

# DATA SHEET

## **TEA0677T**

Dual pre-amplifier and equalizer for  
reverse tape decks

Product specification  
File under Integrated Circuits, IC01

August 1993

## Dual pre-amplifier and equalizer for reverse tape decks

## TEA0677T

### FEATURES

- Head pre-amplifiers
- Reverse head switching
- Equalization with electronically switched time constants
- 0 dB = 387.5 mV
- Pin compatible to TEA0675 Dolby B, music search IC.

### GENERAL DESCRIPTION

The TEA0677T is a monolithic bipolar integrated circuit intended for applications in car radios. It includes head and equalization amplifiers with electronically switchable time constants. Furthermore it includes electronically switchable inputs for tape drives with reverse heads. The device is intended to replace the regular TEA0675T in low-cost car radios using the same PCB. External components that are necessary for Dolby B and music search features can be omitted.

The device will operate with power supplies in the range of 7.6 V to 12.0 V, output overload level increasing with increase in supply voltage. Current drain varies with supply voltage, so it is advisable to use a regulated power supply or a supply with a long time constant.

### QUICK REFERENCE DATA

| SYMBOL    | PARAMETER                        | MIN. | TYP. | MAX. | UNIT |
|-----------|----------------------------------|------|------|------|------|
| $V_{CC}$  | supply voltage                   | 7.6  | 10   | 12   | V    |
| $I_{CC}$  | supply current                   | —    | 23   | 26   | mA   |
| (S + N)/N | signal-plus-noise to noise ratio | 68   | 74   | —    | dB   |

### ORDERING INFORMATION

| EXTENDED TYPE<br>NUMBER | PACKAGE |              |          |                        |
|-------------------------|---------|--------------|----------|------------------------|
|                         | PINS    | PIN POSITION | MATERIAL | CODE                   |
| TEA0677T                | 24      | SO           | plastic  | SOT137A <sup>(1)</sup> |

### Note

1. SOT137-1; 1996 August 27.

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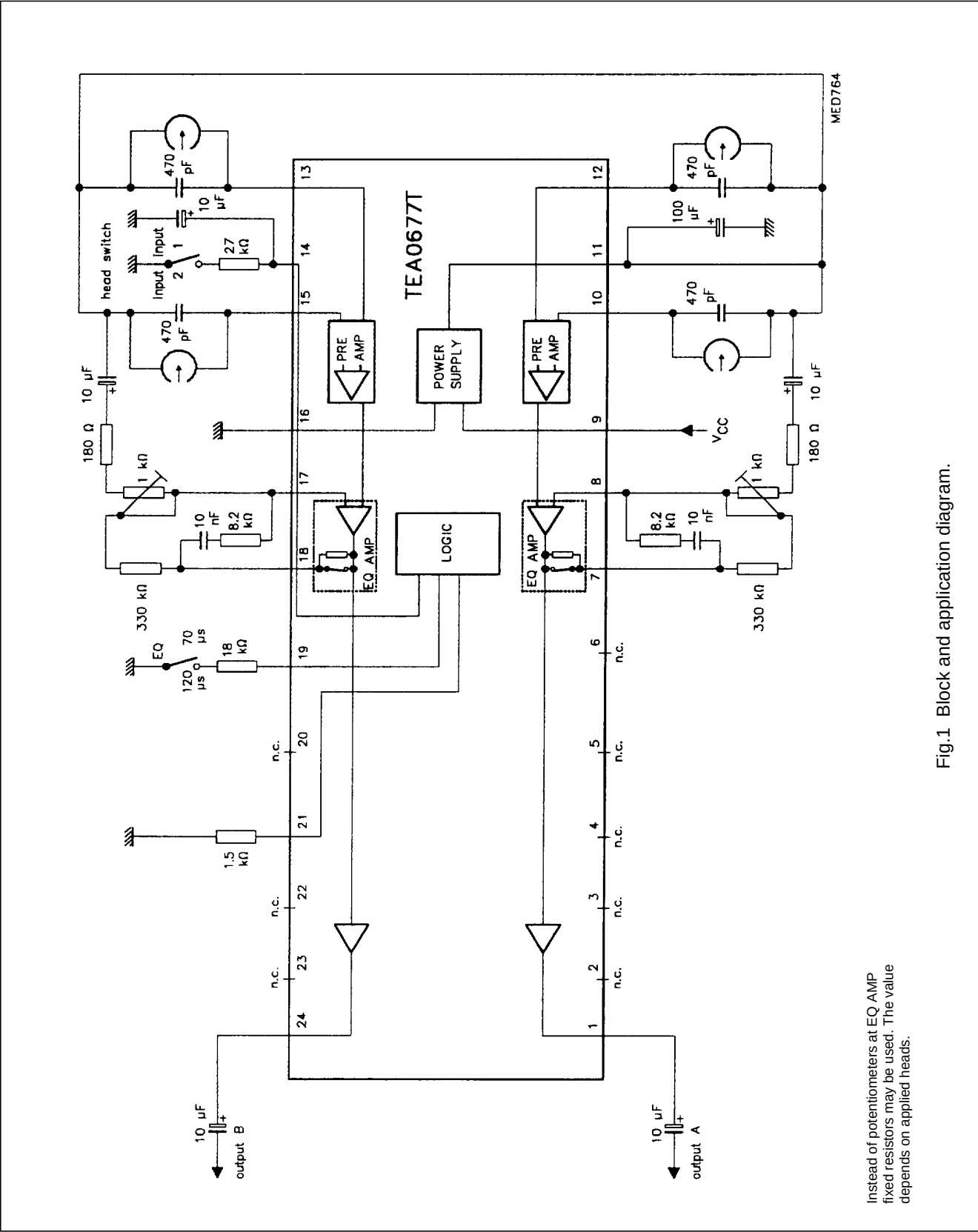


