Dual common-mode rejection differential line receiver

TDA8578

FEATURES

- Excellent common-mode rejection up to high frequencies
- Elimination of source resistance in the common-mode rejection
- Few external components
- High supply voltage ripple rejection
- Low noise
- Low distortion
- Protected against electrostatic discharge
- AC and DC short circuit safe to ground and V_{CC}
- Fast DC settling.

APPLICATIONS

- Audio
- Car radio.

GENERAL DESCRIPTION

The TDA8578 is a two-channel differential amplifier in a 16 pin DIL or SO package intended to receive line inputs in audio applications requiring a high-level of common-mode rejection. The amplifier has a gain of 0 dB and a low distortion. The device is primarily developed for those car radio applications where long connections between signal sources and amplifiers (or boosters) are necessary and ground noise has to be eliminated.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage		5	8.5	18	V
I_{CC}	supply current	V_{CC} = 8.5 V	–	11	14	mA
G_v	voltage gain		–0.5	0	+0.5	dB
SVRR	supply voltage ripple rejection		–55	–60	–	dB
V_{no}	noise output voltage		–	3.7	5	μV
$\|Z_i\|$	input impedance		100	240	–	kΩ
CMRR	common-mode rejection ratio	R_s = 0 Ω	–	80	–	dB

ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
TDA8578	16	DIL16	plastic	SOT38
TDA8578T	16	SO16	plastic	SOT109A

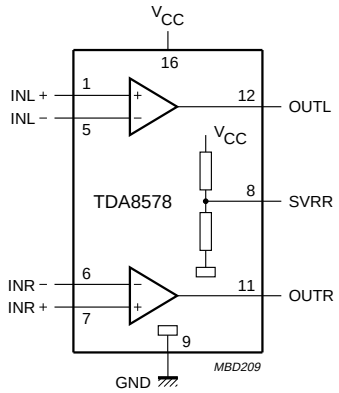


Fig.1 Block diagram.

FUNCTIONAL DESCRIPTION

The TDA8578 contains two identical differential amplifiers with a voltage gain of 0 dB. The device is intended to receive line input signals. The device has a very high-level of common-mode rejection and it eliminates ground noise. The common-mode rejection keeps constant up to high frequencies. The gain of the amplifiers is fixed at 0 dB. The inputs have a high-input impedance and the output stage is a class AB stage with a low-output impedance. For a large common-mode rejection also at low frequencies, an electrolytic input capacitor at the negative input pin is advised. The input impedance is relative high, this would result in a large settling time of the DC input voltage. Therefore a quick charge circuit is included that charges the input capacitor within 0.2 s.

All input and output pins are protected against high electrostatic discharge conditions (4000 V, 150 pF, 150 Ω).

PINNING

SYMBOL	PIN	DESCRIPTION
INL+	1	positive input left
n.c.	2	not connected
n.c.	3	not connected
n.c.	4	not connected
INL–	5	negative input left
INR–	6	negative input right
INR+	7	positive input right
SVRR	8	half supply voltage
GND	9	ground
n.c.	10	not connected
OUTR	11	output right
OUTL	12	output left
n.c.	13	not connected
n.c.	14	not connected
n.c.	15	not connected
V_{CC}	16	supply voltage

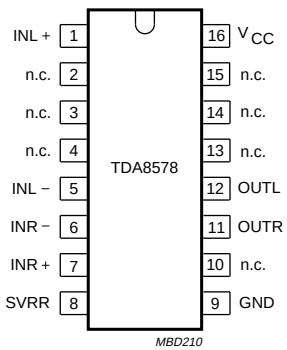


Fig.2 Pin configuration.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CC}	supply voltage	operating	–	18	V
I_{ORM}	repetitive peak output current		–	40	mA
V_{sc}	AC and DC short-circuit safe voltage		–	18	V
T_{stg}	storage temperature		–55	+150	°C
T_{amb}	operating ambient temperature		–40	+85	°C
T_j	junction temperature		–	+150	°C

HANDLING

Inputs and outputs are protected against electrostatic discharges in normal handling. However, to be totally safe, it is desirable to take normal precautions appropriate to handling integrated circuits.

