

PREAMPLIFIER FOR INFRARED  
REMOTE CONTROL TRANSMISSION

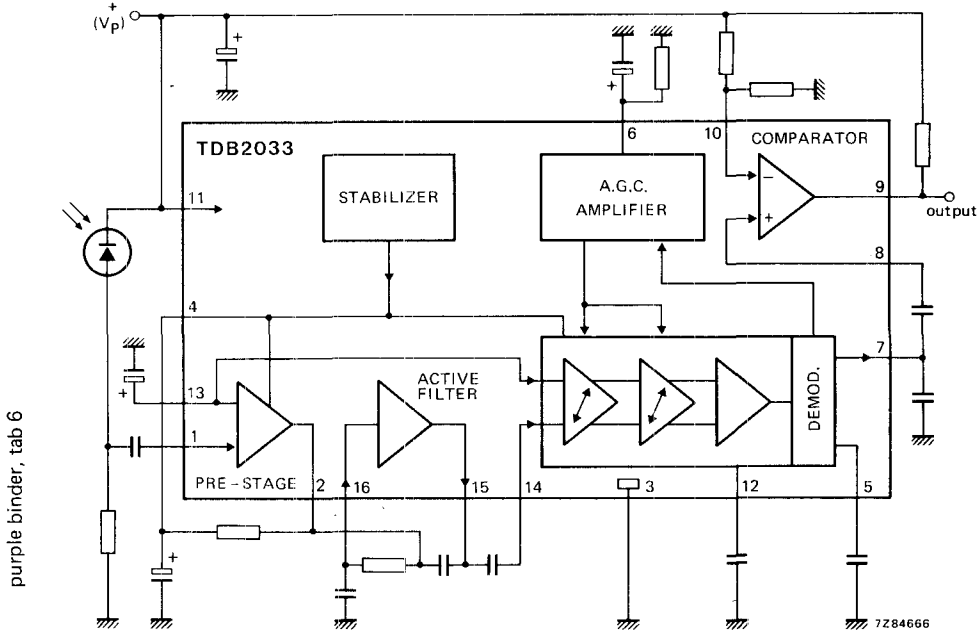


Fig. 1 Block diagram.

Features

- Three differential amplifier stages; two of which are gain controlled.
- The a.g.c. time-constant can be determined externally.
- Comparator for improving the noise performance, with adjustable threshold.
- Low current consumption.
- Active filter that obviates the use of a coil.
- Open collector output, TTL compatible.

QUICK REFERENCE DATA

Supply voltage	$V_{CC}$	typ.	12 V
Supply current	$I_{CC}$	typ.	17 mA
Voltage gain without comparator	$G_V$	typ.	100 dB
Operating ambient temperature range	$T_{amb}$		0 to +70 °C

PACKAGE OUTLINE

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



**GENERAL AND FUNCTIONAL DESCRIPTION**

The TDB2033 comprises a preamplifier (impedance converter) and the operational amplifier for an active filter, of which the filter characteristic is determined by external components. This is followed by a 3-stage amplifier, of which the first and second stages are gain controlled. The control time-constant is determined by an external electrolytic capacitor. The time-constant of the demodulator is determined in the same way, by an external smoothing capacitor.

The demodulator output is externally connected to the input of a symmetrical comparator, with a threshold voltage matched to the available noise level by an external potential divider at pin 10.

The comparator output is an open-collector (n-p-n) which is made TTL compatible by connecting a collector load resistor to 5 V.

The output signal can easily be inverted by interchanging the comparator inputs at pins 8 and 10. These features allow a competitively priced preamplifier for infrared remote control to be constructed with the TDB2033. The outstanding feature is the active filter that obviates the use of a coil.

**Caution**

Due to the high gain of the TDB2033, special attention has to be given to grounding and shielding, when mounting the device.