Fig.1 Block and application diagram.

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### PINNING

| SYMBOL           | PIN | DESCRIPTION                           |
|------------------|-----|---------------------------------------|
| OUTA             | 1   | output channel A                      |
| n.c.             | 2   | not connected                         |
| n.c.             | 3   | not connected                         |
| n.c.             | 4   | not connected                         |
| n.c.             | 5   | not connected                         |
| n.c.             | 6   | not connected                         |
| EQA              | 7   | equalizing output channel A           |
| EQFA             | 8   | equalizing input channel A            |
| V <sub>CC</sub>  | 9   | supply voltage                        |
| INA1             | 10  | input channel A1 (forward or reverse) |
| V <sub>REF</sub> | 11  | reference voltage                     |
| INA2             | 12  | input channel A2 (reverse or forward) |
| INB2             | 13  | input channel B2 (reverse or forward) |
| HS               | 14  | head switch input                     |
| INB1             | 15  | input channel B1 (forward or reverse) |
| GND              | 16  | ground                                |
| EQFB             | 17  | equalizing input channel B            |
| EQB              | 18  | equalizing output channel B           |
| EQS              | 19  | equalizing switch input               |
| n.c.             | 20  | not connected                         |
| ACUR             | 21  | auxiliary current                     |
| n.c.             | 22  | not connected                         |
| n.c.             | 23  | not connected                         |
| OUTB             | 24  | output channel B                      |

