-1
 $P_D = 3.5\text{ W}$ P-DSO-20-6

Characteristics

$V_S = \pm 10\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$, 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 S1 in position 2	I_S	–	–	5	mA	1; 12
	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						
$R_L = 12\ \Omega$; $f = 1\ \text{kHz}$	$V_{Q\text{pp}}$	± 8.5	± 9	–	V	4; 15
$R_L = 4\ \Omega$; $f = 1\ \text{kHz}^{1)}$	$V_{Q\text{pp}}$	± 8	± 8.5	–	V	4; 15
$R_L = 470\ \Omega$; $f = 40\ \text{kHz}$	$V_{Q\text{pp}}$	–	± 8	–	V	4; 15
Input resistance $f = 1\ \text{kHz}$	R_I	1	5	–	M Ω	4; 15
Open-loop voltage gain $f = 100\ \text{kHz}$	G_{VO}	70	80	–	dB	5; 16
Common-mode input voltage range	V_{IC}	7/– 10	$\pm 7.5/– 10.5$	–	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} $-40\text{ }^\circ\text{C} \leq T_j \leq +85\text{ }^\circ\text{C}$	α_{VIO}	–	50	–	$\mu\text{V/K}$	2; 13
Temperature coefficient of I_{IO} $-40\text{ }^\circ\text{C} \leq T_j \leq +85\text{ }^\circ\text{C}$	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	$V_{6\text{OFF}}$	2	–	–	V	1; 12
V_6 for IC turned ON	$V_{6\text{ON}}$	–	–	0.8	V	1; 12

Characteristics (cont'd)

$V_S = \pm 10 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$, 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, $V_6 = 5 \text{ V}^{(2)}$	I_{6H}	–	0.1	0.5	μA	1; 12
L-input current, $V_6 = 0 \text{ V}^{(2)}$	I_6	–	0.5	3	μA	1; 12
Turn-ON dead time $ I_{1;9} > 1 \text{ A}^{(3)}$	} referred to $V_{6 \text{ OFF/ON}}$ $t_{D \text{ ON}}$	–	10	20	μs	1; 12
Turn-OFF dead time $ I_{1;9} < 1 \text{ A}^{(3)}$		$t_{D \text{ OFF}}$	–	10	20	μs
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 $V_S \leq \pm 7 \text{ V}$

Test Circuits

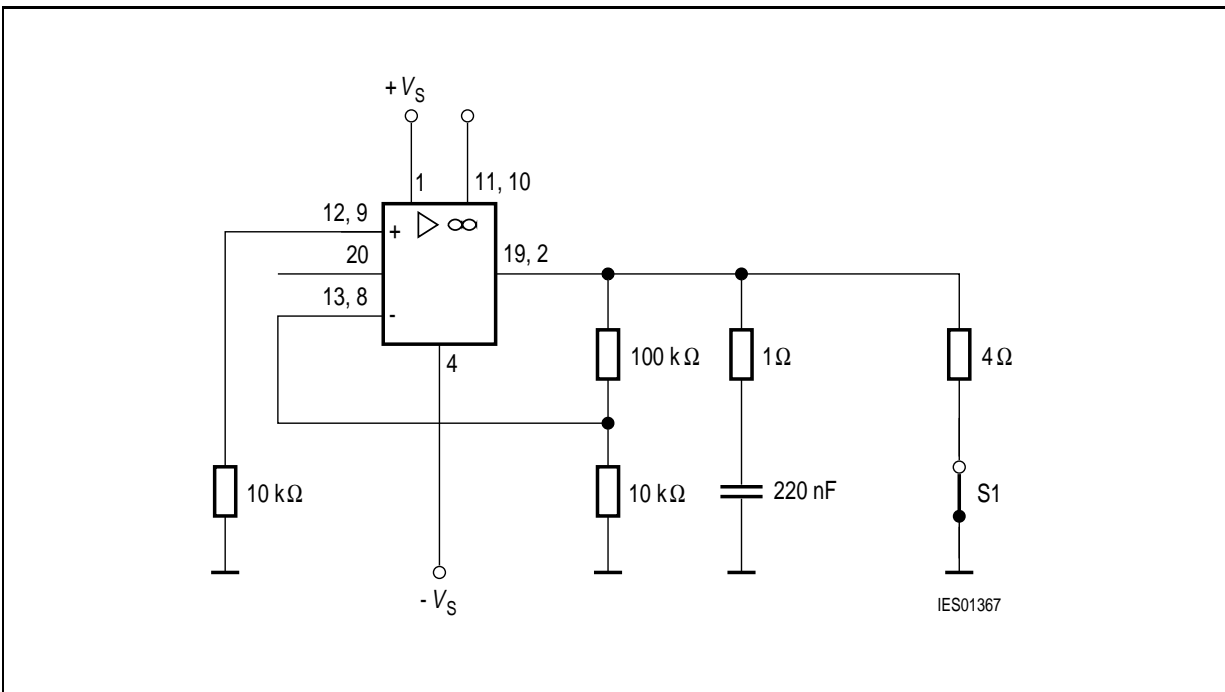


Figure 4 Open-Loop Supply Current Consumption; Noise Voltage (TCA 2465 G)

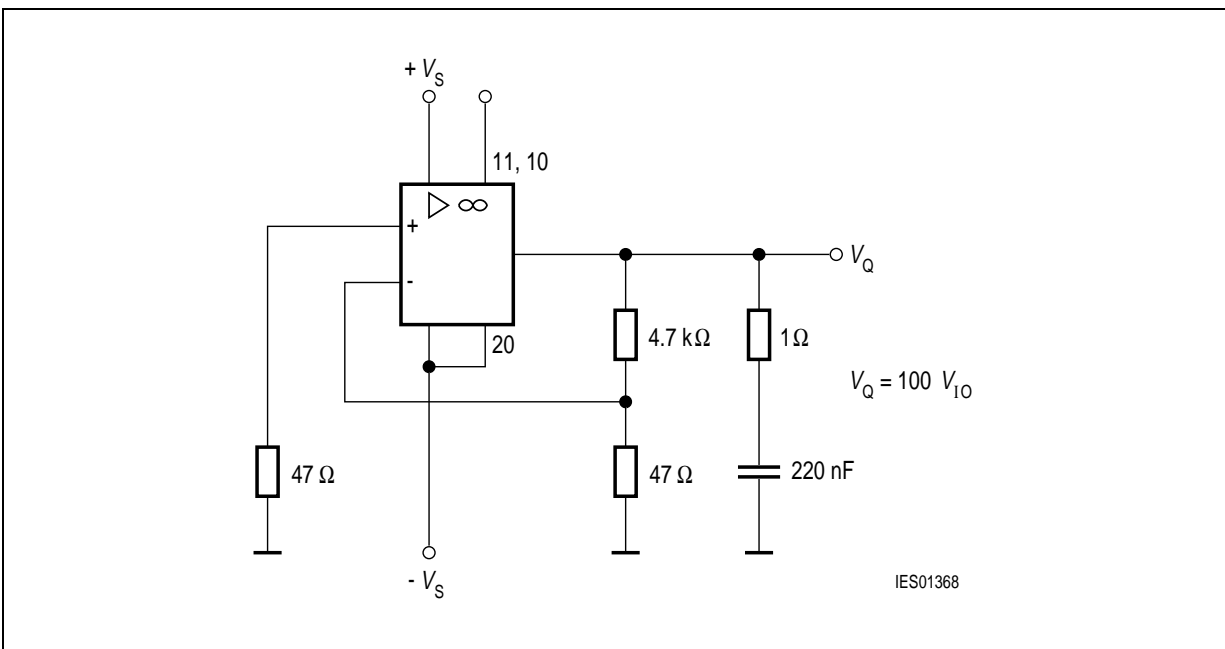


Figure 5 Input Offset Voltage; Temperature Coefficient of V_{IO} (TCA 2465 G)

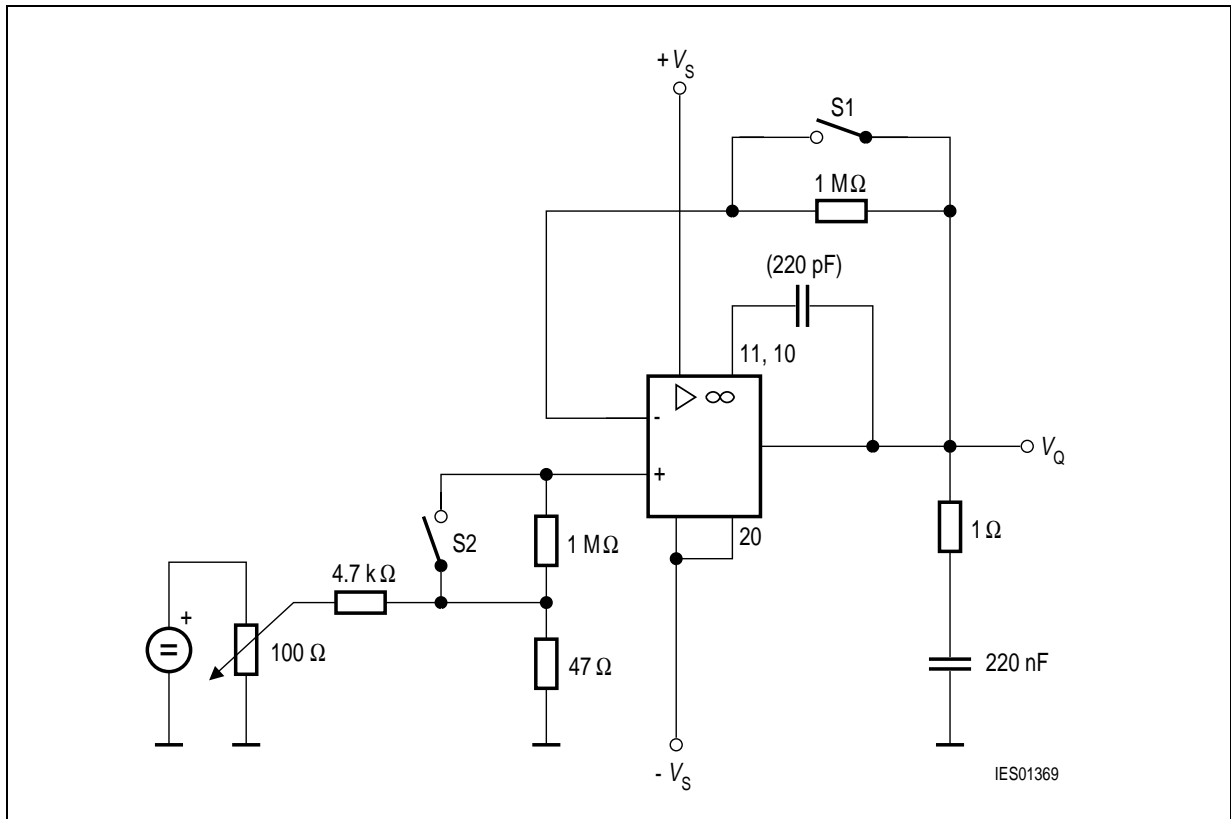


Figure 6 Input Offset Current; Input Current; Temperature Coefficient of I_{IO} (TCA 2465 G)