**RATINGS**

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

		min.	max.	
Supply voltage	$V_P = V_{11-3}$	0	+ 15	V
Voltages on:				
pin 1	$V_{1-3}$	0	$V_{2-3}$	V
pins 2, 13 and 14	$V_{2,13,14}$	0	$V_{4-3}$	V
pins 5, 6, 7, 12 and 16	$V_n$	0	$V_P$	V
pins 8 and 10	$V_{8,10}$	$V_P/4$	$V_P$	V
pin 9	$V_9$	0	+ 15	V
pin 16 with respect to pin 15	$V_{16-15}$	0	+ 6,5	V
Currents at:				
pin 4	$ I_4 $	max.	15	mA
pins 8, 10 and 15	$ I_{8,10,15} $	max.	5	mA
pins 6 and 9	$ I_{6,9} $	max.	20	mA
Total power dissipation per package	$P_{tot}$	max.	330	mW
Operating ambient temperature range	$T_{amb}$		0 to + 70	°C
Storage temperature range	$T_{stg}$		-20 to + 125	°C



## CHARACTERISTICS

$V_P = 12 \text{ V}$ ;  $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ ; measured in Fig. 2; unless otherwise specified

DEVELOPMENT SAMPLE DATA

		min.	typ.	max.	
Supply voltage	$V_P = V_{11-3}$	10	12	15	V
Supply current	$I_P = I_{11}$	—	17	—	mA
<b>Total circuit</b>					
Voltage gain ( $V_{5-3}/V_{1-3}$ )	$G_V$	—	100	—	dB
Required input voltage for obtaining comparator switching (peak-to-peak value) $V_{10-3} = 6,6 \text{ V}$	$V_{1-3} \text{ (p-p)}$	—	150	—	$\mu\text{V}$
Bandwidth without filter	B	—	2	—	MHz
<b>Preamplifier</b>					
Input resistance	$R_{1-3}$	—	25	—	k $\Omega$
Output current	$I_2$	—	200	—	$\mu\text{A}$
Voltage gain	$G_V$	—	18	—	dB
<b>Active filter</b>					
Voltage gain ( $V_{15-3}/V_{16-3}$ )	$G_V$	—	0,98	1	
<b>A.G.C. amplifier and demodulator</b>					
Input resistance	$R_{14-3}$	—	8,5	—	k $\Omega$
Output resistance					
pin 7	$R_{7-3}$	—	22	—	k $\Omega$
pin 5	$R_{5-3}$	—	5	—	k $\Omega$
Voltage gain at $V_{6-3} = 0 \text{ V}$	$G_V$	—	84	—	dB
Noise voltage at the demodulator (r.m.s. value)	$V_{5-3} \text{ (rms)}$	—	0,5	—	V
Control range of voltage gain	$\Delta G_V$	—	60	—	dB
<b>Comparator (open-collector output)</b>					
Input resistance	$R_{8-3} = R_{10-3}$	—	500	—	k $\Omega$
Input current	$I_8 = I_{10}$	—	3,5	5	$\mu\text{A}$
Output voltage LOW at $I_{9L} = 5 \text{ mA}$	$V_{9L}$	—	0,22	0,4	V
Output leakage current HIGH at $V_{9H} = 15 \text{ V}$	$ I_{9H} $	—	—	1	$\mu\text{A}$



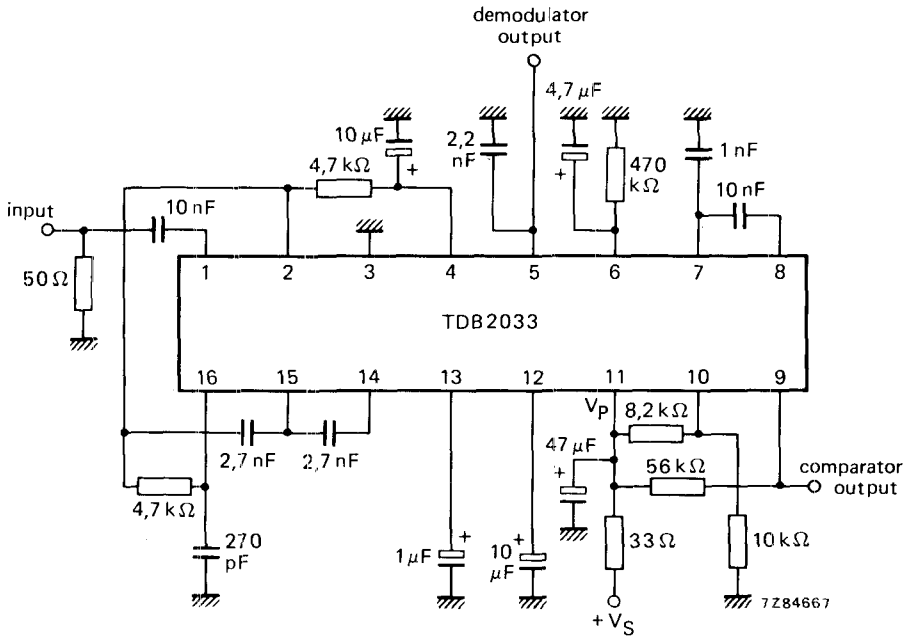


Fig. 2 Test circuit.

