

DATA SHEET

TDA1581T

Decoder for traffic warning (VWF)
radio transmissions

Preliminary specification
File under Integrated Circuits, IC01

March 1992

Decoder for traffic warning (VWF) radio transmissions

TDA1581T

FEATURES

- Selective subcarrier amplifier (57 kHz) with gain control
- Transmitter identification signal (SK) decoder
- Area identification signal (BK) and announcement identification signal (DK) active filtering
- BK and DK decoders (Schmitt trigger with switched hysteresis)
- BK and DK switch-on/switch-off delay circuits
- SK and BK control outputs.

GENERAL DESCRIPTION

The TDA1581T decoder is for radio transmissions having 57 kHz amplitude-modulated subcarriers as used in the german 'Verkehrs Warnfunk' (VWF) traffic warning system.

QUICK REFERENCE DATA

Measured in Fig.3 at $V_{iSK} = 8$ mV; $f = 57$ kHz amplitude modulated with $f_m = 34.95$ Hz and $m = 60\%$ for 'BK-traffic area C' signal; or with $f_m = 125$ Hz and $m = 30\%$ for DK signal

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-----------------|-------------------------------------|-----------------|------|------|------|------------|
| V_P | supply voltage range | | 7.5 | 8.5 | 10 | V |
| I_P | supply current | | — | 6 | — | mA |
| V_{iSK} | nominal input voltage | $f = 57$ kHz | — | 8 | — | mV |
| Z_i | input impedance | $f \leq 57$ kHz | 100 | — | — | k Ω |
| V_{iSK} | control level | -3 dB | — | 2.4 | — | mV |
| $V_{i(p-p)}$ | input voltage peak-to-peak value | | 2 | — | — | V |
| m_{BKon} | SK switch-on threshold level | | — | 42 | — | % |
| Δm_{BK} | SK switch hysteresis | | — | 3.5 | — | dB |
| t_{dSKon} | SK switch-on delay | | — | 150 | — | ms |
| t_{dSKoff} | SK switch-off delay | | — | 750 | — | ms |
| m_{DKon} | DK switch-on threshold level | | — | 13 | — | % |
| Δm_{DK} | DK switch hysteresis | | — | 3.6 | — | dB |
| t_{dDKon} | DK switch-on delay | | — | 750 | — | ms |
| t_{dDKoff} | DK switch-off delay | | — | 750 | — | ms |
| T_{amb} | operating ambient temperature range | | -30 | — | +80 | °C |

ORDERING INFORMATION

| EXTENDED TYPE NUMBER | PACKAGE | | | |
|-------------------------|---------|--------------|----------|------------------------|
| | PINS | PIN POSITION | MATERIAL | CODE |
| TDA1581T | 20 | SO | plastic | SOT163A ⁽¹⁾ |