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient in free air	
	TDA8578 (DIL16)	75 K/W
	TDA8578T (SO16)	120 K/W

DC CHARACTERISTICS

V_{CC} = 8.5 V; T_{amb} = 25 °C; in accordance with test circuit (see Fig.3); unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage		5	8.5	18	V
I_{CC}	supply current		–	11	14	mA
V_O	DC output voltage	note (1)	–	4.3	–	V
t_{set}	DC input voltage settling time		–	0.2	–	s

Note to the DC characteristics

1. The DC output voltage with respect to ground is approximately $0.5V_{CC}$.

AC CHARACTERISTICS

V_{CC} = 8.5 V; f = 1 kHz; T_{amb} = 25 °C; in accordance with test circuit (see Fig.3); unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_v	voltage gain		–0.5	0	+0.5	dB
α_{cs}	channel separation	R_s = 5 kΩ	70	80	–	dB
$\|\Delta G_v\|$	channel unbalance		–	–	0.5	dB
f_L	low frequency roll-off	–1 dB; note (1)	20	–	–	Hz
f_H	high frequency roll-off	–1 dB	20	–	–	kHz
$\|Z_i\|$	input impedance		100	240	–	kΩ
$\|Z_o\|$	output impedance		–	–	10	Ω
$V_{i(max)}$	maximum input voltage	THD = 1%	–	2	–	V
V_{no}	noise output voltage	R_s = 0 Ω; note (2)	–	3.7	5	μV
$V_{CM(rms)}$	common-mode input voltage (RMS value)		–	–	1	V
CMRR	common-mode rejection ratio	R_s = 5 kΩ	66	70	–	dB
		R_s = 0 Ω; note (3)	–	80	–	dB
SVRR	supply voltage ripple rejection	note (4)	55	65	–	dB
		note (5)	–	60	–	dB
THD	total harmonic distortion	V_i = 1 V	–	0.02	–	%
		V_i = 1 V; f = 20 Hz to 20 kHz	–	–	0.1	%
THD_{max}	total harmonic distortion at maximum output current	V_i = 1 V; R_L = 150 Ω	–	–	1	%

Notes to the AC characteristics

1. Frequency response externally fixed by the input coupling capacitors.
2. Noise output voltage is measured in a bandwidth of 20 Hz to 20 kHz (unweighted).
3. The common-mode rejection ratio is measured at the output, with a voltage source of 1 V (RMS), in accordance with test circuit (see Fig.3), while V_{INL} and V_{INR} are short-circuited. Frequencies between 100 Hz and 100 kHz.
4. Ripple rejection is measured at the output, with R_s = 2 kΩ; f = 1 kHz and a ripple amplitude of 2 V (p-p).
5. Ripple rejection is measured at the output, with R_s = 0 Ω up to 2 kΩ and f = 100 Hz to 20 kHz; maximum ripple amplitude of 2V (p-p).

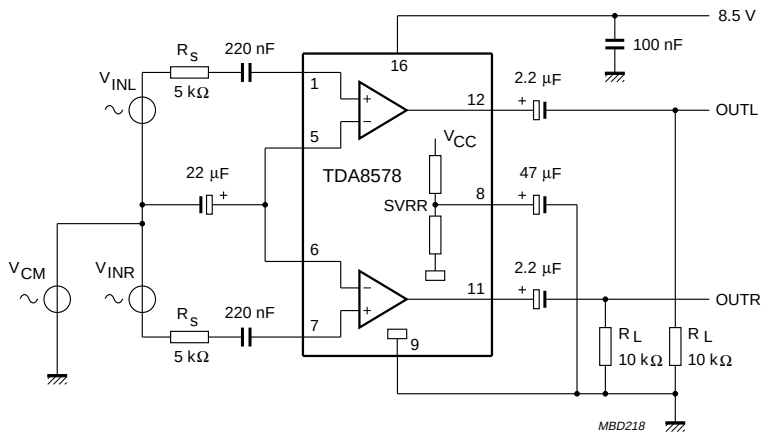


Fig.3 Test circuit.