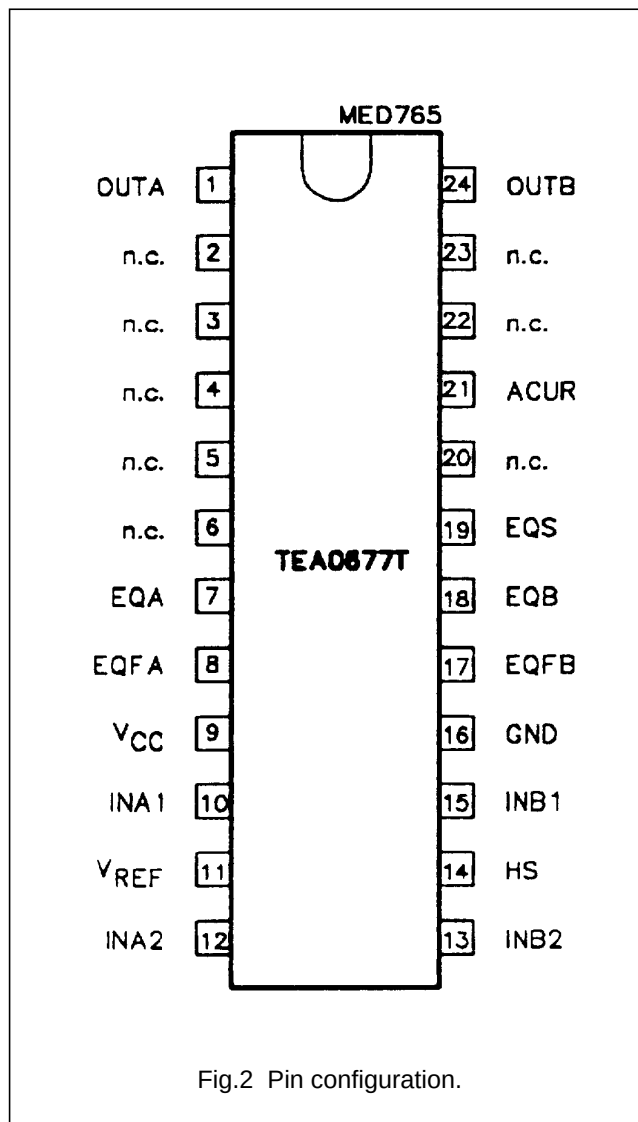


Fig.2 Pin configuration.

### FUNCTIONAL DESCRIPTION

**Head switching** is achieved when pin 14 (HS) is connected to GND via a 27 k $\Omega$  resistor (inputs INA2, INB2 active), or left open-circuit (inputs INA1, INB1 active). The 10  $\mu$ F capacitor at pin 14 sets the time constant for smooth switching.

### Time constant switching for equalization

(70  $\mu$ s/120  $\mu$ s) is achieved when pin 19 (EQS) is connected to ground via an 18 k $\Omega$  resistor (120 $\mu$ s) or left open-circuit (70  $\mu$ s).

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### LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC134).

| SYMBOL      | PARAMETER                                                           | MIN. | MAX.     | UNIT |
|-------------|---------------------------------------------------------------------|------|----------|------|
| $V_{CC}$    | DC supply voltage                                                   | 0    | 16       | V    |
| $V_I$       | input voltage (pin 1 to 24) except pin 11 ( $V_{REF}$ ) to $V_{CC}$ | -0.3 | $V_{CC}$ | V    |
| $t_{short}$ | pin 11 ( $V_{REF}$ ) to $V_{CC}$ short-circuiting duration          | –    | 5        | s    |
| $T_{amb}$   | operating ambient temperature                                       | -40  | +85      | °C   |
| $T_{stg}$   | storage temperature                                                 | -65  | +150     | °C   |
| $T_s$       | soldering temperature (wave solder for 10 s at lead)                | –    | 260      | °C   |
| $V_{es}$    | electrostatic handling (note 1)                                     | –    | –        | –    |

### Note to the Limiting values

1. Classification A: human body model;  $C = 100$  pF,  $R = 1.5$  k $\Omega$ ,  $V \geq 2$  kV; charge device model;  $C = 200$  pF,  $R = 0$   $\Omega$ ,  $V \geq 500$  V.

### CHARACTERISTICS

$V_{CC} = 10$  V;  $f = 20$  Hz to 20 kHz;  $T_{amb} = +25$  °C; all levels are referenced to 387.5 mV (RMS; 0 dB) at output; see Fig.1; EQ switch in the 70  $\mu$ s position; unless otherwise specified.

| SYMBOL        | PARAMETER                                                                 | CONDITIONS                                    | MIN. | TYP. | MAX. | UNIT       |
|---------------|---------------------------------------------------------------------------|-----------------------------------------------|------|------|------|------------|
| $V_{CC}$      | supply voltage                                                            |                                               | 7.6  | 10   | 12   | V          |
| $I_{CC}$      | supply current                                                            | pins 10, 12, 13 and 15 connected to $V_{REF}$ | –    | 23   | 26   | mA         |
|               | channel matching                                                          | $f = 1$ kHz; $V_O = 0$ dB                     | -0.5 | –    | +0.5 | dB         |
| THD           | total harmonic distortion 2nd and 3rd harmonic                            | $f = 1$ kHz; $V_O = 0$ dB                     | –    | 0.04 | 0.1  | %          |
|               |                                                                           | $f = 10$ kHz; $V_O = 6$ dB                    | –    | 0.08 | 0.15 | %          |
|               | head room at output                                                       | $V_{CC} = 7.6$ V;<br>THD = 1%; $f = 1$ kHz    | 12   | 14   | –    | dB         |
| PSRR          | power supply ripple rejection                                             | 0.25 V (RMS);<br>$f = 1$ kHz; see Fig.3       | 45   | 50   | –    | dB         |
| $\alpha_{CS}$ | channel separation                                                        | $f = 1$ kHz; $V_O = +10$ dB;<br>see Fig.4     | 64   | 70   | –    | dB         |
| $\alpha_{CC}$ | crosstalk between active and inactive input                               | $f = 1$ kHz; $V_O = +10$ dB                   | 70   | 77   | –    | dB         |
| $R_{Lmin}$    | minimum load resistance at output                                         | $f = 1$ kHz; $V_O = 12$ dB;<br>THD = 1%       | 10   | –    | –    | k $\Omega$ |
| $G_v$         | voltage gain (pre-amplifier) from input pins 10, 12, 13 and 15 to pin EQF | $f = 1$ kHz                                   | 29   | 30   | 31   | dB         |
| $V_{off}$     | input offset voltage                                                      |                                               | –    | 2    | –    | mV         |
| $I_B$         | input bias current                                                        |                                               | –    | 0.1  | 0.4  | $\mu$ A    |
| $R_{EQ}$      | equalizing resistor                                                       |                                               | 4.7  | 5.8  | 6.9  | k $\Omega$ |
| $R_I$         | input resistance head inputs                                              |                                               | 60   | 100  | –    | k $\Omega$ |