Note

1. SOT163-1; 1996 August 28.

Decoder for traffic warning (VWF) radio transmissions

TDA1581T

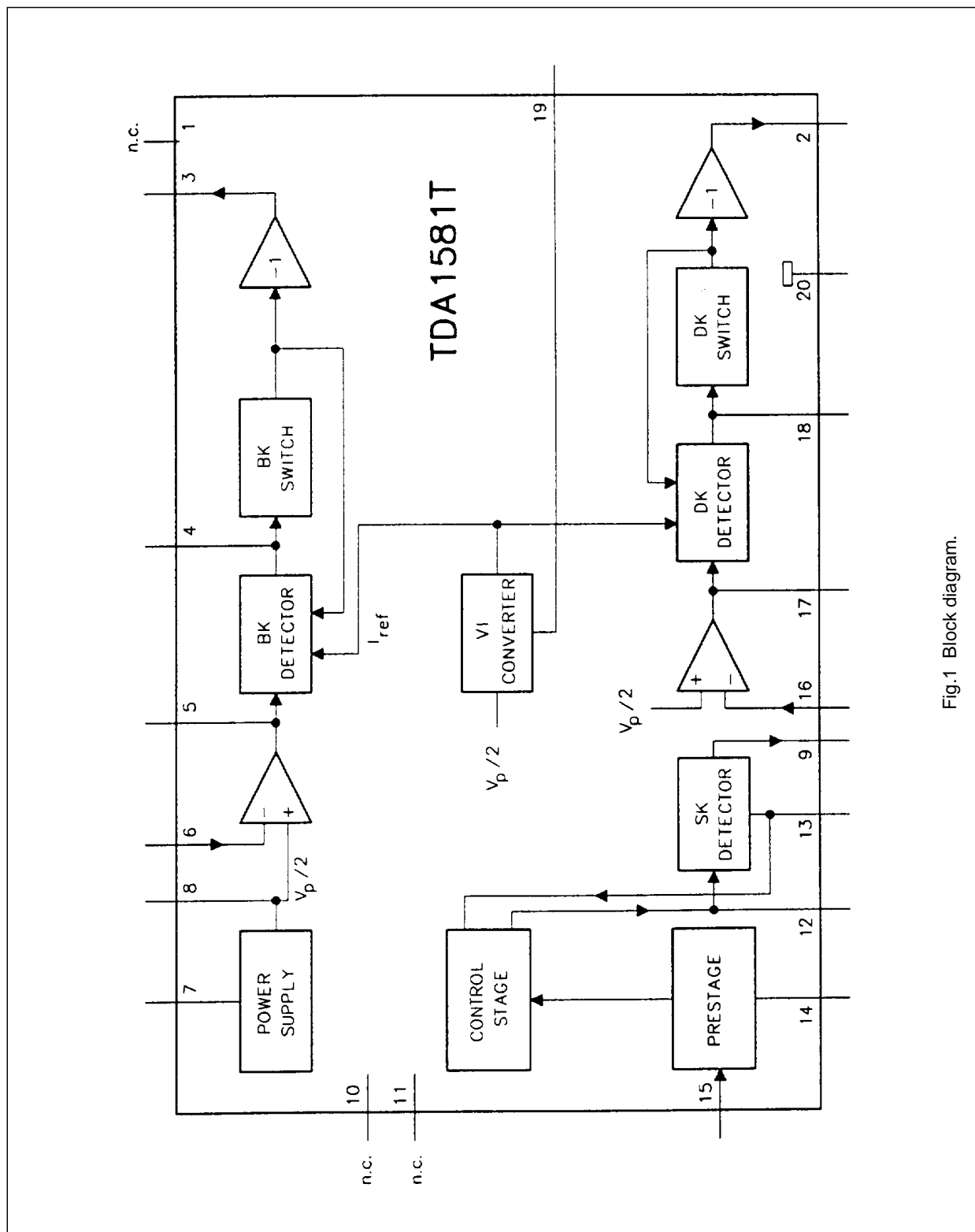


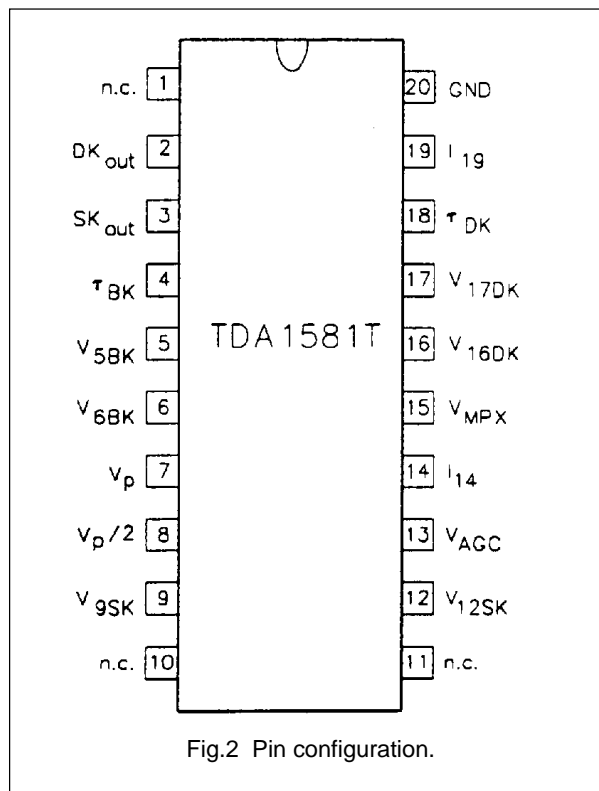
Fig.1 Block diagram.