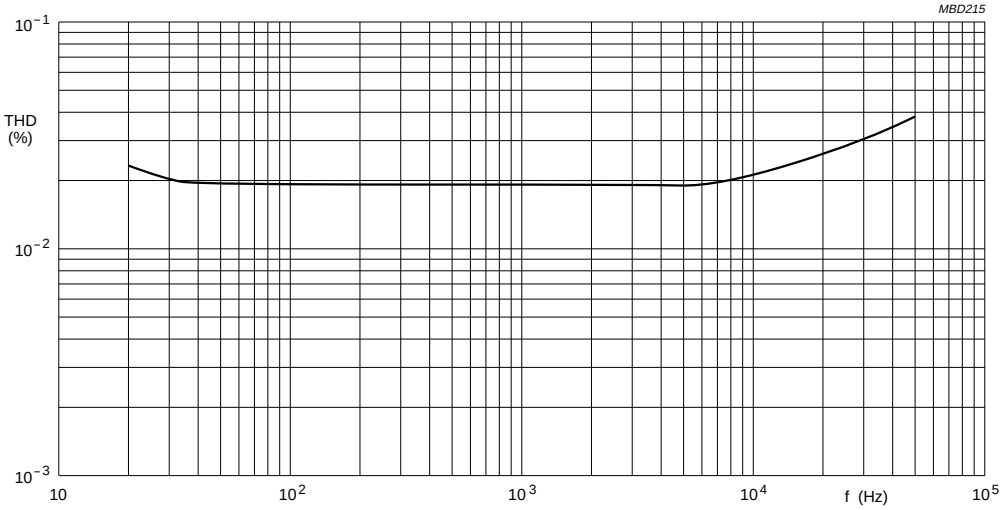
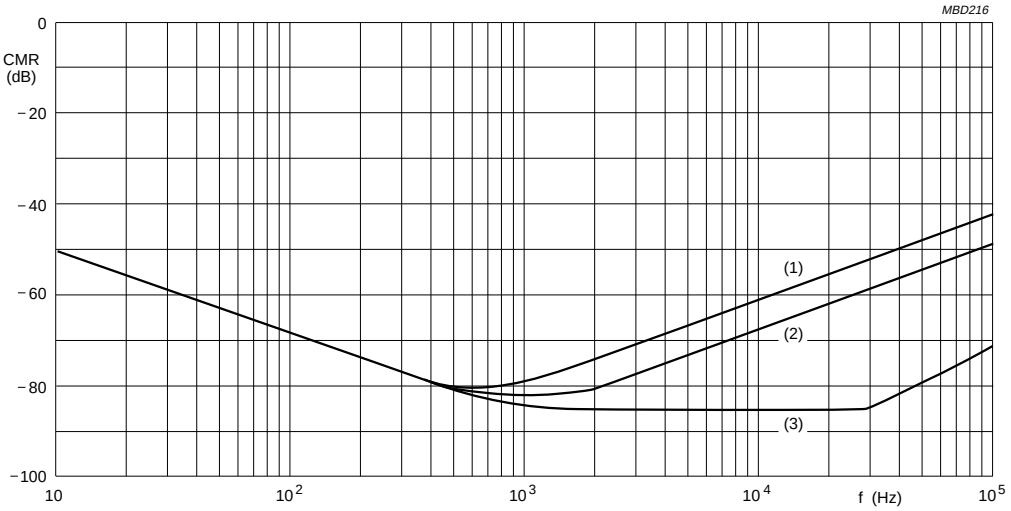


Fig.4 Total harmonic distortion as a function of frequency; V_i = 1.0 V (RMS).



(1) R_s = 5 kΩ.
(2) R_s = 2 kΩ.
(3) R_s = 0 Ω.

Fig.5 Common-mode rejection as function of frequency; V_{CM} = 1.0 V (RMS).