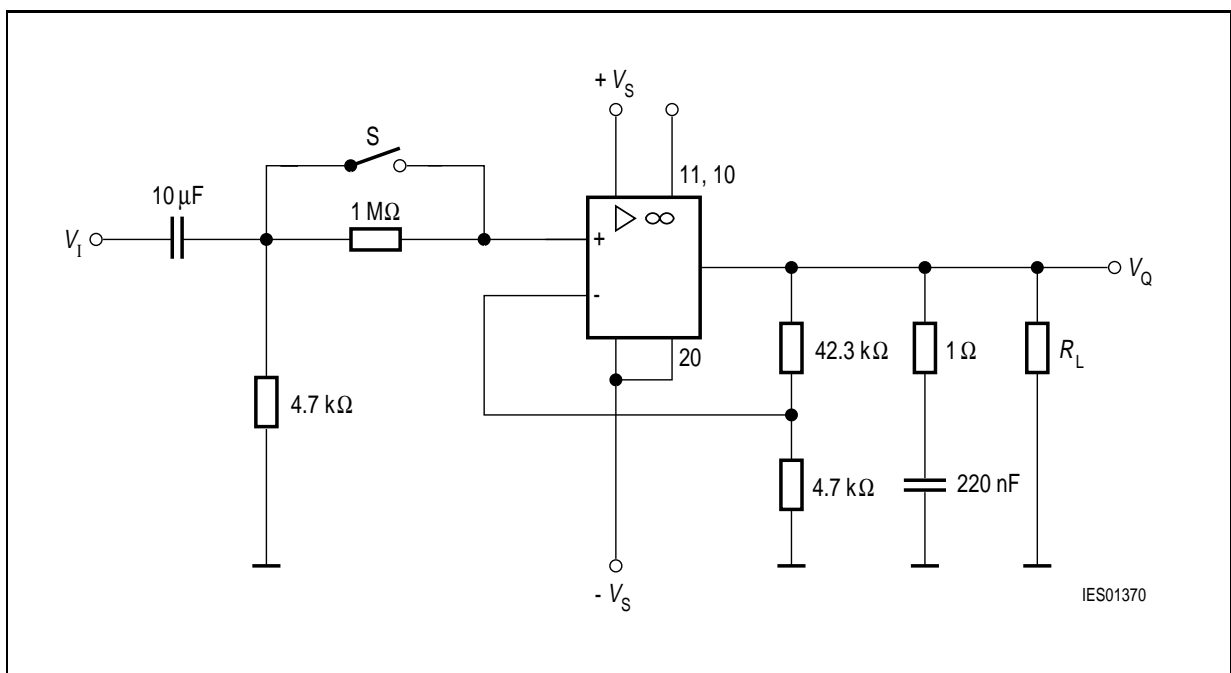


Figure 7 Output Voltage; Input Resistance (TCA 2465 G)

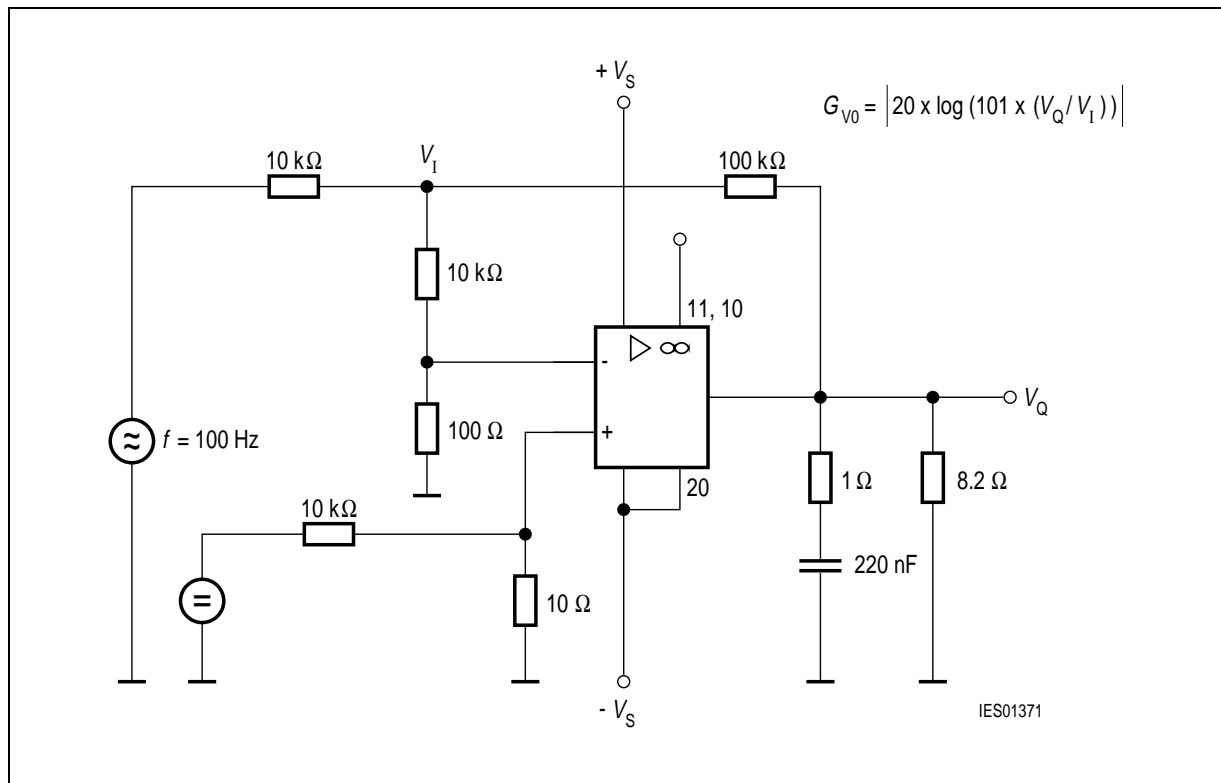


Figure 8 Open-Loop Voltage Gain G_{VO} (TCA 2465 G)

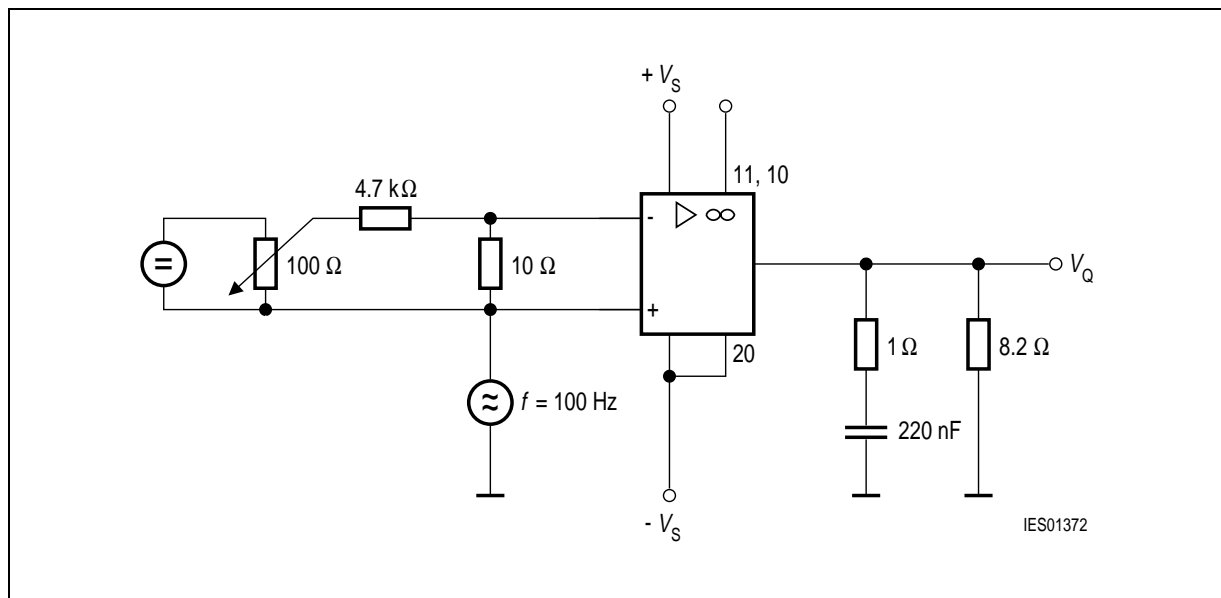


Figure 9 Common Mode Voltage Gain G_{VC}
 Common-Mode Rejection
 $k_{CMR} \text{ (dB)} = G_{VO} \text{ (dB)} - G_{VC} \text{ (dB)}$ (TCA 2465 G)

