

Power Operational Amplifier

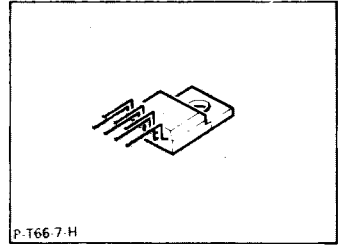
TCA 1365 B

Preliminary Data

Bipolar IC

Features

- High peak output current up to 4 A
- High supply voltage up to 42 V
- Suitable up to gain of 1
- Thermal overload protection
- Internal power limiting
- External compensation
- Inhibit input
- DC short-circuit protection to $+V_S$ and $-V_S$
- Integrated clamp diodes



Applications

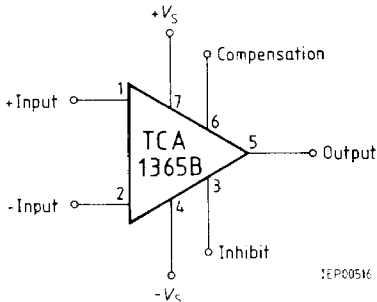
- Power comparator
- Power Schmitt trigger
- Speed control of DC motors
- Power buffer

Type	Ordering Code	Package
TCA 1365 B	Q67000-A8190	Plastic power package P-T66-7-H (similar to TO-220)

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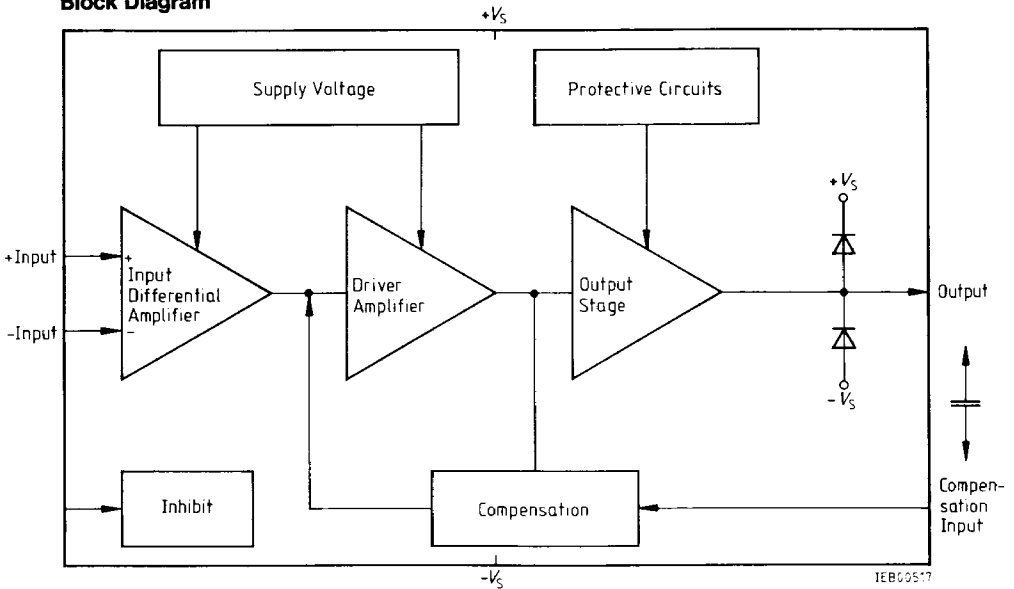
The TCA 1365 B is a power op amp in a plastic power package P-T66-7 H. At maximum supply voltage of ± 21 V it produces a high output current of 4 A. The op amp is protected against short circuits and thermal overload.

Pin Configuration



Pin 4 is electrically connected to cooling fin.

