

Power Operational Amplifier

TCA 365 B

Preliminary Data

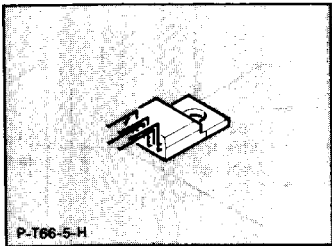
Bipolar IC

Features

- High peak output current, up to 4 A
- High supply voltage, up to 42 V
- Thermal overload protection
- Internal power limitation
- DC voltage short-circuit proof to $+V_S$ and $-V_S$
- Integrated clamp diodes

Applications

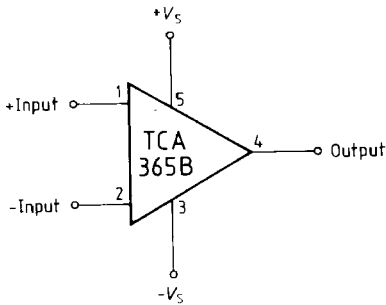
- Power comparator
- Power Schmitt trigger
- Speed control of DC motors



Type	Ordering Code	Package
■ TCA 365 B	Q67000–A8189	Plastic power package P-T66-5-H (similar to TO-220)

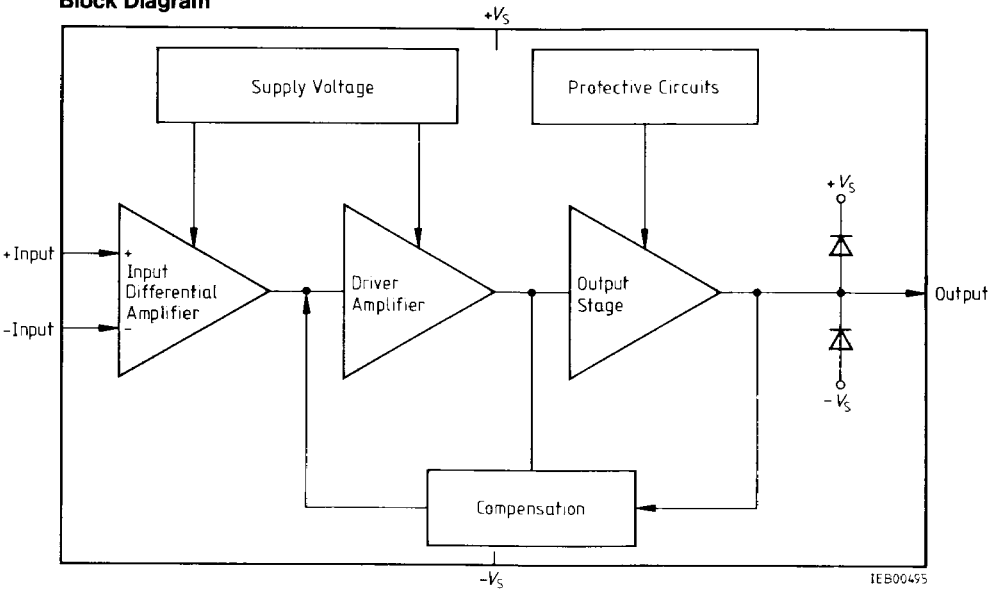
The TCA 365 B is a power op amp in a plastic package P-T66-5-H. At a maximum supply voltage of ± 21 V, the IC produces a high output current of 4 A. The op amp is protected against thermal overload and short circuits.

Pin Configuration



Pin 3 is electrically connected to cooling fin.

Block Diagram



Absolute Maximum Ratings

$T_C = -25^{\circ}\text{C}$ 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	
Output current	I_O	-4.0	4.0	A	
Output current	I_O	-2.0		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	-3.0		A	
Ground current	I_{GND}	-4.0	3.5	A	
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

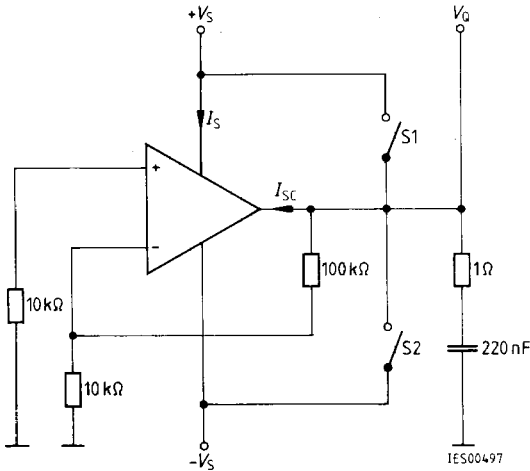
Supply voltage	V_S	± 3	± 20	V	
Case temperature	T_C	-25	85	$^{\circ}\text{C}$	$P_D = 13\text{ W}$
Voltage gain	$G_{V\min}$	20		dB	
Forward current of clamp diode	I_F		3	A	$T_{j\max} = 125^{\circ}\text{C}$
Thermal resistance junction – ambient	$R_{th\ jA}$		65	K/W	
junction – case	$R_{th\ jC}$		3	K/W	

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_{I0}	-10		10	mV	2
Input offset current	I_{I0}	-100		100	nA	3
Input current	I_I		0.2	1	μA	3
Output voltage $R_L = 12 \text{ }\Omega$; $f = 1 \text{ kHz}$	$V_{Q \text{ pp}}$	± 13.0	± 13.5		V	4
$R_L = 4 \text{ }\Omega$; $f = 1 \text{ kHz}$	$V_{Q \text{ pp}}$	± 12.5	± 13.0		V	
Input resistance $f = 1 \text{ kHz}$	R_I	1	5		M Ω	4
Open-loop voltage gain $f = 100 \text{ Hz}$	G_{V0}	70	80		dB	5
Common-mode input voltage range	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_{I0} $-25^\circ\text{C} \leq T_j \leq +85^\circ\text{C}$	$\alpha_{V_{I0}}$		50		$\mu\text{V/K}$	2
Temperature coefficient of I_{I0} $-25^\circ\text{C} \leq T_j \leq +85^\circ\text{C}$	$\alpha_{I_{I0}}$		0.4		nA/K	3
Slew rate of V_O for non-inverting operation	SR		2		V/ μs	8
Slew rate of V_O for inverting operation	SR		2		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

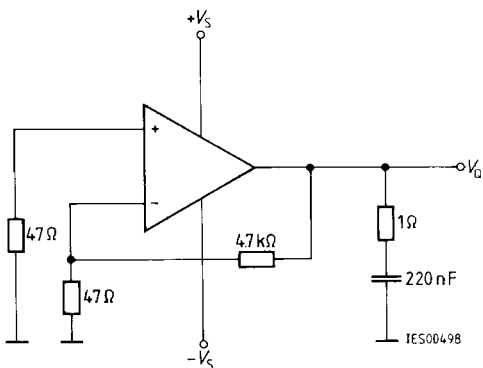
Test and Measurement Circuits

Figure 1
Open-Loop Supply Current Consumption, Noise Voltage

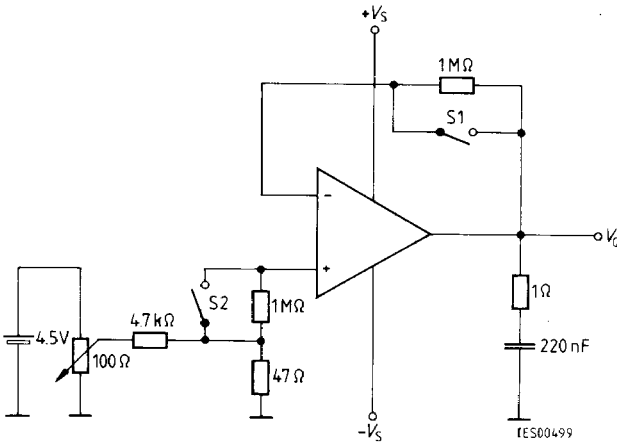


S1 and S2 as shown
 unless otherwise specified

Figure 2
Input Offset Voltage, Temperature Coefficient of V_{I0}



$$V_Q = 100 V_{I0}$$

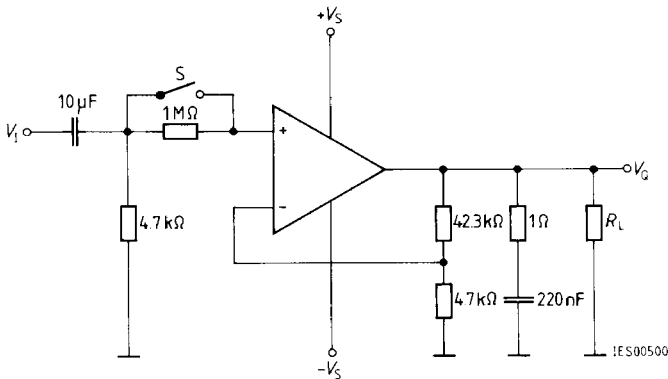
Figure 3**Input Offset Current; Input Current, Temperature Coefficient of I_{I0}** 

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

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

$$S1 \text{ open} - S2 \text{ open: } I_{I0} = \frac{V_O}{1 \text{ M}\Omega}$$

S1 closed - S2 closed: offset alignment

Figure 4**Output Voltage, Input Resistance**

S closed: to measure V_{Oapp}

S open/closed: to measure R_I

Figure 5
Open-Loop Voltage Gain

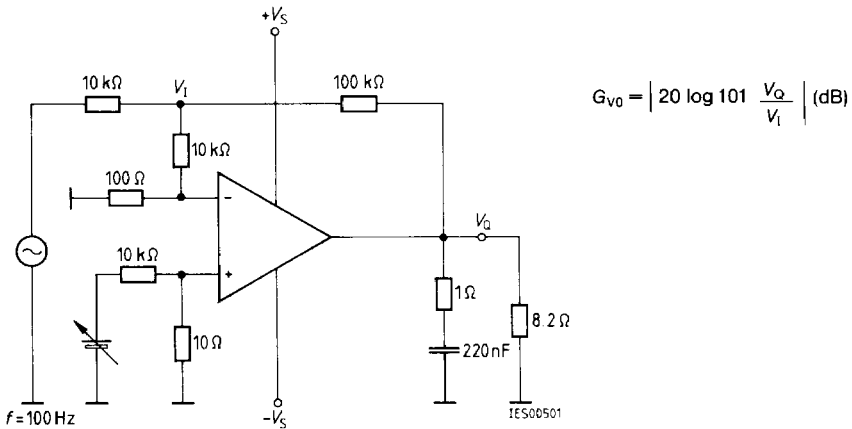


Figure 6
Common-Mode Voltage Gain G_{VC}
Common-Mode Rejection k_{CMR} (dB) = G_{V0} (dB) - G_{VC} (dB)

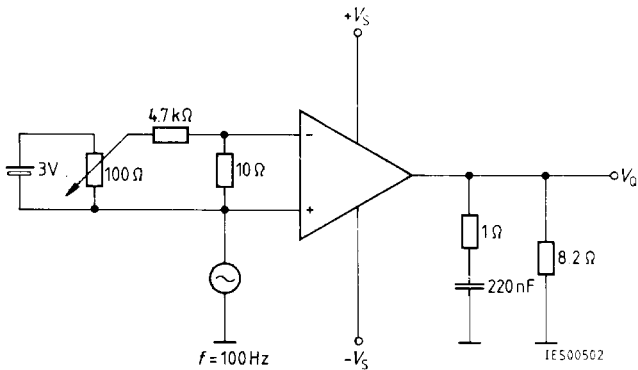
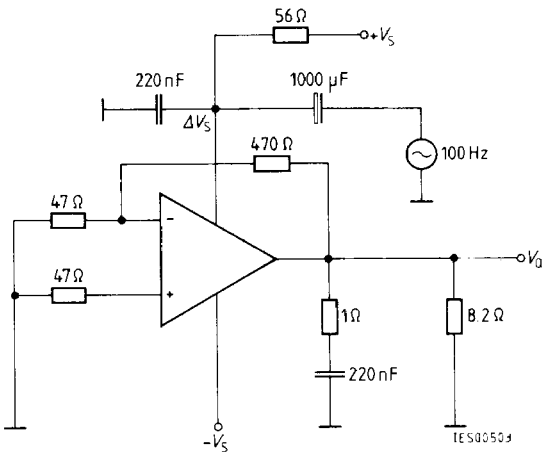


Figure 7
Supply Voltage Rejection



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

Figure 8
Slew Rate for Non-Inverting Operation

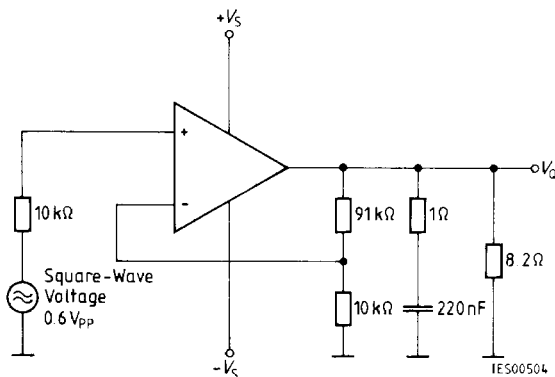
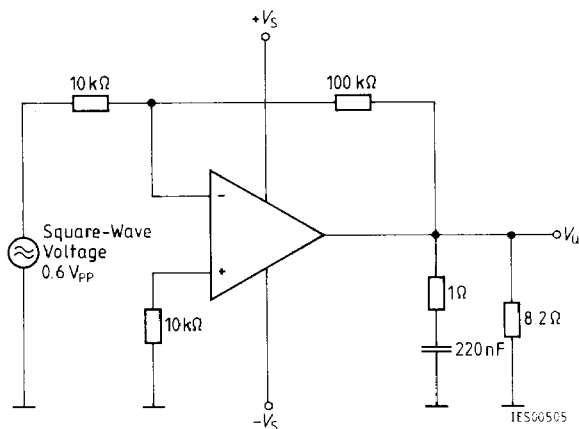
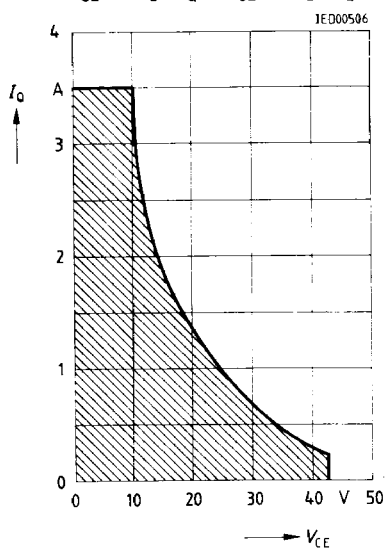


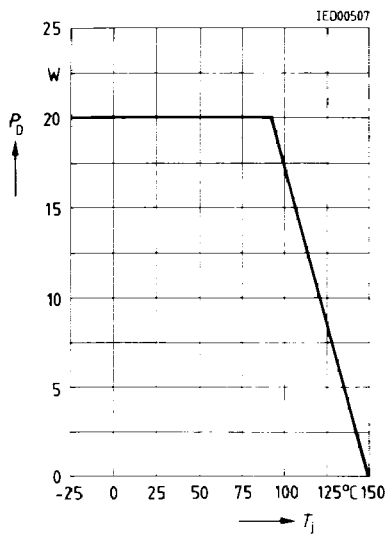
Figure 9
Slew Rate for Inverting Operation



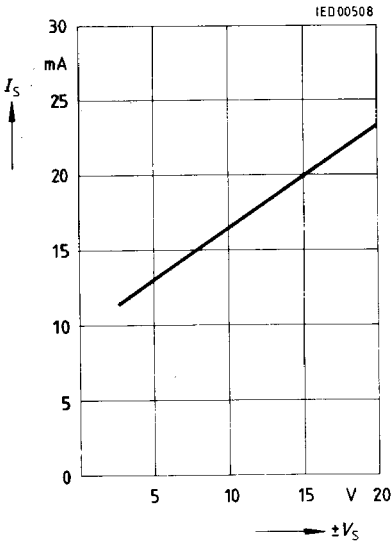
Safe Operating Area of Output Stage
Output Current versus Collector
Emitter Voltage $T_j = 25^\circ C$
 $V_{CE} = +V_S - V_Q$ or $V_{CE} = -V_S - V_Q$



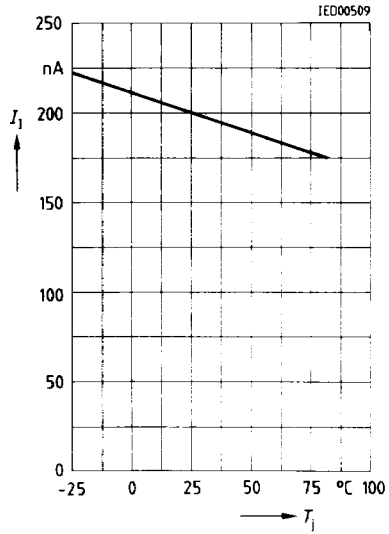
Maximum Permissible Power
Dissipation versus
Case Temperature



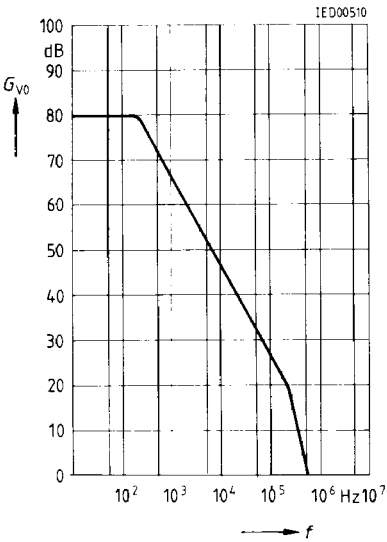
**Supply Current versus
Supply Voltage**
 $T_j = 25^\circ\text{C}$



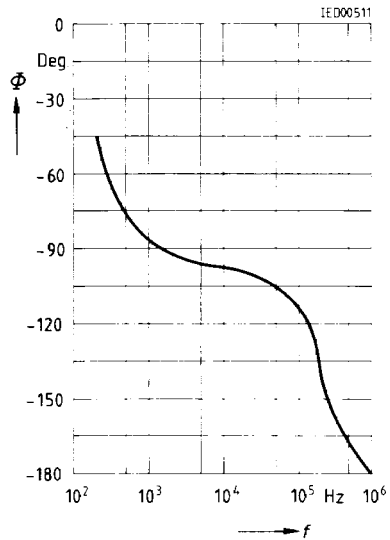
**Input Current versus
Junction Temperature**
 $V_S = \pm 15\text{ V}$



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

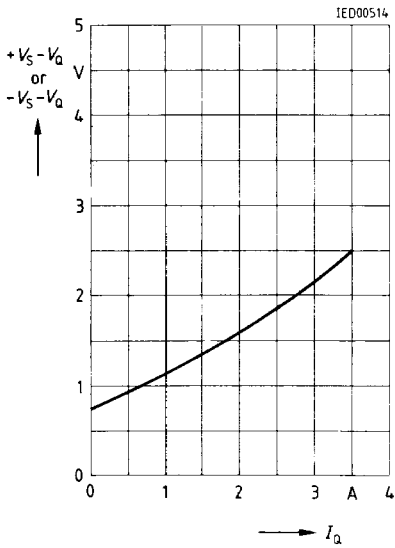


Phase Response versus Frequency
 $V_S = \pm 15\text{ V}, T_j = 25^\circ\text{C}$

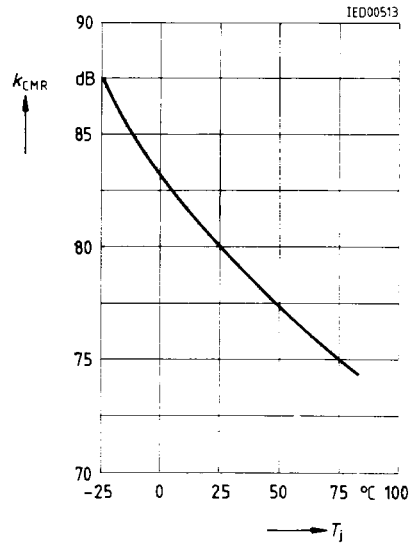


**Saturation Voltage versus
Output Current**

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



**Common-Mode Rejection
versus Junction Temperature**
 $V = \pm 15\text{ V}$



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