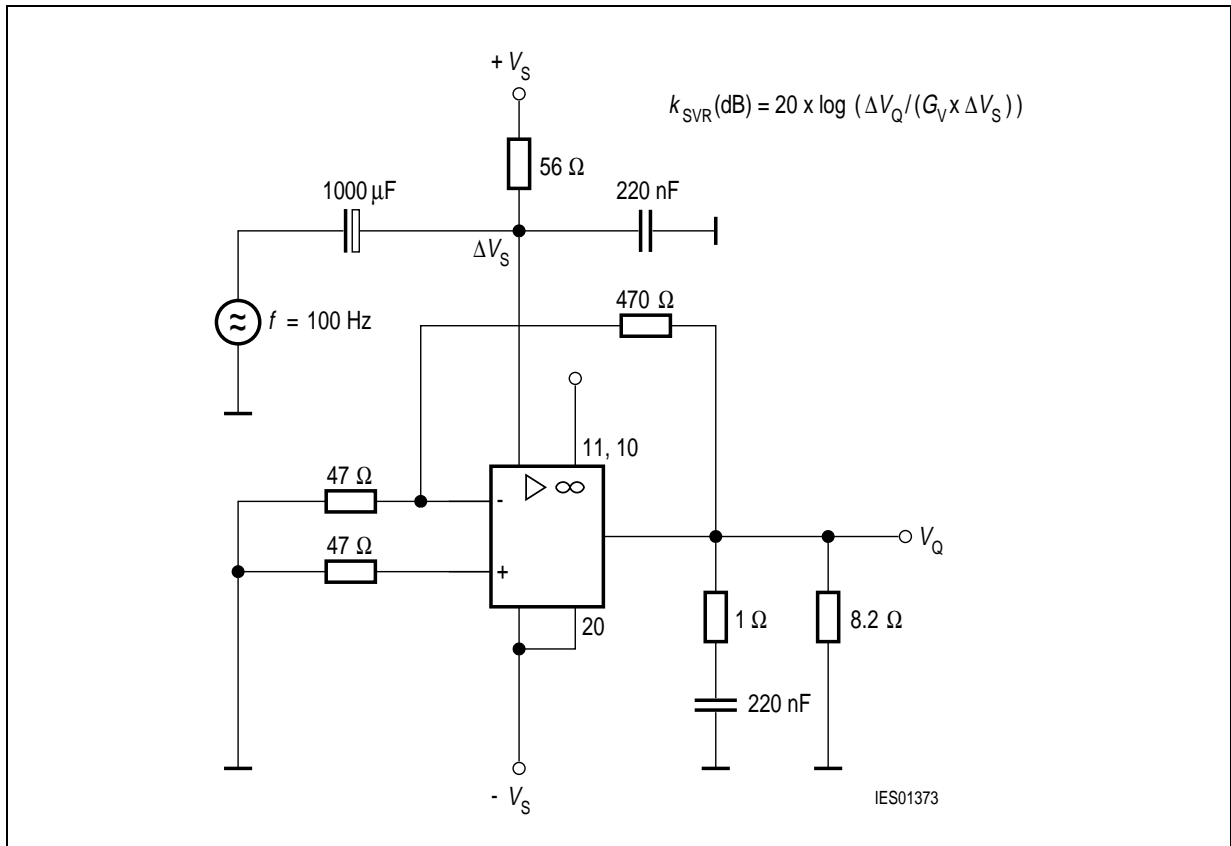


Figure 10 Supply Voltage Rejection k_{SVR} (TCA 2465 G)

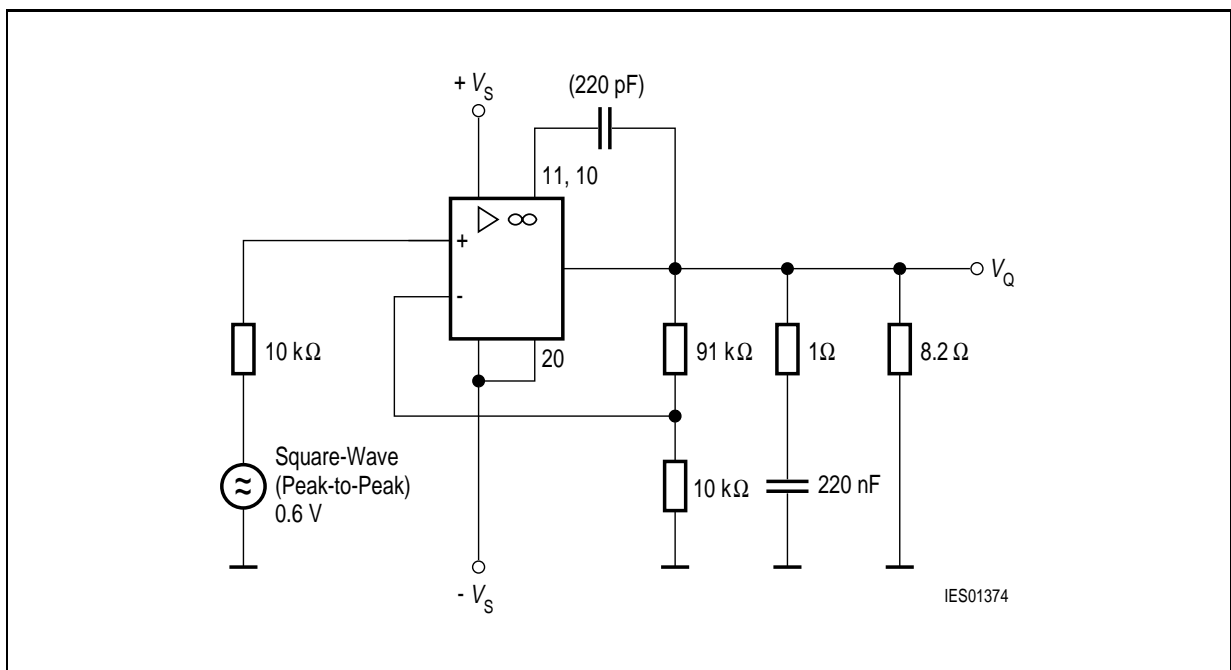


Figure 11 Slew Rate for Non-Inverting Operation (TCA 2465 G)

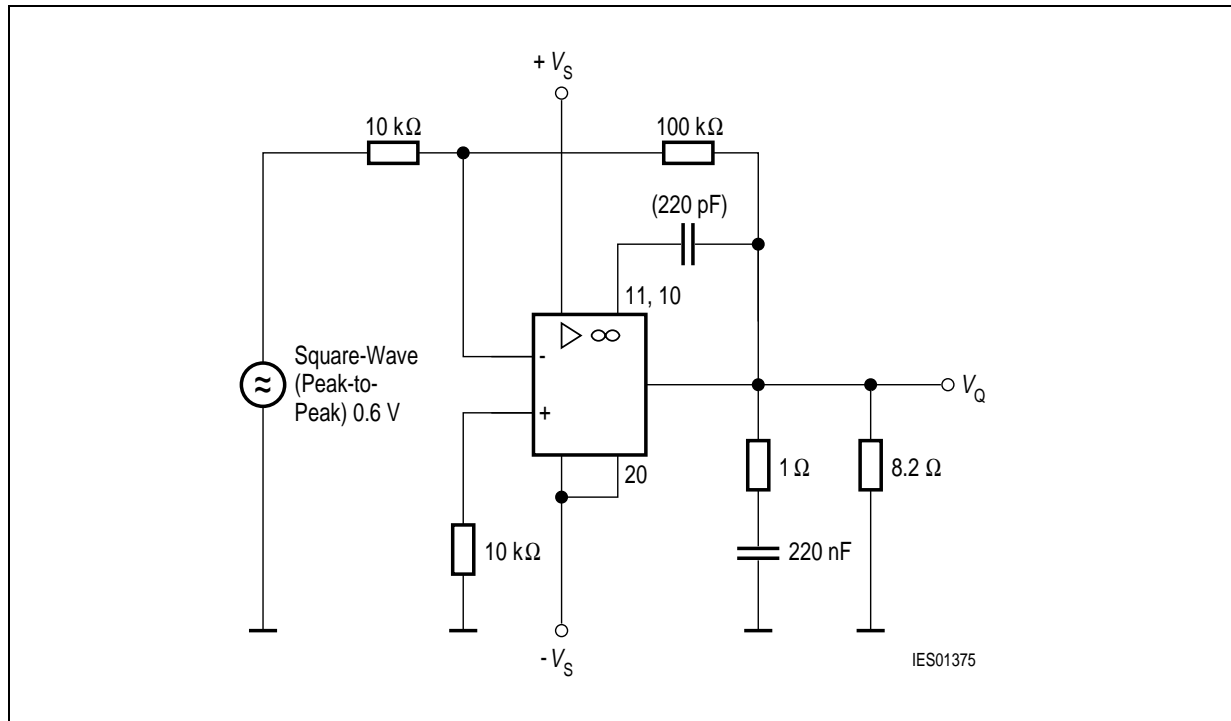


Figure 12 Slew Rate for Inverting Operation (TCA 2465 G)

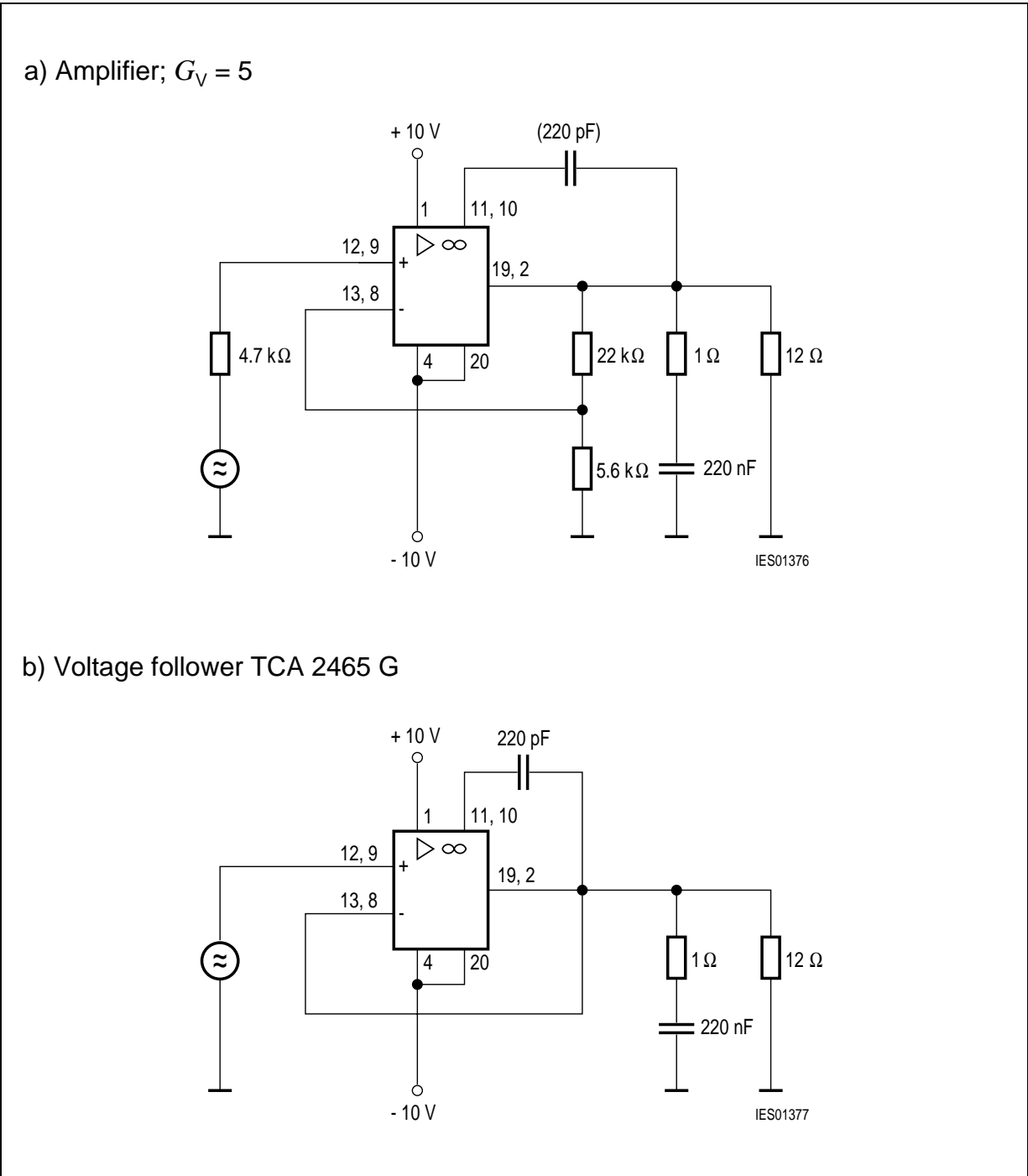


Figure 13 Non-Inverting Operation (TCA 2465 G)

