# MULTI-STABILIZER FOR ELECTRONIC TUNING

The TCA750 is basically a stabilizer for use in electronic tuning systems. The circuit is combined with an external reference diode which entirely determines the thermal stability of the system and can be adapted to the stability requirements of AM, FM or TV receivers.

The reference diode BZV38 used in conjunction with the TCA750 form an ideal pair for FM tuners in radio or TV receivers.

Additional to a stabilized voltage ($V_O1$) for the electronic tuning system, the TCA750 incorporates two other output voltages ($V_O2$ and $V_O3$) for stabilized supply of the entire receiver combination as well as the following attractive features:

- The output current of any of the three stabilizers can be increased by a discrete power transistor without affecting circuit stability.

- For mute control at switching on, $V_O2$ can be delayed by external components.

- An a.f.c. coupling circuit provides a constant correction factor by superimposing an a.f.c. voltage on $V_O1$.

- Adjustable a.f.c. amplification factor ($< 5$).

- Pulse or touch contact operation switches off the a.f.c. whilst changing stations.

- Delayed switching on of the a.f.c., externally adjustable ($t_d < 2$ s).

- Search tuning becomes very simple when using the a.f.c. current source (pin 10).

- All three stabilized outputs are protected against short-circuit and are individually adjustable.

**QUICK REFERENCE DATA** see page 2

**PACKAGE OUTLINE**

16-lead DIL; plastic (SOT-38).

## QUICK REFERENCE DATA

| | | | |
|---|---|---|---|
| Input voltage range | $V_{13-16}$ | 26,5 to 54 | V |
| Ambient temperature | $T_{amb}$ | typ. 25 | $^{o}C$ |
| Input voltage | $V_{13-16}$ | typ. 45 | V |
| Tuning voltage ($V_O 1$) * | $V_{12-16}$ | 21 to 34 | V |
| Output current (I1) * | $I_{12}$ | < 14,5 | mA |
| Stabilizing time | $t_{stab}$ | typ. 0,8 | s |
| Temperature coefficient ($V_O 1$) | | | |
|    TCA750 | $\Delta V_O 1/\Delta T$ | typ. 1 | ppm/$^{o}C$ |
|    BZV38 | | typ. 30 | ppm/$^{o}C$ |
| Line regulation | $\Delta V_O 1/\Delta V_{in}$ | typ. 10 | ppm/V |
| Output voltage ($V_O 2$) * | $V_{14-16}$ | 8 to 21 | V |
| Output current (I2) * | $I_{14}$ | < 6 | mA |
| Output voltage ($V_O 3$) * | $V_{2-16}$ | 8 to 29 | V |
| Output current (I3) * | $I_2$ | < 6 | mA |

* Symbols used in test circuit Fig. 3.