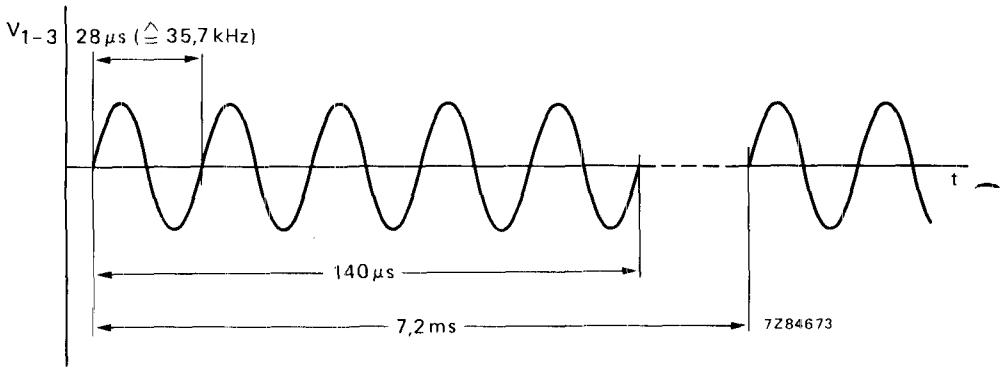


Fig. 3 Sine-wave test signal at input pin 1 for modulating input pulses.



DEVELOPMENT SAMPLE DATA

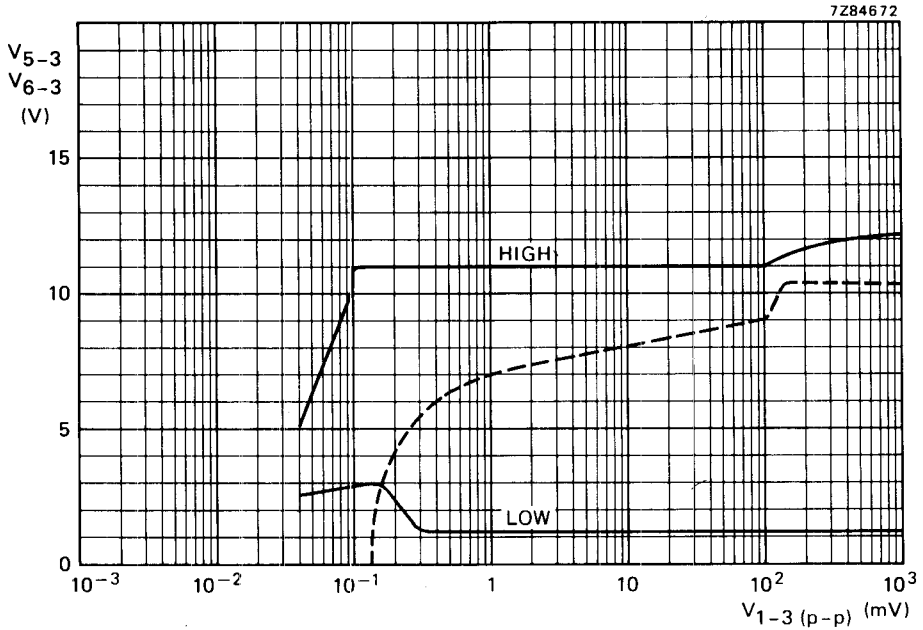


Fig. 4 Voltage  $V_{5-3}$  at the demodulator output (pin 5) and the control voltage  $V_{6-3}$  (pin 6) as a function of the peak-to-peak input voltage  $V_{1-3}$  (p-p) (pin 1).

—  $V_{5-3}$ ; ---  $V_{6-3}$ .