Downloaded from Elcodis.com electronic components distributor

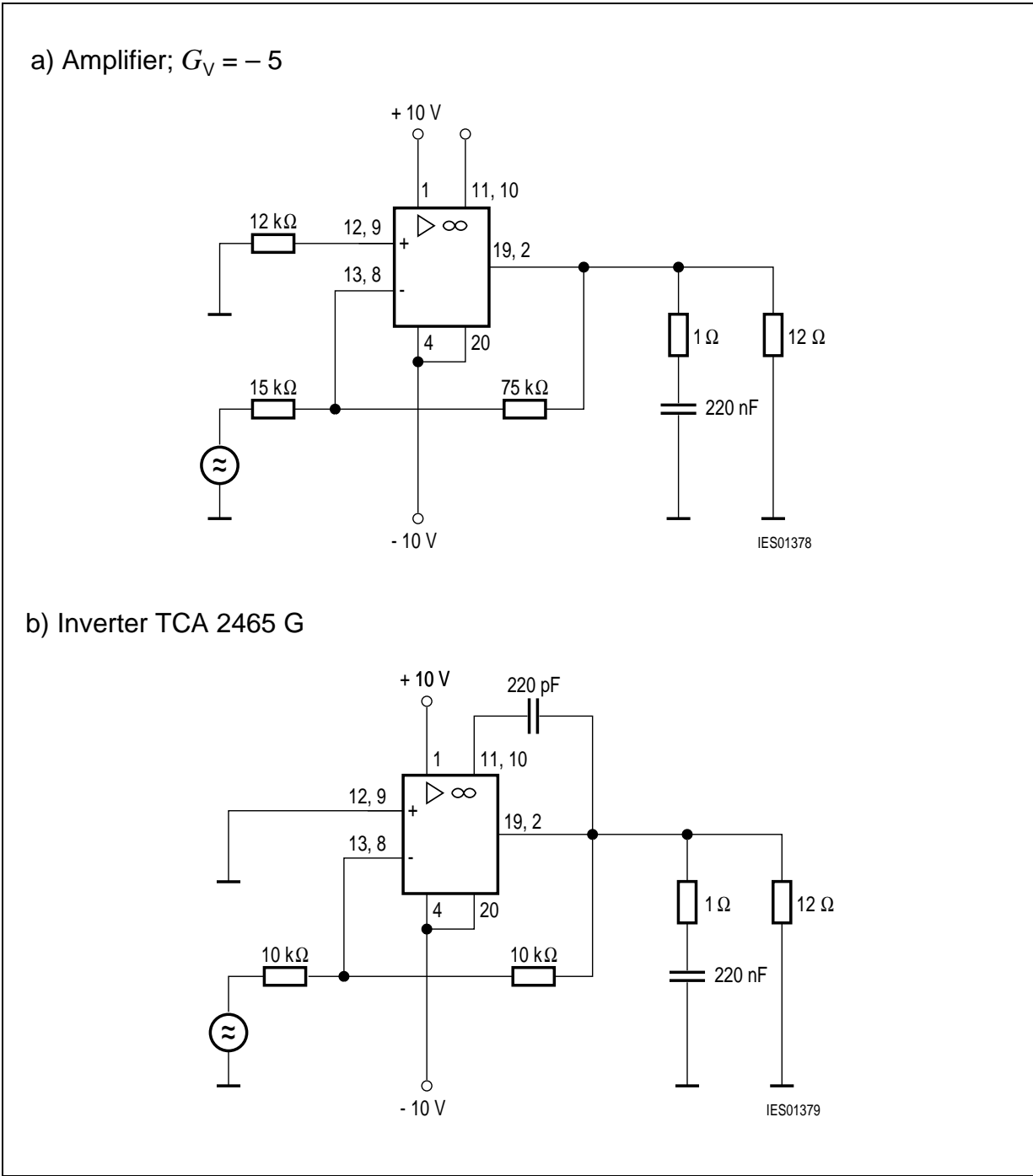


Figure 14 Inverting Operation (TCA 2465 G)

Downloaded from Elcodis.com electronic components distributor

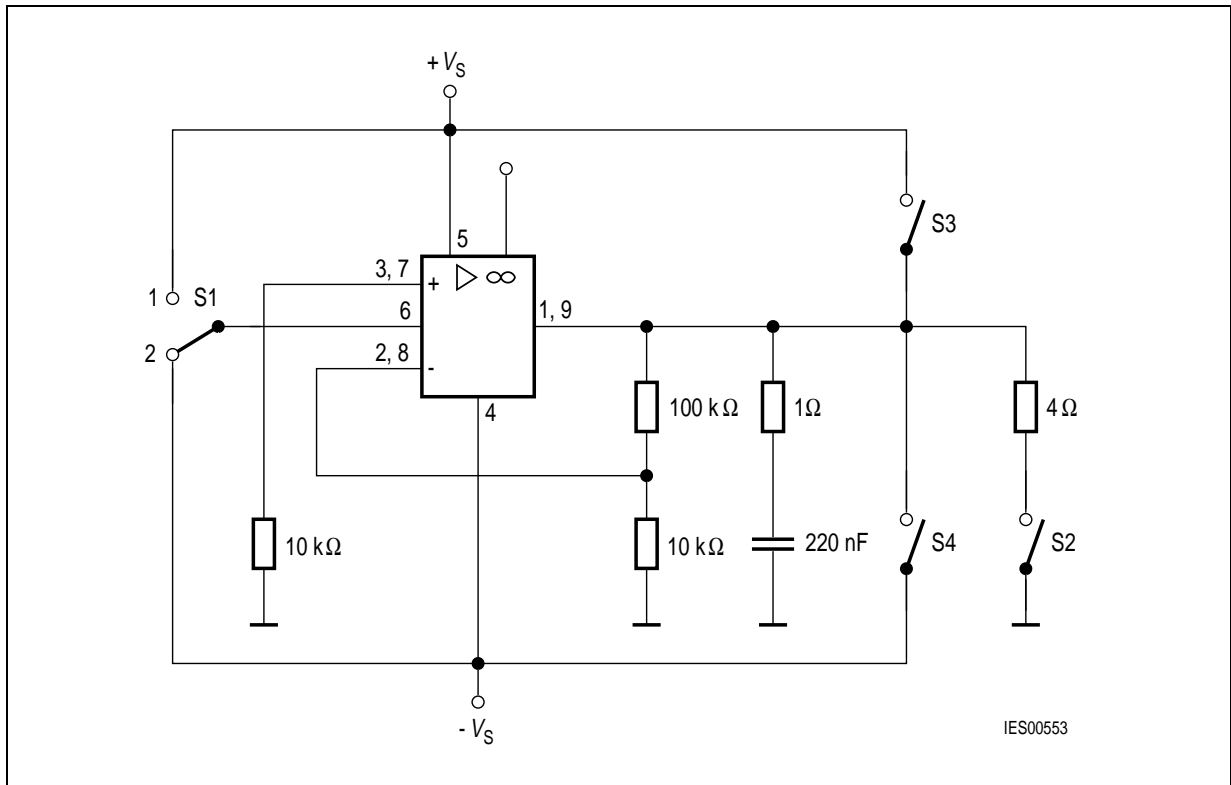


Figure 15 Open-Loop Supply Current Consumption; Noise Voltage (TCA 2465/A)

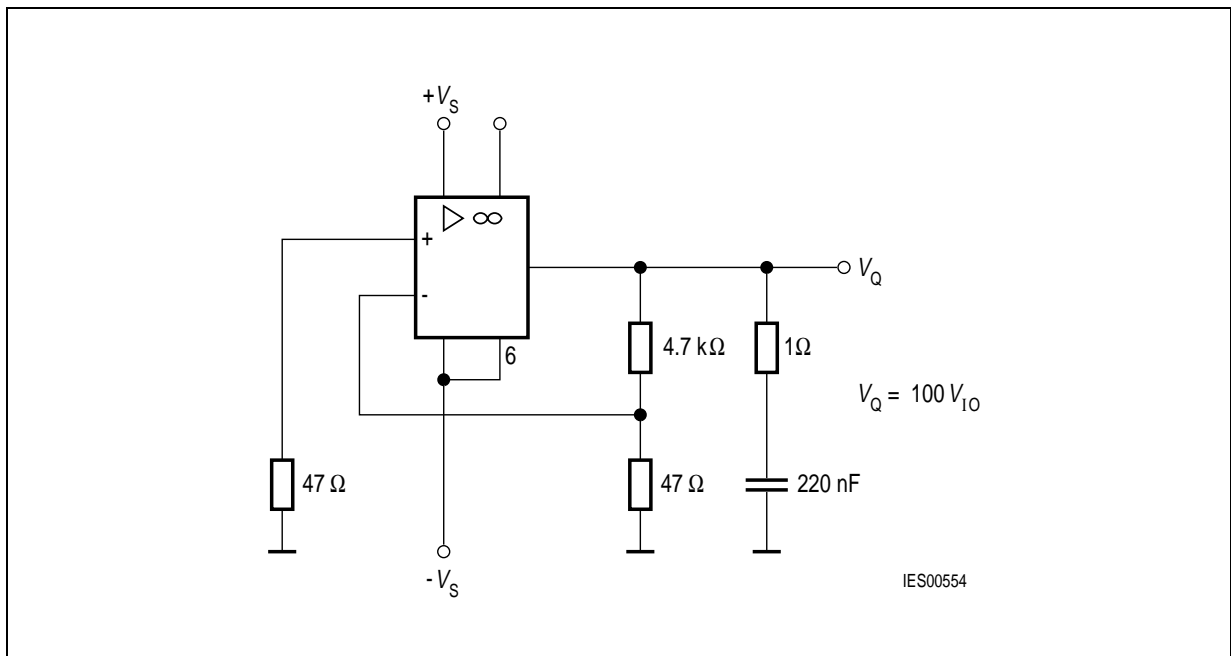


Figure 16 Input Offset Voltage; Temperature Coefficient of V_{I0} (TCA 2465/A)