# Multi-stabilizer for electronic tuning

# TCA750
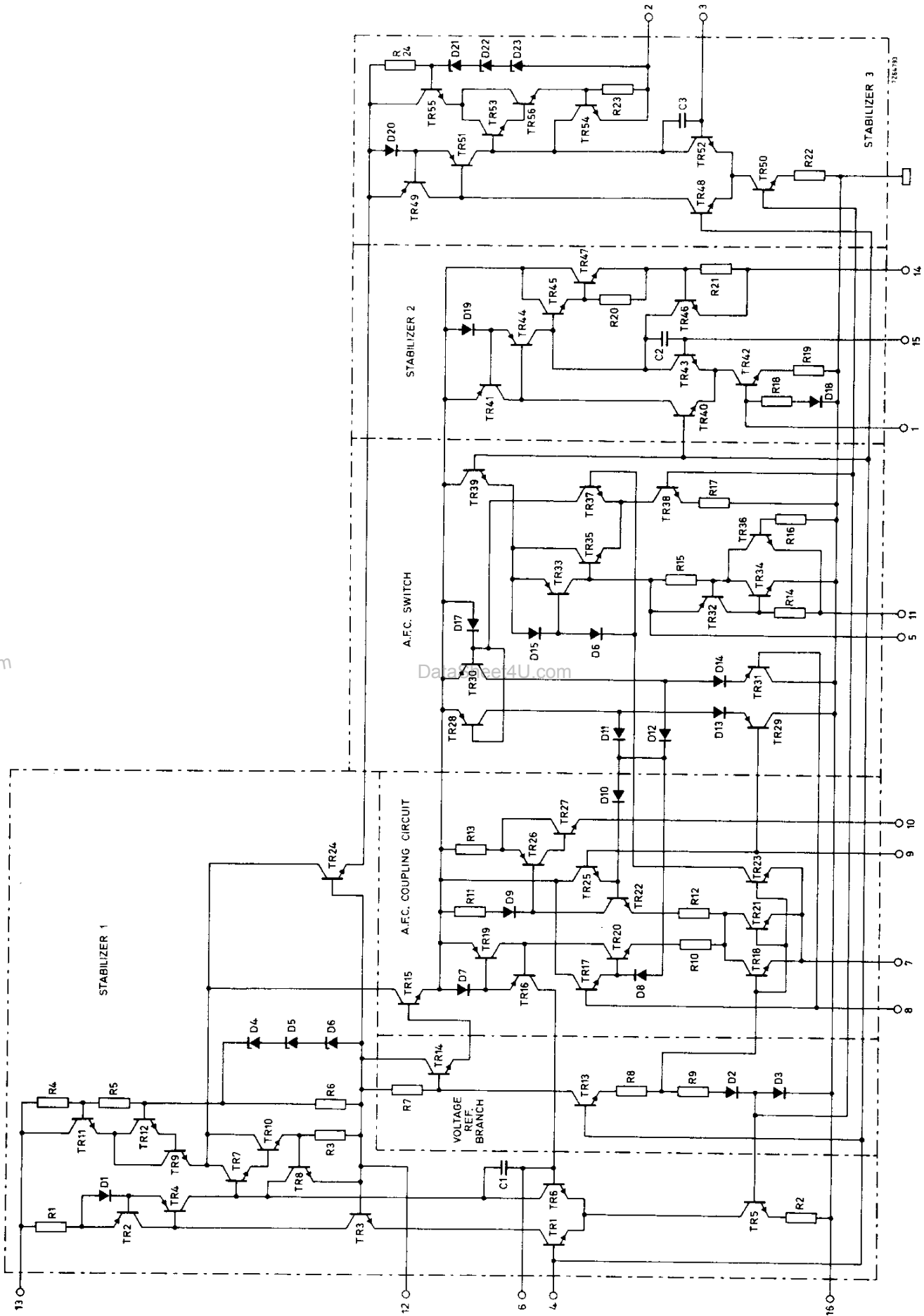


Fig. 1 Circuit diagram.