Block Diagram



Absolute Maximum Ratings

 $T_A = -25^\circ\text{C}$ to 85°C

Parameter	Symbol	Limit Values		Unit	Notes
		min.	max.		
Supply voltage	V_S	0	± 21	V	
Differential input voltage	V_{ID}	$-V_S$	$+V_S$	V	
Supply current	I_S	-3.5	+4.0	A	$V_S \geq \pm 15\text{ V}; V_O < -V_S$ $V_S \geq \pm 10\text{ V}; V_O < -V_S$
Output current	I_O	-4	+4	A	
Output current	I_Q	-2		A	
Output current	I_Q	-3		A	
Ground current	I_{GND}	-4.0	+3.5	A	
Current Pin 3, 6	$I_{3,6}$	0	5	mA	
Power dissipation at $T_C = 85^\circ\text{C}$	P_D		20	W	
Junction temperature	T_j		150	$^\circ\text{C}$	
Storage temperature range	T_{stg}	-50	125	$^\circ\text{C}$	

Operating Range

Supply voltage	V_S	± 3	± 20	V	
Case temperature	T_C	-25	85	$^\circ\text{C}$	$P_D = 13\text{ W}$
Forward current of free-wheel diode	I_F		3	A	$T_{j\text{ max}} = 125^\circ\text{C}$
Thermal resistance junction - ambient	$R_{th\ jA}$		65	K/W	
junction - case	$R_{th\ jC}$		3	K/W	

Characteristics

$$V_S = \pm 15 \text{ V}, T_J = 25^\circ\text{C}$$

Parameter	Symbol	Limit Values			Unit	Test Circuit
		min.	typ.	max.		
Open-loop supply current consumption	I_S		20	40	mA	1
Input offset voltage	V_{IO}	-10		10	mV	2
Input offset current	I_{IO}	-100		100	nA	3
Input current	I_I		0.2	1	μA	3
Output voltage $R_L = 12 \Omega; f = 1 \text{ kHz}$ $R_L = 4 \Omega; f = 1 \text{ kHz}$	$V_{Q \text{ pp}}$ $V_{Q \text{ pp}}$	± 13.0 ± 12.5	± 13.5 ± 13.0		V V	4
Input resistance $f = 1 \text{ kHz}$	R_I	4	5		M Ω	4
Open-loop voltage gain $f = 100 \text{ Hz}$	G_{V0}	70	80		dB	5
Common-mode input voltage	V_{IC}	+13/-15	+13.5/-15.1		V	6
Common-mode rejection	k_{CMR}	70	80		dB	6
Supply voltage rejection	k_{SVR}	-70	-80		dB	7
Temperature coefficient of V_{IO} ($-25^\circ\text{C} \leq T_C \leq +85^\circ\text{C}$)	α_{VIO}		50		$\mu\text{V/K}$	2
Temperature coefficient of I_{IO} ($-25^\circ\text{C} \leq T_C \leq +85^\circ\text{C}$)	α_{II0}		0.4		nA/K	3
Slew rate of V_O for non-inverting operation	SR		0.5		V/ μs	8
Slew rate of V_O for inverting operation	SR		0.5		V/ μs	9
Noise voltage referred to input DIN 45 405	V_n		2	5	μV	1
Short-circuit current (S1 closed)	I_{SC}		0.75		A	1
(S2 closed)	I_{SC}		-0.75		A	1
Open-loop supply current consumption (S3 open; $V_3 \geq 2 \text{ V}^1$)	I_S		1.5	3.5	mA	1

Inhibit Input (pin 3)