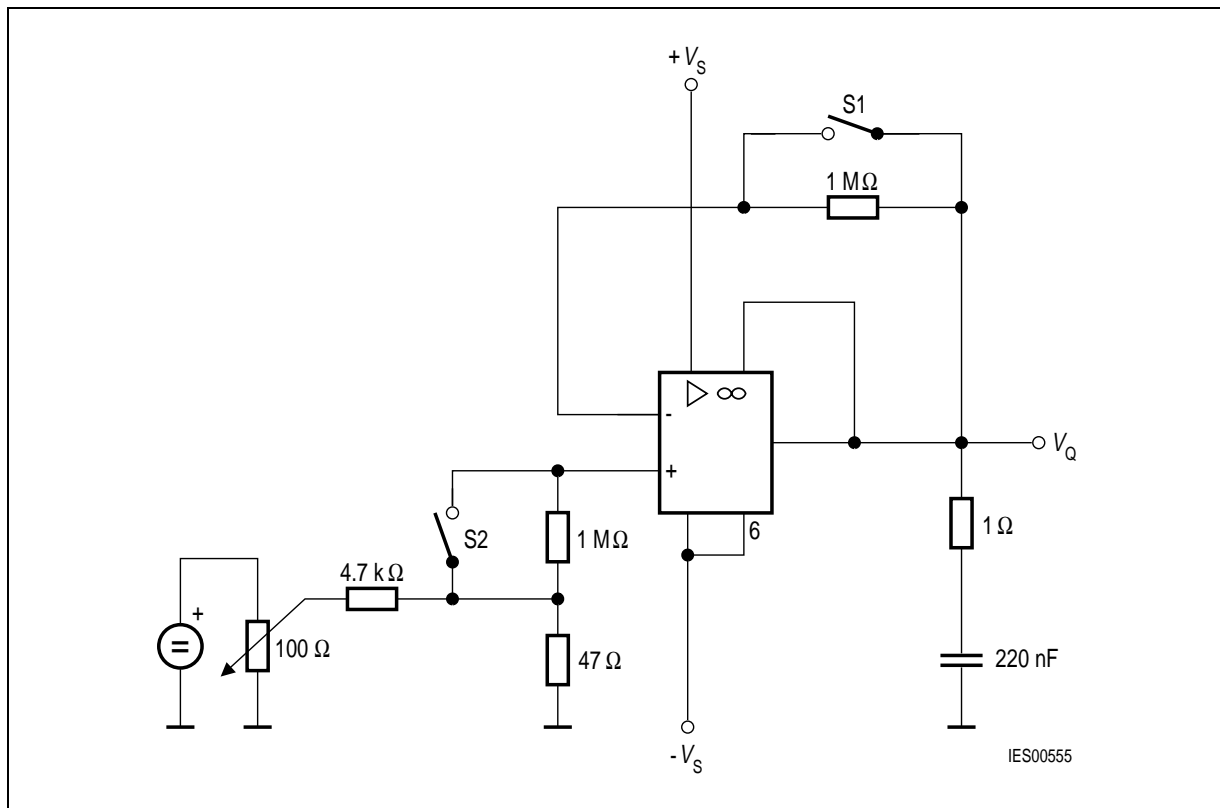


Figure 17 Input Offset Current; Input Current; Temperature Coefficient of I_{IO} (TCA 2465)

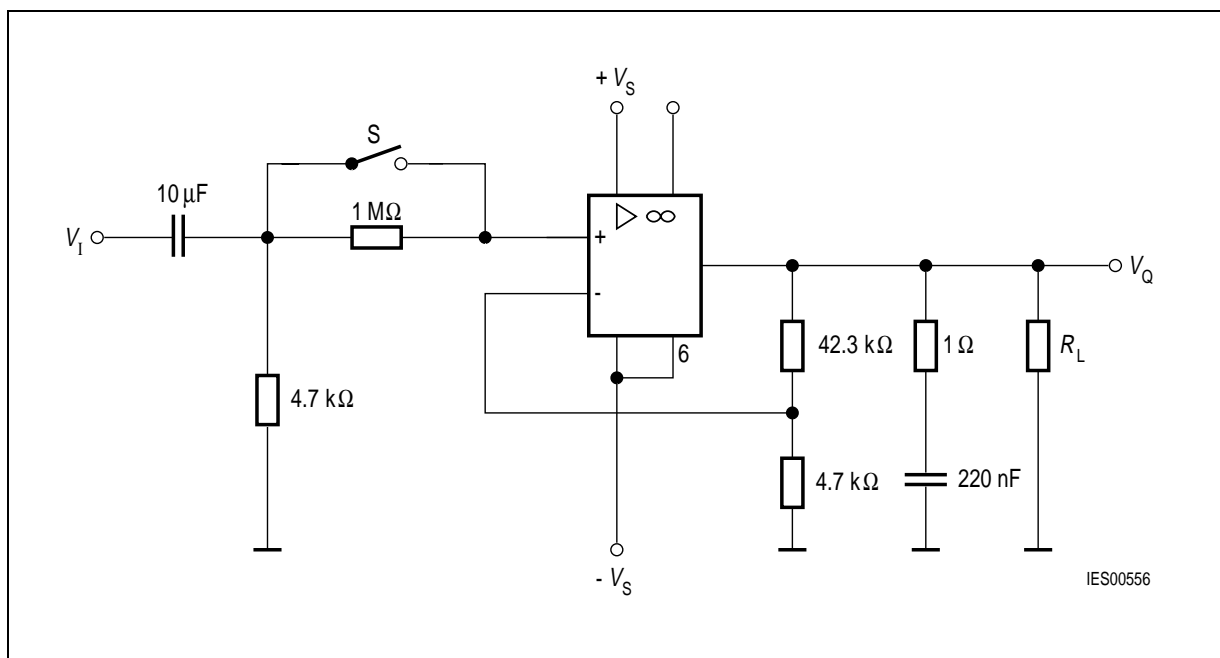


Figure 18 Output Voltage; Input Resistance (TCA 2465)

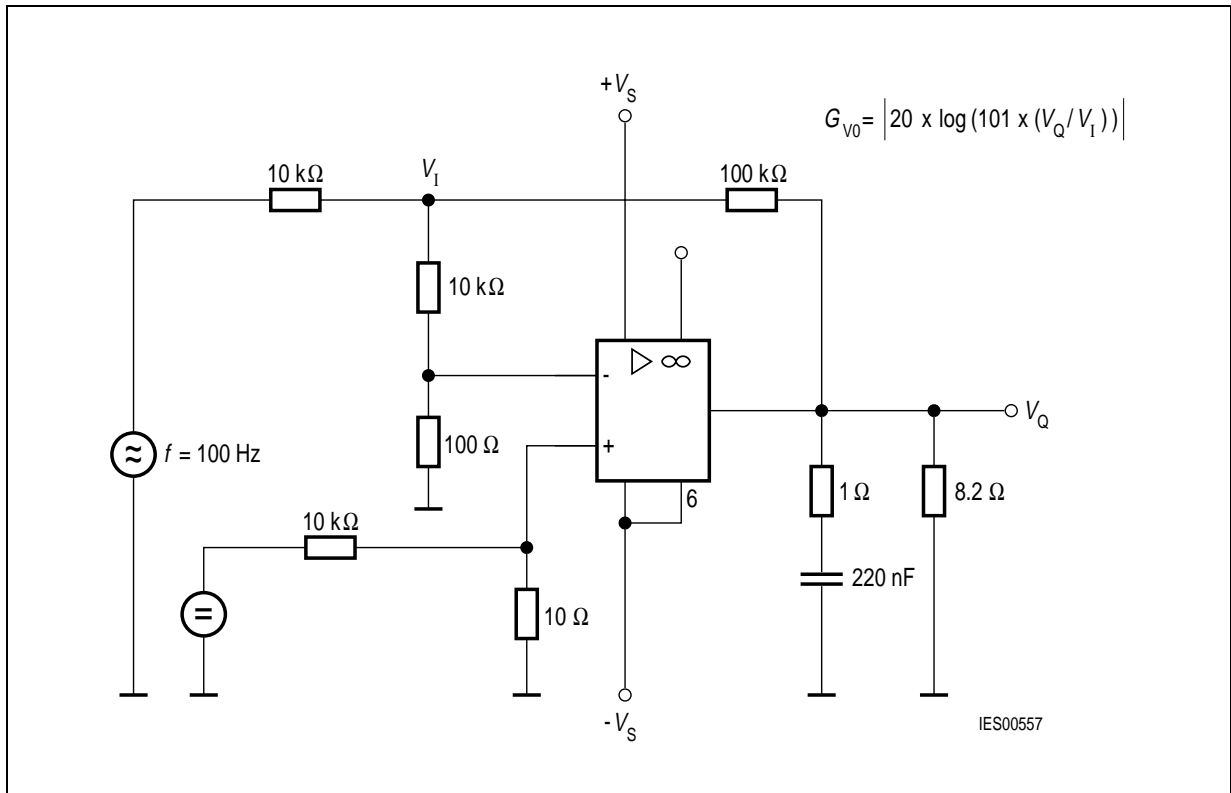


Figure 19 Open-Loop Voltage Gain G_{V0} (TCA 2465)