Decoder for traffic warning (VWF) radio transmissions

TDA1581T

PINNING

| SYMBOL | PIN | DESCRIPTION |
|--------------------|-----|---------------------------------------|
| n.c. | 1 | not connected |
| DK _{out} | 2 | DK output current |
| SK _{out} | 3 | SK output current |
| τ_{BK} | 4 | time delay BK |
| V _{5BK} | 5 | filter output BK |
| V _{6BK} | 6 | filter input BK |
| V _P | 7 | supply voltage |
| V _P / 2 | 8 | half supply voltage |
| V _{9SK} | 9 | SK detector output |
| n.c. | 10 | not connected |
| n.c. | 11 | not connected |
| V _{12SK} | 12 | 57 kHz band pass filter |
| V _{AGC} | 13 | AGC |
| I ₁₄ | 14 | prestage biasing current |
| V _{MPX} | 15 | MPX input |
| V _{16DK} | 16 | filter input DK |
| V _{17DK} | 17 | filter output DK |
| τ_{DK} | 18 | time delay DK |
| I ₁₉ | 19 | reference current for BK, DK detector |
| GND | 20 | ground |



Decoder for traffic warning (VWF) radio transmissions

TDA1581T

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|------------------|-------------------------------------|-------------|------|------|-------|------|
| $V_P = V_{7-20}$ | supply voltage | pin 7 | – | – | 15 | V |
| $V_{2; 3-20}$ | switch output voltage | pins 2 or 3 | –0.5 | – | 15 | V |
| $I_{2; 3}$ | switch output current | pins 2 or 3 | –10 | – | 5 | mA |
| V_{15-20} | signal input voltage | pin 15 | –0.5 | – | V_P | V |
| I_{15} | signal input current | pin 15 | – | – | –10 | mA |
| P_{tot} | total power dissipation | | – | – | 800 | mW |
| T_{stg} | storage temperature range | | –55 | – | +150 | °C |
| T_{amb} | operating ambient temperature range | | –30 | – | +80 | °C |

CHARACTERISTICS

$V_P = 8.5$ V; $T_{amb} = +25$ °C; measured at nominal input signal: $V_{iSK} = 8$ mV, $f = 57$ kHz amplitude modulated with $f_m = 34.95$ Hz and $m = 60\%$ for 'BK-traffic area C' signal; or with $f_m = 125$ Hz and $m = 30\%$ for DK signal.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|----------------------------------|---|--------------------------------------|------|--------------------|------|------|
| V _P | supply voltage | pin 7 | 7.5 | – | 10 | V |
| I _P | supply current | pin 7 | – | 6 | 15 | mA |
| SK amplifier/decoder | | | | | | |
| Z _i | input impedance | f ≤ 57 kHz | 60 | – | – | kΩ |
| V _{i(p-p)} | input voltage (peak-to-peak value) | | 2 | – | – | V |
| V _{iSK} | input voltage at start of gain control | V _{09BK} = –3 dB | – | 2.4 ⁽¹⁾ | – | mV |
| G _{v9-15} | voltage gain | V _{9BK} / V _{15SK} | – | 44 ⁽¹⁾ | – | dB |
| ΔG _{v9-15} | gain spread | | – | – | ±2 | dB |
| ΔG _v | gain control range | | 40 | – | – | dB |
| V _{09BK} | controlled output voltage | | – | 440 | – | mV |
| V _{09DK} | | | – | 220 | – | mV |
| BK circuit | | | | | | |
| V _{05BKon} | switch-on threshold level | pin 3 high-Z | 600 | 670 | 750 | mV |
| $\frac{V_{05BKon}}{V_{05BKoff}}$ | switch hysteresis | | 3 | 3.5 | 4 | dB |
| V _{4-20off} | BK switch threshold level for BK-off (SK-off) (typ. value = 0.21V ₈₋₂₀) | pin 3 conducting | 0.8 | 0.88 | 0.97 | V |
| | SK output (pin 3) | | | | | |
| I ₃ | permitted load current | | – | – | 0.5 | mA |
| V _{3-20sat} | saturation voltage | I ₃ = 1.5 mA | – | – | 0.35 | V |
| V ₃₋₂₀ | rejection voltage | I ₃ < 5 μA | 18 | – | – | V |