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| SYMBOL                      | PARAMETER                                                | CONDITIONS                                                        | MIN.                | TYP.                 | MAX.                | UNIT          |
|-----------------------------|----------------------------------------------------------|-------------------------------------------------------------------|---------------------|----------------------|---------------------|---------------|
| $A_V$                       | open-loop gain                                           |                                                                   |                     |                      |                     |               |
|                             | pins INA1/INA2 to pin OUTA<br>pins INB1/INB2 to pin OUTB | $f = 10 \text{ kHz}$<br>$f = 400 \text{ Hz}$                      | 80<br>104           | 86<br>110            | –<br>–              | dB<br>dB      |
| N                           | equivalent noise voltage input<br>(RMS value)            | unweighted;<br>20 Hz to 20 kHz;<br>$R_{\text{source}} = 0 \Omega$ | –                   | 0.7                  | 1.4                 | $\mu\text{V}$ |
| (S+N)/N                     | signal-plus-noise to noise ratio                         | internal gain 40 dB<br>linear;<br>CCIR/ARM weighted;<br>see Fig.4 | 68                  | 74                   | –                   | dB            |
|                             | DC output voltage; pins 1 (OUTA)<br>and 16 (OUTB)        | reference to $V_{\text{REF}}$ ;<br>tape head DC coupled           | –                   | –                    | $\pm 0.15$          | V             |
| $I_{\text{OGND}}$           | DC output current capability                             | to ground                                                         | –2                  | –                    | –                   | mA            |
| $I_{\text{OVCC}}$           | DC output current capability                             | to $V_{\text{CC}}$                                                | 300                 | –                    | –                   | $\mu\text{A}$ |
| $Z_O$                       | output impedance                                         |                                                                   | –                   | 80                   | 100                 | $\Omega$      |
| <b>Switching thresholds</b> |                                                          |                                                                   |                     |                      |                     |               |
| Equalization (pin 19)       |                                                          |                                                                   |                     |                      |                     |               |
| $V_{\text{EQS}}$            | voltage at pin EQS                                       |                                                                   | –                   | –                    | 5                   | V             |
| $I_{\text{EQ70}}$           | 70 $\mu\text{s}$ input current                           |                                                                   | –                   | –                    | –150                | $\mu\text{A}$ |
| $I_{\text{EQ120}}$          | 120 $\mu\text{s}$ input current                          |                                                                   | –250                | –                    | –1000               | $\mu\text{A}$ |
| Head switch (pin 14)        |                                                          |                                                                   |                     |                      |                     |               |
| $V_{\text{IN1}}$            | inputs INA1 and INB1 active                              | note 1                                                            | $0.65V_{\text{CC}}$ | $0.775V_{\text{CC}}$ | $1.0V_{\text{CC}}$  | V             |
| $I_{\text{IN1}}$            | maximum input current                                    |                                                                   | –150                | 90                   | 150                 | $\mu\text{A}$ |
| $V_{\text{IN2}}$            | inputs INA2 and INB2 active                              |                                                                   | $0.1V_{\text{CC}}$  | $0.225V_{\text{CC}}$ | $0.35V_{\text{CC}}$ | V             |
| $I_{\text{IN2}}$            | maximum input current                                    |                                                                   | –50                 | –90                  | –150                | $\mu\text{A}$ |

## Note to the characteristics

- For an application with a fixed EQ time constant of 120  $\mu\text{s}$  the equalizing network may be applied completely external. In this application the 8.2 k $\Omega$  resistor has to be changed to 14 k $\Omega$  and the internal resistor  $R_{\text{EQ}} = 5.8 \text{ k}\Omega$  must be short-circuited by fixing the EQ-switch input at the 70  $\mu\text{s}$  position (pin 19; EQS left open-circuit). To activate the inputs INA1 and INB1 pin 10 (HS) may be left open-circuit. In this event the DC level at pin 10 (HS) is  $0.775 V_{\text{CC}}$ .