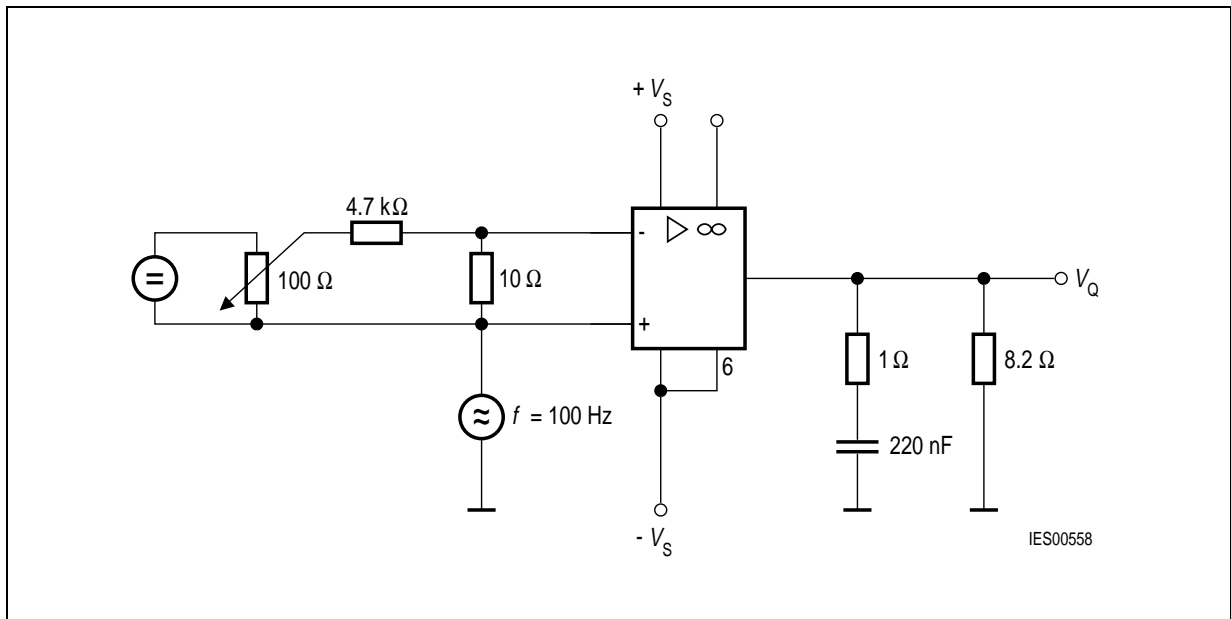


Figure 20 Common Mode Voltage Gain G_{VC}
 Common-Mode Rejection k_{CMR} (dB) = G_{V0} (dB) - G_{VC} (dB) (TCA 2465/A)

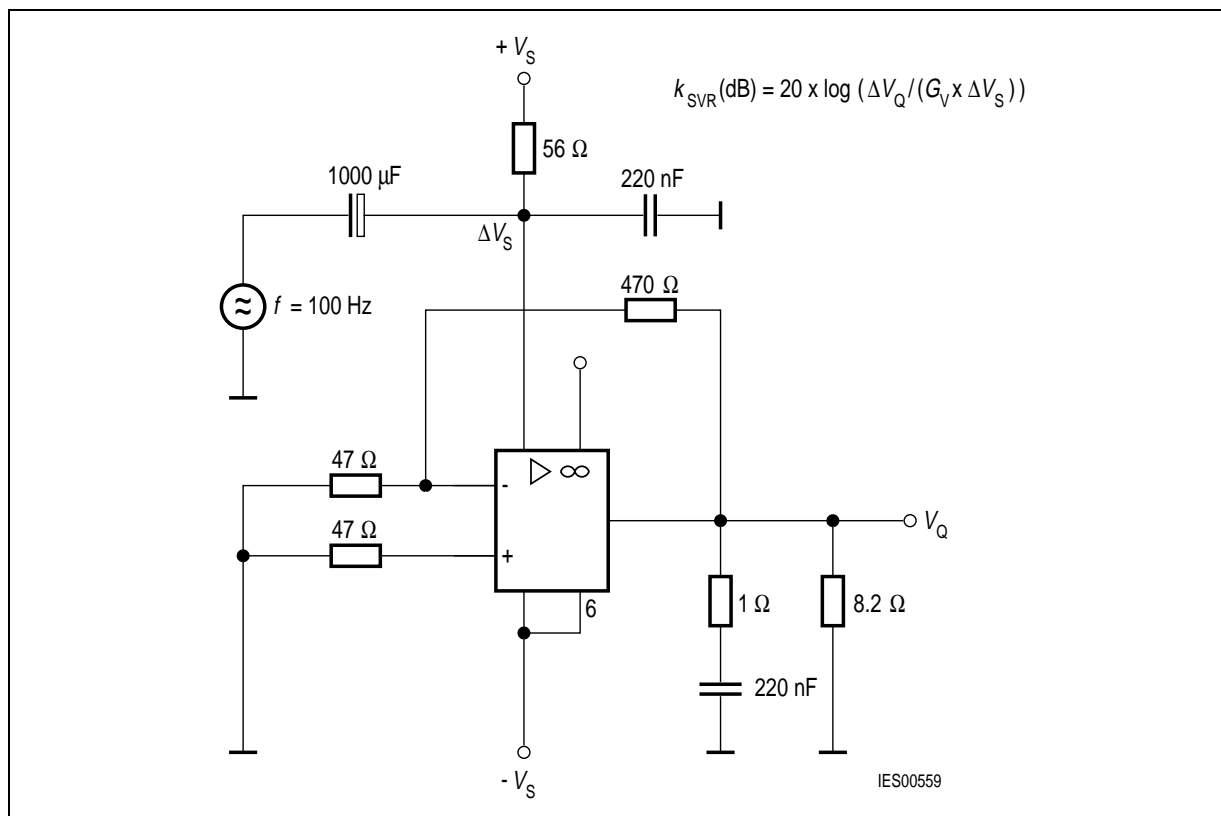


Figure 21 Supply Voltage Rejection k_{SVR} (TCA 2465)

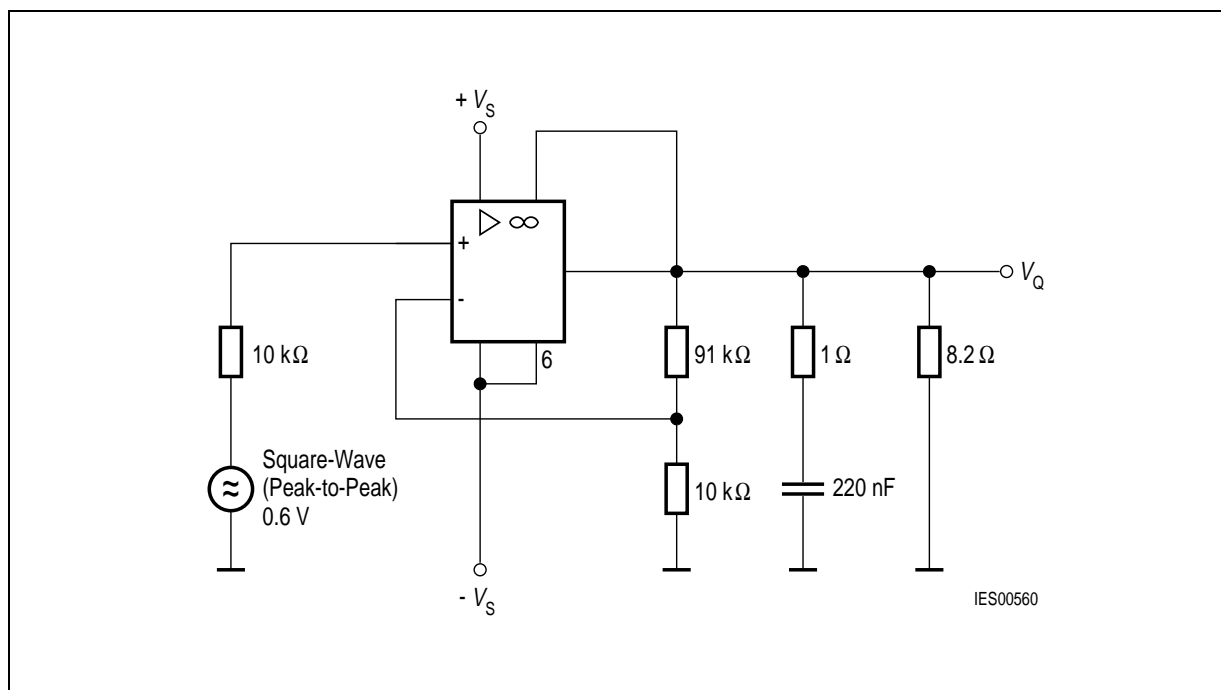


Figure 22 Slew Rate for Non-Inverting Operation (TCA 2465)

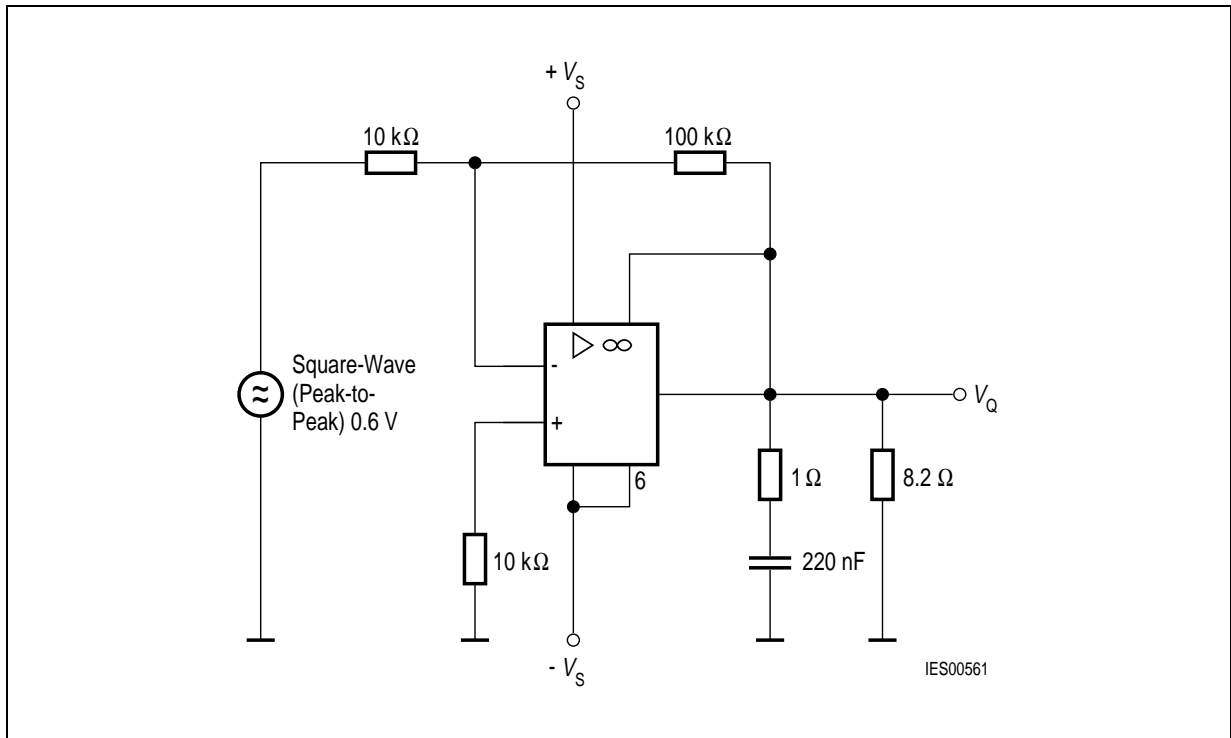


Figure 23 Slew Rate for Inverting Operation (TCA 2465)