Decoder for traffic warning (VWF) radio transmissions

TDA1581T

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|------------------------------------|---|---|---------|------|----------|------------|
| DK circuit | | | | | | |
| V_{17DKon} | switch-on threshold level | pin 2 high-Z | 600 | 670 | 750 | mV |
| $\frac{V_{17DKon}}{V_{17DKoff}}$ | switch hysteresis | | 3.1 | 3.6 | 4.1 | dB |
| $V_{18-20off}$ | DK switch threshold level for DK-off (Schmitt trigger output) (typ. value = $1 \times V_{BE}$) | pin 2 conducting | – | 0.6 | – | V |
| | DK output (pin 2) | | | | | |
| I_2 | permitted load current | | – | – | 0.5 | mA |
| $V_{2-20sat}$ | saturation voltage | $I_2 = 1.5 \text{ mA}$ | – | – | 0.35 | V |
| V_{2-20} | rejection voltage | $I_2 < 5 \text{ } \mu\text{A}$ | 18 | – | – | V |
| BK and DK filter amplifiers | | | | | | |
| G_o | open loop gain | $f = 100 \text{ Hz}$ | 84 | – | – | dB |
| G_i | current gain | | 120 | – | – | dB |
| I_i | input bias current | | – | – | ± 50 | nA |
| V_{o5-8} | output offset voltage | $R_{5-6} = R_{16-17} = 680 \text{ k}\Omega$ | – | – | ± 50 | mV |
| V_{17-8} | | | | | | |
| I_o | available output current | | ± 1 | – | – | mA |
| R_o | output resistance | | – | 2 | 3.5 | k Ω |
| C_L | permitted load capacitance | | – | – | 50 | pF |
| Internal reference voltage | | | | | | |
| V_{8-20} | output voltage (typ. value = $0.5V_P$) | | 4.0 | 4.25 | 4.5 | V |
| R_8 | internal resistance of voltage source | | – | – | 5 | Ω |
| I_{8-20} | available output current | | –2 | – | – | mA |
| I_{20-8} | | | 0.6 | – | – | mA |
| I_{8sc} | output short-circuit current (typ. value = $V_P / 1 \text{ k}\Omega$) | | – | –8 | – | mA |
| Reference current source | | | | | | |
| V_{19-20} | reference voltage (typ. value = $V_{8-20} - V_{BE}$) | | – | 3.6 | – | V |
| R_{119} | internal biasing resistor | | – | 5 | – | k Ω |
| R_{19-20} | permitted range of external reference resistor | | 180 | – | 270 | k Ω |

Note

1. selectable by R_{14-8} or Z_{12-8} .

Decoder for traffic warning (VWF) radio transmissions

TDA1581T

APPLICATION INFORMATION (see Fig.3)

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|------------------------------|------------------------------|-------------------------|------|------|------|------|
| V_{ISKon} | SK switch-on threshold level | $m_{BK} = 60\%$ | – | 1.8 | – | mV |
| m_{BKon} | SK switch-on threshold level | $V_{ISK} = 8\text{ mV}$ | – | 32 | – | % |
| $\frac{m_{BKon}}{m_{BKoff}}$ | SK switch hysteresis | | 3.0 | 3.5 | 4.0 | dB |
| t_{dSKon} | SK switch-on delay | note 1 | – | 95 | 200 | ms |
| t_{dSKoff} | SK switch-off delay | note 2 | 380 | 500 | 700 | ms |
| V_{IDKon} | DK switch-on threshold level | $m_{DK} = 30\%$ | – | 1.5 | – | mV |
| m_{DKon} | DK switch-on threshold level | $V_{IDK} = 8\text{ mV}$ | – | 13 | – | % |
| $\frac{m_{DKon}}{m_{DKoff}}$ | DK switch hysteresis | | 3.1 | 3.6 | 4.1 | dB |
| t_{dDKon} | DK switch-on delay | note 1 | – | 750 | 1000 | ms |
| t_{dDKoff} | DK switch-off delay | note 2 | 600 | 750 | 1000 | ms |

Notes to the application information

- Sequence for measuring switch-on delay times (t_{don})
 - Nominal BK or DK input signal at pin 15: $V_{i(p-p)} = 8\text{ mV}$; $f = 57\text{ kHz}$; modulation-on.
 - Pin 4 of the BK detector (pin 18 of the DK detector) is switched to ground to cause a low signal at the SK output at pin 3 (DK output at pin 2).
 - t_{don} commences when the ground connection is removed from pin 4 (pin 18) as the positive-going V_{oBK} signal at pin 5 (V_{oDK} signal at pin 17) crosses zero.
 t_{don} ends when the positive-going edge of the SK output arrives at pin 15 (DK at pin 2).
- Sequence for measuring switch-off delay times (t_{doff})
 - Nominal operating conditions as in note 1.
 - t_{doff} commences when the input is switched off as the negative-going V_{oBK} signal at pin 5 (V_{oDK} signal at pin 17) crosses zero.
 t_{doff} ends when the negative-going edge of the SK output arrives at pin 3 (DK at pin 2).

Decoder for traffic warning (VWF) radio transmissions

TDA1581T

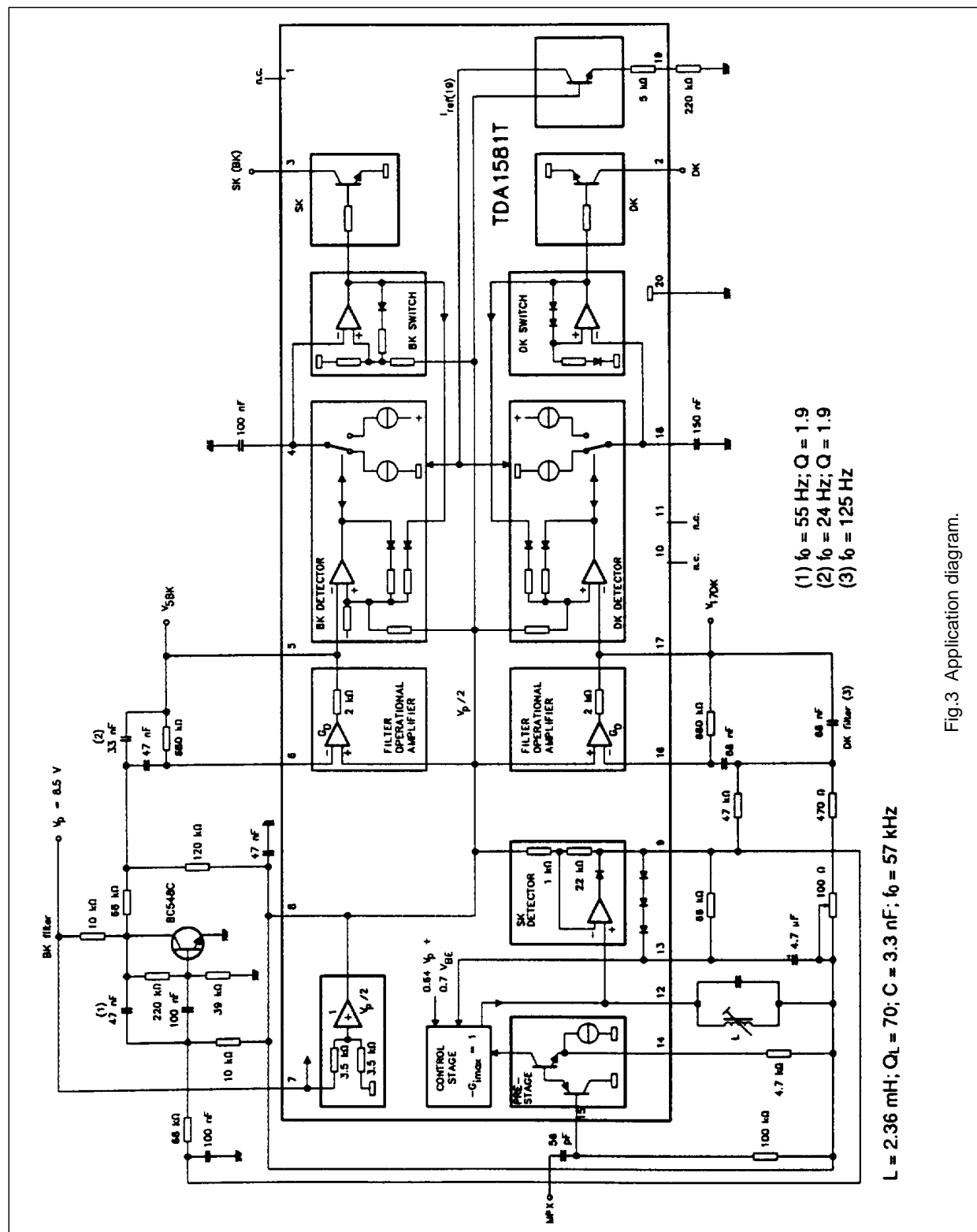


Fig.3 Application diagram.