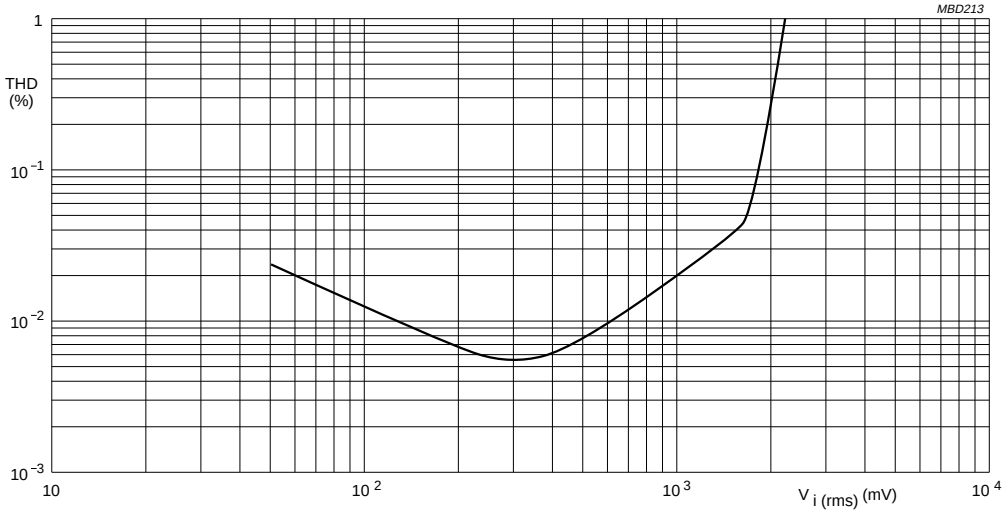


Fig.6 Total harmonic distortion as a function of input voltage; f = 1 kHz.

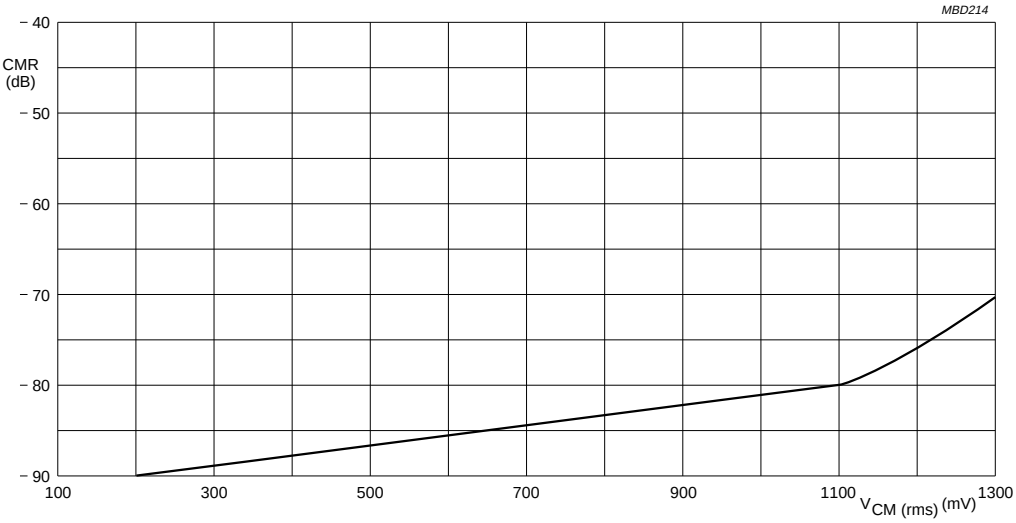
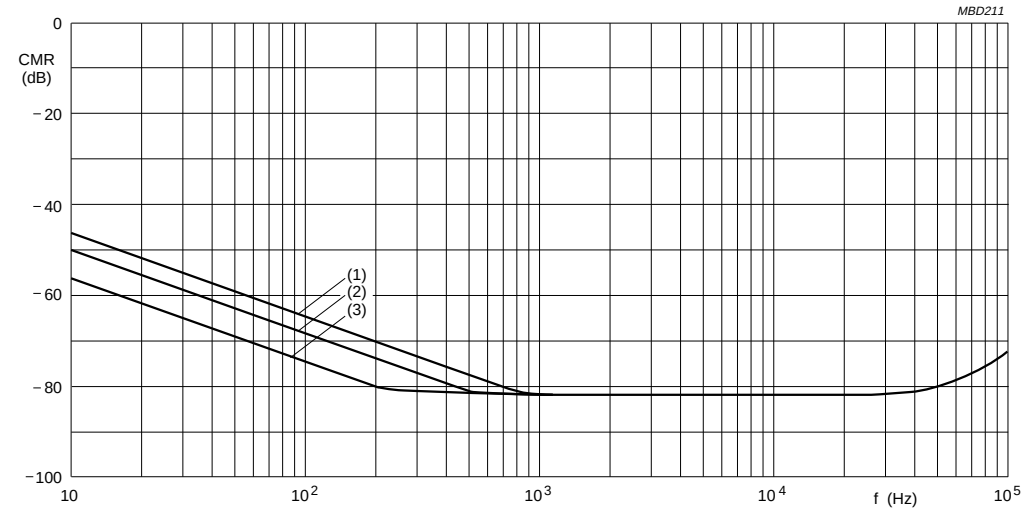
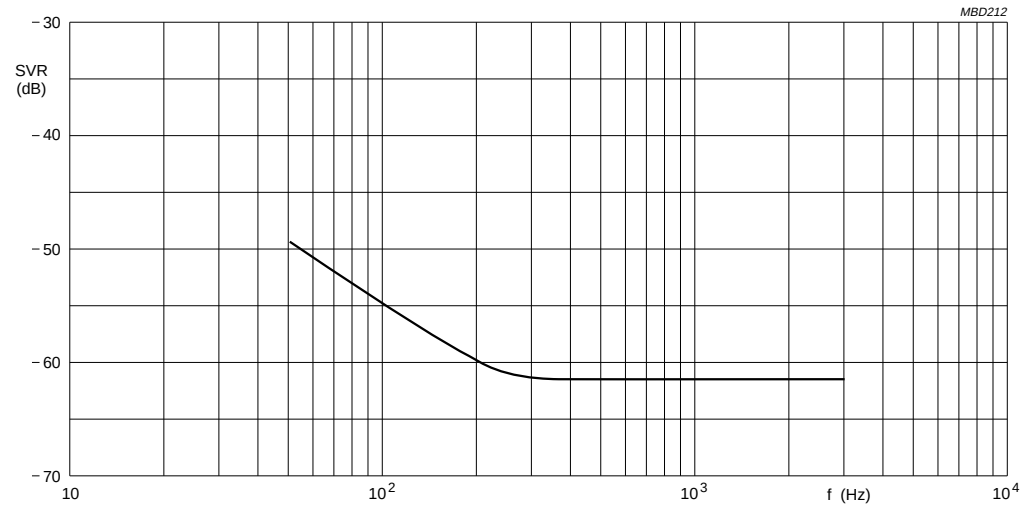