Note: Values in brackets refer to TCA 2465 A

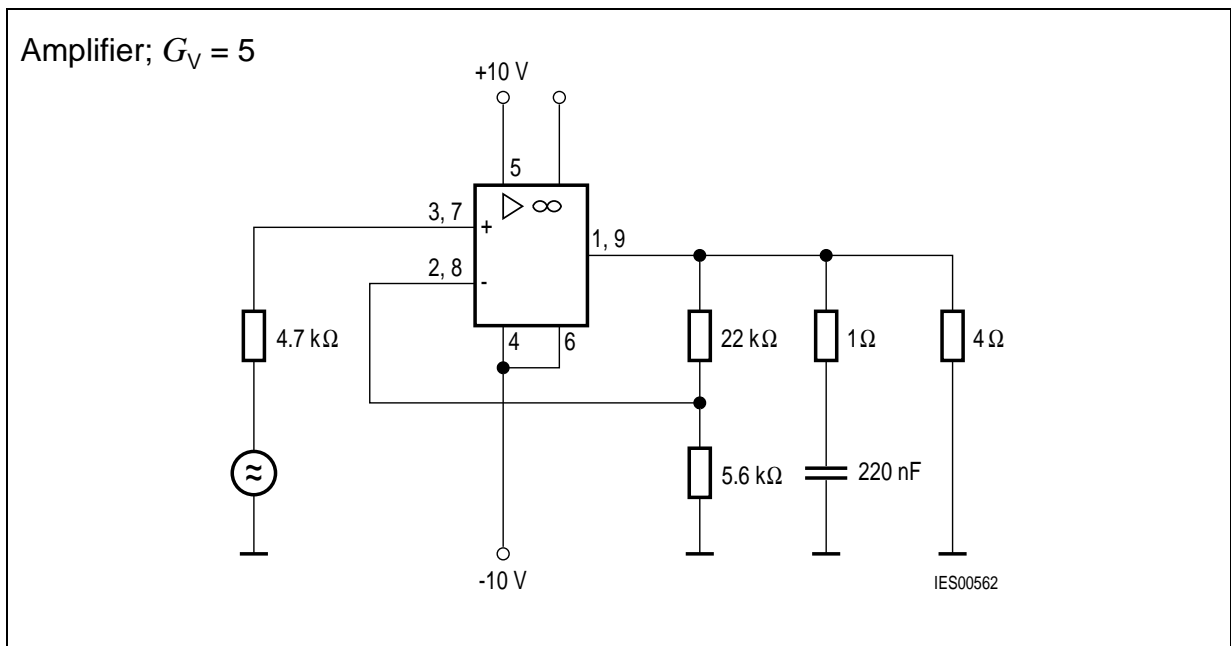


Figure 24 Non-Inverting Operation (TCA 2465)

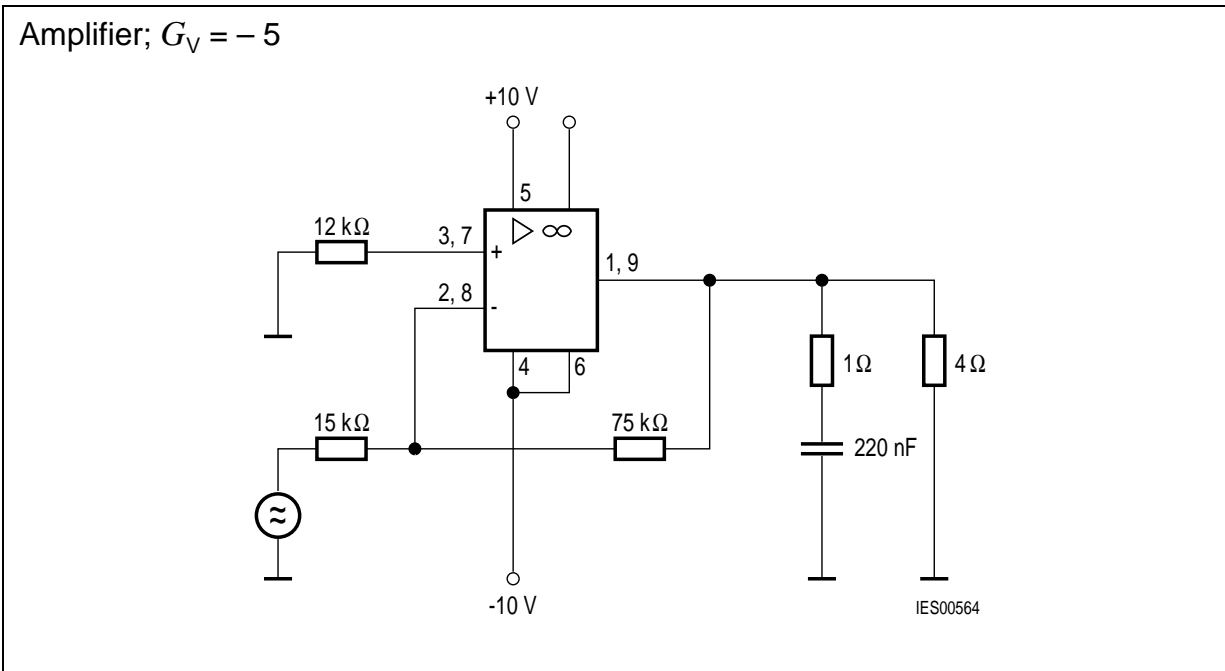
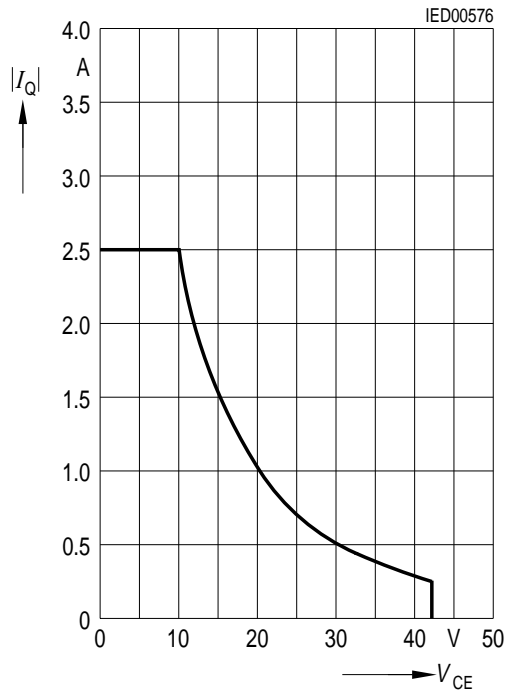


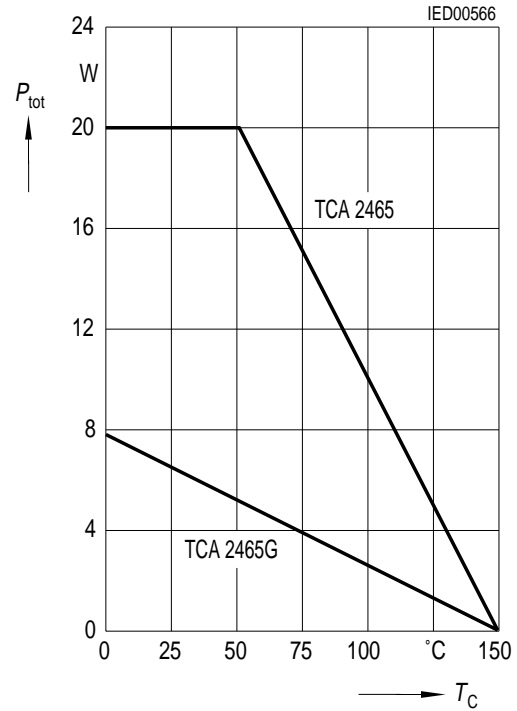
Figure 25 Inverting Operation (TCA 2465)

Safe Operating Area (SOA) Peak Output Current versus Collector-Emitter Voltage

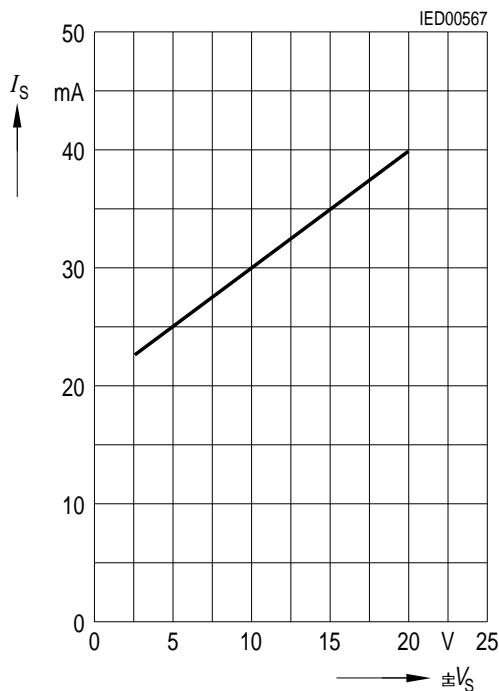
$T_j = 25\text{ }^\circ\text{C}$, $V_{CE} = +V_S - V_Q$ or $V_{CE} = -V_S - V_Q$



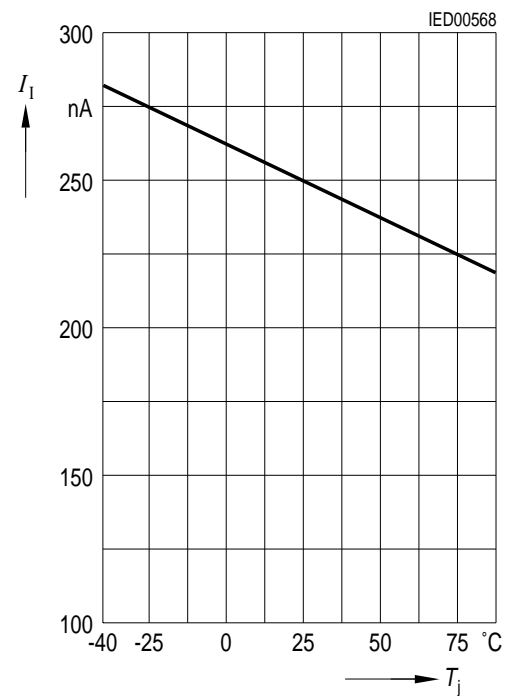
Max. Permissible Power Dissipation versus Case Temperature