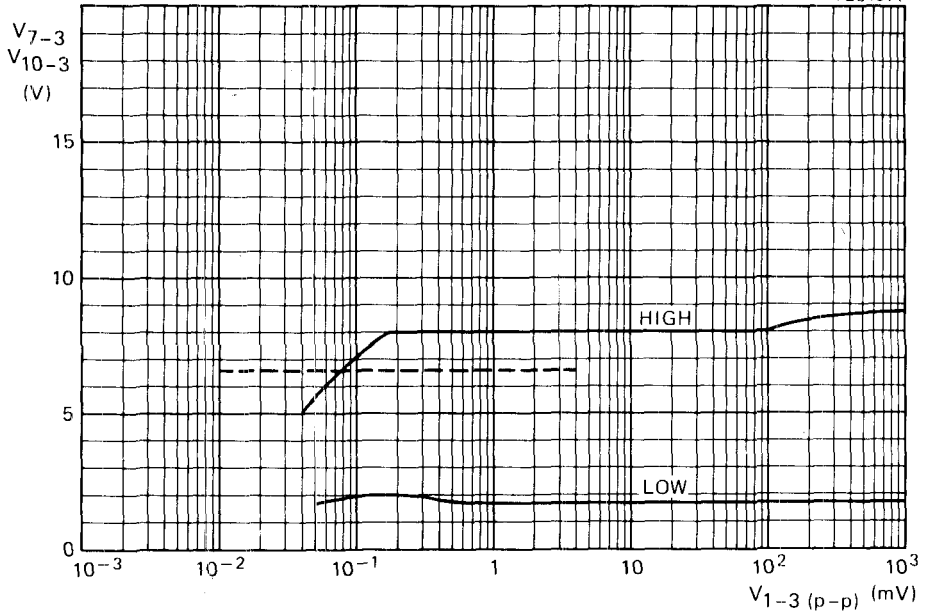


Fig. 5 Voltage V<sub>7-3</sub> at the demodulator output (pin 7) and the comparator threshold voltage V<sub>10-3</sub> (pin 10) as a function of the peak-to-peak input voltage V<sub>1-3</sub> (p-p) (pin 1).

— V<sub>7-3</sub>; - - - V<sub>10-3</sub> (externally adjustable)



DEVELOPMENT SAMPLE DATA

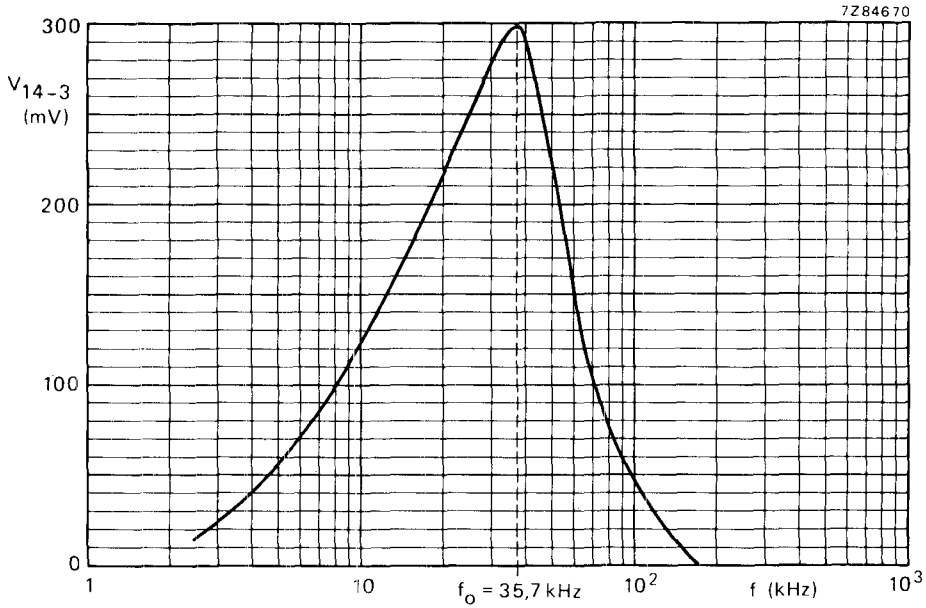


Fig. 6 Frequency response of the active filter using the peripheral circuitry shown in Fig. 2.