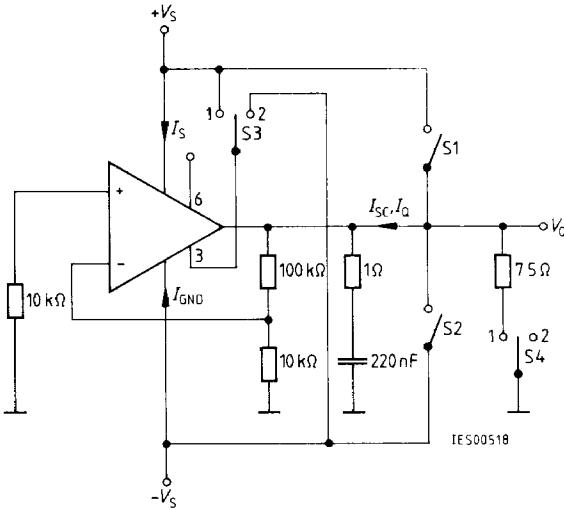
V_3 for amp off	$V_{3 \text{ OFF}}$	2			V	1
V_3 for amp on ¹⁾	$V_{3 \text{ ON}}$			0.5	V	1
Turn-on dead time $I_O \geq 1 \text{ A}^2$	$t_{D \text{ ON}}$		2	5	μs	1
Turn-off dead time $I_O \leq 1 \text{ A}^2$	$t_{D \text{ OFF}}$		50	100	μs	1

1) referred to $-V_S$

2) S4 closed

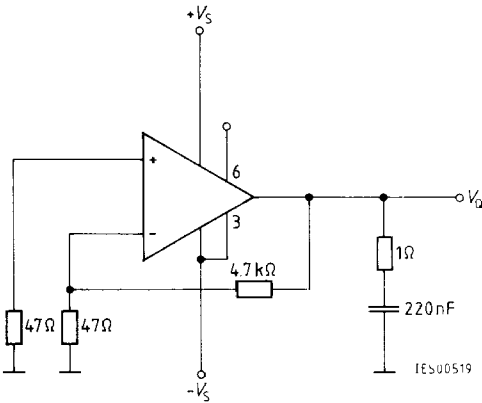
Test and Measurement Circuits

Figure 1
Open-Loop Supply Current Consumption; Noise Voltage



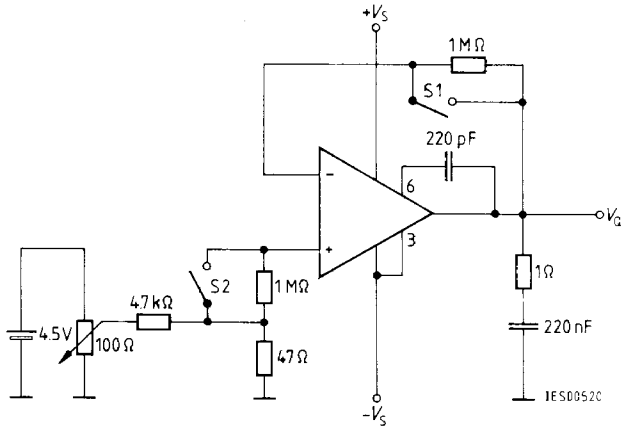
S1 to S4 as shown
unless otherwise specified

Figure 2
Input Offset Voltage, Temperature Coefficient of V_{IO}



$$V_Q = 100 V_{IO}$$

Figure 3
Input Offset Current; Input Current, Temperature Coefficient of I_{IO}



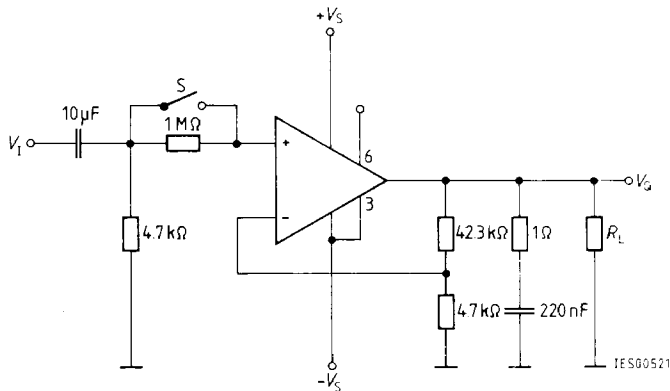
$$S1 \text{ open} - S2 \text{ closed: } I_{I-} = \frac{V_O}{1 \text{ M}\Omega}$$