## General note

It is recommended to switch off  $V_{\text{CC}}$  with a gradient of 400 V/s at maximum to avoid plops on tape in the event of contact between tape and tape head while switching off.

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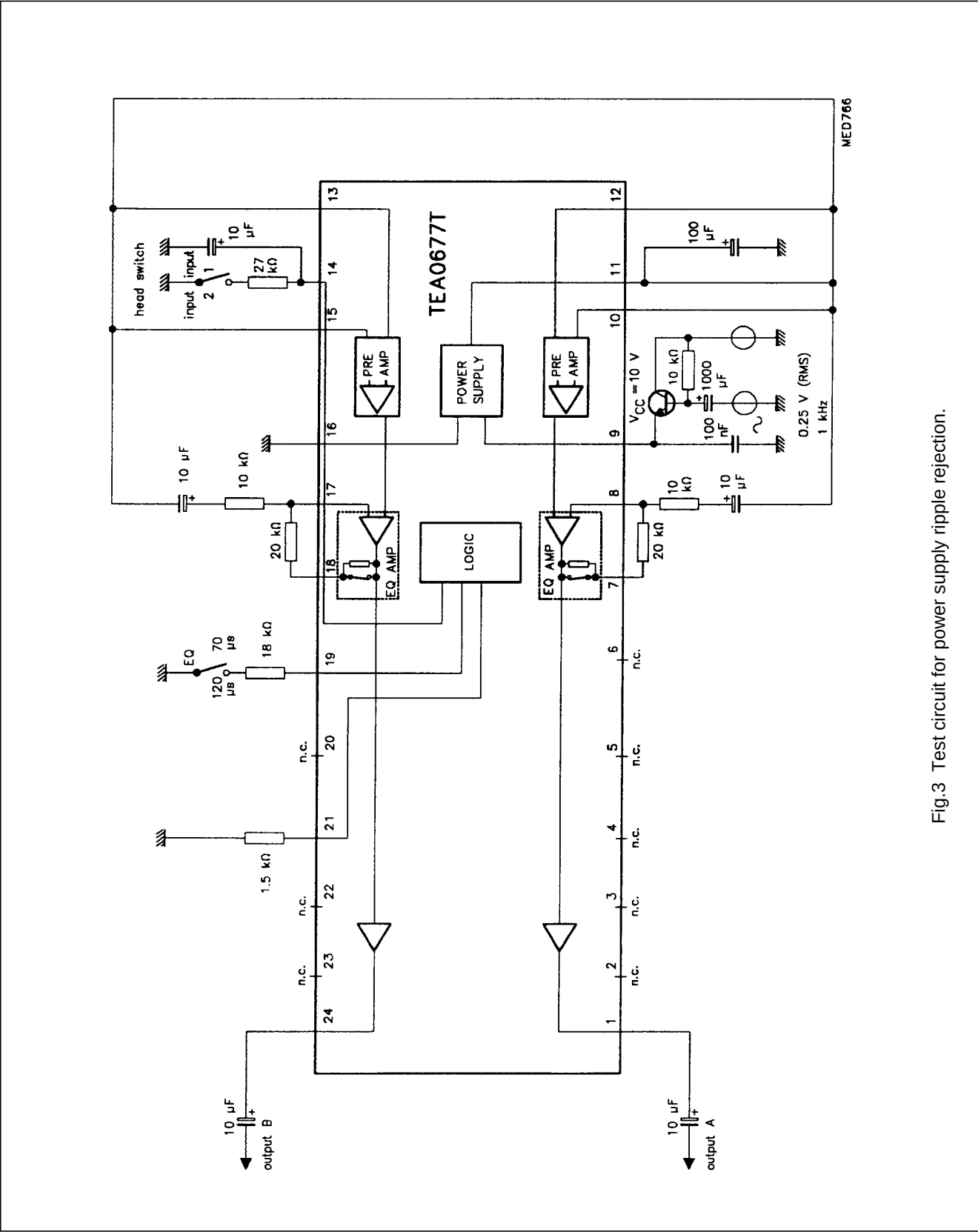


Fig.3 Test circuit for power supply ripple rejection.

