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Switching Regulators 5 and 10 Watt

24 ISR 5
24 ISR 10

without input to output isolation

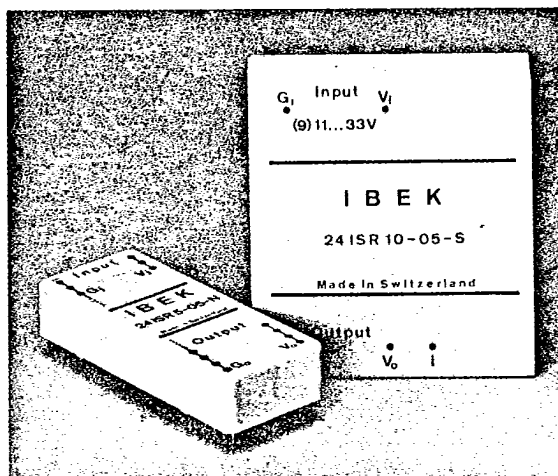
The regulator should **not** be operated without an external input capacitor!
See page 4.

Input : $U_i = U_{o \text{ nom}} + 4 \text{ V} \dots 33 \text{ V DC}^{1)}$

Output : 5, 12, 15 V DC

Description

The series ISR switching regulators have been developed to power logic systems. The ISR regulators feature high efficiency, high reliability and good dynamic response to load transients and at startup. Efficiency is high and practically constant over the entire input voltage range. The ISR modules are continuously short circuit proof.



Features

- High efficiency
- high reliability
- Optimal dynamic characteristics
- Continuously short-circuit-proof
- Metal case (ISR 10)
- Height of 10.5 mm only
- No derating
- Large input voltage range

Benefits

- low heat generation
- MTBF = 250 000 h (24 ISR 5)
200 000 h (24 ISR 10, $T_A = +40^\circ\text{C}$, G_F)
- excellent dynamic load behavior
- safe and simple handling
- self cooling
- compact circuitry and system design
- full load capability over full ambient temperature range
- flexible application area

Applications

Power supply for op Amps, A/D converters, D/A converters
Power supply for μ Ps, RAMs, CMOS

¹⁾ For $U_i = 11 \dots 9 \text{ V}$: linear derating of the output current I_o from 100 to 80 % of $I_{o \text{ nom}}$.

Type Survey

Type		U _{0 nom}	I _{0 nom}	Temp. range	Dimensions
24 ISR 5-05-N	1)3)	+ 5 V	1.0 A	0...+71 °C	55.5 × 22.5 × 10.5 mm
24 ISR 5-12-N	1)	+12 V	0.42 A		
24 ISR 5-15-N	1)	+15 V	0.33 A		
24 ISR 5-05-S	1)3)	+ 5 V	1.0 A	-40...+85 °C	
24 ISR 5-12-S	1)	+12 V	0.42 A		
24 ISR 5-15-S	1)	+15 V	0.33 A		
24 ISR 10-05-N	2)3)	+ 5 V	2.0 A	0...+71 °C	50.8 × 58.0 ×
24 ISR 10-05-S	2)3)	+ 5 V	2.0 A	-40...+85 °C	10.5 mm

Maximum Ratings

Characteristic		Values
Input voltage without defect	$U_{i \text{ abs}}$ (max 60 s)	min max
Operating input voltage	U_i	min max
Storage temp.	T_s	
Ambient temperature	T_A	
Case temperature	T_c	

- ¹⁾ Available with inhibit (suffix I). Example : 24 ISR 5-05-NI
²⁾ Available with inhibit (suffix I), Potentiometer (suffix P) or combined (suffix IP) Example : 24 ISR 10-05-SIP
³⁾ For $U_i = 11...9 \text{ V}$: linear derating of the output current I_o from 100 to 80 % of $I_o \text{ nom}$