Decoder for traffic warning (VWF) radio transmissions

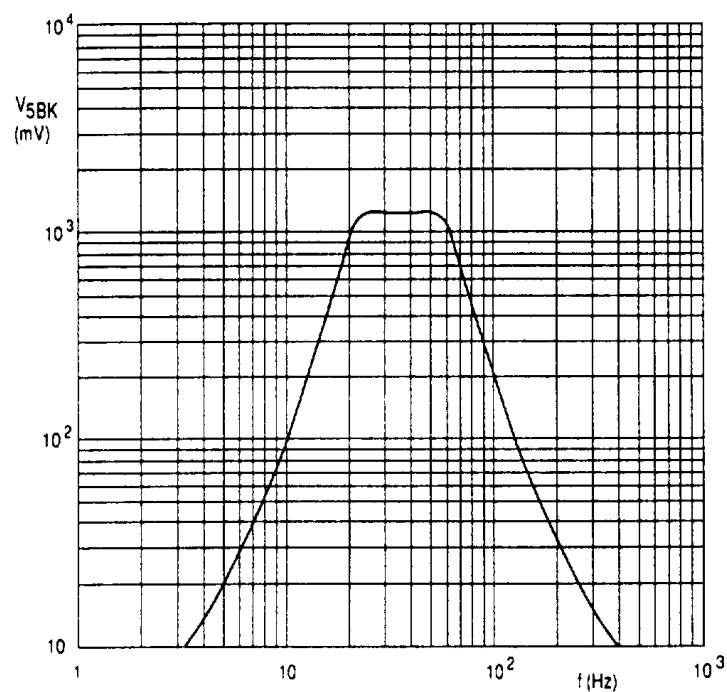
TDA1581T

Fig.4 BK signal voltage at pin 5 as a function of frequency.

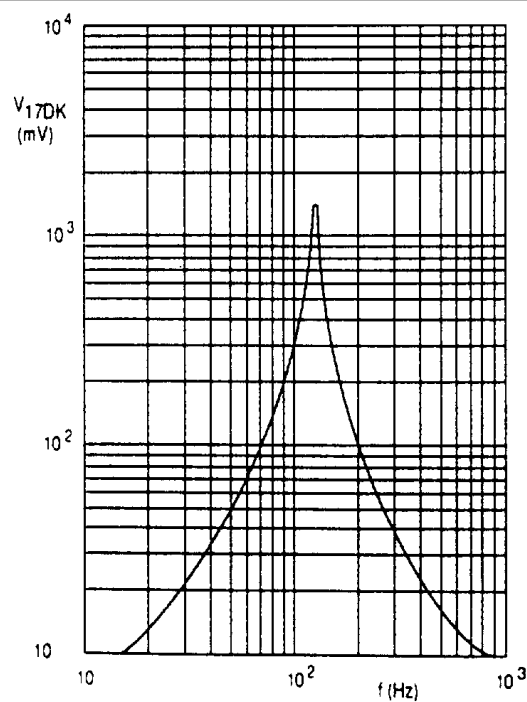
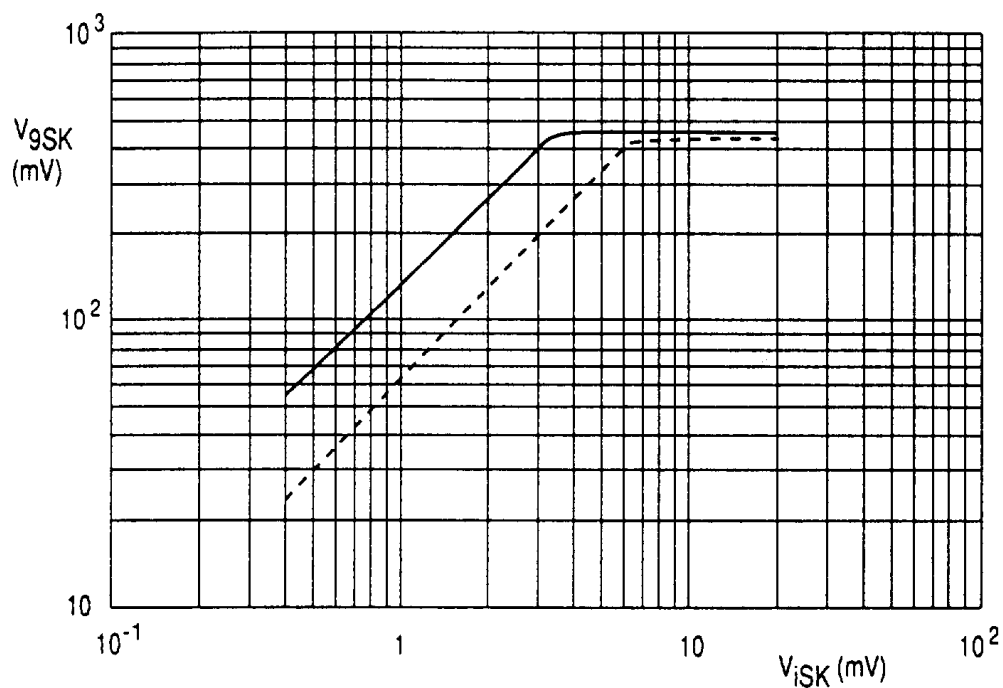