# TCA750

## RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

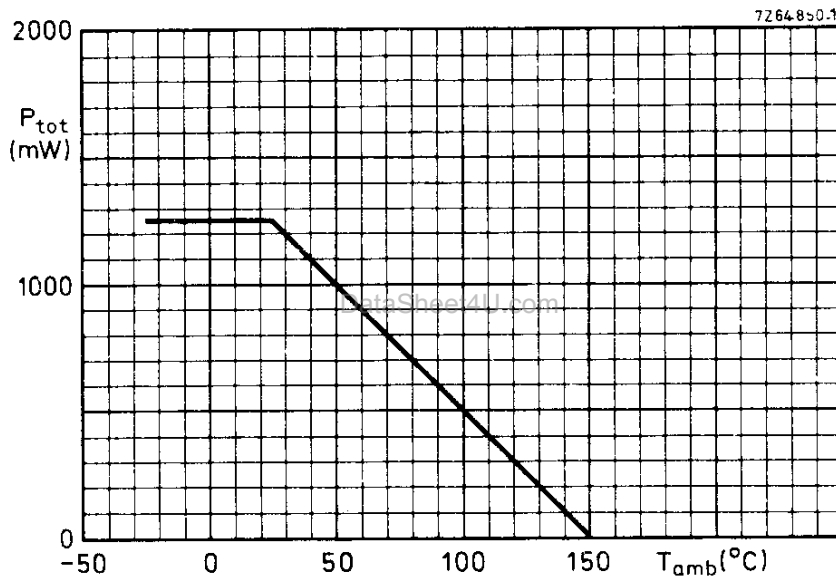| | | | | |
|---|---|---|---|---|
| Input voltage (supply) | $V_{13-16}$ | max. | 54 | V |
| A.F.C. input voltages (pins 8 and 9) | $V_{8-16}$, $V_{9-16}$ | max. | 17 | V |
| | $\pm V_{8-9}$ | max. | 6 | V |
| Output current | | | | |
| pin 12 | $I_{12}$ | max. | 55 | mA |
| pin 14 | $I_{14}$ | max. | 20 | mA |
| pin 2 | $I_2$ | max. | 25 | mA |
| Input current (pin 11) | $\pm I_{11}$ | max. | 6 | mA |
| Storage temperature | $T_{stg}$ | | −55 to + 150 | °C |
| Operating ambient temperature | $T_{amb}$ | | −25 to + 150 | °C * |
| Total power dissipation | | see derating curve Fig. 2 | | |



Fig. 2 Power derating curve.

\* See derating curve Fig. 2.
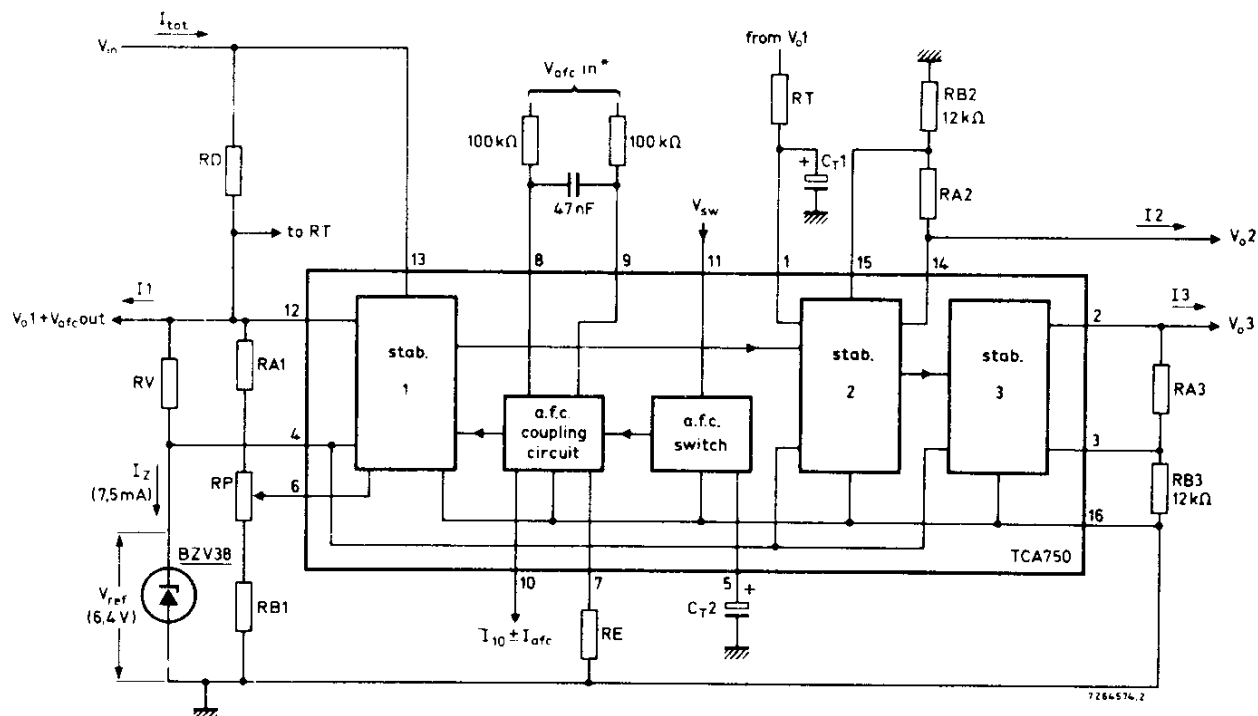
\* $V_{afc}$in is superimposed on a common-mode voltage ($V_{com}$) of 5 V to 17 V.

