

DATA SHEET

TDA5736; TDA5737 5 V VHF, hyperband and UHF mixers/oscillators for TV and VCR 3-band tuners

Product specification
Supersedes data of 1996 Oct 25
File under Integrated Circuits, IC02

1997 Feb 24

5 V VHF, hyperband and UHF mixers/oscillators for TV and VCR 3-band tuners

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FEATURES

- Balanced mixer with a common emitter input for band A (single input)
- 2-pin oscillator for band A
- Balanced mixer with a common base input for bands B and C (balanced input)
- 3-pin oscillator for band B
- 4-pin oscillator for band C
- Local oscillator buffer output for external prescaler
- SAW filter preamplifier with a low output impedance to drive the SAW filter directly
- Band gap voltage stabilizer for oscillator stability
- Electronic band switch
- External IF filter between the mixer output and the IF amplifier input.

GENERAL DESCRIPTION

The TDA5736 and TDA5737 are monolithic integrated circuits that perform the mixer/oscillator functions for bands A, B and C in TV and VCR tuners. These low power mixer/oscillators require a power supply of 5 V and are available in a very small package.

These devices give the designer the capability to design an economical and physically small 3-band tuner.

They are suitable for European standards, as illustrated in Fig.17, with the following RF bands: 48.25 to 168.25 MHz, 175.25 to 447.25 MHz and 455.25 to 855.25 MHz. With an appropriate tuned circuit, they are also suitable for NTSC all channel tuners (USA and Japan).

The tuner development time can be drastically reduced by using these devices.

APPLICATIONS

- 3-band all channel TV and VCR tuners
- Any standard.

QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|----------|---|--------------------------|------|------|------|------------|
| V_P | supply voltage | | – | 5.0 | – | V |
| I_P | supply current | | – | 50 | – | mA |
| f_{RF} | frequency range | RF input; band A; note 1 | 41 | – | 171 | MHz |
| | | RF input; band B; note 1 | 166 | – | 451 | MHz |
| | | RF input; band C; note 1 | 446 | – | 861 | MHz |
| G_V | voltage gain | band A | – | 23 | – | dB |
| | | band B | – | 34 | – | dB |
| | | band C | – | 34 | – | dB |
| NF | noise figure | band A | – | 7.5 | – | dB |
| | | band B | – | 8 | – | dB |
| | | band C | – | 9 | – | dB |
| V_o | output voltage level causing 1% cross modulation in channel | band A | – | 116 | – | dB μ V |
| | | band B | – | 115 | – | dB μ V |
| | | band C | – | 115 | – | dB μ V |

Note

1. The limits are related to the tank circuits used in Fig.17 and the intermediate frequency. Frequency bands may be adjusted by the choice of external components.

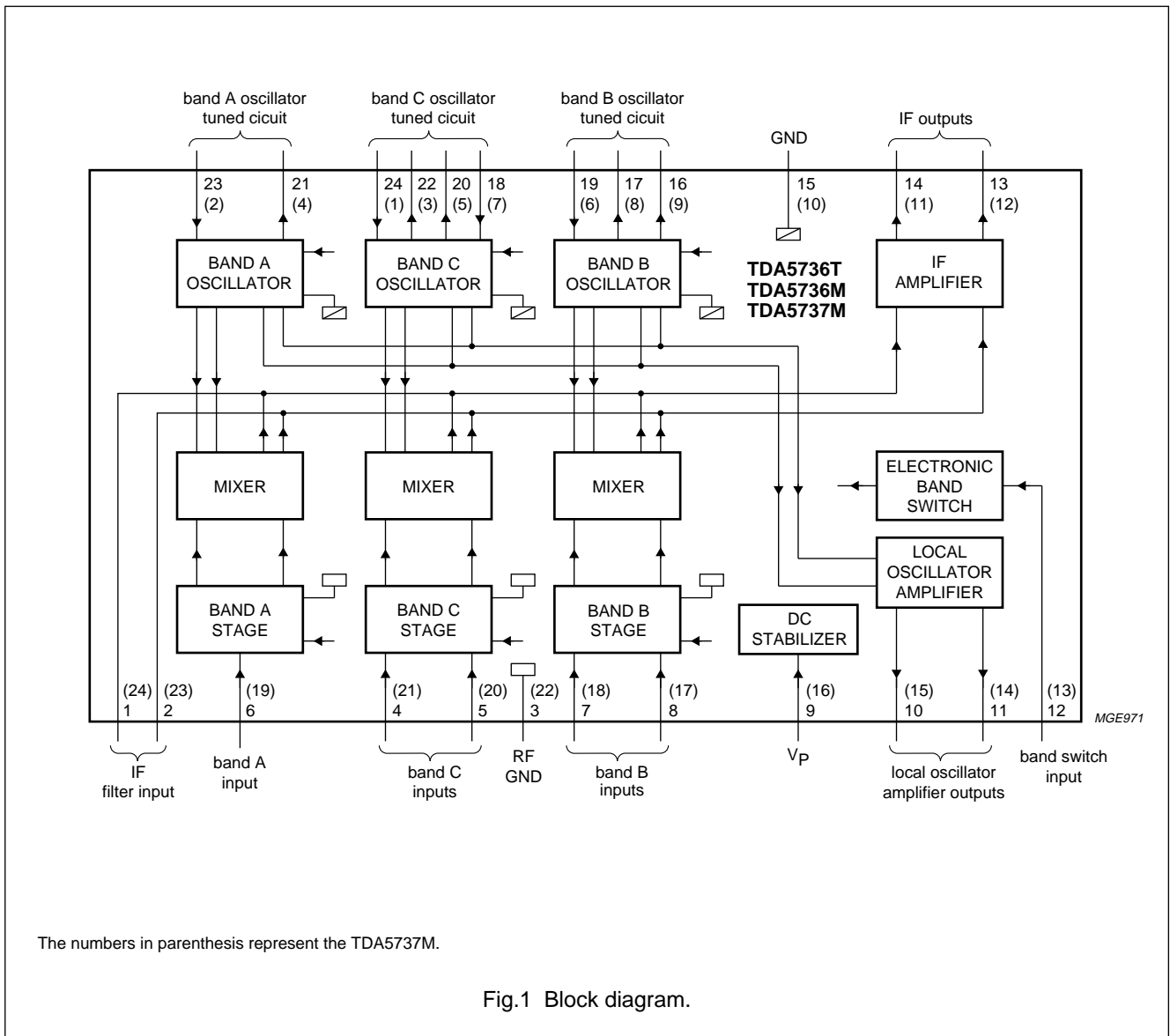
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ORDERING INFORMATION

| TYPE NUMBER | PACKAGE | | |
|-------------|---------|---|----------|
| | NAME | DESCRIPTION | VERSION |
| TDA5736T | SO24 | plastic small outline package; 24 leads; body width 7.5 mm | SOT137-1 |
| TDA5736M | SSOP24 | plastic shrink small outline package; 24 leads; body width 5.3 mm | SOT340-1 |
| TDA5737M | SSOP24 | plastic shrink small outline package; 24 leads; body width 5.3 mm | SOT340-1 |

BLOCK DIAGRAM



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PINNING

| SYMBOL | PIN | | DESCRIPTION |
|----------------|---------|---------|--------------------------------------|
| | TDA5736 | TDA5737 | |
| IFIN1 | 1 | 24 | IF filter input 1 |
| IFIN2 | 2 | 23 | IF filter input 2 |
| RFGND | 3 | 22 | ground for RF inputs |
| CIN1 | 4 | 21 | band C input 1 |
| CIN2 | 5 | 20 | band C input 2 |
| AIN | 6 | 19 | band A input |
| BIN1 | 7 | 18 | band B input 1 |
| BIN2 | 8 | 17 | band B input 2 |
| V _P | 9 | 16 | supply voltage |
| LOOUT1 | 10 | 15 | local oscillator amplifier output 1 |
| LOOUT2 | 11 | 14 | local oscillator amplifier output 2 |
| BS | 12 | 13 | band switch input |
| IFOUT1 | 13 | 12 | IF amplifier output 1 |
| IFOUT2 | 14 | 11 | IF amplifier output 2 |
| GND | 15 | 10 | ground (0 V) |
| BOSCOC1 | 16 | 9 | band B oscillator output collector 1 |
| BOSCOC2 | 17 | 8 | band B oscillator output collector 2 |
| COSCIB1 | 18 | 7 | band C oscillator input base 1 |
| BOSCIB | 19 | 6 | band B oscillator input base |
| COSCOC1 | 20 | 5 | band C oscillator output collector 1 |
| AOSCOC | 21 | 4 | band A oscillator output collector |
| COSCOC2 | 22 | 3 | band C oscillator output collector 2 |
| AOSCIB | 23 | 2 | band A oscillator input base |
| COSCIB2 | 24 | 1 | band C oscillator input base 2 |

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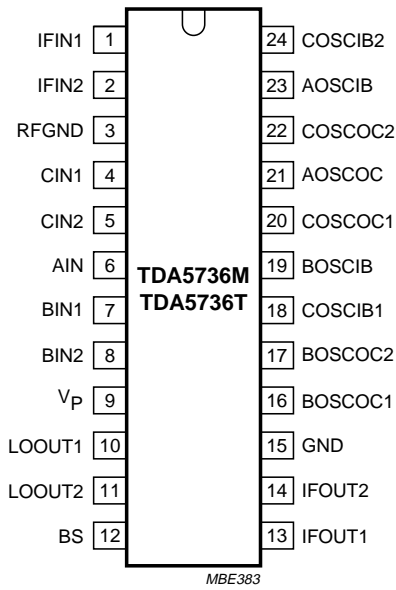


Fig.2 Pin configuration (TDA5736M, TDA5736T).