Fig.5 DK signal voltage at pin 17 as a function of frequency: $f_0 = 125$ Hz; $Q \approx 18$.

Decoder for traffic warning (VWF) radio
transmissions

TDA1581T

Fig.6 Control characteristic of the SK amplifier at $V_P = 8.5$ V, $m_{BK} = 60\%$ and $Q_L = 70$.

Decoder for traffic warning (VWF) radio transmissions

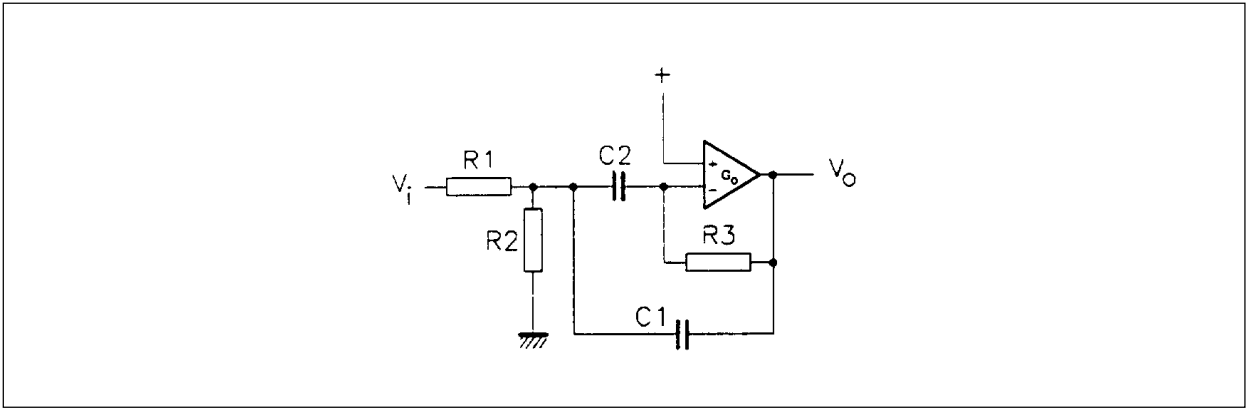
TDA1581T

FILTER INFORMATION

Gain

Amplifier conditions: $G_o \gg G_v$ and $G_o \gg 2 \times Q^2$

$$G_v = - \frac{\frac{p}{R1 \times C1}}{p^2 + p \times \frac{C1 + C2}{R3 \times C1 \times C2} + \frac{R1 + R2}{R1 \times R2 \times R3 \times C1 \times C2}} \text{ , in which } p = j\omega \text{ and } G_v = \frac{V_o}{V_i}$$



| | GENERAL EQUATION | C1 = C2 = C | C1 = C2 = C R2 << R1 |
|--|--|---|------------------------------------|
| resonance frequency $\omega_r =$ | $\frac{1}{\sqrt{\frac{R1 \times R2}{R1 + R2}} \times R3 \times C1 \times C2}$ | $\frac{1}{C \sqrt{\frac{R1 \times R2}{R1 + R2}} \times R3}$ | $\frac{1}{C \sqrt{R2 \times R3}}$ |
| gain at $\omega = \omega_r$ $-G_{vr} =$ | $\frac{C2}{C1 + C2} \times \frac{R3}{R1}$ | $\frac{1}{2} \times \frac{R3}{R1}$ | $\frac{1}{2} \times \frac{R3}{R1}$ |
| quality $Q =$ | $\frac{\sqrt{C1 \times C2}}{\sqrt{C1 + C2}} \times \sqrt{\frac{R3 (R1 + R2)}{R1 \times R2}}$ | $\frac{1}{2} \sqrt{\frac{R3 (R1 + R2)}{R1 \times R2}}$ | $\frac{1}{2} \times \frac{R3}{R2}$ |

Recommended components

- C1, C2

metallized polycarbonate film (MKC) capacitors; ±5%
- and
- R1, R2, R3

metal film (MR) resistors; ±2%
- or
- C1, C2

metallized polyester film (MKT) capacitors; ±5%
- and
- R1, R2, R3

carbon film (CR) resistors; ±2%

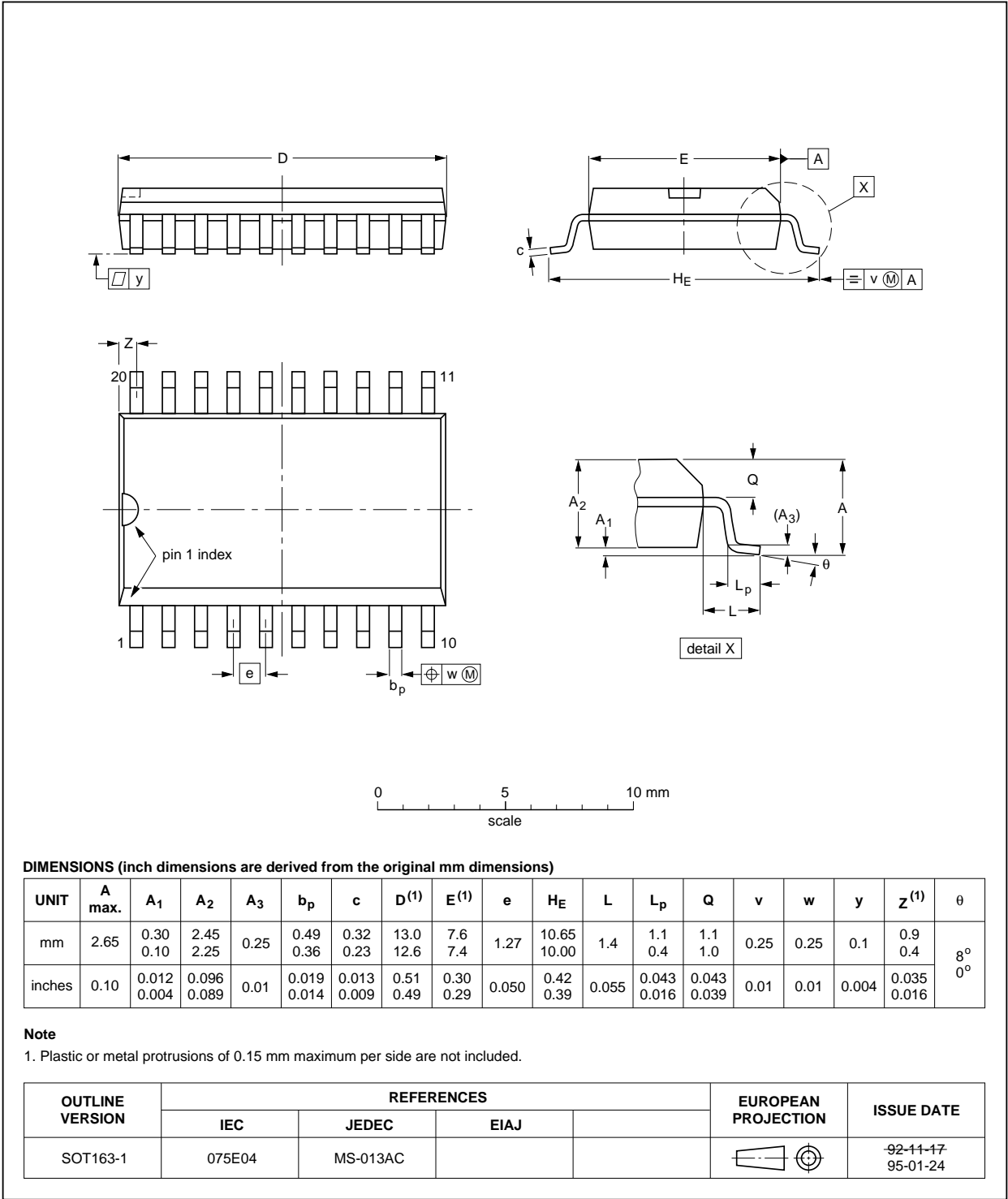
Decoder for traffic warning (VWF) radio transmissions

TDA1581T

PACKAGE OUTLINE

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



Decoder for traffic warning (VWF) radio transmissions

TDA1581T

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 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

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.

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.

Decoder for traffic warning (VWF) radio transmissions

TDA1581T

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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