Fig. 3 Test circuit and multi-stabilizer peripheral components.

**Note to power reduction resistor RD**

For worst case conditions (maximum output currents of the three stabilizers and a high supply voltage $V_{in}$) the power dissipation ($P_{tot}$) must be reduced by the use of the external resistor RD.

$$\text{Power reduction} = \frac{(V_{in} - V_o1)^2}{RD}$$

The minimum permissible value of RD is derived by the formula

$$RD_{min} = \frac{V_{in\,max} - V_o1 - V_{afc}out}{I_{12} - I_{13\,min}}$$

where,

$$I_{13\,min} = 4,5 \text{ mA (stand-by current } I_s)$$
$$I_{12} = I_Z + I_{RA1} + I1_{min}$$

# TCA750

## CHARACTERISTICS and APPLICATION INFORMATION

$T_{amb} = 25\ ^{\circ}C$; see test circuit Fig. 3.

| | | note | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| **Supplies** | | | | | | |
| Input voltage | $V_{in}$ | 1 | 26,5 | – | 54 | V |
| Input current | $I_{tot}$ | 2 | – | – | 31 | mA |
| **Output characteristics** | | | | | | |
| D.C. output resistance (all stabilizers) | $R_{out}$ | – | – | 1 | – | $\Omega$ |
| Permissible output short-circuit duration | | | | | | |
| stabilizer 1 | $t_{short}$ | – | continuous | | | |
| stabilizers 2 or 3 | | – | – | – | 10 | s |
| **Stabilizer 1** | | | | | | |
| Output voltage range (adjustable) | $V_o1$ | 3 | 21 | – | 34 | V |
| Output current | I1 | 4, 5 | 0 | – | 5 | mA |
| Stabilizing time | $t_{stab}$ | 6 | – | – | 1 | s |
| Output voltage temp. coefficient | $\Delta V_o1/\Delta T$ | 7, 8 | – | 40 | – | ppm/$^{\circ}C$ |
| Line regulation | $\Delta V_o1/\Delta V_{in}$ | 8 | – | 10 | – | ppm/V |
| **A.F.C. coupling circuit** | | | | | | |
| A.F.C. input voltage (½ $V_{afc}$ swing) | $V_{afc}$ in | – | – | – | 5 | V |
| A.F.C. output voltage (½ $V_{afc}$lim swing) | $V_{afc}$ lim | 15, 16 | – | – | 0,9 | V |
| A.F.C. output current threshold | I10 | 15, 16 | – | – | 1,5 | mA |
| A.F.C. output current swing | $I_{afc}$ lim | 15, 16 | – | – | 3,0 | mA |
| A.F.C. off delay | $t_d$ | – | – | 2 | – | s |
| Amplification factor | $\mu$ | – | – | – | 5 | |
| A.F.C. slope ($\Delta I_{afc}/\Delta V_{afc}$ in) | S | 14 | – | 2,5 | – | mA/V |
| Common-mode voltage | $V_{com}$ | 9 | 5 | – | 17 | V |
| $V_o1$ change due to a.f.c. switching | $\Delta V_o1/afc$ | – | – | – | 25 | mV |
| Asymmetry of a.f.c. input (a.f.c. off) | $\pm$ (I8-I9) | – | – | – | 0,5 | $\mu$A |
| **A.F.C. switch operated by manual switch** | | | | | | |
| Input voltage (a.f.c. on) | $V_{sw}$ | – | –0,5 | – | +0,5 | V |
| Positive input voltage (a.f.c. off) | +$V_{sw}$ | – | 0,8 | – | 6 | V |
| Negative input voltage (a.f.c. off) | –$V_{sw}$ | – | 0,8 | – | – | V |
| Positive input current (a.f.c. off) | +I11 | – | 0,004 | – | 3 | mA |
| Negative input current (a.f.c. off) | –I11 | – | 0,8 | – | 2 | mA |
| **A.F.C. switch operated by pulse** | | | | | | |
| Positive trigger pulse peak current | +I11 pulse | 13 | | | | |
| pulse width = 10 $\mu$s | | – | 800 | – | 3000 | $\mu$A |
| 100 $\mu$s | | – | 80 | – | 3000 | $\mu$A |
| 1 ms | | – | 8 | – | 3000 | $\mu$A |
| 10 ms | | – | 4 | – | 3000 | $\mu$A |
| Negative trigger pulse peak current | –I11 pulse | – | 0,8 | – | 2 | mA |
| Negative trigger pulse width | | – | 10 | – | – | $\mu$s |