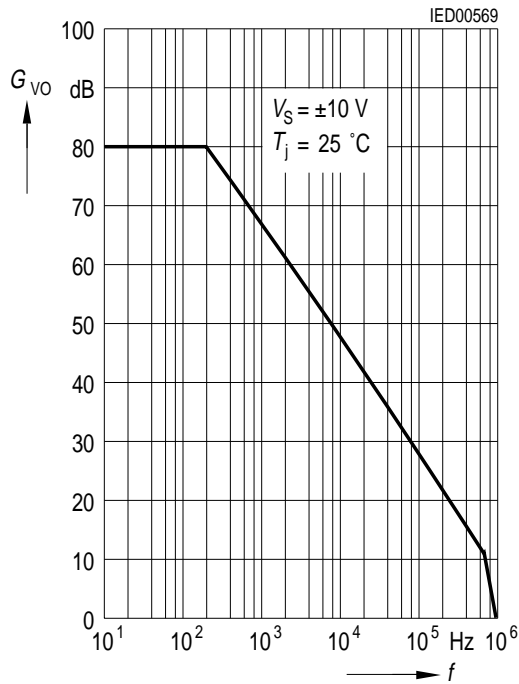
Supply Current versus Supply Voltage $T_j = 25\text{ }^\circ\text{C}$



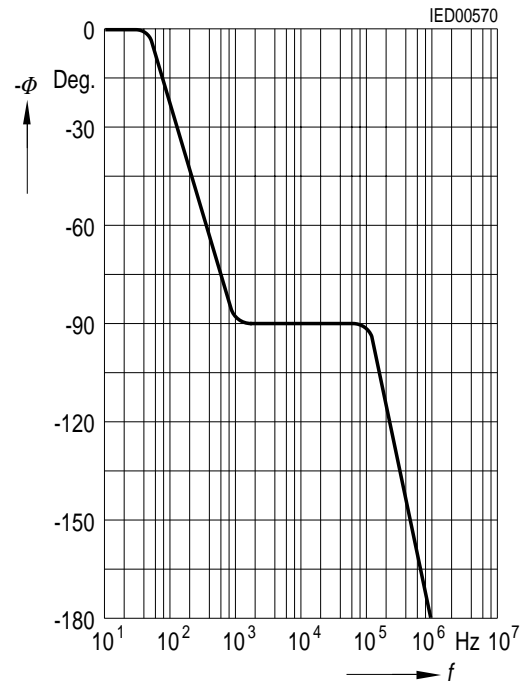
Input Current versus Junction Temperature $V_S = \pm 10\text{ V}$



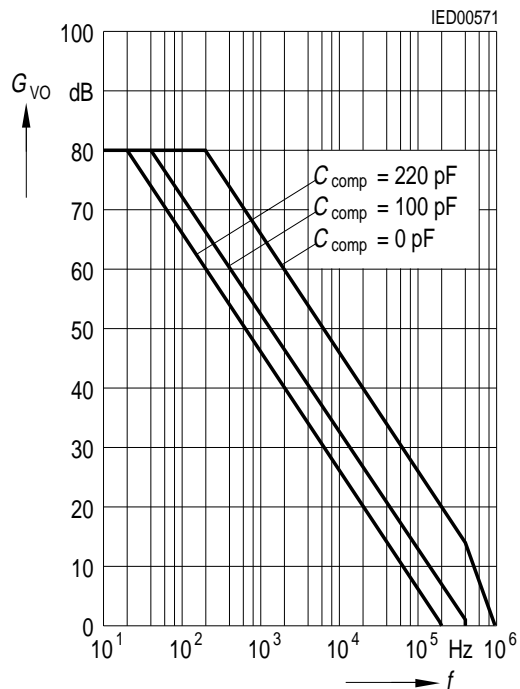
Open-Loop Voltage Gain versus Frequency



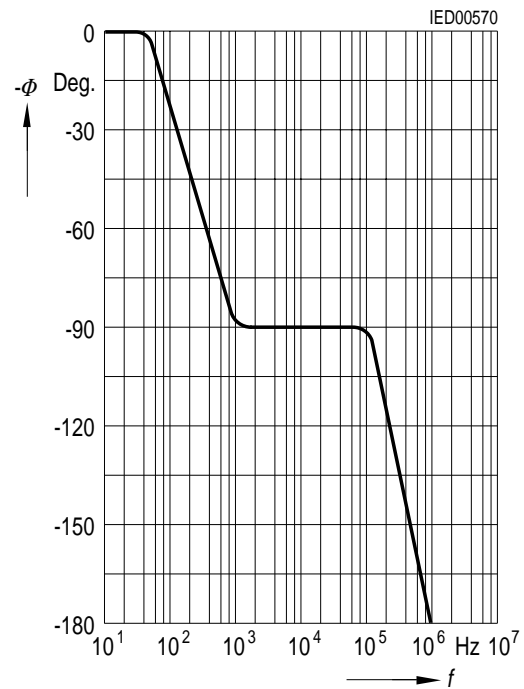
Phase Response versus Frequency
 $V_S = \pm 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$



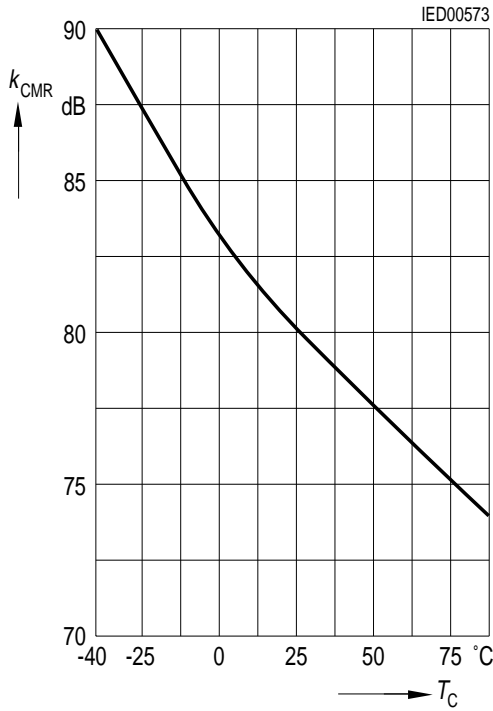
TCA 2465, G Open-Loop Voltage Gain versus Frequency
 $V_S = \pm 10 \text{ V}, T_j = 25 \text{ }^\circ\text{C}$



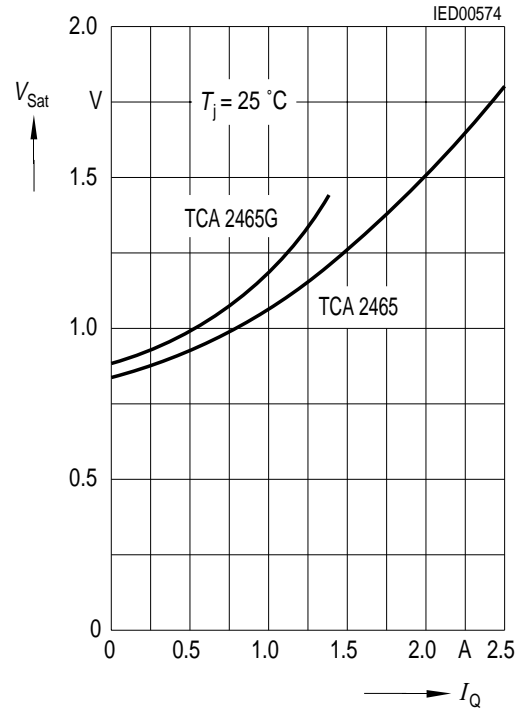
TCA 2465, G Phase Response versus Frequency
 $V_S = \pm 10 \text{ V}, T_j = 25 \text{ }^\circ\text{C}$



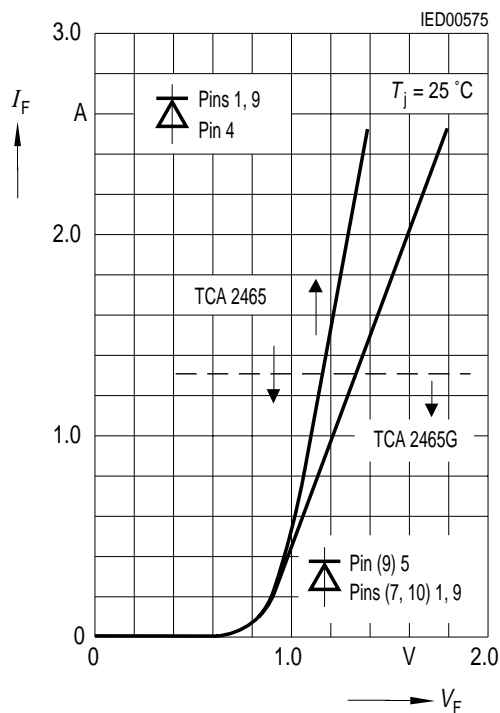
Common-Mode Rejection versus Case Temperature
 $V_S = \pm 10\text{ V}$



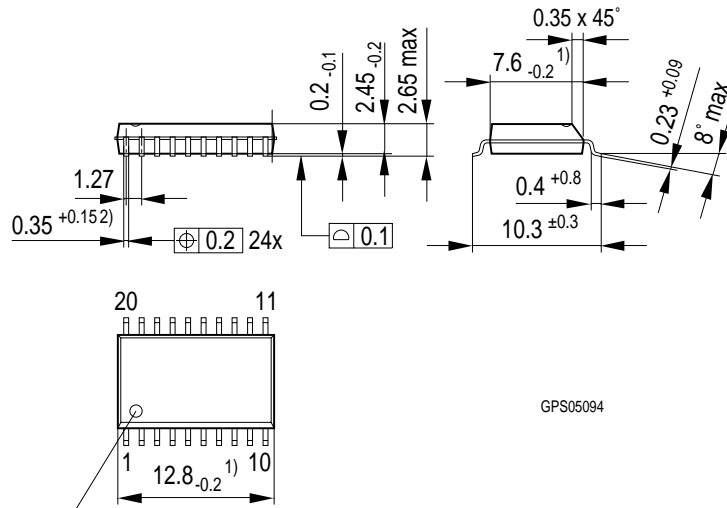
Saturation Voltage versus Peak Output Current
 $T_j = 25\text{ }^{\circ}\text{C}$



Forward Current versus Forward Voltage



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



GPS05094

Index Marking

- 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