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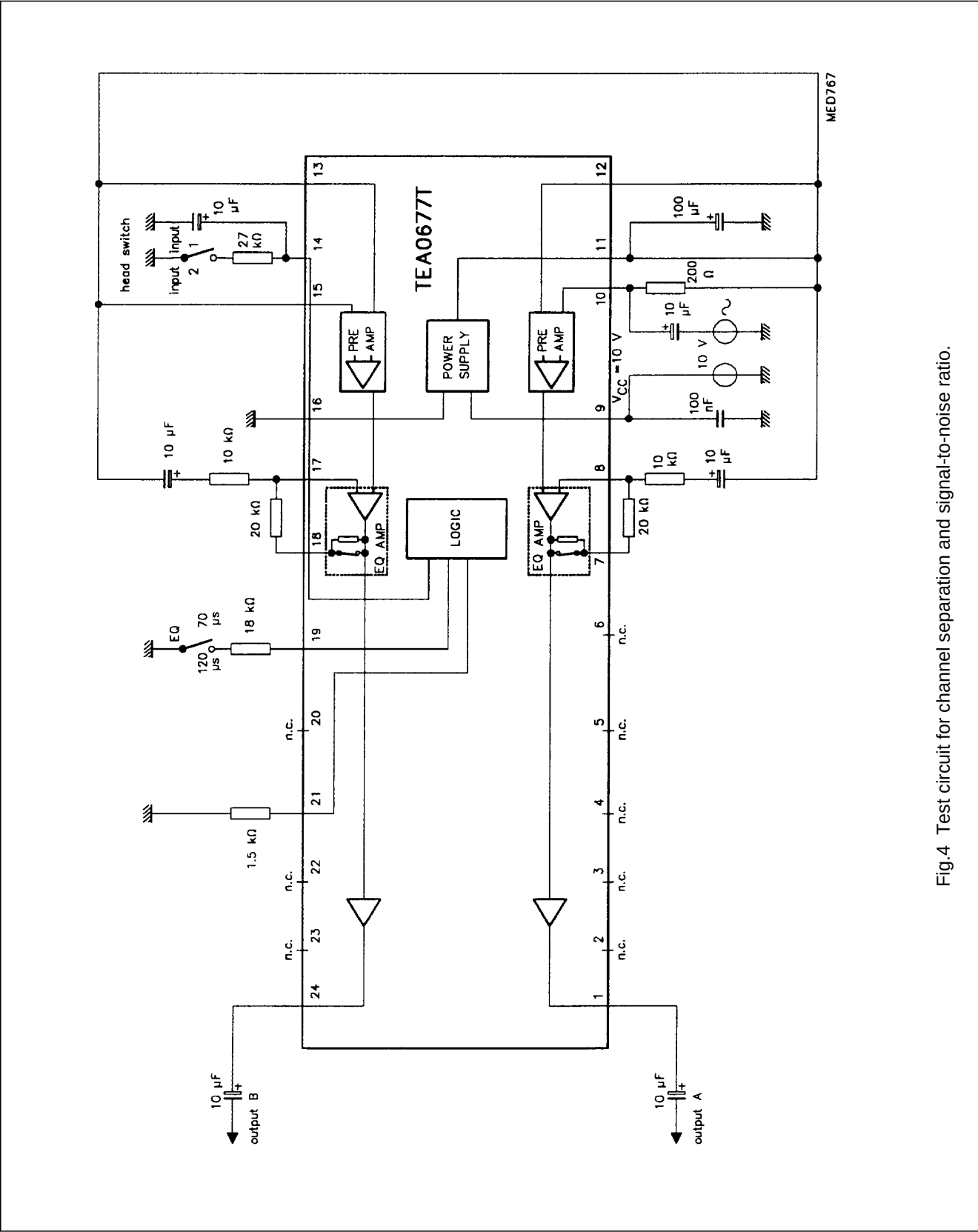


Fig.4 Test circuit for channel separation and signal-to-noise ratio.