**Multi-stabilizer for electronic tuning**

| Stabilizer 2 | | note | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Output voltage range (adjustable) | $V_O2$ | 10 | 8 | – | 21 | V |
| Output current | I2 | 5 | 0 | – | 5,5 | mA |
| Output voltage temp. coefficient | $\Delta V_O2/\Delta T$ | 7, 8 | – | 45 | – | ppm/°C |
| Switch-on delay time | $t_{d\,on}$ | 11 | 0 | – | 6 | s |
| Switching voltage | $V_{1-16}$ | – | 0,8 | – | 1 | V |

| Stabilizer 3 | | note | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Output voltage range (adjustable) | $V_O3$ | 12 | 8 | – | 29 | V |
| Output current | I3 | 5 | 0 | – | 5,5 | mA |
| Output voltage temp. coefficient | $\Delta V_O3/\Delta T$ | 7, 8 | – | 45 | – | ppm/°C |

## Notes

1. The $V_{in}$ range depends on the value of $V_O1$ (see Fig. 4).
2. At I1 = 5 mA, I2 = I3 = 5,5 mA, $I_{10}$ = 0.
3. Adjustable by means of RA1, RB1 and RP.
4. If a higher level is required from the output of stabilizer 1, the reference diode supply may be obtained from the emitter of a power transistor connected to the output from stabilizer 3 (see Fig. 8). In this case, the current available from stabilizer 1 is increased to 12,5 mA (bleeder current $I_{RA1}$ = 2 mA).