Block Diagrams

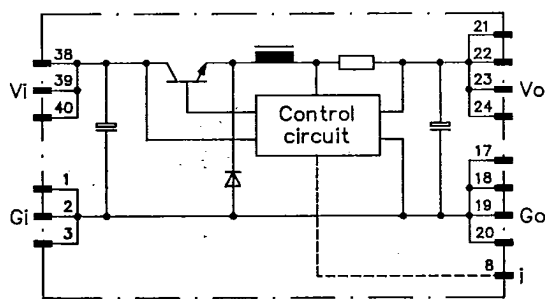


Fig. 1
Block Diagram 24 ISR 5

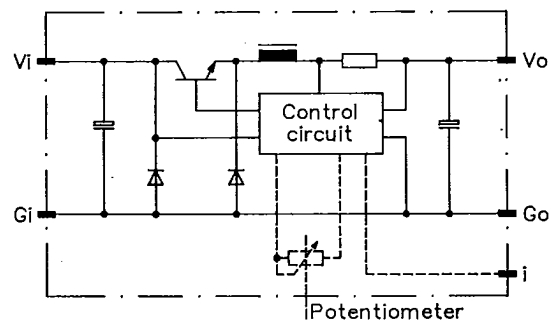


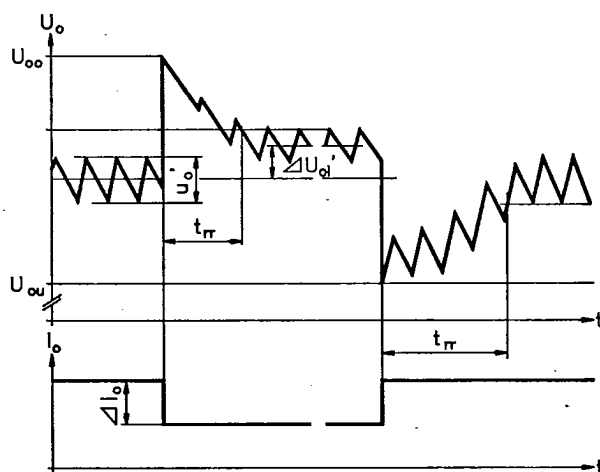
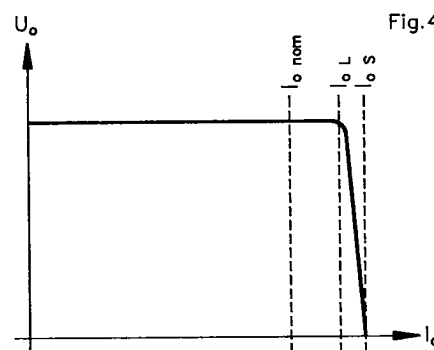
Fig. 2
Block Diagram 24 ISR 10

Electrical Characteristics

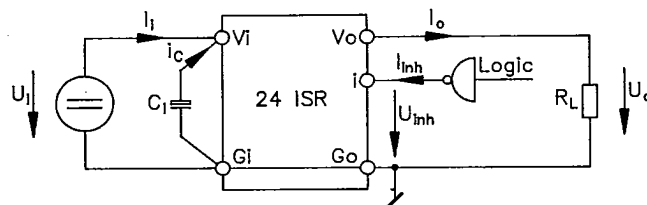
 $T_A = +25\text{ }^{\circ}\text{C}$, unless otherwise specified

Characteristic	Conditions	ISR 5-05	ISR 5-12	ISR 5-15	ISR 10
No load input current I_{i0}	$U_i = 24\text{ V}$ $I_o = 0$	9 mA 14 mA			
Switching freq. f_s		100 kHz			
Output voltage U_o	$U_i = 24\text{ V}$ $I_o \text{ nom}$ $T_A \text{ min} \dots T_A \text{ max}$	4.90 V	11.88 V	14.85 V	4.98 V
Suffix N		5.00 V	12.00 V	15.00 V	5.02 V
		5.10 V	12.12 V	15.15 V	5.08 V
Output voltage U_o	$U_i = 24\text{ V}$ $I_o \text{ nom}$ $T_A \text{ min} \dots T_A \text{ max}$	4.85 V	11.75 V	14.70 V	4.93 V
Suffix S		5.00 V	12.00 V	15.00 V	5.02 V
		5.15 V	12.25 V	15.30 V	5.10 V
Output ripple u_o (BW = 20 MHz)	$U_i = 24\text{ V}$ $I_o \text{ max}$	40 mV _{pp} 80 mV _{pp}	15 mV _{pp} 30 mV _{pp}	10 mV _{pp} 10 mV _{pp}	50 mV _{pp} 100 mV _{pp}
Static deviation versus input voltage $\Delta U_o U$	$U_i \text{ min} \dots U_i \text{ max}$ $I_o \text{ nom}$	$\pm 10\text{ mV}$	$\pm 25\text{ mV}$	$\pm 30\text{ mV}$	$\pm 10\text{ mV}$
Static deviation versus output current $\Delta U_o I$	$U_i = 24\text{ V}$ $I_o = 0 \dots I_o \text{ nom}$	$\pm 10\text{ mV}$	$\pm 25\text{ mV}$	$\pm 30\text{ mV}$	$\pm 10\text{ mV}$
Output current limitation response I_{oL}	$U_i = 24\text{ V}$ $U_o = 0.95 U_o \text{ nom}$	1.2 $I_o \text{ nom}$			
Short circuit output current I_{oS}	$U_i = 24\text{ V}$ $U_o = 0\text{ V}$	1.3 $I_o \text{ nom}$			
Efficiency η	$U_i = 24\text{ V}$ $I_o \text{ max}$	76 % 80 %			
Dynamic undershoot-level U_{ou}	$U_i = 24\text{ V}$ $\Delta I_o = +1/3 I_o \text{ nom}$	4.80 V	11.85 V	14.85 V	4.78 V
Dynamic overshoot-level U_{oo}	$U_i = 24\text{ V}$ $\Delta I_o = -1/3 I_o \text{ nom}$	5.20 V	12.15 V	15.15 V	5.22 V
Load transient recovery time t_{rr}	$U_i = 24\text{ V}$ $\Delta I_o = \pm 1/3 I_o \text{ nom}$	150 μs			
		30 μs			