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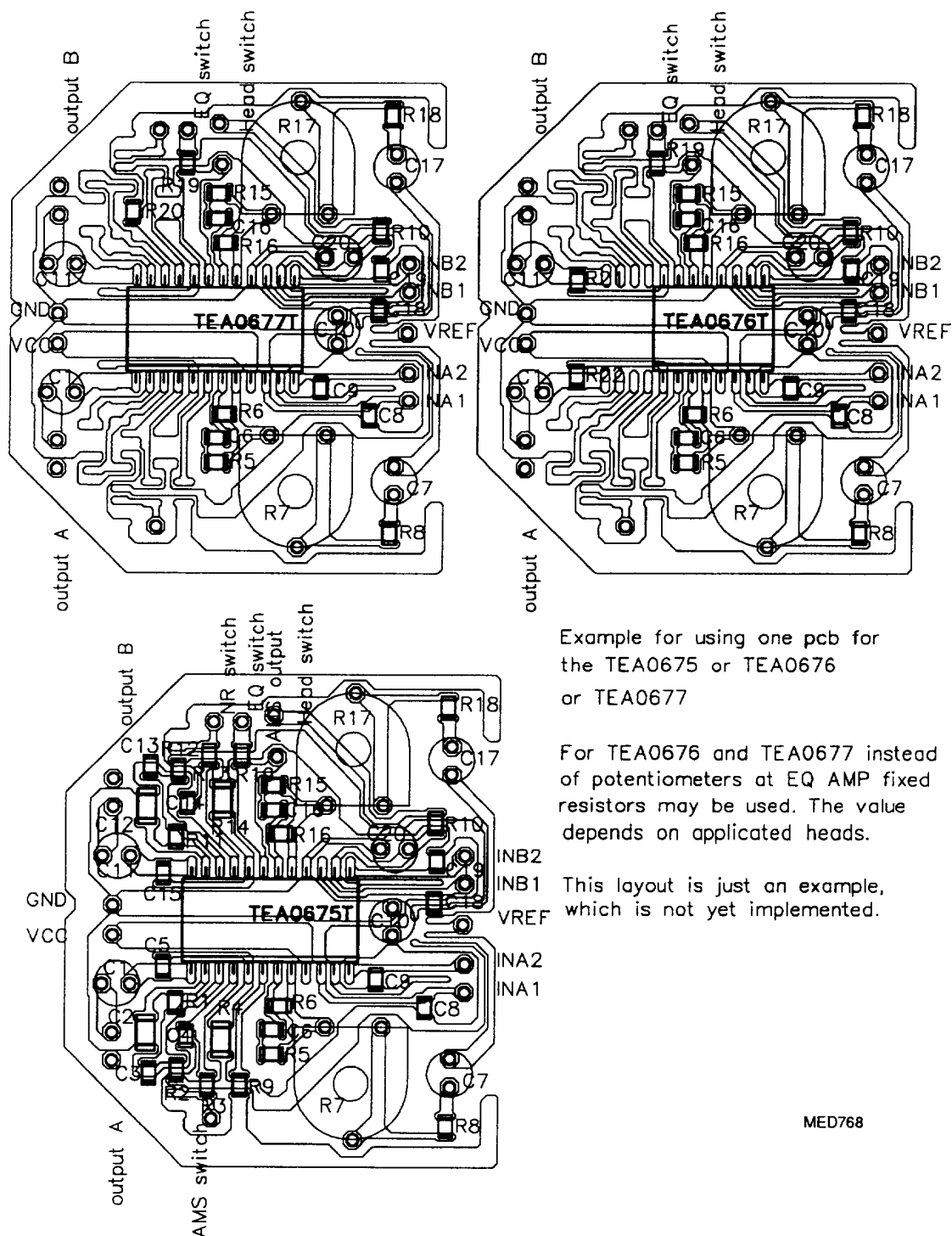


Fig.5 PCB layout example.

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**Table 1** Component list pcb layout example.

| COMPONENT             | VALUE                            |
|-----------------------|----------------------------------|
| R1, R11               | 270 k $\Omega$                   |
| R2, R12               | 180 k $\Omega$                   |
| R3, R13, R20          | 1.5 k $\Omega$                   |
| R4, R14               | 24 k $\Omega$                    |
| R5, R15               | 8.2 k $\Omega$                   |
| R6, R16               | 330 k $\Omega$                   |
| R7, R17               | 1 k $\Omega$                     |
| R8, R18               | 0.18 k $\Omega$                  |
| R9                    | 68 k $\Omega$ to 1000 k $\Omega$ |
| R10                   | 27 k $\Omega$                    |
| R19                   | 18 k $\Omega$                    |
| R21, R22              | 0 k $\Omega$                     |
| C1, C11, C7, C17, C20 | 10 $\mu$ F                       |
| C2, C12               | 330 nF                           |
| C3, C13               | 100 nF                           |
| C4, C14               | 15 nF                            |
| C5, C15               | 4.7 nF                           |
| C6, C16               | 10 nF                            |
| C8, C9, C18, C19      | 0.47 nF                          |
| C10                   | 100 $\mu$ F                      |

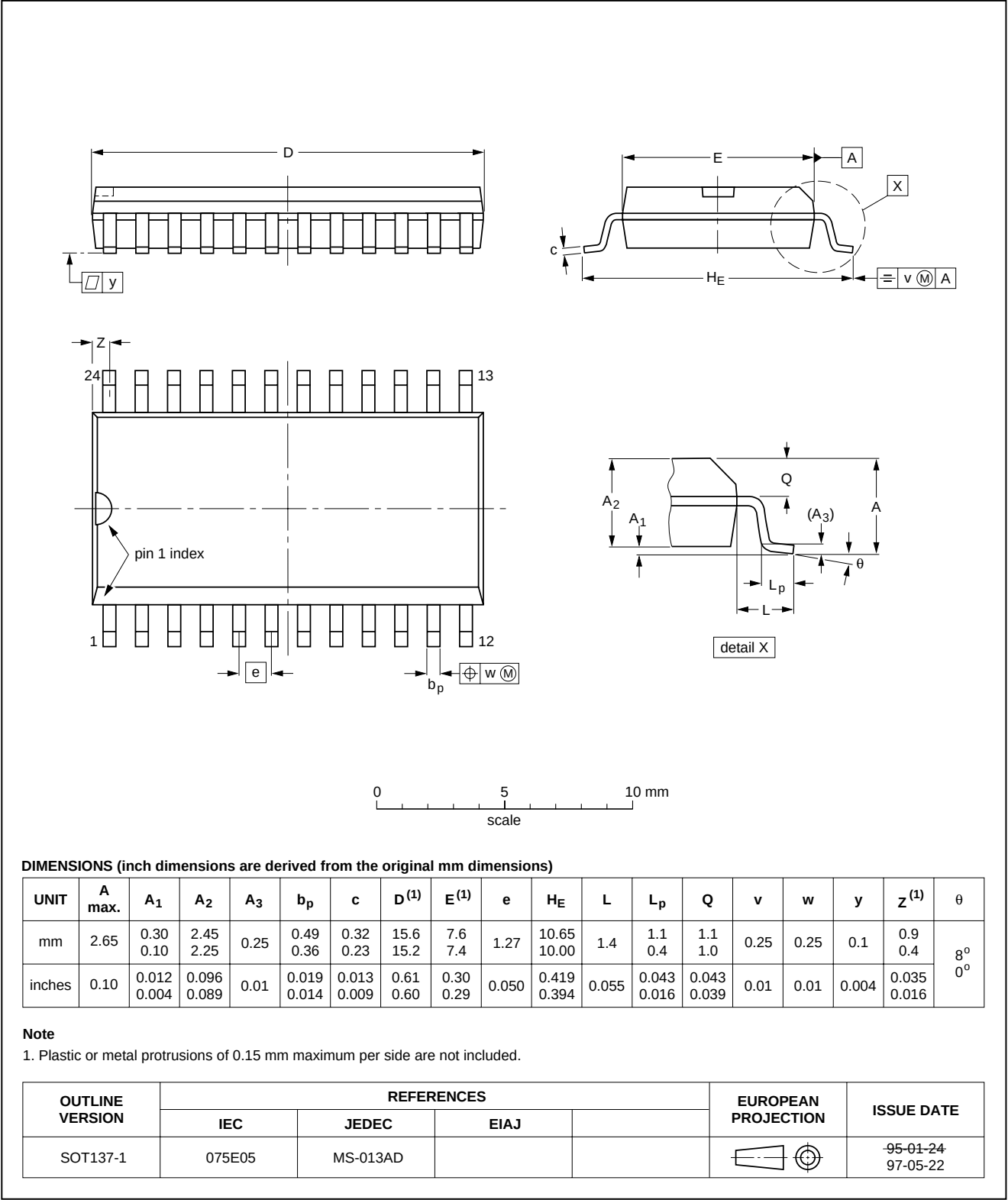
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PACKAGE OUTLINE

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

SOT137-1



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### 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.

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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.                                                                                                                                                                                                                                                                                                                                                       |                                                                                       |

### LIFE SUPPORT APPLICATIONS

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