5. At $T_{amb}$ = 60 °C maximum with all stabilizers at rated currents.
6. With $V_O1$ within 0,05% of its steady value.
7. Temperature coefficient at $T_{amb}$ from 10 °C to 60 °C with $V_{in}$ constant, and using metal film bleed resistors having a temperature coefficient of ⩽ 50 ppm/°C.
8. With all stabilizer output currents constant and within the specified limits.
9. Common-mode voltage = voltage between pins 8 and 16, and 9 and 16 of the I.C.
10. $V_O2$ depends on the value of $V_O1$ (see Fig. 6); adjustable with RA2.
11. Adjustable by means of RT and $C_T1$. The delay time is limited by the leakage current of $C_T1$.
12. $V_O3$ depends on the value of $V_O1$ (see Fig. 7); adjustable with RA3.
13. The delay time after triggering depends on the value of $C_T2$.
14. With RE = 10 kΩ and $T_{amb}$ = 25 °C.
15. $V_{afc}$ out at $V_{afc}$ in after limiting.
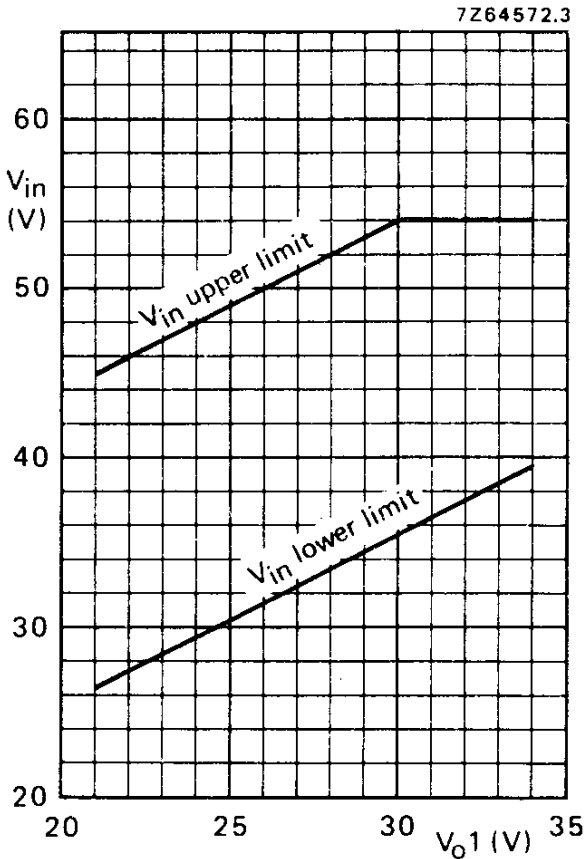16. With RE = 10 kΩ; RA1 = 12 kΩ.

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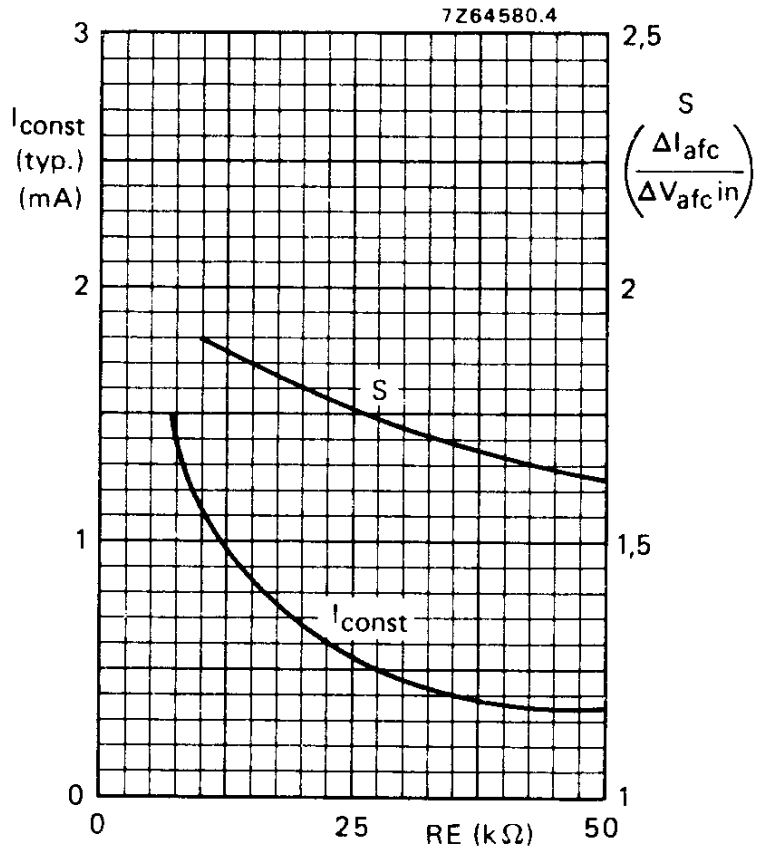Fig. 4 Range of values for $V_O1$.

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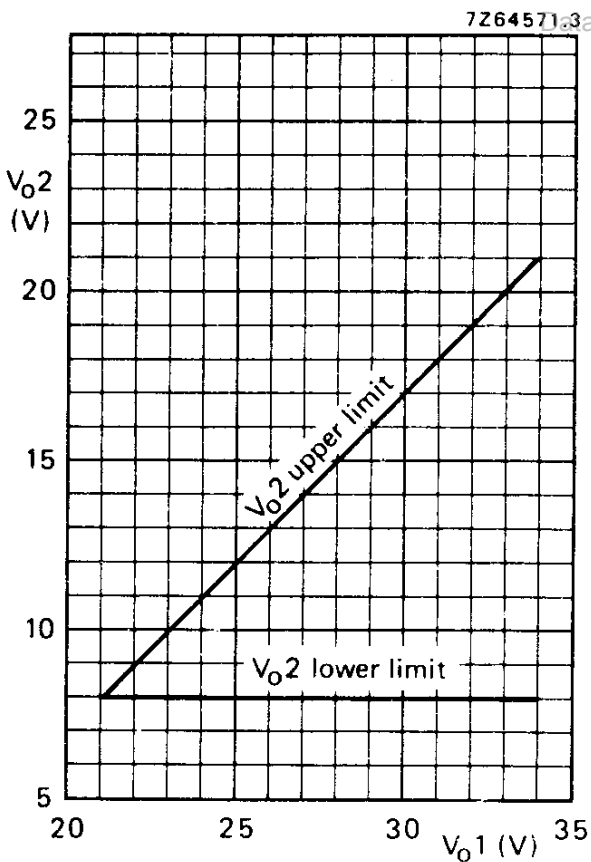Fig. 5 Determination of $I_{10}$ and S-factor (S = a.f.c. slope) from RE.
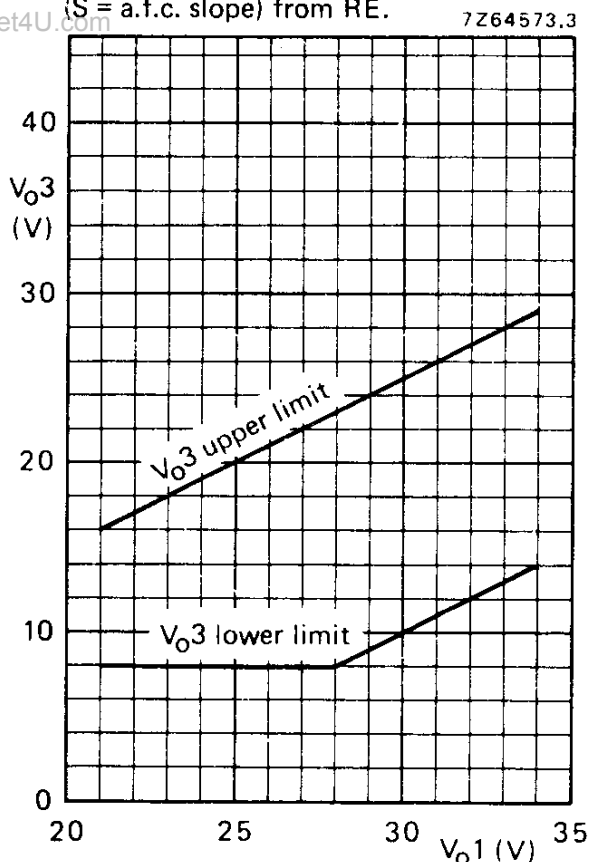
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Fig. 6 Range of values for $V_O2$.
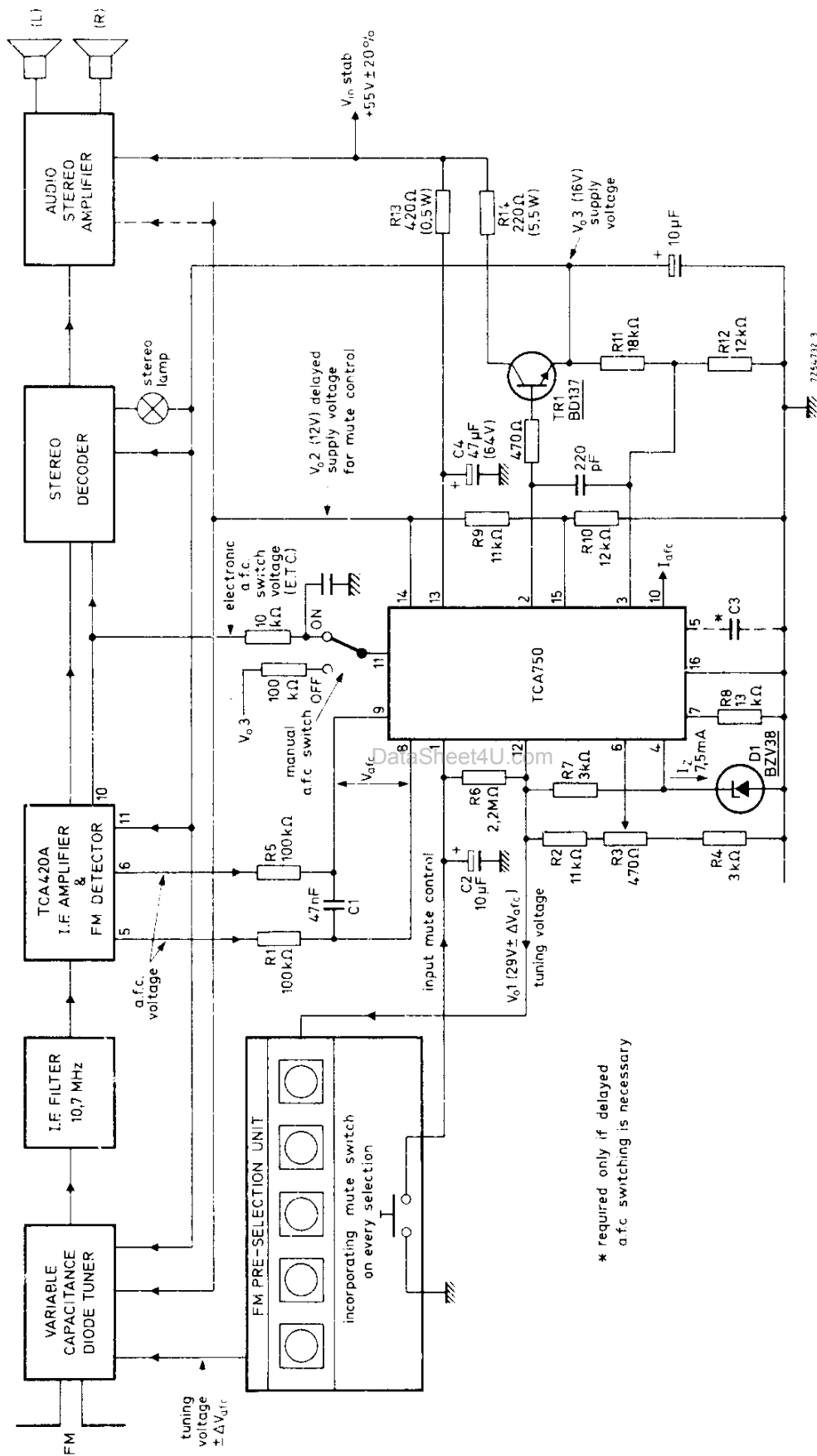
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Fig. 7 Range of values for $V_O3$.

Fig. 8 Hi-fi radio receiver with electronic tuning using TCA750.