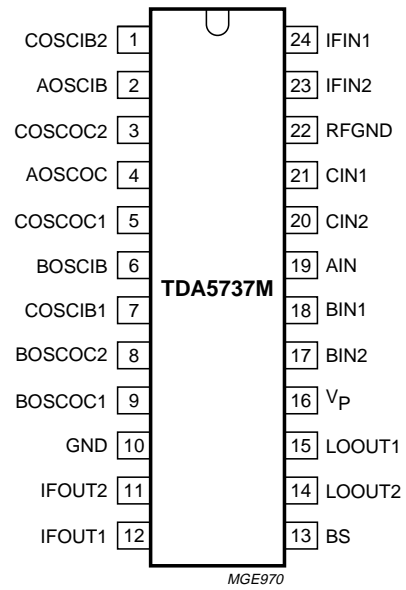


Fig.3 Pin configuration (TDA5737M).

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LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

| SYMBOL | PARAMETER | MIN. | MAX. | UNIT |
|---------------|---|------|------|--------------|
| V_P | supply voltage | -0.3 | +7.0 | V |
| V_{SW} | switching voltage | -0.3 | +7.0 | V |
| $V_{n(max)}$ | maximum voltage on each pin with a 22 k Ω resistor connected in series | - | 35 | V |
| I_O | output current of each pin to ground | - | -10 | mA |
| $t_{sc(max)}$ | maximum short-circuit time (all pins) | - | 10 | s |
| T_{stg} | IC storage temperature | -55 | +150 | $^{\circ}$ C |
| T_{amb} | operating ambient temperature | -20 | +80 | $^{\circ}$ C |
| T_j | junction temperature | - | 150 | $^{\circ}$ C |

HANDLING

Human Body Model:

- For TDA5736 GND (15), RFGND (3), V_P (9) separate
- For TDA5737 GND (10), RFGND (22), V_P (16) separate.

All pins withstand 2000 V in accordance with the "UZW-BO/FQ-A302". Philips specification equivalent to the "MIL-STD-883C" category B (2000 V) except pins 16 and 17 (8 and 9 for the TDA5737) which withstand 1000 V; $R = 1500 \Omega$, $C = 100 \text{ pF}$.

Machine Model:

- For TDA5736 GND (15), RFGND (3), V_P (9) separate
- For TDA5737 GND (10), RFGND (22), V_P (16) separate.

All pins withstand 200 V in accordance with the "UZW-BO/FQ-B302", Philips specification (revision of: Nov. 6th, 1990) except pins 16 and 17 (8 and 9 for the TDA5737) which withstand 100 V; $R = 0 \Omega$, $C = 200 \text{ pF}$.

THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | VALUE | UNIT |
|--------------|---|-------|------|
| $R_{th j-a}$ | thermal resistance from junction to ambient in free air | | |
| | SSOP24 | 120 | K/W |
| | SO24 | 75 | K/W |

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CHARACTERISTICS $V_P = 5\text{ V}$; $T_{amb} = 25\text{ °C}$; measured in circuit of Fig.17; unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--|--|---|-----------|------|-----------|------------------------|
| Supply | | | | | | |
| V_P | supply voltage | | 4.5 | 5.0 | 5.5 | V |
| I_P | supply current | | 42 | 50 | 58 | mA |
| V_{SW} | switching voltage depending on supply voltage V_P | band A; note 1 | 0 | – | $0.18V_P$ | V |
| | | band B; note 1 | $0.26V_P$ | – | $0.47V_P$ | V |
| | | band C; note 1 | $0.55V_P$ | – | V_P | V |
| I_{SW} | switching current | band A; note 1 | – | – | 2 | μA |
| | | band B; note 1 | – | – | 10 | μA |
| | | band C; note 1 | – | – | 25 | μA |
| Band A mixer (including IF amplifier) | | | | | | |
| f_{RF} | frequency range | note 2 | 41 | – | 171 | MHz |
| G_V | voltage gain | $f_{RF} = 50\text{ MHz}$; see Fig.4; note 3 | 20.5 | 23.0 | 25.5 | dB |
| | | $f_{RF} = 170\text{ MHz}$; see Fig.4; note 3 | 20.5 | 23.0 | 25.5 | dB |
| NF | noise figure | $f_{RF} = 50\text{ MHz}$; see Figs.5 and 6 | – | 7.5 | 9 | dB |
| | | $f_{RF} = 170\text{ MHz}$; see Figs.5 and 6 | – | 9 | 10 | dB |
| V_o | output voltage level causing 1% cross modulation in channel | $f_{RF} = 50\text{ MHz}$; see Fig.7 | 115 | 118 | – | $\text{dB}\mu\text{V}$ |
| | | $f_{RF} = 170\text{ MHz}$; see Fig.7 | 113 | 116 | – | $\text{dB}\mu\text{V}$ |
| V_i | input voltage level causing 10 kHz pulling in channel | $f_{RF} = 170\text{ MHz}$; note 4 | 96 | 100 | – | dBmV |
| g_{os} | optimum source conductance for noise figure | $f_{RF} = 50\text{ MHz}$ | – | 0.5 | – | mS |
| | | $f_{RF} = 170\text{ MHz}$ | – | 1.1 | – | mS |
| Y_i | input admittance | $f_{RF} = 50\text{ to }170\text{ MHz}$; see Fig.12 | – | 0.3 | – | mS |
| C_i | input capacitance | $f_{RF} = 50\text{ to }170\text{ MHz}$; see Fig.12 | – | 1.9 | – | pF |
| Band A oscillator | | | | | | |
| f_{osc} | frequency range | $0.45\text{ V} < V_t < 28\text{ V}$; notes 1 and 5 | 80 | – | 210 | MHz |
| f_{shift} | frequency shift | $\Delta V_P = 5\%$; note 6 | – | – | 53 | kHz |
| f_{drift} | frequency drift with no compensation | $\Delta T = 25\text{ °C}$; NP0 capacitors; note 7 | – | – | 650 | kHz |
| | | 5 s to 15 mins after switch on; NP0 capacitors; note 8 | – | – | 250 | kHz |
| | frequency drift with compensation | $\Delta T = 25\text{ °C}$; notes 7 and 9; see Fig.18 | – | – | 500 | kHz |
| | | 5 s to 15 mins after switch on; notes 8 and 9; see Fig.18 | – | – | 100 | kHz |
| V_{ripple} | ripple susceptibility of supply voltage (peak-to-peak value) | $f_{osc} = 80\text{ MHz}$; $4.75\text{ V} < V_P < 5.25\text{ V}$; see Fig.8 | 20 | – | – | mV |
| | | $f_{osc} = 210\text{ MHz}$; $4.75\text{ V} < V_P < 5.25\text{ V}$; see Fig.8 | 20 | – | – | mV |
| Φ_N | phase noise | measured at the IF output at 10 kHz offset; $V_o = 105\text{ dB}\mu\text{V}$ | 81 | – | – | dBc/Hz |

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| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--|---|---|------|------|------|------------|
| Band B mixer (including IF amplifier) | | | | | | |
| f_{RF} | frequency range | note 2 | 166 | – | 451 | MHz |
| G_v | voltage gain | $f_{RF} = 170$ MHz; see Fig.9; note 3 | 31 | 34 | 37 | dB |
| | | $f_{RF} = 450$ MHz; see Fig.9; note 3 | 31 | 34 | 37 | dB |
| N | noise figure (not corrected for image) | $f_{RF} = 170$ MHz; see Fig.10 | – | 8 | 10 | dB |
| | | $f_{RF} = 450$ MHz; see Fig.10 | – | 8 | 10 | dB |
| V_o | output voltage level causing 1% cross modulation in channel | $f_{RF} = 170$ MHz; see Fig.7 | 114 | 117 | – | dB μ V |
| | | $f_{RF} = 450$ MHz; see Fig.7 | 112 | 115 | – | dB μ V |
| V_i | input voltage level causing 10 kHz pulling in channel | $f_{RF} = 450$ MHz; note 4 | 83 | 87 | – | dB μ V |
| Z_i | input impedance ($R_s + jL_s\omega$) | $f_{RF} = 170$ to 450 MHz; see Fig.13 | – | 23 | – | Ω |
| | | $f_{RF} = 170$ to 450 MHz; see Fig.13 | – | 9 | – | nH |
| Band B oscillator | | | | | | |
| f_{osc} | frequency range | $0.45\text{ V} < V_t < 28\text{ V}$; notes 1 and 5 | 205 | – | 490 | MHz |
| f_{shift} | frequency shift | $\Delta V_p = 5\%$; note 6 | – | – | 53 | kHz |
| f_{drift} | frequency drift with no compensation | $\Delta T = 25\text{ }^\circ\text{C}$; NP0 capacitors; note 7 | – | – | 2000 | kHz |
| | | 5 s to 15 mins after switch on; NP0 capacitors; note 8 | – | – | 750 | kHz |
| | frequency drift with compensation | $\Delta T = 25\text{ }^\circ\text{C}$; notes 7 and 9; see Fig.18 | – | – | 750 | kHz |
| | | 5 s to 15 mins after switch on; notes 8 and 9; see Fig.18 | – | – | 300 | kHz |
| V_{ripple} | ripple susceptibility of supply voltage (peak-to-peak value) | $f_{osc} = 250$ MHz; $4.75\text{ V} < V_p < 5.25\text{ V}$; see Fig.8 | 20 | – | – | mV |
| | | $f_{osc} = 490$ MHz; $4.75\text{ V} < V_p < 5.25\text{ V}$; see Fig.8 | 20 | – | – | mV |
| Φ_N | phase noise | measured at the IF output at 10 kHz offset; $V_o = 105$ dBmV | 81 | – | – | dBc/Hz |
| Band C Mixer (including IF amplifier) | | | | | | |
| f_{RF} | frequency range | note 2 | 446 | – | 861 | MHz |
| G_v | voltage gain | $f_{RF} = 450$ MHz; see Fig.9; note 3 | 31 | 34 | 37 | dB |
| | | $f_{RF} = 860$ MHz; see Fig.9; note 3 | 31 | 34 | 37 | dB |
| N | noise figure (not corrected for image) | $f_{RF} = 450$ MHz; see Fig.10 | – | 9 | 11 | dB |
| | | $f_{RF} = 860$ MHz; see Fig.10 | – | 9 | 11 | dB |
| V_o | output voltage level causing 1% cross modulation in channel | $f_{RF} = 450$ MHz; see Fig.7 | 112 | 115 | – | dB μ V |
| | | $f_{RF} = 860$ MHz; see Fig.7 | 112 | 115 | – | dB μ V |
| V_i | input voltage level causing 10 kHz pulling in channel | $f_{RF} = 860$ MHz; note 4 | 91 | 95 | – | dB μ V |
| Z_i | input impedance ($R_s + jL_s\omega$) | $f_{RF} = 450$ to 860 MHz; see Fig.14 | – | 28 | – | Ω |
| | | $f_{RF} = 450$ to 860 MHz; see Fig.14 | – | 10 | – | nH |

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| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--------------------------|---|---|------|------|------|------------------|
| Band C oscillator | | | | | | |
| f_{osc} | frequency range | $0.45\text{ V} < V_t < 28\text{ V}$; notes 1 and 5 | 485 | – | 900 | MHz |
| f_{shift} | frequency shift | $\Delta V_P = 5\%$; note 6 | – | – | 53 | kHz |
| f_{drift} | frequency drift with no compensation | $\Delta T = 25\text{ }^\circ\text{C}$; NP0 capacitors; note 7 | – | – | 2800 | kHz |
| | | 5 s to 15 mins after switch on; NP0 capacitors; note 8 | – | – | 700 | kHz |
| | frequency drift with compensation | $\Delta T = 25\text{ }^\circ\text{C}$; notes 7 and 9; see Fig.18 | – | – | 1000 | kHz |
| V_{ripple} | ripple susceptibility of supply voltage (peak to peak value) | $f_{osc} = 485\text{ MHz}$; $4.75\text{ V} < V_P < 5.25\text{ V}$; see Fig.8 | 20 | – | – | mV |
| | | $f_{osc} = 900\text{ MHz}$; $4.75\text{ V} < V_P < 5.25\text{ V}$; see Fig.8 | 18 | – | – | mV |
| Φ_N | phase noise | measured at the IF output at 10 kHz offset; $V_o = 105\text{ dB}\mu\text{V}$ | 81 | – | – | dBc/Hz |
| LO output | | | | | | |
| Z_O | output admittance ($Y_P + j\omega C_P$) | $Y_P = 80\text{ MHz}$; see Fig.12 | – | 2.5 | – | mS |
| | | $Y_P = 900\text{ MHz}$; see Fig.12 | – | 5 | – | mS |
| | | C_P ; see Fig.12 | – | 0.9 | – | pF |
| V_o | output voltage | $R_L = 50\text{ }\Omega$; $0 < V_t < 35\text{ V}$ | 80 | 91 | 100 | dB μV |
| SRF | spurious signal on LO output with respect to LO output signal | $R_L = 50\text{ }\Omega$; $0.2\text{ V} < V_t < 35\text{ V}$; notes 1 and 10 | – | – | –10 | dB |
| HLO | LO signal harmonics with respect to LO signal | $R_L = 50\text{ }\Omega$; $0 < V_t < 35\text{ V}$; note 1 | – | – | –10 | dB |
| IF amplifier | | | | | | |
| S_{22} | output reflection coefficient | magnitude; see Fig.15 | – | –16 | – | dB |
| | | phase; see Fig.15 | – | 12 | – | deg. |
| Z_O | output impedance ($R_s + jL_s\omega$) | R_s | – | 67 | – | Ω |
| | | L_s | – | 20 | – | nH |

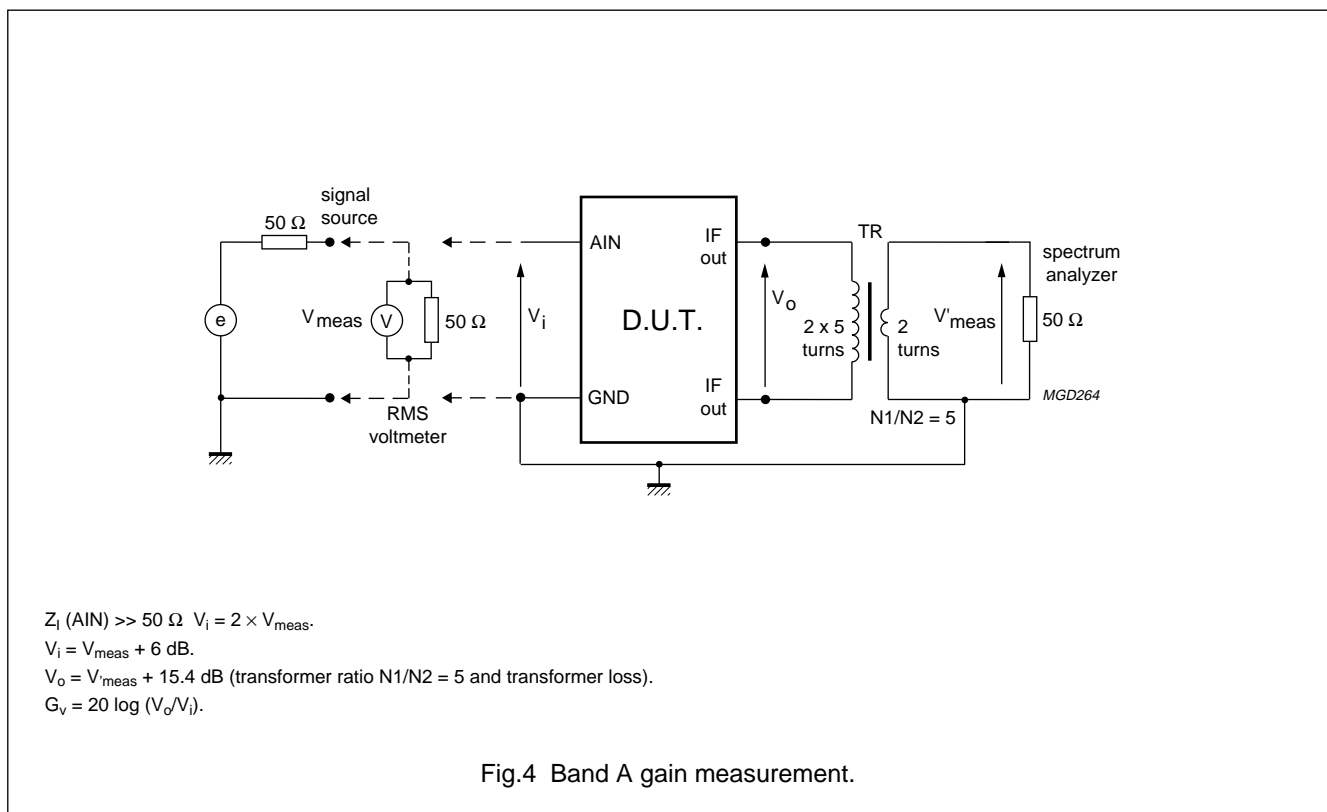
Notes

- $-20\text{ }^\circ\text{C} < T_{amb} < +80\text{ }^\circ\text{C}$; $4.5\text{ V} < V_P < 5.5\text{ V}$.
- The RF frequency range is defined by the oscillator frequency range and the intermediate frequency.
- The gain is defined as the transducer gain (measured in Fig.17) plus the voltage transformation ratio of L7 to L8 (10 : 2, 15.4 dB including transformer loss).
- The input level causing 10 kHz frequency detuning at the LO output. $f_{osc} = f_{RF} + 33.4\text{ MHz}$.
- Limits are related to the tank circuits used in Fig.17. Frequency bands may be adjusted by the choice of external components.
- The frequency shift is defined as the change in oscillator frequency when the supply voltage varies from $V_P = 5$ to 4.75 V and from $V_P = 5$ to 5.25 V .

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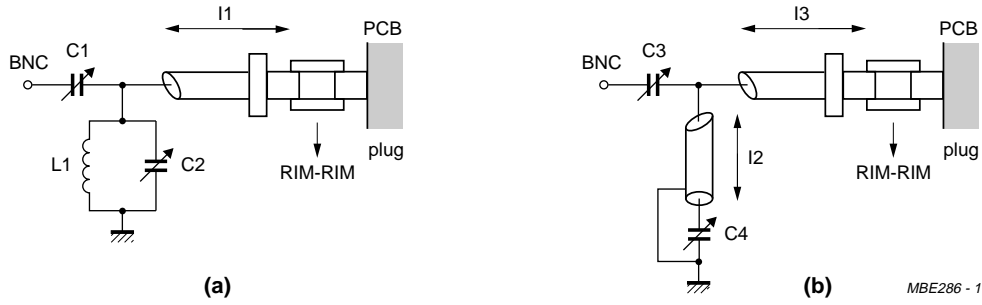
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7. The frequency drift is defined as the change in oscillator frequency when the ambient temperature varies from $T_{amb} = 25$ to 0 °C and from $T_{amb} = 25$ to 50 °C.
8. Switch-on drift is defined as the change in oscillator frequency between 5 s and 15 mins after switch on.
9. With thermal compensation, the capacitors of the tank circuits have the following temperature coefficients:
 - a) In band A: C1, C6 and C8 are N750.
 - b) In band B: C4, C11, C12, C13 and C36 are N750.
 - c) In band C: C5, C7, C9 and C10 are N750; C2 is N220 and C3 is NP0.
10. SRF: spurious signal on LO with respect to LO output signal:
 - a) RF level = 120 dB μ V at $f_{RF} < 180$ MHz.
 - b) RF level = 107.5 dB μ V at $f_{RF} = 180$ to 225 MHz.
 - c) RF level = 97 dB μ V at $f_{RF} = 225$ to 860 MHz.



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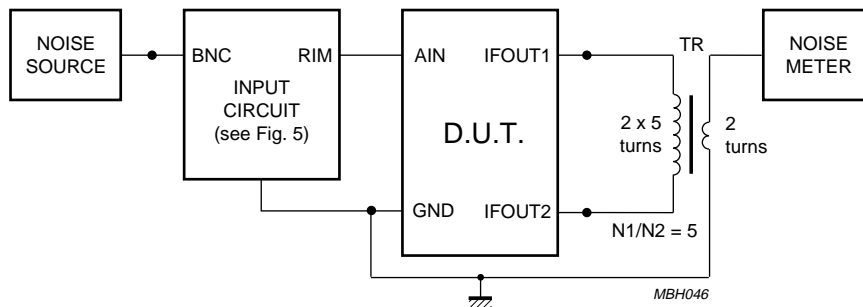
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(a) For $f_{RF} = 50$ MHz:
 mixer A frequency response measured = 57 MHz, loss = 0 dB
 image suppression = 16 dB.
 C1 = 9 pF
 C2 = 15 pF
 L1 = 7 turns (diam. = 5.5 mm, wire diam. = 0.5 mm)
 I1 = semi rigid cable (RIM): 5 cm long (semi rigid cable (RIM);
 33 dB/100 m; 50 Ω ; 96 pF/m).

(b) For $f_{RF} = 150$ MHz:
 mixer A frequency response measured = 150.3 MHz, loss = 1.3 dB
 image suppression = 13 dB.
 C3 = 5 pF
 C4 = 25 pF
 I2 = semi rigid cable (RIM): 30 cm long
 I3 = semi rigid cable (RIM): 5 cm long (semi rigid cable (RIM);
 33 dB/100 m; 50 Ω ; 96 pF/m).

Fig.5 Input circuit for optimum noise figure in band A.

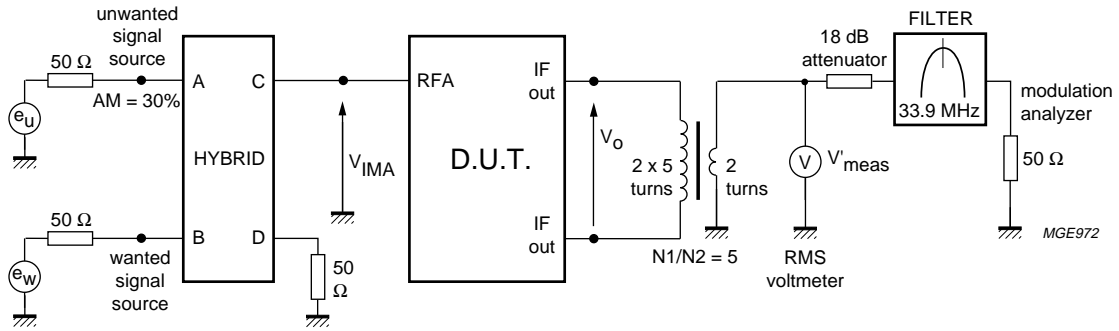


$NF = NF_{meas} - \text{loss (input circuit) dB.}$

Fig.6 Noise figure measurement in band A.

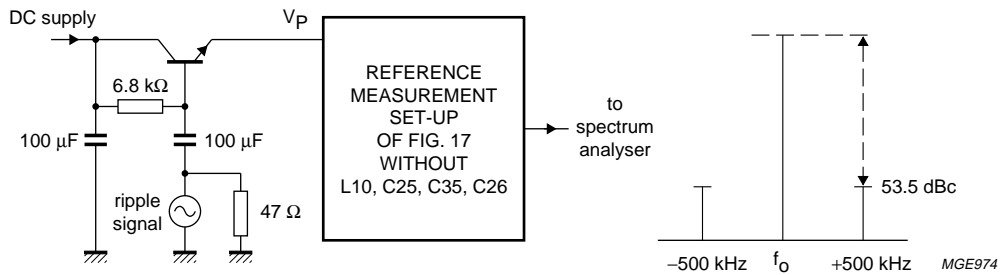
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$V'_{meas} = V_o - 15.4 \text{ dB}$ (transformer ratio $N1/N2 = 5$ and transformer loss).
 Wanted output signal at $f_{RFW} = 50 \text{ MHz}$ (170 MHz); $V_{ow} = 80 \text{ dB}\mu\text{V}$.
 We measure the level of the unwanted signal V_{ou} causing 1% AM modulation in the wanted output signal; $f_{RFU} = 45.5 \text{ MHz}$ (165.5 MHz);
 $f_{osc} = 83.9 \text{ MHz}$ (203.9 MHz).
 $V_{ou} = V'_{meas} + 15.4 \text{ dB}$.
 Filter characteristics: $f_c = 33.9 \text{ MHz}$; $f_{-3\text{dB}\text{BW}} = 1 \text{ MHz}$; $f_{-30\text{dB}\text{BW}} = 2.3 \text{ MHz}$.

Fig.7 Cross modulation measurement in band A.

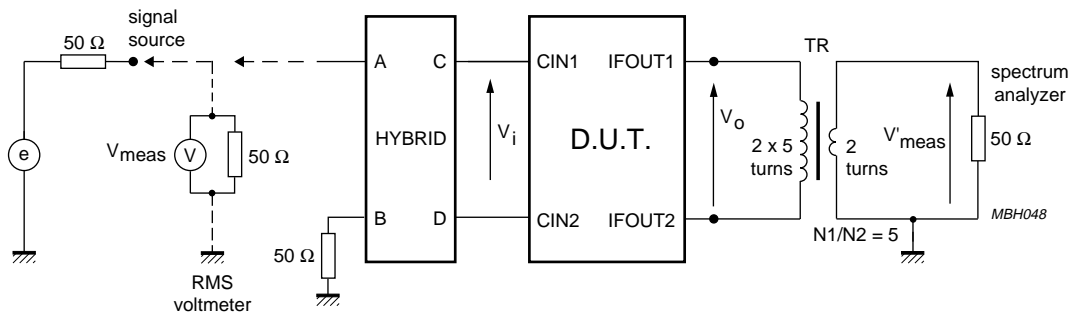


The ripple susceptibility is defined as the level of a signal added to the supply voltage causing sidebands in the LO output at 53.5 dBc. This signal has a frequency between 20 Hz and 500 kHz.

Fig.8 Ripple susceptibility.

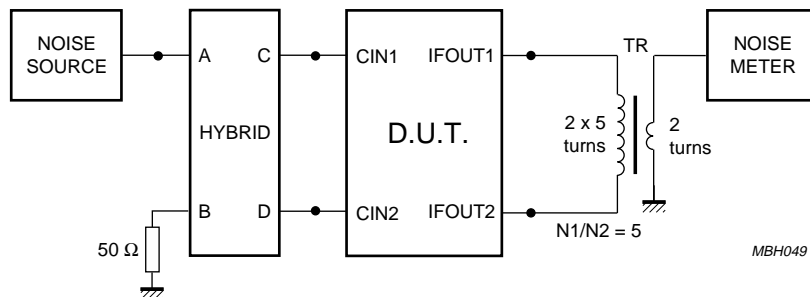
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$loss_{(hybrid)} = 1 \text{ dB.}$
 $V_i = V_{meas} - loss_{(hybrid)}$
 $V_o = V'_{meas} + 15.4 \text{ dB (transformer ratio } N1/N2 \text{ and transformer loss).}$
 Voltage gain for band B and C = $20 \log (V_o/V_i)$.

Fig.9 Gain measurement in bands B and C.

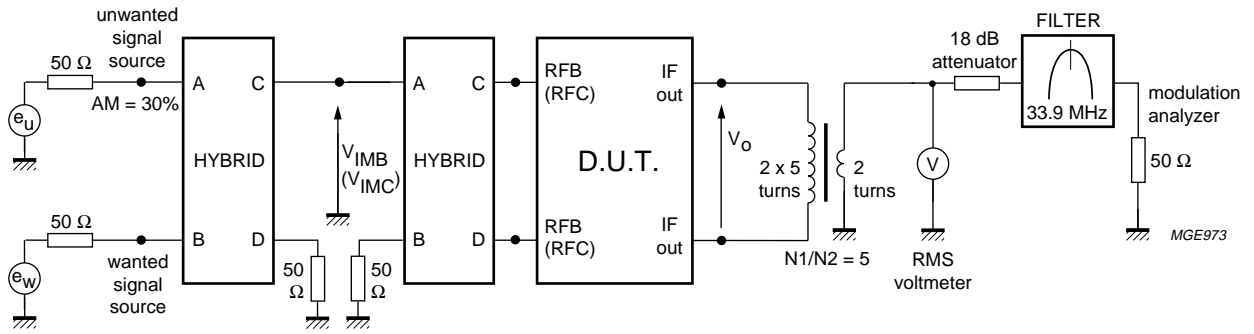


Loss of the hybrid: 1 dB.
 $NF = NF_{meas} - loss \text{ of the hybrid.}$

Fig.10 Noise figure measurement in bands B and C.

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$V'_{meas} = V_o - 15.4 \text{ dB}$ (transformer ratio $N1/N2 = 5$ and transformer loss).
 Wanted output signal at $f_{RFW} = 170$ or 450 MHz (450 or 860 MHz); $V_{ow} = 70 \text{ dB}\mu\text{V}$.
 We measure the level of the unwanted signal V_{ou} causing 1% AM modulation in the wanted output signal;
 $f_{RFU} = 165.5$ or 445.5 MHz (445.5 or 855.5 MHz); $f_{OSC} = 203.9$ or 483.9 MHz (483.9 or 893.9 MHz).
 $V_{ou} = V'_{meas} + 15.4 \text{ dB}$.
 Filter characteristics: $f_c = 33.9 \text{ MHz}$, $f_{-3\text{dB}\text{BW}} = 1 \text{ MHz}$; $f_{-30\text{dB}\text{BW}} = 2.3 \text{ MHz}$.

Fig.11 Cross modulation measurement in bands B and C.

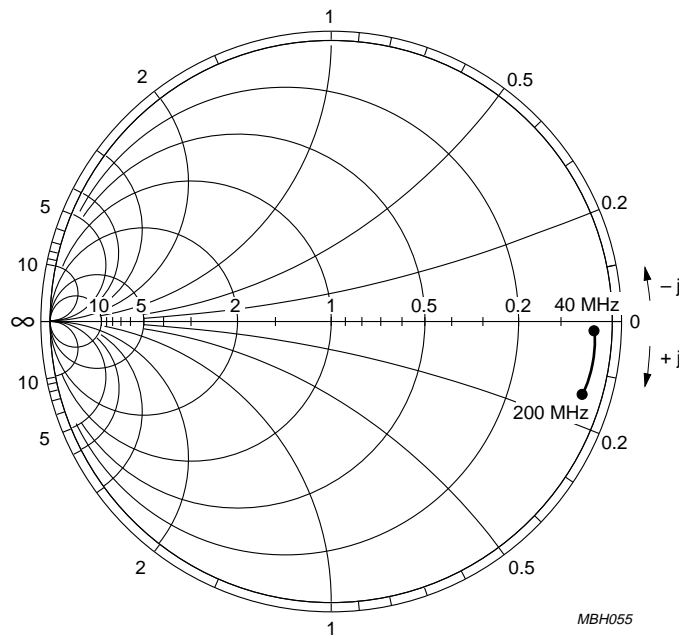


Fig.12 Input admittance (S_{11}) of the band A mixer input (40 to 200 MHz); $Y_o = 20 \text{ mS}$.

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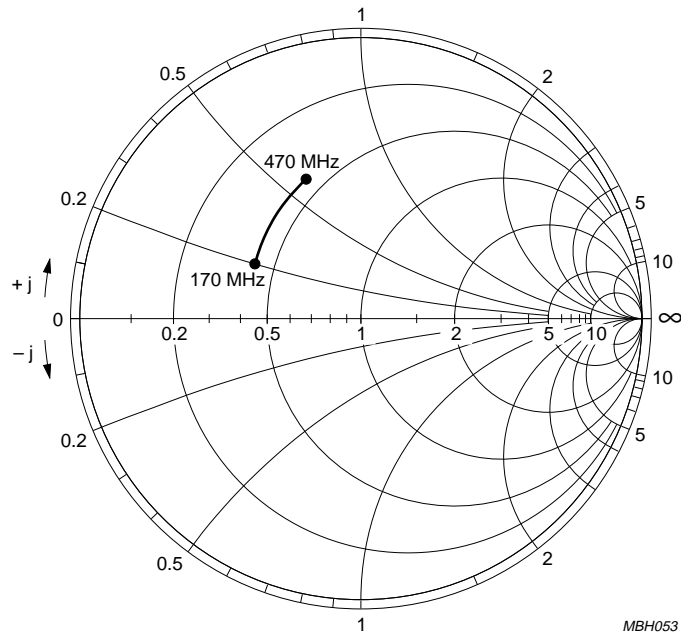


Fig.13 Input impedance (S_{11}) of the band B mixer input (170 to 470 MHz); $Z_o = 50 \Omega$.

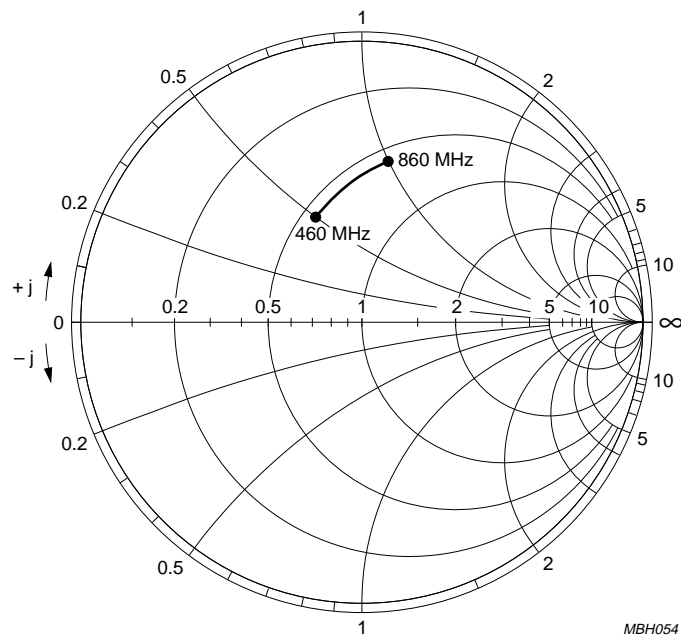


Fig.14 Input impedance (S_{11}) of the band C mixer input (460 to 860 MHz); $Z_o = 50 \Omega$.

5 V VHF, hyperband and UHF mixers/oscillators
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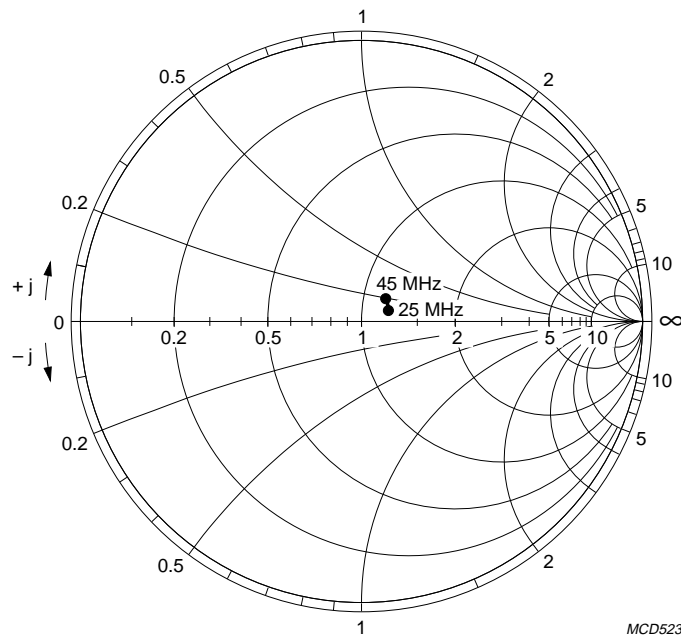


Fig.15 Input impedance (S_{22}) of the IF amplifier (25 to 45 MHz); $Z_o = 100 \Omega$.

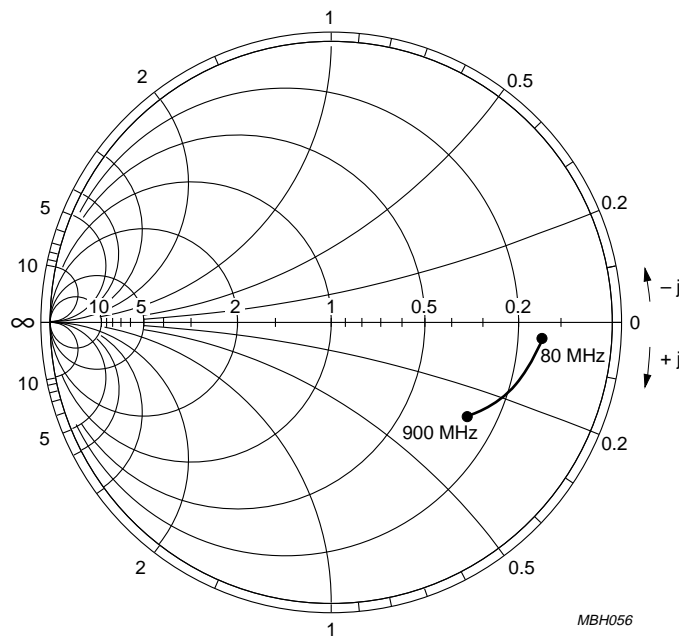
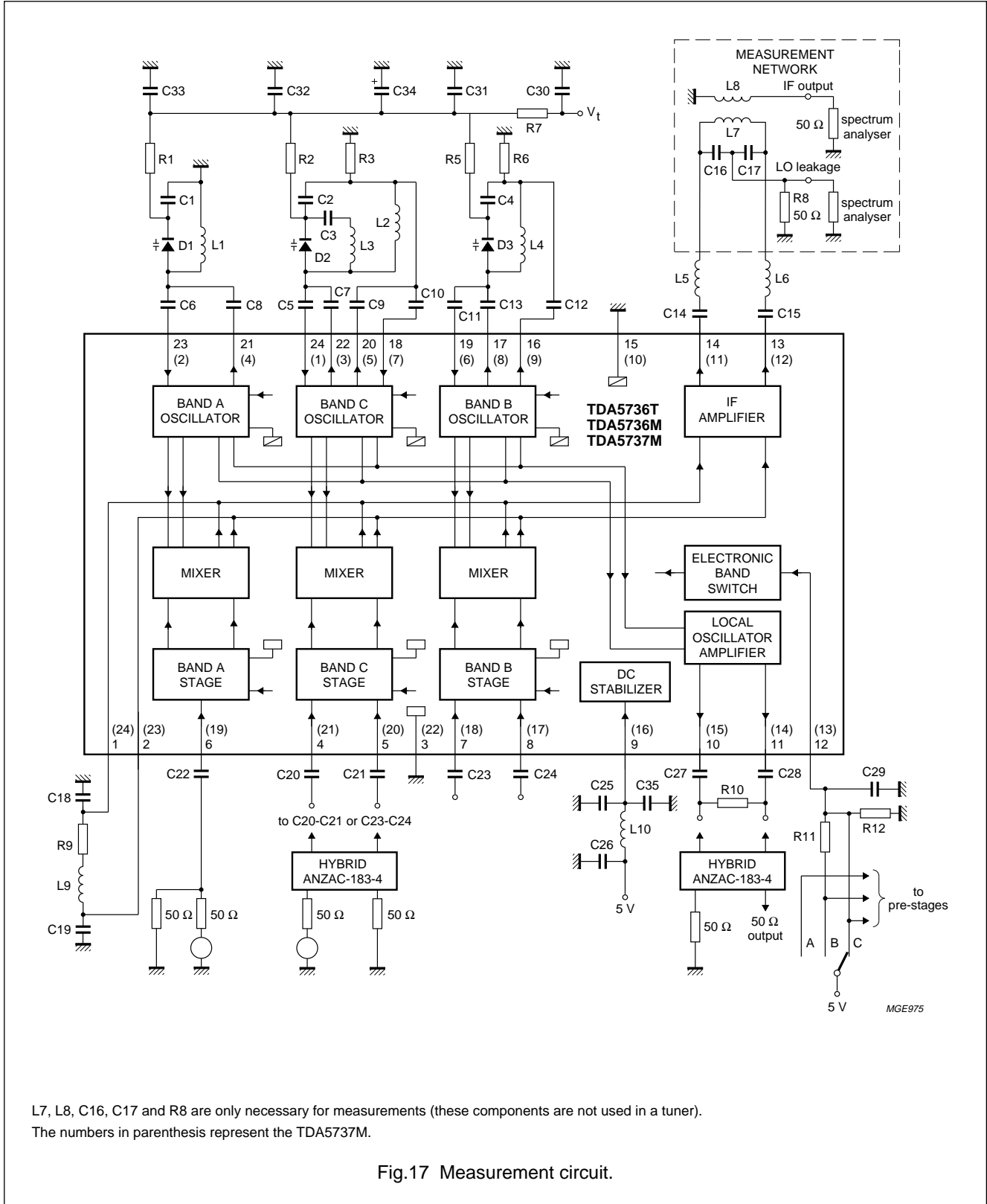


Fig.16 Input impedance (S_{22}) of the LO amplifier (80 to 900 MHz); $Y_o = 20 \text{ mS}$.

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for TV and VCR 3-band tuners

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APPLICATION INFORMATION



L7, L8, C16, C17 and R8 are only necessary for measurements (these components are not used in a tuner).
The numbers in parenthesis represent the TDA5737M.

Fig.17 Measurement circuit.

5 V VHF, hyperband and UHF mixers/oscillators for TV and VCR 3-band tuners

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Table 1 Capacitors of Fig.17
(all SMD and NP0 except C34 and C35)

| NUMBER | VALUE |
|--------|--------------------------------|
| C1 | 82 pF |
| C2 | 5.6 pF |
| C3 | 100 pF |
| C4 | 82 pF |
| C5 | 1 pF |
| C6 | 2 pF |
| C7 | 2 pF |
| C8 | 2 pF |
| C9 | 2 pF |
| C10 | 1 pF |
| C11 | 3.3 pF |
| C12 | 3.3 pF |
| C13 | 4.7 pF |
| C14 | 1 nF |
| C15 | 1 nF |
| C16 | 39 pF |
| C17 | 39 pF |
| C18 | 68 pF |
| C19 | 68 pF |
| C20 | 1 nF |
| C21 | 1 nF |
| C22 | 1 nF |
| C23 | 1 nF |
| C24 | 1 nF |
| C25 | 2.2 nF |
| C26 | 1 nF |
| C27 | 1 nF |
| C28 | 1 nF |
| C29 | 1 nF |
| C30 | 1 nF |
| C31 | 1 nF |
| C32 | 1 nF |
| C33 | 1 nF |
| C34 | 2.2 μ F, 40 V electrolytic |
| C35 | 4.7 nF |

Table 2 Resistors of Fig.17 (all SMD)

| NUMBER | VALUE |
|--------|---------------|
| R1 | 47 k Ω |
| R2 | 22 k Ω |
| R3 | 22 k Ω |
| R5 | 27 k Ω |
| R6 | 27 k Ω |
| R7 | 10 k Ω |
| R8 | 50 Ω |
| R9 | 4.7 Ω |
| R10 | 100 Ω |
| R11 | 27 k Ω |
| R12 | 15 k Ω |

Table 3 Diodes, coils and transformers of Fig.17

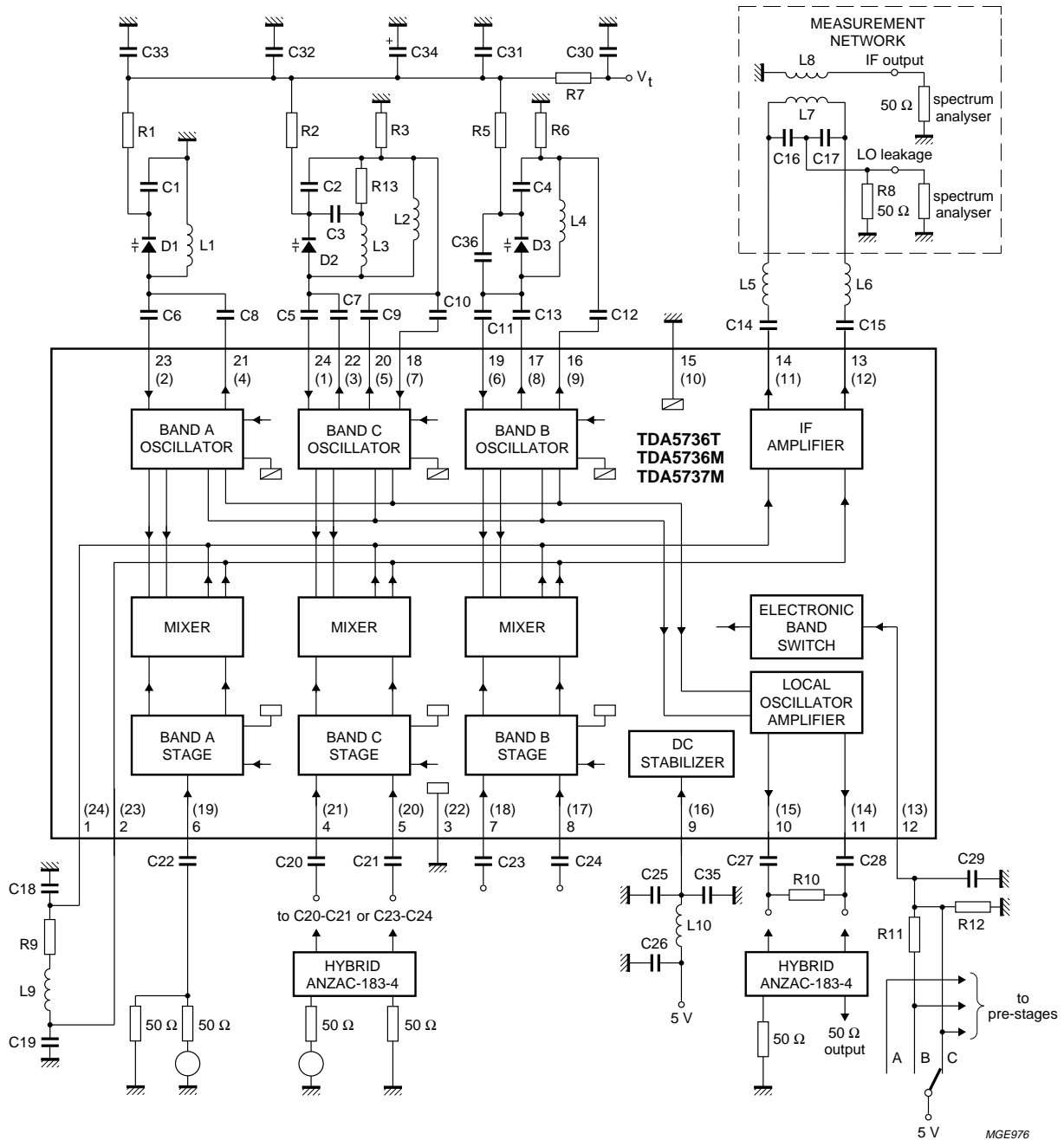
| NUMBER | VALUE |
|-----------------------------------|-------------------------------|
| Diodes | |
| D1 | BB132 |
| D2 | BB134 |
| D3 | BB133 |
| Coils⁽¹⁾ | |
| L1 | 7.5 t (\varnothing 3 mm) |
| L2 | 2.5 t (\varnothing 3.5 mm) |
| L3 | 1.5 t (\varnothing 2.5 mm) |
| L4 | 2.5 t (\varnothing 3 mm) |
| L5 | 5.5 t (\varnothing 2.5 mm) |
| L6 | 5.5 t (\varnothing 2.5 mm) |
| L9 | 12.5 t (\varnothing 5 mm) |
| L10 | 2.2 μ H (choke coil) |
| Transformers⁽²⁾ | |
| L7 | 2 \times 5 t |
| L8 | 2 t |

Notes

- Wire size for L1 to L6 is 0.4 mm.
- Coil type: TOKO 7kL.

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L7, L8, C16, C17 and R8 are only necessary for measurements (these components are not used in a tuner).
The numbers in parenthesis represent the TDA5737M.

Fig.18 Measurement circuit with thermal compensation.

5 V VHF, hyperband and UHF mixers/oscillators for TV and VCR 3-band tuners

TDA5736; TDA5737

Table 4 Capacitors of Fig.18 (all SMD except C34)

| NUMBER | VALUE |
|--------|--------------------------------|
| C1 | 62 pF |
| C2 | 6 pF |
| C3 | 100 pF |
| C4 | 68 pF |
| C5 | 1.2 pF |
| C6 | 2 pF |
| C7 | 1.2 pF |
| C8 | 2 pF |
| C9 | 1.5 pF |
| C10 | 1.5 pF |
| C11 | 3 pF |
| C12 | 3 pF |
| C13 | 4.3 pF |
| C14 | 1 nF |
| C15 | 1 nF |
| C16 | 39 pF |
| C17 | 39 pF |
| C18 | 68 pF |
| C19 | 68 pF |
| C20 | 1 nF |
| C21 | 1 nF |
| C22 | 1 nF |
| C23 | 1 nF |
| C24 | 1 nF |
| C25 | 2.2 nF |
| C26 | 1 nF |
| C27 | 1 nF |
| C28 | 1 nF |
| C29 | 1 nF |
| C30 | 1 nF |
| C31 | 1 nF |
| C32 | 1 nF |
| C33 | 1 nF |
| C34 | 2.2 μ F; 40 V electrolytic |
| C35 | 4.7 nF |
| C36 | 0.5 pF |

Table 5 Resistors of Fig.18 (all SMD)

| NUMBER | VALUE |
|--------|----------------|
| R1 | 47 k Ω |
| R2 | 22 k Ω |
| R3 | 22 k Ω |
| R5 | 27 k Ω |
| R6 | 27 k Ω |
| R7 | 10 k Ω |
| R8 | 50 Ω |
| R9 | 4.7 Ω |
| R10 | 100 Ω |
| R11 | 27 k Ω |
| R12 | 15 k Ω |
| R13 | 4.7 k Ω |

Table 6 Diodes, coils and transformers of Fig.18

| NUMBER | VALUE |
|-----------------------------------|-------------------------------|
| Diodes | |
| D1 | BB132 |
| D2 | BB134 |
| D3 | BB133 |
| Coils⁽¹⁾ | |
| L1 | 7.5 t (\varnothing 3 mm) |
| L2 | 2.5 t (\varnothing 2 mm) |
| L3 | 2.5 t (\varnothing 2 mm) |
| L4 | 2.5 t (\varnothing 2.5 mm) |
| L5 | 5.5 t (\varnothing 2.5 mm) |
| L6 | 5.5 t (\varnothing 2.5 mm) |
| L9 | 12.5 t (\varnothing 5 mm) |
| L10 | 2.2 μ H; choke coil |
| Transformers⁽²⁾ | |
| L7 | 2 \times 5 turns |
| L8 | 2 turns |

Notes

- The wire size for L1, L2, L5 and L6 is 0.4 mm.
The wire size for L3 and L4 is 0.5 mm.
- Coil type: TOKO 7kL.

5 V VHF, hyperband and UHF mixers/oscillators
for TV and VCR 3-band tuners

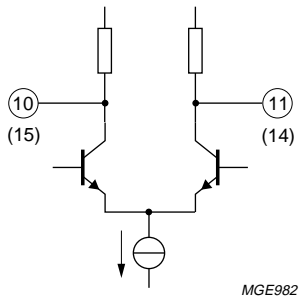
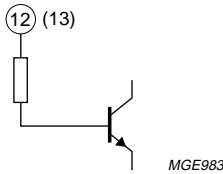
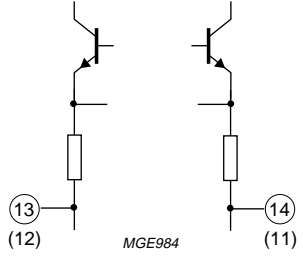
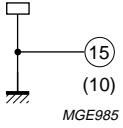
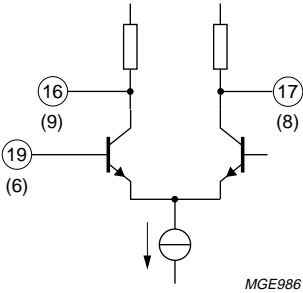
TDA5736; TDA5737

INTERNAL PIN CONFIGURATION

| SYMBOL | PIN | | DESCRIPTION | AVERAGE DC VOLTAGE IN (V) ⁽¹⁾ measured in circuit of Fig.17 | | |
|----------------|---------|---------|----------------|---|--------|--------|
| | TDA5736 | TDA5737 | | BAND A | BAND B | BAND C |
| IFIN1 | 1 | 24 | | 3.6 | 3.6 | 3.6 |
| IFIN2 | 2 | 23 | | 3.6 | 3.6 | 3.6 |
| RFGND | 3 | 22 | | 0 | 0 | 0 |
| CIN1 | 4 | 21 | | NR | NR | 1.0 |
| CIN2 | 5 | 20 | | NR | NR | 1.0 |
| AIN | 6 | 19 | | 1.8 | NR | NR |
| BIN1 | 7 | 18 | | NR | 1.0 | NR |
| BIN2 | 8 | 17 | | NR | 1.0 | NR |
| V _P | 9 | 16 | supply voltage | 5.0 | 5.0 | 5.0 |

5 V VHF, hyperband and UHF mixers/oscillators
for TV and VCR 3-band tuners

TDA5736; TDA5737

| SYMBOL | PIN | | DESCRIPTION | AVERAGE DC VOLTAGE IN (V) ⁽¹⁾ measured in circuit of Fig.17 | | |
|---------|---------|---------|---|---|--------|--------|
| | TDA5736 | TDA5737 | | BAND A | BAND B | BAND C |
| LOOUT1 | 10 | 15 |  <p>MGE982</p> | 4.2 | NR | NR |
| LOOUT2 | 11 | 14 | | 4.2 | NR | NR |
| BS | 12 | 13 |  <p>MGE983</p> | 0.0 | 1.8 | 5.0 |
| IFOUT1 | 13 | 12 |  <p>MGE984</p> | 2.1 | NR | NR |
| IFOUT2 | 14 | 11 | | 2.1 | NR | NR |
| GND | 15 | 10 |  <p>MGE985</p> | 0.0 | 0.0 | 0.0 |
| BOSCOC1 | 16 | 9 |  <p>MGE986</p> | NR | 2.7 | NR |
| BOSCOC2 | 17 | 8 | | NR | 2.7 | NR |
| BOSCIB | 19 | 6 | | NR | 2.0 | NR |

5 V VHF, hyperband and UHF mixers/oscillators
for TV and VCR 3-band tuners

TDA5736; TDA5737

| SYMBOL | PIN | | DESCRIPTION | AVERAGE DC VOLTAGE IN (V) ⁽¹⁾ measured in circuit of Fig.17 | | |
|---------|---------|---------|---------------|---|--------|--------|
| | TDA5736 | TDA5737 | | BAND A | BAND B | BAND C |
| COSCIB1 | 18 | 7 | <p>MGE987</p> | NR | NR | 2.0 |
| COSCOC1 | 20 | 5 | | NR | NR | 2.7 |
| COSCOC2 | 22 | 3 | | NR | NR | 2.7 |
| COSCIB2 | 24 | 1 | | NR | NR | 2.0 |
| AOSCOC | 21 | 4 | <p>MGE988</p> | 2.5 | NR | NR |
| AOSCIB | 23 | 2 | | 2.0 | NR | NR |

Note

- 1. NR = not relevant.

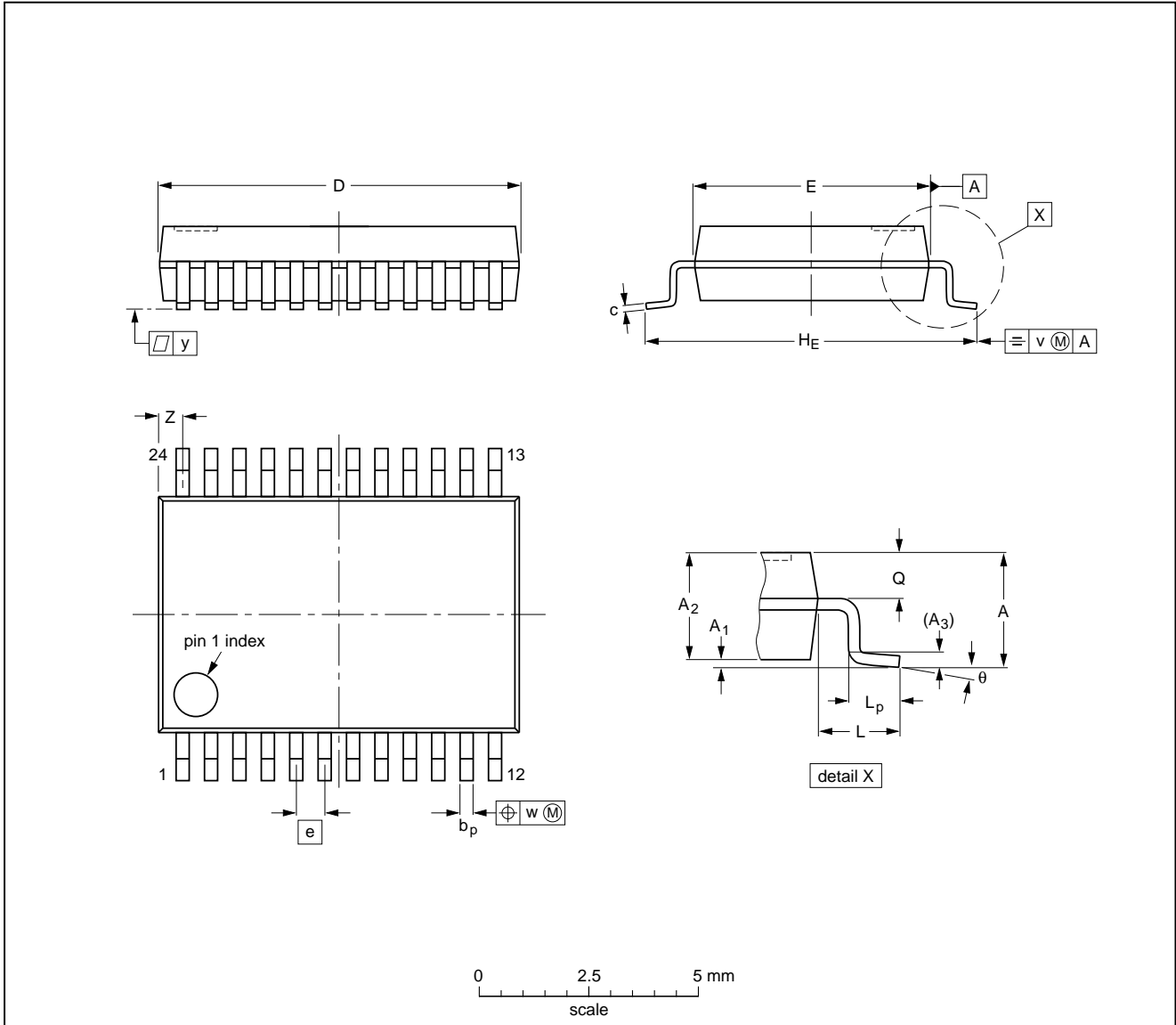
5 V VHF, hyperband and UHF mixers/oscillators
for TV and VCR 3-band tuners

TDA5736; TDA5737

PACKAGE OUTLINES

SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm

SOT340-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽¹⁾ | e | H _E | L | L _p | Q | v | w | y | Z ⁽¹⁾ | θ |
|------|--------|----------------|----------------|----------------|----------------|--------------|------------------|------------------|------|----------------|------|----------------|------------|-----|------|-----|------------------|----------|
| mm | 2.0 | 0.21 0.05 | 1.80 1.65 | 0.25 | 0.38 0.25 | 0.20 0.09 | 8.4 8.0 | 5.4 5.2 | 0.65 | 7.9 7.6 | 1.25 | 1.03 0.63 | 0.9 0.7 | 0.2 | 0.13 | 0.1 | 0.8 0.4 | 8° 0° |

Note

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

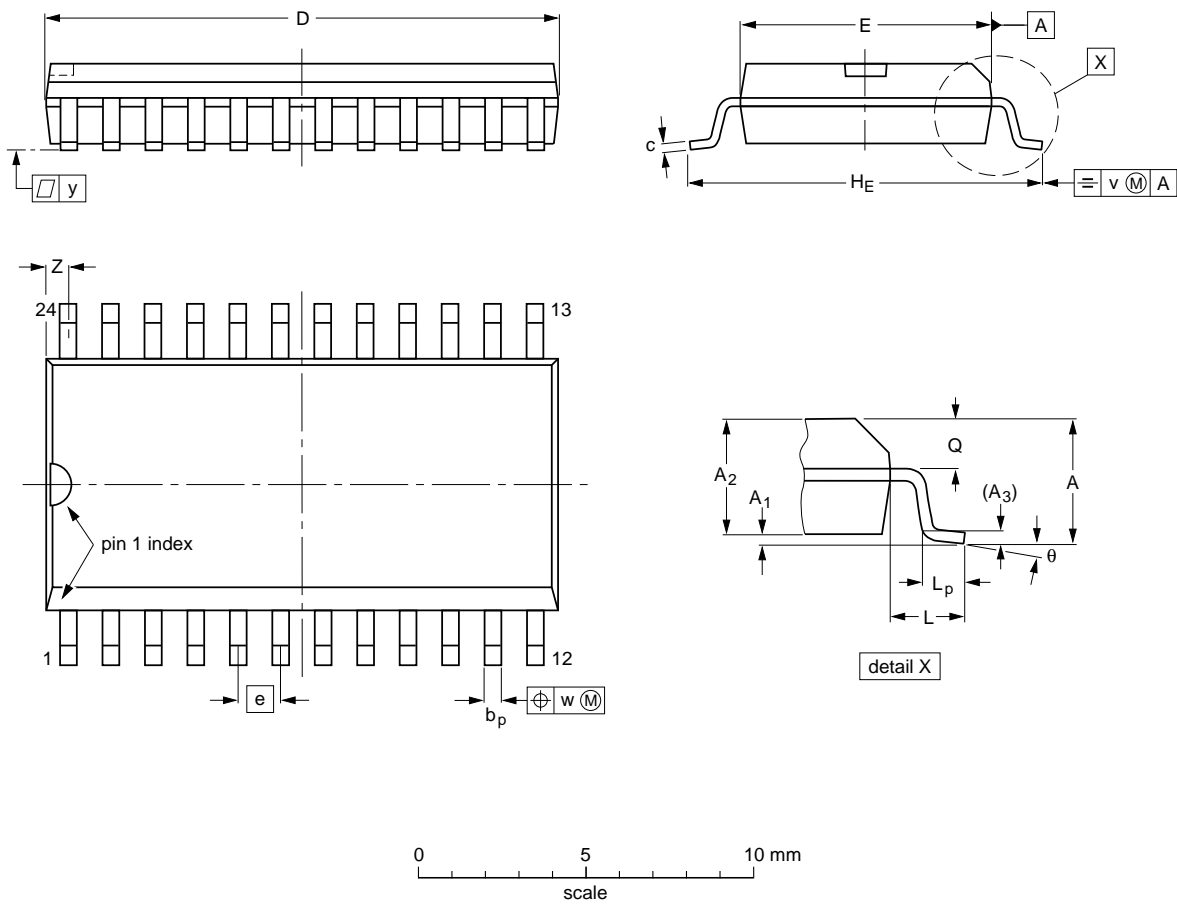
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT340-1 | | MO-150AG | | | | 93-09-08 95-02-04 |

5 V VHF, hyperband and UHF mixers/oscillators
for TV and VCR 3-band tuners

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SO24: plastic small outline package; 24 leads; body width 7.5 mm

SOT137-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽¹⁾ | e | H _E | L | L _p | Q | v | w | y | Z ⁽¹⁾ | θ |
|--------|--------|----------------|----------------|----------------|----------------|----------------|------------------|------------------|-------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm | 2.65 | 0.30 0.10 | 2.45 2.25 | 0.25 | 0.49 0.36 | 0.32 0.23 | 15.6 15.2 | 7.6 7.4 | 1.27 | 10.65 10.00 | 1.4 | 1.1 0.4 | 1.1 1.0 | 0.25 | 0.25 | 0.1 | 0.9 0.4 | 8° 0° |
| inches | 0.10 | 0.012 0.004 | 0.096 0.089 | 0.01 | 0.019 0.014 | 0.013 0.009 | 0.61 0.60 | 0.30 0.29 | 0.050 | 0.42 0.39 | 0.055 | 0.043 0.016 | 0.043 0.039 | 0.01 | 0.01 | 0.004 | 0.035 0.016 | |

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT137-1 | 075E05 | MS-013AD | | | | 92-11-17 95-01-24 |

5 V VHF, hyperband and UHF mixers/oscillators for TV and VCR 3-band tuners

TDA5736; TDA5737

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our "IC Package Databook" (order code 9398 652 90011).

Reflow soldering

Reflow soldering techniques are suitable for all SO and SSOP packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

Wave soldering

SO

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

SSOP

Wave soldering is **not** recommended for SSOP packages. This is because of the likelihood of solder bridging due to closely-spaced leads and the possibility of incomplete solder penetration in multi-lead devices.

If wave soldering cannot be avoided, the following conditions must be observed:

- **A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.**
- **The longitudinal axis of the package footprint must be parallel to the solder flow and must incorporate solder thieves at the downstream end.**

Even with these conditions, only consider wave soldering SSOP packages that have a body width of 4.4 mm, that is SSOP16 (SOT369-1) or SSOP20 (SOT266-1).

METHOD (SO AND SSOP)

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

Repairing soldered joints

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

**5 V VHF, hyperband and UHF mixers/oscillators
for TV and VCR 3-band tuners**

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DEFINITIONS

| | |
|---|---|
| Data sheet status | |
| Objective specification | This data sheet contains target or goal specifications for product development. |
| Preliminary specification | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification | This data sheet contains final product specifications. |
| Limiting values | |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability. | |
| Application information | |
| Where application information is given, it is advisory and does not form part of the specification. | |

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Printed in The Netherlands

547047/1200/04/pp28

Date of release: 1997 Feb 24

Document order number: 9397 750 01692

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