Fig.7 Common-mode rejection as a function of common-mode input voltage; f = 1 kHz; R_s = 0 Ω.



(1) C2 = 22 μF.
(2) C2 = 47 μF.
(3) C2 = 100 μF.

Fig.8 Common-mode rejection as a function of frequency; V_{CM} = 1.0V.



V_{ripple} = 2 V (p-p); R_s = 2 kΩ.

Fig.9 Supply voltage ripple rejection as a function of frequency.

APPLICATION INFORMATION

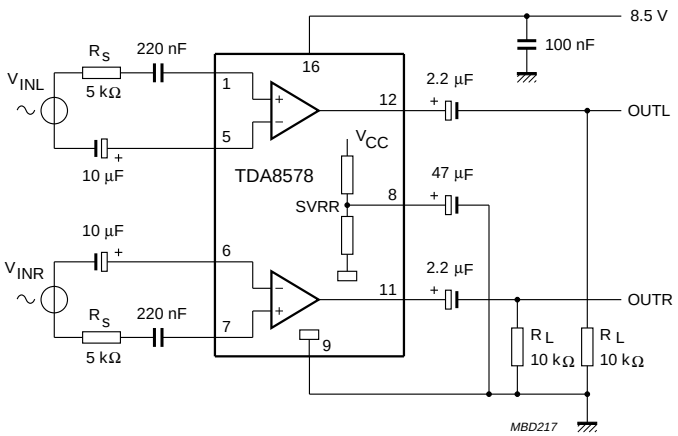
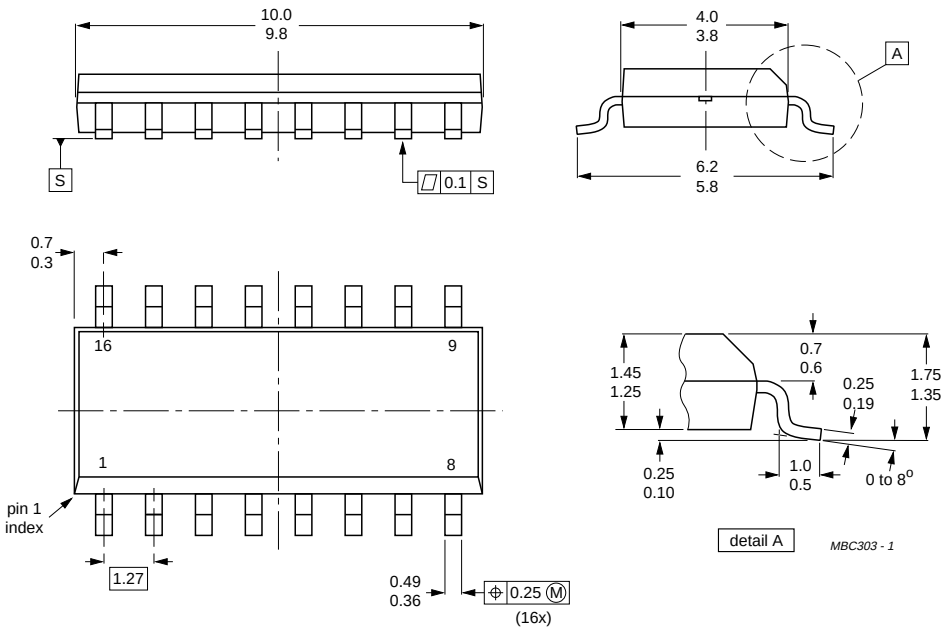