$$S2 \text{ open} - S1 \text{ closed: } I_{I+} = \frac{V_O}{1 \text{ M}\Omega}$$

$$S1 \text{ open} - S2 \text{ open: } I_{IO} = \frac{V_O}{1 \text{ M}\Omega}$$

S1 closed - S2 closed: offset alignment

Figure 4
Output Voltage, Input Resistance



S closed: to measure V_{Opp}

S open/closed: to measure R_I

Figure 5
Open-Loop Voltage Gain

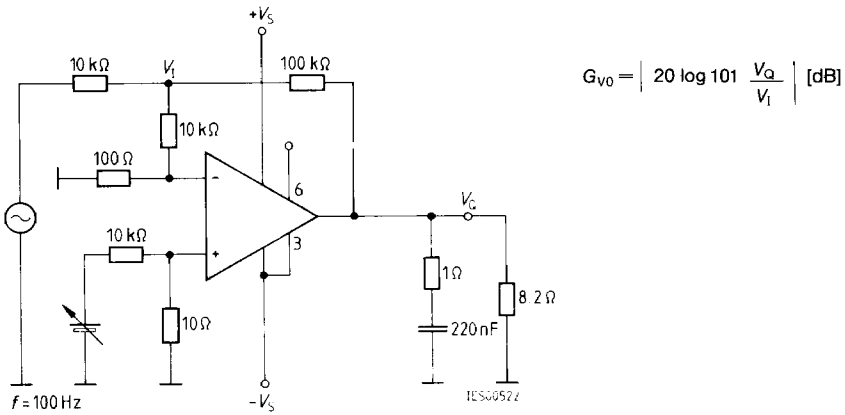


Figure 6
Common-Mode Voltage Gain G_{VC}
Common-Mode Rejection k_{CMR} (dB) = G_{V0} (dB) - G_{VC} (dB)

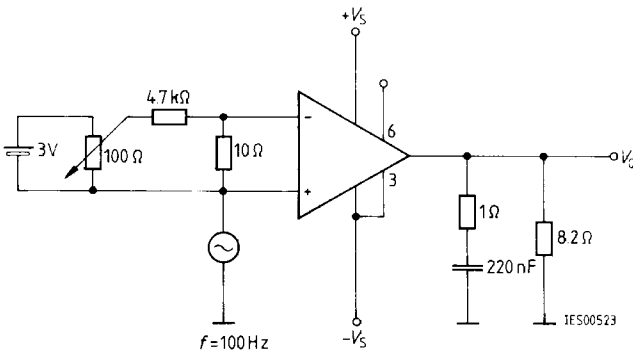
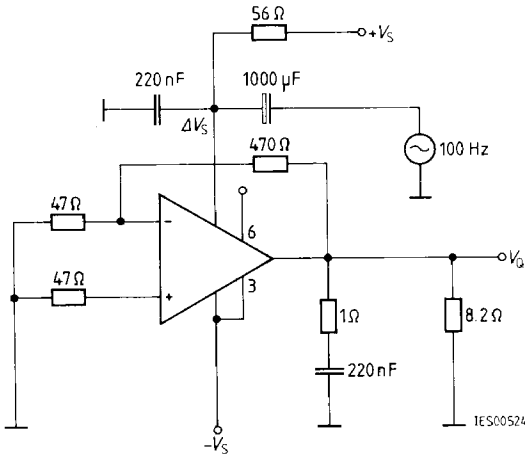
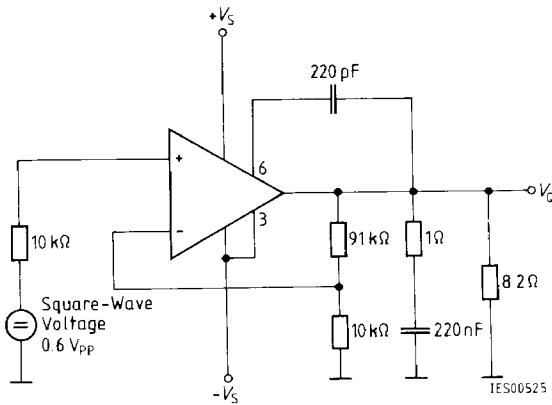


Figure 7
Supply-Voltage Rejection



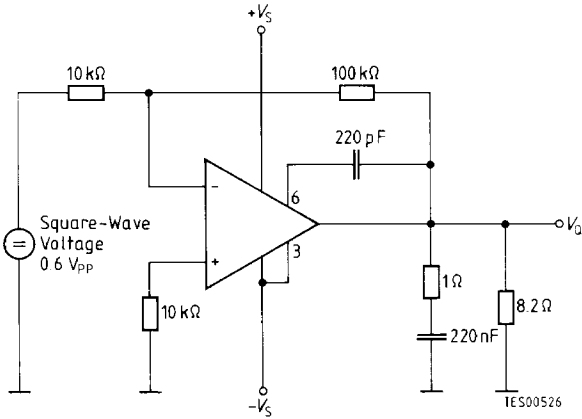
$$k_{SVR} = 20 \log \frac{\Delta V_O}{G_V \times \Delta V_S} \text{ [dB]}$$

Figure 8
Slew Rate for Non-Inverting Operation

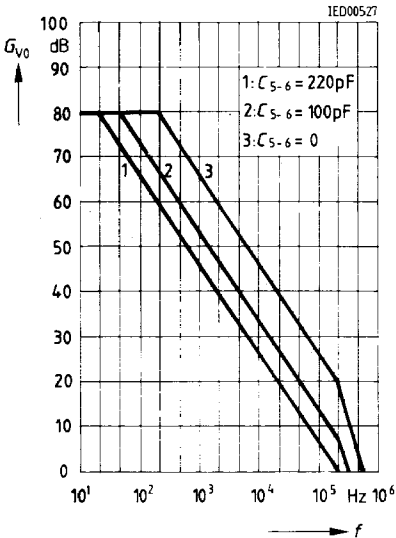


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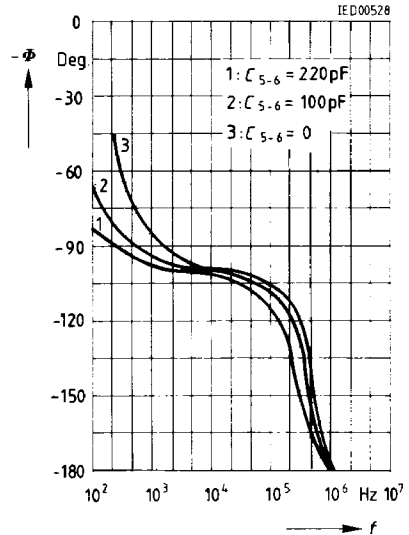
Figure 9
Slew Rate for Inverting Operation



Open-Loop Voltage Gain versus Frequency
 $T_j = 25^\circ\text{C}; V_S = \pm 15\text{ V}$