APPLICATION INFORMATION

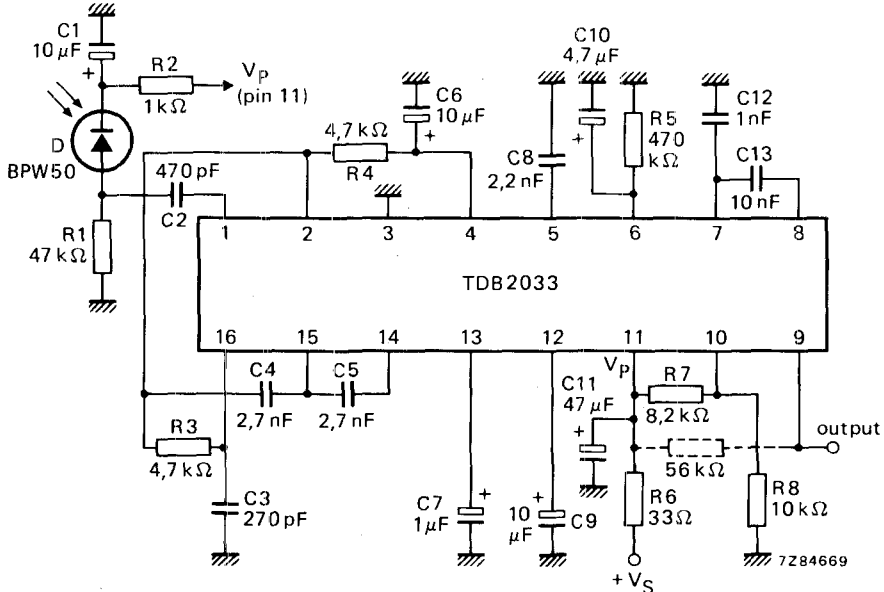


Fig. 7 The TDB2033 used as preamplifier for infrared remote control signals from the SAB3021 transmitter.



APPLICATION INFORMATION (continued)

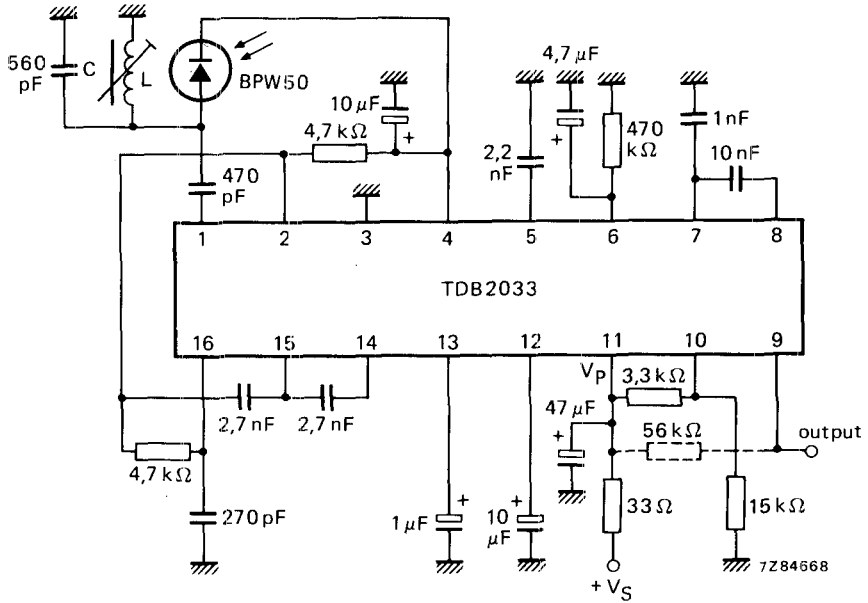


Fig. 8 Similar circuit to that given in Fig. 7, but with LC-input circuit to permit increased operating range and greater immunity to ambient light.