Definitions

Fig. 3
Dynamic characteristicFig. 4
Short-circuit characteristic

External Input Circuitry



Type	C ₁
24 ISR 5-05	470 μ F
24 ISR 5-12	330 μ F
24 ISR 5-15	220 μ F
24 ISR 10-05	680 μ F

Fig. 5
Circuit configuration and definitions

Important: The regulator should not be operated without an external input capacitor C_1 !

The regulator incorporates a small internal input filter capacitor only. The AC component i_c of the input current caused by the switching principle must be supplied by the capacitor C_1 , which is normally necessary in rectifier-type supplies: $i_c \approx 0.5 I_o$

Example: ISR 5-05-N at $I_o = 1$ A: $i_c \approx 0.5$ A_{rms} at 100 kHz.

The connection lines capacitor-VI and capacitor-GI should not exceed a length of together 150 mm.

It is recommendable to check the circuitry by measuring the AC component at the input terminals with a CRO (minimum bandwidth 20 MHz). Tolerated voltage = max. 3 V_{pp} at regulator switching frequency.

Inhibit (Suffix I)

Characteristic		Condition	Unit
Inhibit input voltage U_{inh} ¹⁾ such that regulator output voltage is	operational	$U_i \min \dots U_i \max$ $R_L = U_o \text{ nom} / I_o \text{ nom} \dots \dots \infty$	-3.5...+0.8 V
	non operational	$T_A \min \dots T_A \max$	+2.4...+35 V
Inhibit current I_{inh} ¹⁾	max	$U_{inh} = +0.8$ V	+100 μ A
	max	$U_{inh} = +2.4$ V	+400 μ A
Inhibit input resistance R_{inh}	min max		4.7 k Ω 12 k Ω
Output leakage current I_{o0} ¹⁾	max	$R_L = U_i \text{ nom} / U_o \text{ nom} / I_o \text{ nom}$	0.5 mA
Rise time t_r	typ	$U_i = 11$ V $I_o \text{ nom}$	0.7 ms
Fall time t_f	typ	$U_i = 11 \dots 33$ V	1 ms

¹⁾ Definitions see Fig. 5

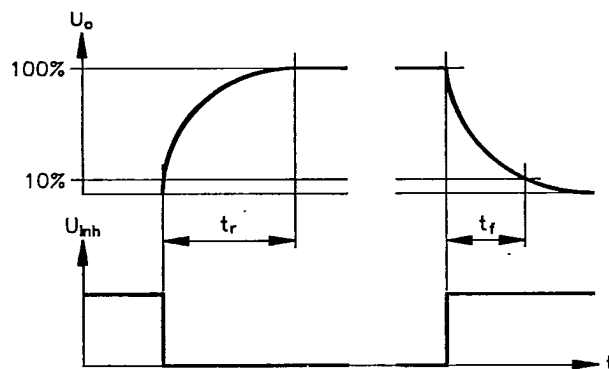


Fig. 6
Inhibit rise and fall times

Potentiometer (suffix P, available only with 24 ISR 10-05)