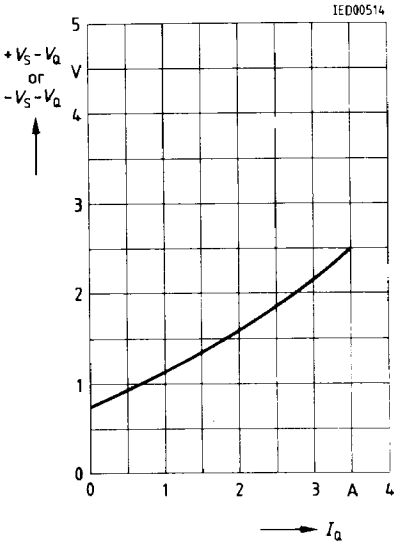


Phase Response versus Frequency
 $T_j = 25^\circ\text{C}; V_S = \pm 15\text{ V}$

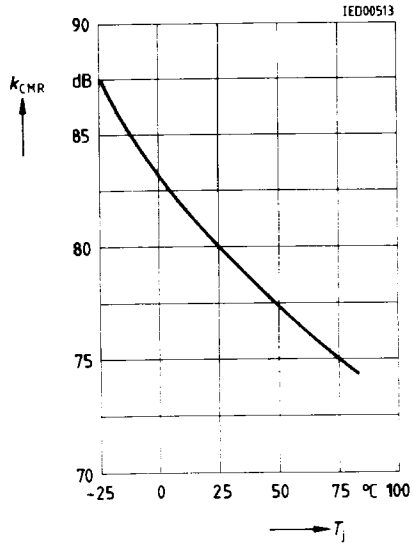


Saturation Voltage versus Output Current

$T_j = 25^\circ\text{C}$

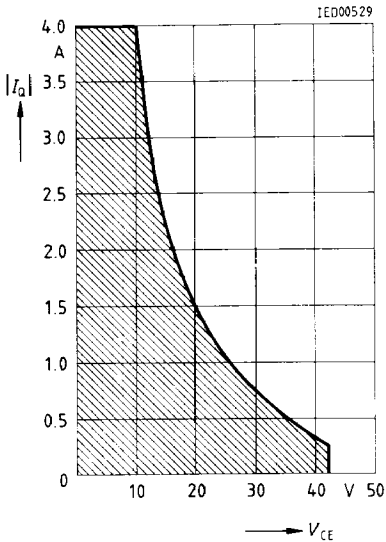


Common-Mode Rejection versus Case Temperature

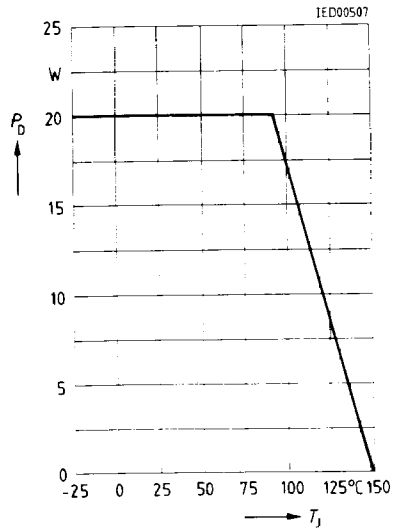


Safe Operating Area of Output Stage Output Current versus Collector Emitter Voltage

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

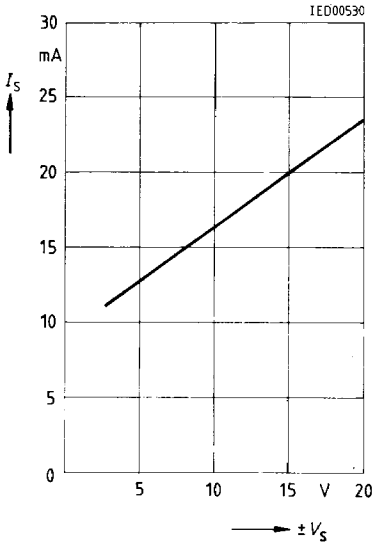


Maximum Permissible Power Dissipation versus Case Temperature



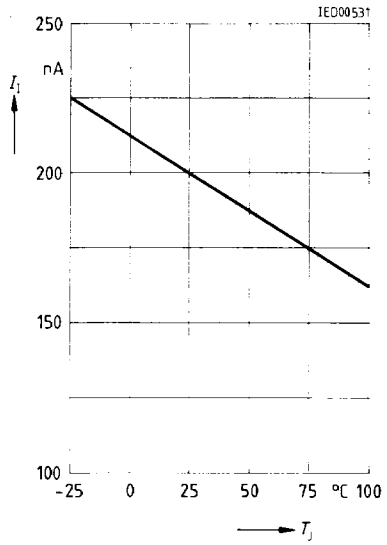
Supply Current versus Supply Voltage

$T_j = 25^\circ\text{C}$



Input Current versus Junction Temperature

$V_S = \pm 15\text{ V}$



Forward Current versus Forward Voltage

$T_j = 25^\circ\text{C}$