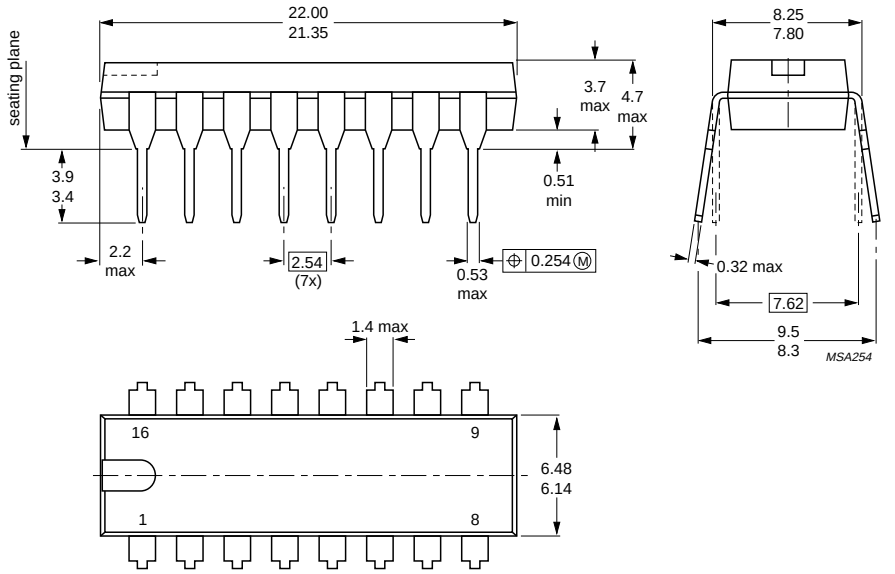
Fig.10 Application circuit balanced signal source.

PACKAGE OUTLINES



Dimensions in mm.

Fig.11 16-lead mini-pack; plastic (SOT109A).



Dimensions in mm.

Fig.12 16-lead DIL; plastic (SOT38).

SOLDERING

Plastic small-outline packages

BY WAVE

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

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

A modified wave soldering technique is recommended using two waves (dual-wave), in which, in a turbulent wave with high upward pressure is followed by a smooth laminar wave. Using a mildly-activated flux eliminates the need for removal of corrosive residues in most applications.

BY SOLDER PASTE REFLOW

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

Several techniques exist for reflowing; for example, thermal conduction by heated belt, infrared, and vapour-phase reflow. Dwell times vary between 50 and 300 s according to 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 min at 45 °C.

REPAIRING SOLDERED JOINTS (BY HAND-HELD SOLDERING IRON OR PULSE-HEATED SOLDER TOOL)

Fix the component by first soldering two, diagonally opposite, end pins. Apply the heating tool to the flat part of the pin only. Contact time must be limited to 10 s at up to 300 °C. When using proper tools, all other pins can be soldered in one operation within 2 to 5 s at between 270 and 320 °C. (Pulse-heated soldering is not recommended for SO packages.)

For pulse-heated solder tool (resistance) soldering of VSO packages, solder is applied to the substrate by dipping or by an extra thick tin/lead plating before package placement.

Plastic dual in-line packages

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 s. The total contact time of successive solder waves must not exceed 5 s.

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.

REPAIRING SOLDERED JOINTS

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 s; if between 300 and 400 °C, for more than 5 s.

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 rating 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

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.