Adjustment range of output voltage U_0 : 4.9...5.4 V DC

Application Notes

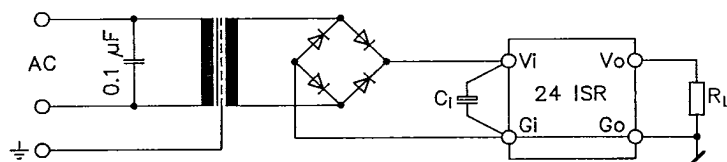


Fig. 7
Power supply system with bridge-type rectifier circuit

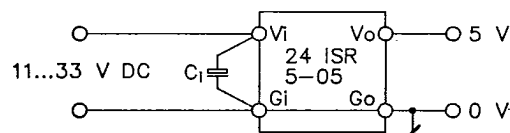


Fig. 8
Battery-buffered power supply system

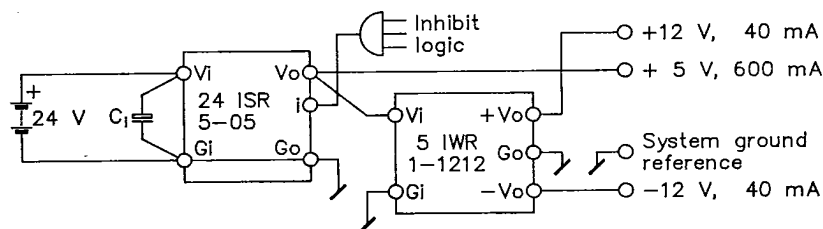


Fig. 9
Power supply system providing 3 output voltages

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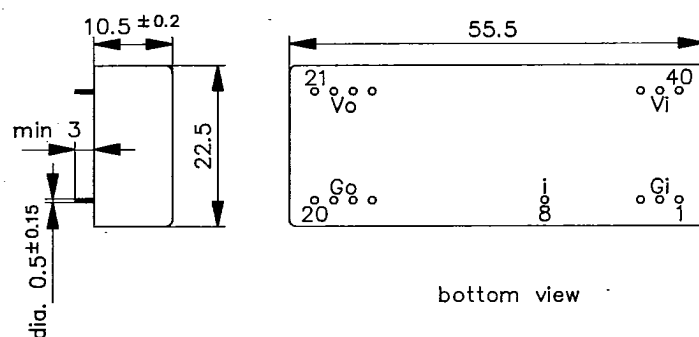
Mechanical DataDimensions in mm, tolerances ± 0.3 mm, unless otherwise specified

Fig. 10
Case 24 ISR 5
Weight 25 g

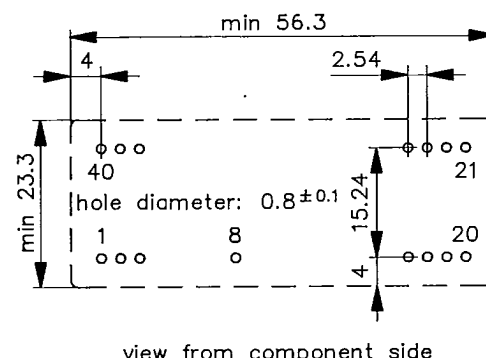


Fig. 11
24 ISR 5 hole location for
circuit board mounting
--- Space reserved for regulator

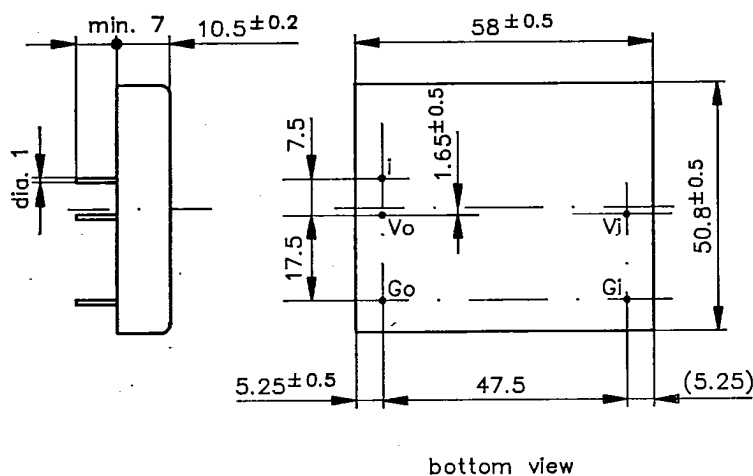


Fig. 12
Case 24 ISR 10
Weight 90 g

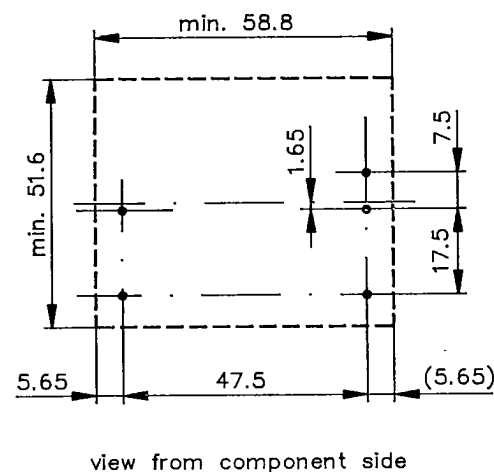


Fig. 13
24 ISR 10 hole location for
circuit board mounting
--- Space reserved for regulator

Represented by: