

DATA SHEET

TDA1519C

**22 W BTL or 2 × 11 W
stereo power amplifier**

Product specification
Supersedes data of 2001 Aug 24

2004 Jan 28



22 W BTL or 2 × 11 W stereo power amplifier

TDA1519C

FEATURES

- Requires very few external components for Bridge-Tied Load (BTL) operation
- Stereo or BTL application
- High output power
- Low offset voltage at output (important for BTL applications)
- Fixed gain
- Good ripple rejection
- Mute/standby switch
- Load dump protection
- AC and DC short-circuit safe to ground and V_P
- Thermally protected
- Reverse polarity safe
- Capability to handle high energy on outputs ($V_P = 0\text{ V}$)
- No switch-on/switch-off plops
- Protected against electrostatic discharge
- Low thermal resistance
- Identical inputs (inverting and non-inverting)
- Pin compatible with TDA1519B (TDA1519C and TDA1519CSP).

GENERAL DESCRIPTION

The TDA1519C is an integrated class-B dual output amplifier in a 9-lead plastic single in-line power package or 20-lead heatsink small outline package.

For the TDA1519CTH (SOT418-3), the heatsink is positioned on top of the package, which allows an external heatsink to be mounted on top. The heatsink of the TDA1519CTD (SOT397-1) is facing the PCB, allowing the heatsink to be soldered onto the copper area of the PCB.

ORDERING INFORMATION

| TYPE NUMBER | PACKAGE | | |
|-------------|---------|---|----------|
| | NAME | DESCRIPTION | VERSION |
| TDA1519C | SIL9P | plastic single in-line power package; 9 leads | SOT131-2 |
| TDA1519CSP | SMS9P | plastic surface mounted single in-line power package; 9 leads | SOT354-1 |
| TDA1519CTD | HSOP20 | plastic, heatsink small outline package; 20 leads | SOT397-1 |
| TDA1519CTH | HSOP20 | plastic, heatsink small outline package; 20 leads; low stand-off height | SOT418-3 |

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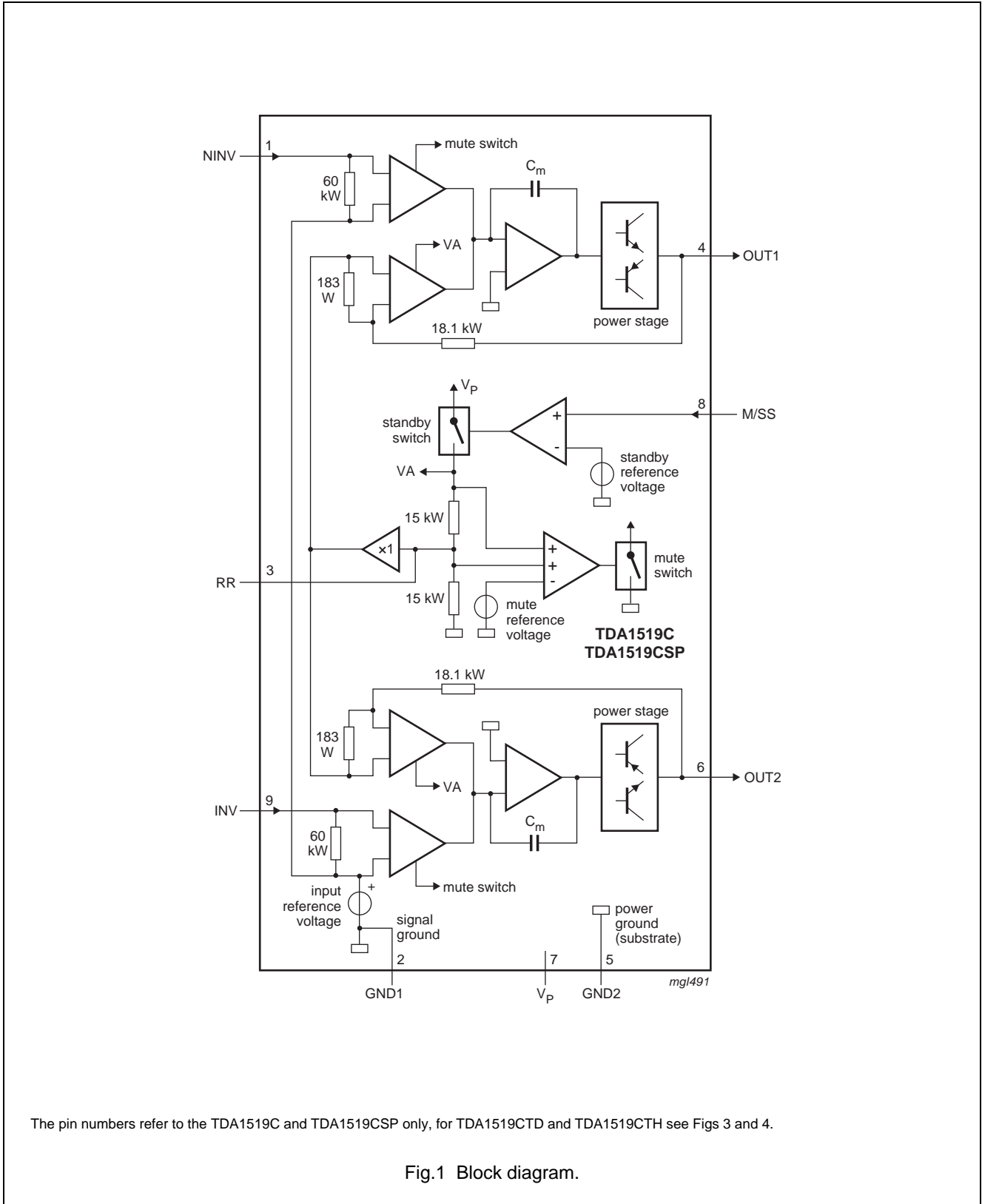
QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---------------------------|----------------------------------|--------------------------------------|------|------|------|--------------|
| Supply | | | | | | |
| V_P | supply voltage | operating | 6.0 | 14.4 | 17.5 | V |
| | | non-operating | – | – | 30 | V |
| | | load dump protected | – | – | 45 | V |
| I_{ORM} | repetitive peak output current | | – | – | 4 | A |
| $I_{q(tot)}$ | total quiescent current | | – | 40 | 80 | mA |
| I_{stb} | standby current | | – | 0.1 | 100 | μ A |
| $I_{sw(on)}$ | switch-on current | | – | – | 40 | μ A |
| Inputs | | | | | | |
| $ Z_i $ | input impedance | BTL | 25 | – | – | k Ω |
| | | stereo | 50 | – | – | k Ω |
| Stereo application | | | | | | |
| P_o | output power | THD = 10 % | – | 6 | – | W |
| | | $R_L = 4 \Omega$ | – | 11 | – | W |
| | | $R_L = 2 \Omega$ | – | – | – | – |
| α_{cs} | channel separation | | 40 | – | – | dB |
| $V_{n(o)(rms)}$ | noise output voltage (RMS value) | | – | 150 | – | μ V |
| BTL application | | | | | | |
| P_o | output power | THD = 10 %; $R_L = 4 \Omega$ | – | 22 | – | W |
| SVRR | supply voltage ripple rejection | $R_S = 0 \Omega$ | – | – | – | – |
| | | $f_i = 100 \text{ Hz}$ | 34 | – | – | dB |
| | | $f_i = 1 \text{ to } 10 \text{ kHz}$ | 48 | – | – | dB |
| $ \Delta V_{OO} $ | DC output offset voltage | | – | – | 250 | mV |
| T_j | junction temperature | | – | – | 150 | $^{\circ}$ C |

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BLOCK DIAGRAM



The pin numbers refer to the TDA1519C and TDA1519CSP only, for TDA1519CTD and TDA1519CTH see Figs 3 and 4.

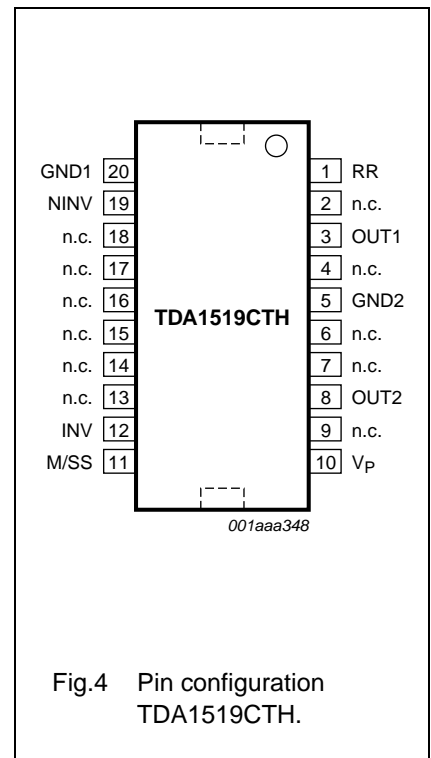
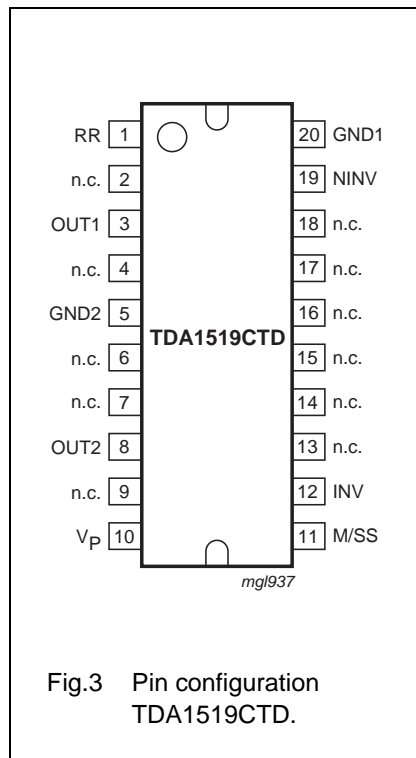
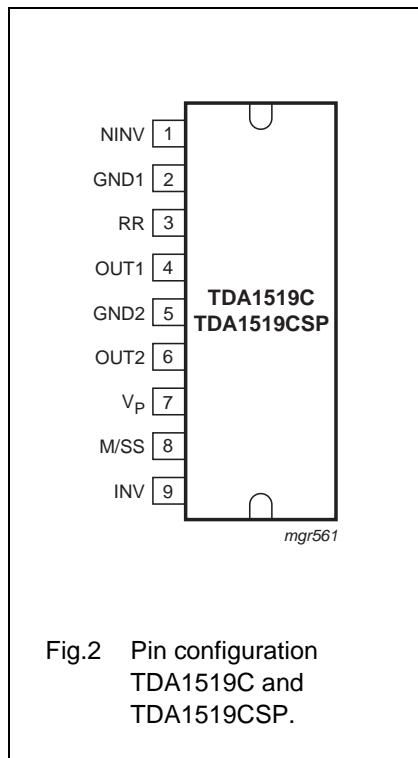
Fig.1 Block diagram.

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PINNING

| SYMBOL | PIN | | | DESCRIPTION |
|----------------|-------------------------|----------------------------|----------------------------|---------------------------------|
| | TDA1519C; TDA1519CSP | TDA1519CTD | TDA1519CTH | |
| NINV | 1 | 19 | 19 | non-inverting input |
| GND1 | 2 | 20 | 20 | ground 1 (signal) |
| RR | 3 | 1 | 1 | supply voltage ripple rejection |
| OUT1 | 4 | 3 | 3 | output 1 |
| GND2 | 5 | 5 | 5 | ground 2 (substrate) |
| OUT2 | 6 | 8 | 8 | output 2 |
| V _P | 7 | 10 | 10 | positive supply voltage |
| M/SS | 8 | 11 | 11 | mute/standby switch input |
| INV | 9 | 12 | 12 | inverting input |
| n.c. | – | 2, 4, 6, 7, 9 and 13 to 18 | 2, 4, 6, 7, 9 and 13 to 18 | not connected |



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FUNCTIONAL DESCRIPTION

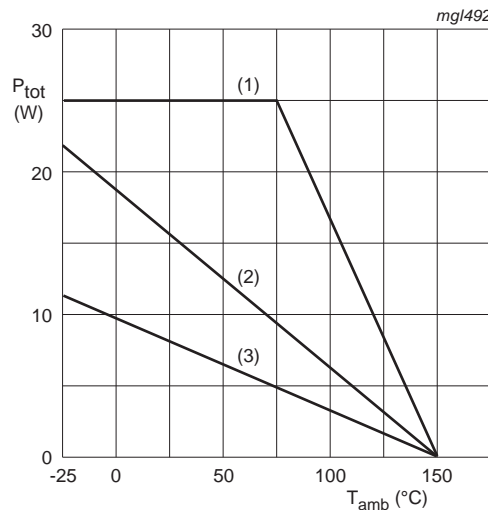
The TDA1519C contains two identical amplifiers with differential input stages. The gain of each amplifier is fixed at 40 dB. A special feature of this device is the mute/standby switch which has the following features:

- Low standby current (<100 μA)
- Low mute/standby switching current (allows for low-cost supply switch)
- Mute condition.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|------------------|---------------------------------------|--|------|------|------|
| V _P | supply voltage | operating | – | 17.5 | V |
| | | non-operating | – | 30 | V |
| | | load dump protected; during 50 ms; t _r ≥ 2.5 ms | – | 45 | V |
| V _{sc} | AC and DC short-circuit-safe voltage | | – | 17.5 | V |
| V _{rp} | reverse polarity voltage | | – | 6 | V |
| E _o | energy handling capability at outputs | V _P = 0 V | – | 200 | mJ |
| I _{OSM} | non-repetitive peak output current | | – | 6 | A |
| I _{ORM} | repetitive peak output current | | – | 4 | A |
| P _{tot} | total power dissipation | see Fig.5 | – | 25 | W |
| T _j | junction temperature | | – | 150 | °C |
| T _{stg} | storage temperature | | –55 | +150 | °C |



- (1) Infinite heatsink.
- (2) R_{th(c-a)} = 5 K/W.
- (3) R_{th(c-a)} = 13 K/W.

Fig.5 Power derating curve for TDA1519C.

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THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---------------|---|-------------|-------|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient; TDA1519C, TDA1519CTH and TDA1519CTD | in free air | 40 | K/W |
| $R_{th(j-c)}$ | thermal resistance from junction to case; TDA1519C, TDA1519CTH and TDA1519CTD | | 3 | K/W |

DC CHARACTERISTICS

$V_P = 14.4$ V; $T_{amb} = 25$ °C; measured in circuit of Fig.6; unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-------------------------------|--------------------------|--|------|------|------|------|
| Supply | | | | | | |
| V_P | supply voltage | note 1 | 6.0 | 14.4 | 17.5 | V |
| $I_{q(tot)}$ | total quiescent current | | – | 40 | 80 | mA |
| V_O | DC output voltage | note 2 | – | 6.95 | – | V |
| $ \Delta V_{OO} $ | DC output offset voltage | | – | – | 250 | mV |
| Mute/standby switch | | | | | | |
| $V_{sw(on)}$ | switch-on voltage level | | 8.5 | – | – | V |
| V_{mute} | mute voltage level | | 3.3 | – | 6.4 | V |
| V_{stb} | standby voltage level | | 0 | – | 2 | V |
| Mute/standby condition | | | | | | |
| V_o | output voltage | mute mode; $V_i = 1$ V (maximum); $f_i = 20$ Hz to 15 kHz | – | – | 20 | mV |
| $ \Delta V_{OO} $ | DC output offset voltage | mute mode | – | – | 250 | mV |
| I_{stb} | standby current | standby mode | – | – | 100 | μA |
| $I_{sw(on)}$ | switch-on current | | – | 12 | 40 | μA |

Notes

- The circuit is DC adjusted at $V_P = 6$ to 17.5 V and AC operating at $V_P = 8.5$ to 17.5 V.
- At $V_P = 17.5$ to 30 V, the DC output voltage is $\leq 0.5V_P$.

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AC CHARACTERISTICS

$V_P = 14.4\text{ V}$; $R_L = 4\ \Omega$; $f = 1\text{ kHz}$; $T_{amb} = 25\text{ }^\circ\text{C}$; unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---------------------------------------|----------------------------------|---|------|-------------|------|---------------|
| Stereo application (see Fig.6) | | | | | | |
| P_o | output power | note 1 | | | | |
| | | THD = 0.5 % | 4 | 5 | – | W |
| | | THD = 10 % | 5.5 | 6.0 | – | W |
| | | $R_L = 2\ \Omega$; note 1 | | | | |
| | | THD = 0.5 % | 7.5 | 8.5 | – | W |
| | | THD = 10 % | 10 | 11 | – | W |
| THD | total harmonic distortion | $P_o = 1\text{ W}$ | – | 0.1 | – | % |
| $f_{ro(l)}$ | low frequency roll-off | –3 dB; note 2 | – | 45 | – | Hz |
| $f_{ro(h)}$ | high frequency roll-off | –1 dB | 20 | – | – | kHz |
| $G_{V(cl)}$ | closed-loop voltage gain | | 39 | 40 | 41 | dB |
| SVRR | supply voltage ripple rejection | on; notes 3 and 4 | 40 | – | – | dB |
| | | on; notes 3 and 5 | 45 | – | – | dB |
| | | mute; notes 3 and 6 | 45 | – | – | dB |
| | | standby; notes 3 and 6 | 80 | – | – | dB |
| $ Z_i $ | input impedance | | 50 | 60 | 75 | $k\Omega$ |
| $V_{n(o)(rms)}$ | noise output voltage (RMS value) | note 7 | | | | |
| | | on; $R_S = 0\ \Omega$ | – | 150 | – | μV |
| | | on; $R_S = 10\ k\Omega$ | – | 250 | 500 | μV |
| | | mute; note 8 | – | 120 | – | μV |
| α_{cs} | channel separation | $R_S = 10\ k\Omega$ | 40 | – | – | dB |
| $ \Delta G_{V(ub)} $ | channel unbalance | | – | 0.1 | 1 | dB |
| BTL application (see Fig.7) | | | | | | |
| P_o | output power | note 1 | | | | |
| | | THD = 0.5 % | 15 | 17 | – | W |
| | | THD = 10 % | 20 | 22 | – | W |
| | | $V_P = 13.2\text{ V}$; note 1 | | | | |
| | | THD = 0.5 % | – | 13 | – | W |
| | | THD = 10 % | – | 17.5 | – | W |
| THD | total harmonic distortion | $P_o = 1\text{ W}$ | – | 0.1 | – | % |
| B_p | power bandwidth | THD = 0.5 %; $P_o = -1\text{ dB}$; with respect to 15 W | – | 35 to 15000 | – | Hz |
| $f_{ro(l)}$ | low frequency roll-off | –1 dB; note 2 | – | 45 | – | Hz |
| $f_{ro(h)}$ | high frequency roll-off | –1 dB | 20 | – | – | kHz |
| $G_{V(cl)}$ | closed-loop voltage gain | | 45 | 46 | 47 | dB |

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| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-----------------|----------------------------------|---------------------------|------|------|------|------------|
| SVRR | supply voltage ripple rejection | on; notes 3 and 4 | 34 | – | – | dB |
| | | on; notes 3 and 5 | 48 | – | – | dB |
| | | mute; notes 3 and 6 | 48 | – | – | dB |
| | | standby; notes 3 and 6 | 80 | – | – | dB |
| $ Z_i $ | input impedance | | 25 | 30 | 38 | k Ω |
| $V_{n(o)(rms)}$ | noise output voltage (RMS value) | note 7 | | | | |
| | | on; $R_S = 0 \Omega$ | – | 200 | – | μV |
| | | on; $R_S = 10 k\Omega$ | – | 350 | 700 | μV |
| | | mute; note 8 | – | 180 | – | μV |

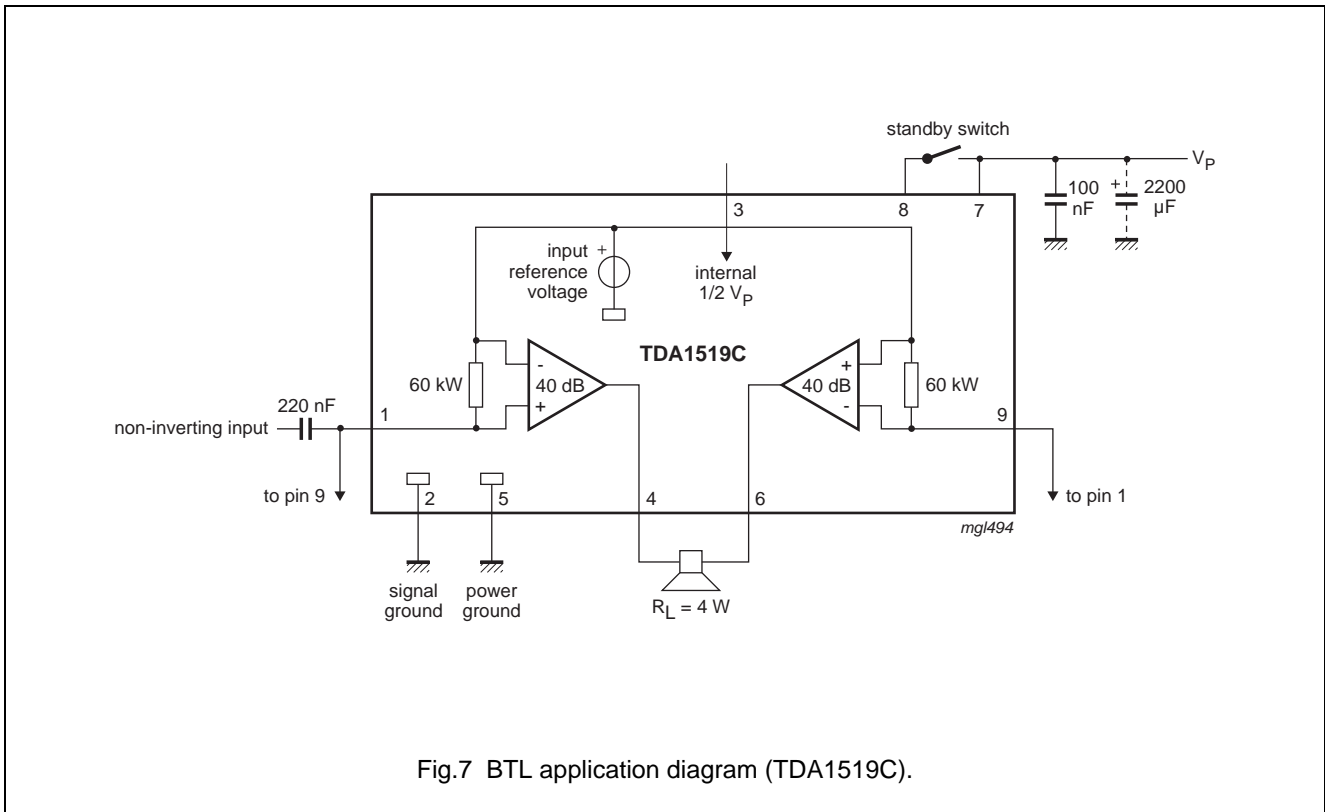
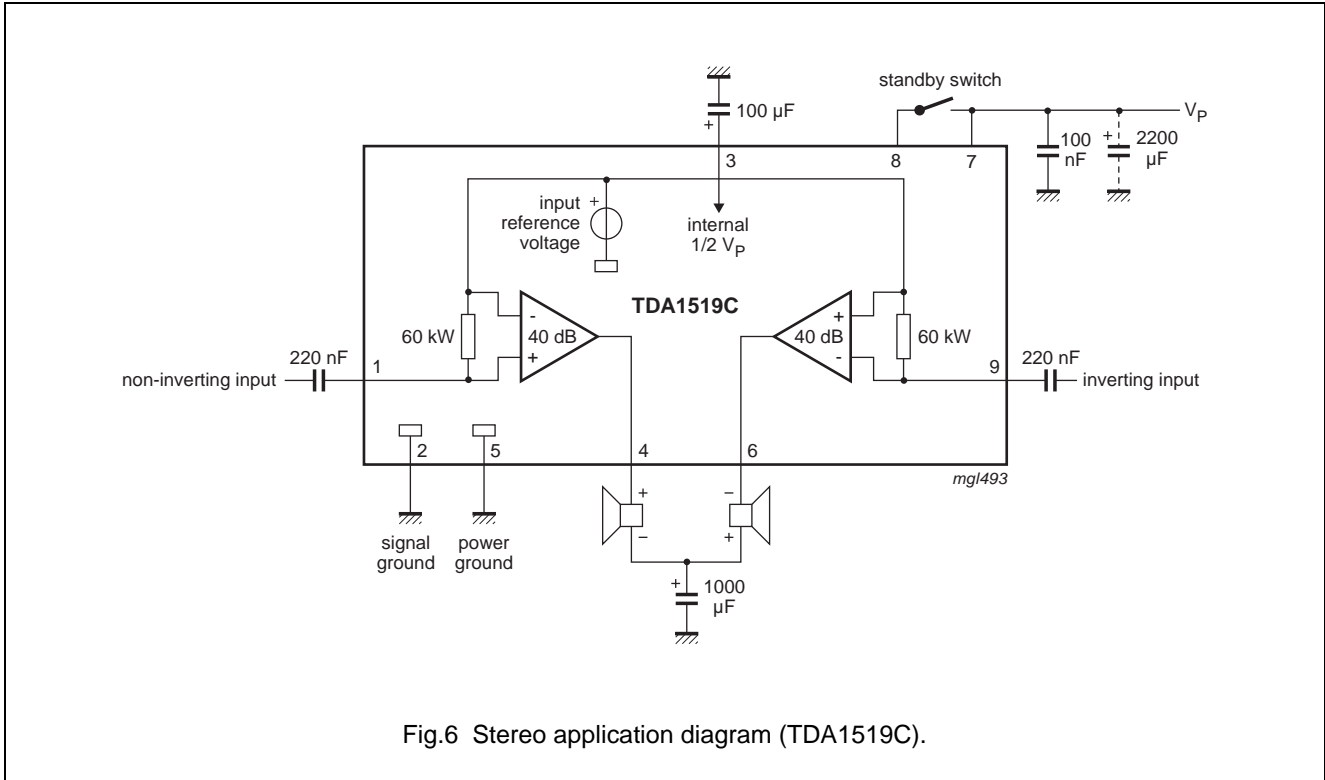
Notes

- Output power is measured directly at the output pins of the device.
- Frequency response externally fixed.
- Ripple rejection measured at the output with a source impedance of 0 Ω (maximum ripple amplitude of 2 V).
- Frequency $f = 100$ Hz.
- Frequency between 1 and 10 kHz.
- Frequency between 100 Hz and 10 kHz.
- Noise voltage measured in a bandwidth of 20 Hz to 20 kHz.
- Noise output voltage independent of R_S ($V_i = 0$ V).

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APPLICATION INFORMATION



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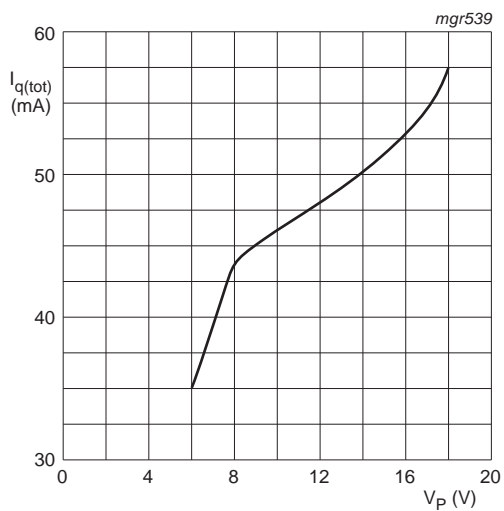
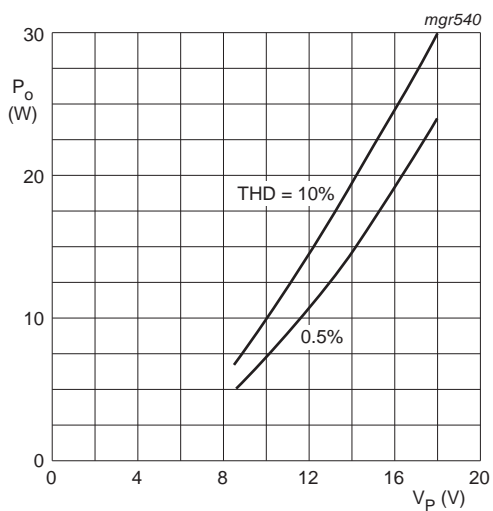


Fig.8 Total quiescent current as a function of the supply voltage.

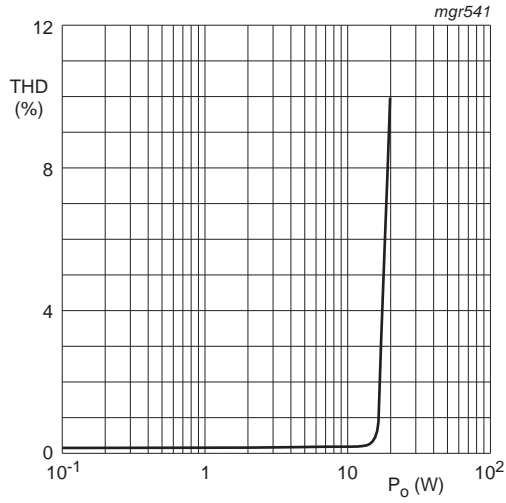


BTL application.
 $R_L = 4 \Omega$.
 $f_i = 1 \text{ kHz}$.

Fig.9 Output power as a function of the supply voltage.

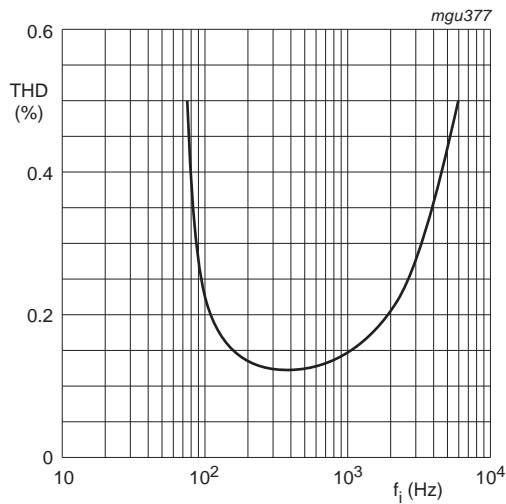
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BTL application.
 $R_L = 4 \Omega$.
 $f_i = 1 \text{ kHz}$.

Fig.10 Total harmonic distortion as a function of the output power.



BTL application.
 $R_L = 4 \Omega$.
 $P_o = 1 \text{ W}$.

Fig.11 Total harmonic distortion as a function of the operating frequency.

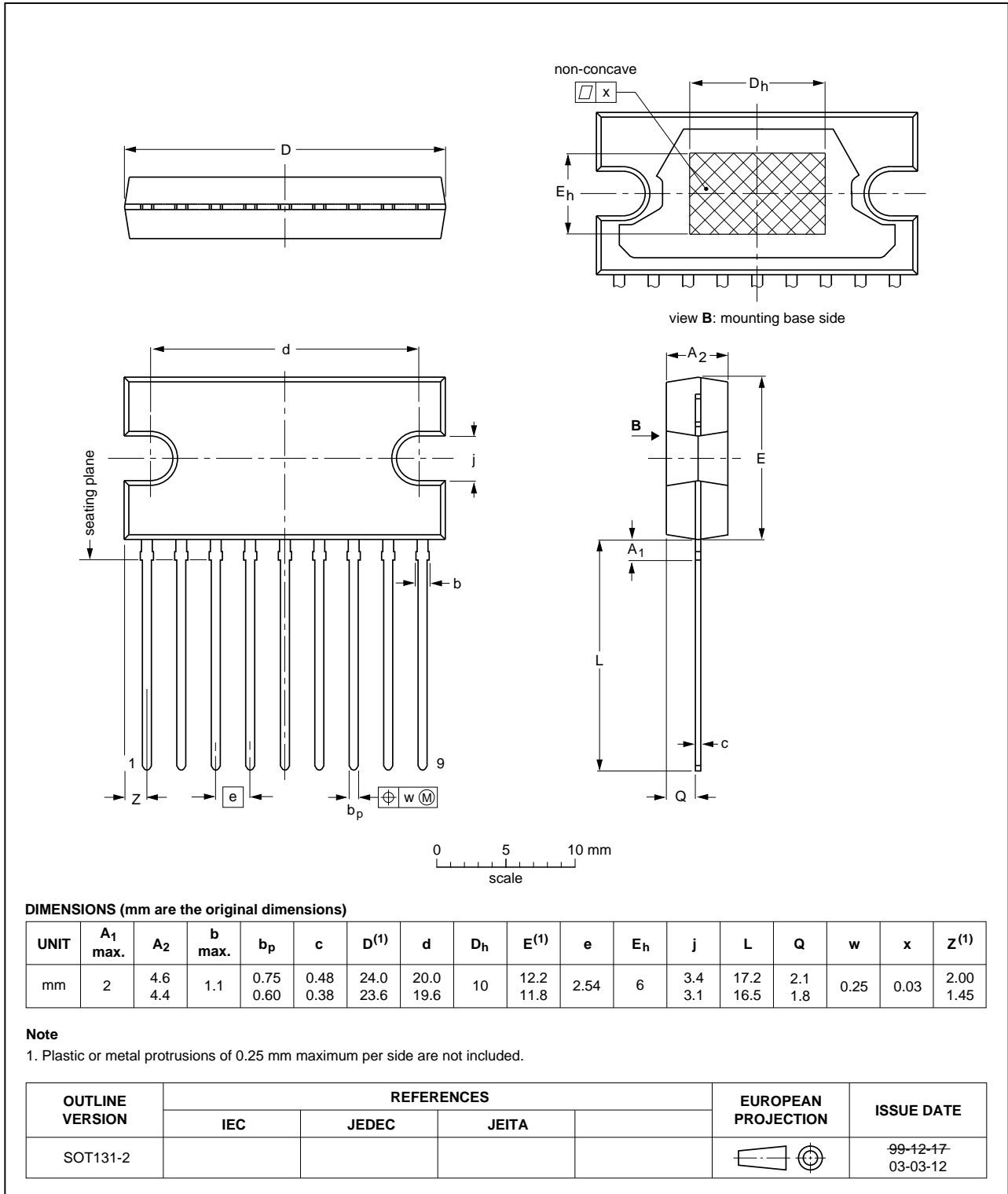
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PACKAGE OUTLINES

SIL9P: plastic single in-line power package; 9 leads

SOT131-2

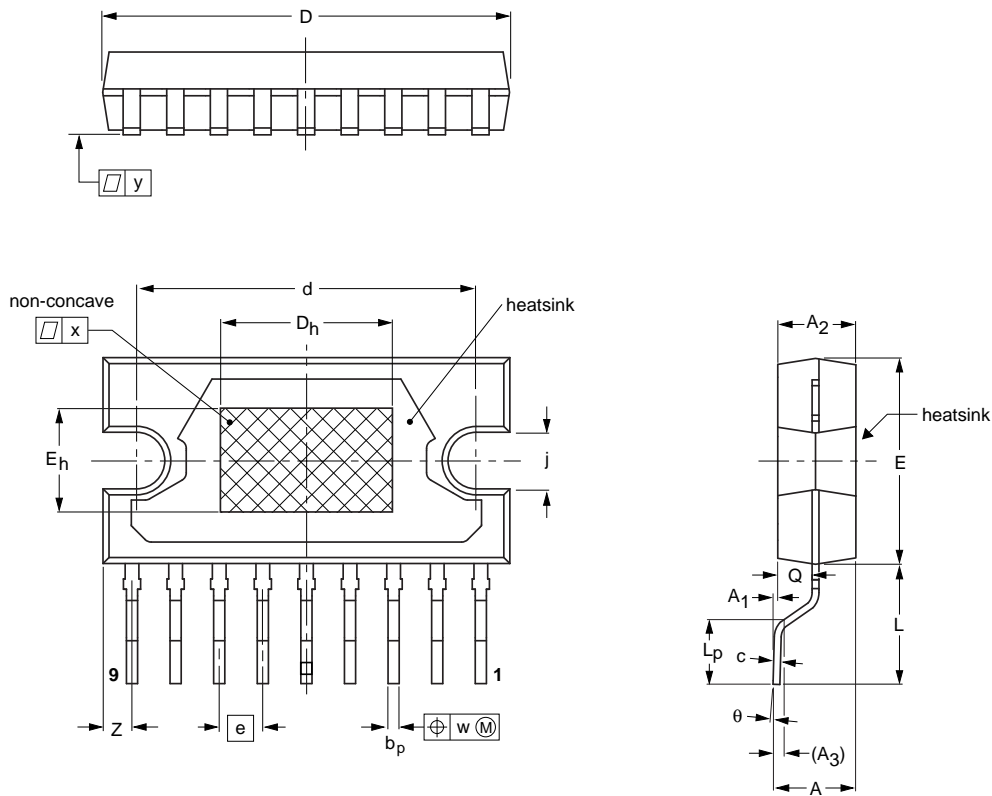


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SMS9P: plastic surface-mounted single in-line power package; 9 leads

SOT354-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | d | D _h | E ⁽¹⁾ | e | E _h | j | L | L _p | Q | w | x | y | Z ⁽¹⁾ | θ |
|------|-----|----------------|----------------|----------------|----------------|------|------------------|------|----------------|------------------|------|----------------|-----|-----|----------------|-----|------|------|------|------------------|----|
| mm | 4.9 | 0.35 | 4.6 | 0.25 | 0.75 | 0.48 | 24.0 | 20.0 | 10 | 12.2 | 2.54 | 6 | 3.4 | 7.4 | 3.4 | 2.1 | 0.25 | 0.03 | 0.15 | 2.00 | 3° |
| | 4.2 | 0.05 | 4.4 | 0.25 | 0.60 | 0.38 | 23.6 | 19.6 | 10 | 11.8 | 2.54 | 6 | 3.1 | 6.6 | 2.8 | 1.9 | 0.25 | 0.03 | 0.15 | 1.45 | 0° |

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

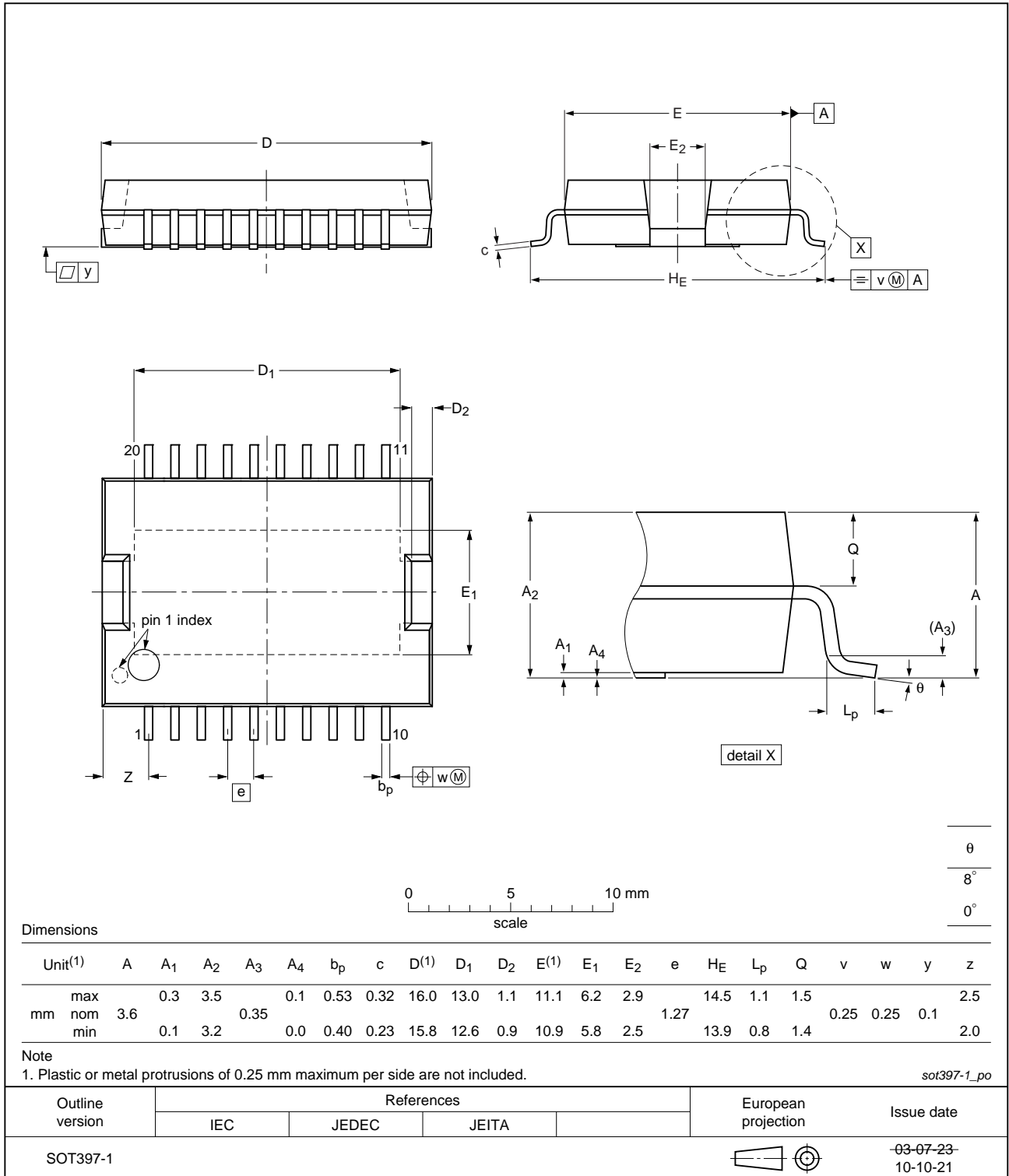
| OUTLINE VERSION | REFERENCES | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|-------|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | |
| SOT354-1 | | | | | 03-03-12 06-03-16 |

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HSOP20: plastic, heatsink small outline package; 20 leads

SOT397-1

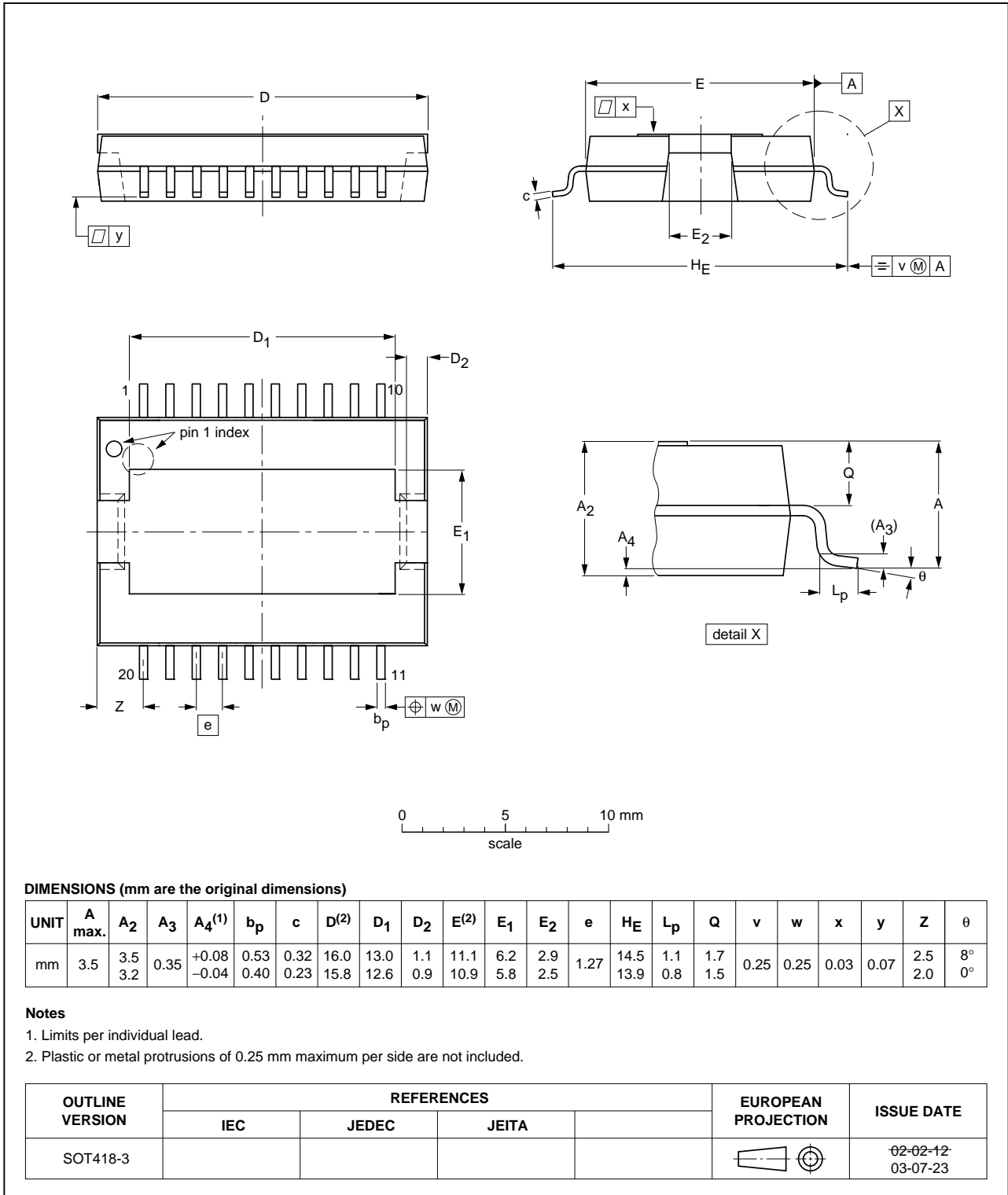


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HSOP20: plastic, heatsink small outline package; 20 leads; low stand-off height

SOT418-3



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SOLDERING

Introduction

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our “*Data Handbook IC26; Integrated Circuit Packages*” (document order number 9398 652 90011).

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mount components are mixed on one printed-circuit board. Wave soldering can still be used for certain surface mount ICs, but it is not suitable for fine pitch SMDs. In these situations reflow soldering is recommended. Driven by legislation and environmental forces the worldwide use of lead-free solder pastes is increasing.

Through-hole mount packages

SOLDERING BY DIPPING OR BY SOLDER WAVE

Typical dwell time of the leads in the wave ranges from 3 to 4 seconds at 250 °C or 265 °C, depending on solder material applied, SnPb or Pb-free respectively.

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 maximum storage temperature ($T_{stg(max)}$). 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.

MANUAL SOLDERING

Apply the soldering iron (24 V or less) to the lead(s) of the package, either below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

Surface mount packages

REFLOW SOLDERING

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 methods exist for reflowing; for example, convection or convection/infrared heating in a conveyor type oven. Throughput times (preheating, soldering and

cooling) vary between 100 and 200 seconds depending on heating method.

Typical reflow peak temperatures range from 215 to 270 °C depending on solder paste material. The top-surface temperature of the packages should preferably be kept:

- below 225 °C (SnPb process) or below 245 °C (Pb-free process)
 - for all the BGA, HTSSON..T and SSOP-T packages
 - for packages with a thickness ≥ 2.5 mm
 - for packages with a thickness < 2.5 mm and a volume ≥ 350 mm³ so called thick/large packages.
- below 240 °C (SnPb process) or below 260 °C (Pb-free process) for packages with a thickness < 2.5 mm and a volume < 350 mm³ so called small/thin packages.

Moisture sensitivity precautions, as indicated on packing, must be respected at all times.

WAVE SOLDERING

Conventional single wave soldering is not recommended for surface mount devices (SMDs) or printed-circuit boards with a high component density, as solder bridging and non-wetting can present major problems.

To overcome these problems the double-wave soldering method was specifically developed.

If wave soldering is used the following conditions must be observed for optimal results:

- Use a double-wave soldering method comprising a turbulent wave with high upward pressure followed by a smooth laminar wave.
- For packages with leads on two sides and a pitch (e):
 - larger than or equal to 1.27 mm, the footprint longitudinal axis is **preferred** to be parallel to the transport direction of the printed-circuit board;
 - smaller than 1.27 mm, the footprint longitudinal axis **must** be parallel to the transport direction of the printed-circuit board.

The footprint must incorporate solder thieves at the downstream end.

- For packages with leads on four sides, the footprint must be placed at a 45° angle to the transport direction of the printed-circuit board. The footprint must incorporate solder thieves downstream and at the side corners.

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

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dispensing. The package can be soldered after the adhesive is cured.

Typical dwell time of the leads in the wave ranges from 3 to 4 seconds at 250 °C or 265 °C, depending on solder material applied, SnPb or Pb-free respectively.

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

MANUAL SOLDERING

Fix the component by first soldering two diagonally-opposite end leads. Use a low voltage (24 V or less) soldering iron 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.

Suitability of IC packages for wave, reflow and dipping soldering methods

| MOUNTING | PACKAGE ⁽¹⁾ | SOLDERING METHOD | | |
|----------------------------|---|-----------------------------------|-----------------------|----------|
| | | WAVE | REFLOW ⁽²⁾ | DIPPING |
| Through-hole mount | CPGA, HCPGA | suitable | – | suitable |
| | DBS, DIP, HDIP, RDBS, SDIP, SIL | suitable ⁽³⁾ | – | – |
| Through-hole-surface mount | PMFP ⁽⁴⁾ | not suitable | not suitable | – |
| Surface mount | BGA, HTSSON..T ⁽⁵⁾ , LPGA, LFBGA, SQFP, SSOP-T ⁽⁵⁾ , TFBGA, USON, VFBGA | not suitable | suitable | – |
| | DHVQFN, HBCC, HBGA, HLQFP, HSO, HSOP, HSQFP, HSSON, HTQFP, HTSSOP, HVQFN, HVSON, SMS | not suitable ⁽⁶⁾ | suitable | – |
| | PLCC ⁽⁷⁾ , SO, SOJ | suitable | suitable | – |
| | LQFP, QFP, TQFP | not recommended ⁽⁷⁾⁽⁸⁾ | suitable | – |
| | SSOP, TSSOP, VSO, VSSOP | not recommended ⁽⁹⁾ | suitable | – |
| | CWQCCN..L ⁽¹¹⁾ , PMFP ⁽¹⁰⁾ , WQCCN32L ⁽¹¹⁾ | not suitable | not suitable | – |

Notes

- For more detailed information on the BGA packages refer to the “(LF)BGA Application Note” (AN01026); order a copy from your NXP Semiconductors sales office.
- All surface mount (SMD) packages are moisture sensitive. Depending upon the moisture content, the maximum temperature (with respect to time) and body size of the package, there is a risk that internal or external package cracks may occur due to vaporization of the moisture in them (the so called popcorn effect). For details, refer to the Drypack information in the “Data Handbook IC26; Integrated Circuit Packages; Section: Packing Methods”.
- For SDIP packages, the longitudinal axis must be parallel to the transport direction of the printed-circuit board.
- Hot bar soldering or manual soldering is suitable for PMFP packages.
- These transparent plastic packages are extremely sensitive to reflow soldering conditions and must on no account be processed through more than one soldering cycle or subjected to infrared reflow soldering with peak temperature exceeding 217 °C ± 10 °C measured in the atmosphere of the reflow oven. The package body peak temperature must be kept as low as possible.
- These packages are not suitable for wave soldering. On versions with the heatsink on the bottom side, the solder cannot penetrate between the printed-circuit board and the heatsink. On versions with the heatsink on the top side, the solder might be deposited on the heatsink surface.
- If wave soldering is considered, then the package must be placed at a 45° angle to the solder wave direction. The package footprint must incorporate solder thieves downstream and at the side corners.

**22 W BTL or 2 × 11 W
stereo power amplifier**

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8. Wave soldering is suitable for LQFP, QFP and TQFP packages with a pitch (e) larger than 0.8 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.65 mm.
9. Wave soldering is suitable for SSOP, TSSOP, VSO and VSSOP packages with a pitch (e) equal to or larger than 0.65 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.5 mm.
10. Hot bar or manual soldering is suitable for PMFP packages.
11. Image sensor packages in principle should not be soldered. They are mounted in sockets or delivered pre-mounted on flex foil. However, the image sensor package can be mounted by the client on a flex foil by using a hot bar soldering process. The appropriate soldering profile can be provided on request.

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stereo power amplifier

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DATA SHEET STATUS

| DOCUMENT STATUS ⁽¹⁾ | PRODUCT STATUS ⁽²⁾ | DEFINITION |
|--------------------------------|-------------------------------|---|
| Objective data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary data sheet | Qualification | This document contains data from the preliminary specification. |
| Product data sheet | Production | This document contains the product specification. |

Notes

1. Please consult the most recently issued document before initiating or completing a design.
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Customer notification

This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content, except for package outline drawings which were updated to the latest version.

Contact information

For additional information please visit: <http://www.nxp.com>

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