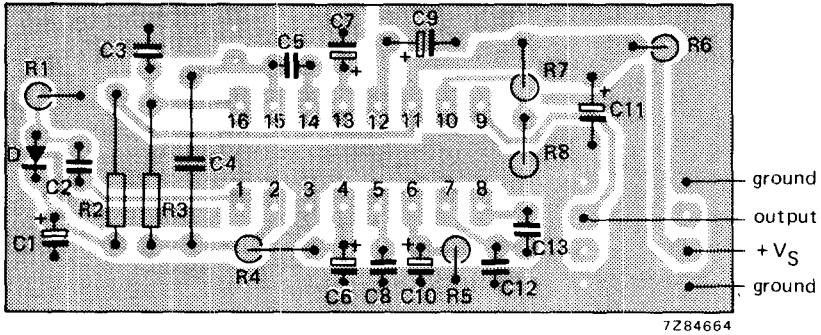


Fig. 9 Component side of printed-circuit board showing component layout used for the circuit of Fig. 7.

DEVELOPMENT SAMPLE DATA

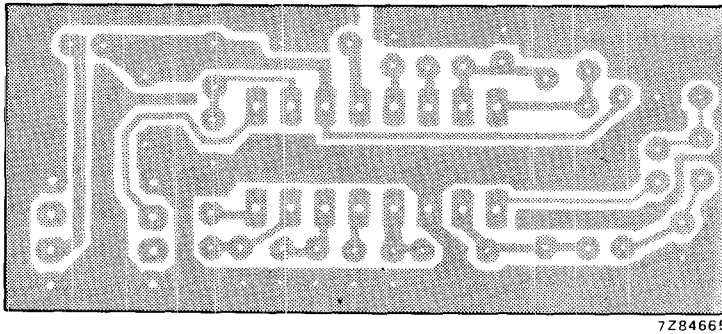
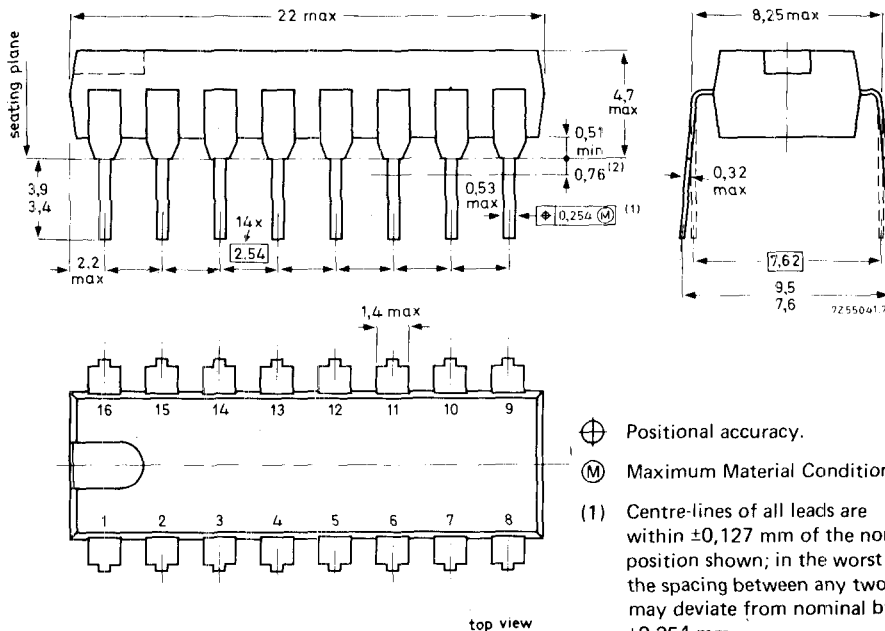


Fig. 10 Track side of printed-circuit board used for the circuit of Fig. 7; p.c. board dimensions 53 mm x 23 mm.



16-LEAD DUAL IN-LINE; PLASTIC (SOT-38)



Dimensions in mm

- ⊕ Positional accuracy.
- Ⓜ Maximum Material Condition.
- (1) Centre-lines of all leads are within  $\pm 0,127$  mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by  $\pm 0,254$  mm.
- (2) Lead spacing tolerances apply from seating plane to the line indicated.

SOLDERING

1. By hand

Apply the soldering iron below the seating plane (or not more than 2 mm above it). If its temperature is below 300 °C it must not be in contact for more than 10 seconds; if between 300 °C and 400 °C, for not more than 5 seconds.

2. By dip or wave

The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.  
 The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

3. Repairing soldered joints

The same precautions and limits apply as in (1) above.

