

DATA SHEET



TZA1027

Analog current buffer for CD-R and
CD-RW systems

Preliminary specification
File under Integrated Circuits, IC01

1999 Sep 17

Analog current buffer for CD-R and CD-RW systems

TZA1027

FEATURES

- Eight amplifiers for servo and power calibration functions
- Gain selector for CD-R and CD-RW discs
- Separate data amplifier for read speed up to thirty times nominal data speed.



GENERAL DESCRIPTION

The TZA1027 is an analog current buffer IC for CD-R and CD-RW systems with a 3-spot push-pull tracking system. The IC interfaces directly to the photo diodes and TZA1020. A HF current amplifier is implemented to detect the actual HF data signal.

QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-------------|-------------------------------|-----------------------------------|------|------|------|--------------|
| V_{DD} | supply voltage | | 4.5 | 5.0 | 5.5 | V |
| $I_{i(cd)}$ | central diode input current | WRON = 1 | 0 | – | 3400 | μ A |
| $I_{i(sd)}$ | satellite diode input current | WRON = 1 | 0 | – | 520 | μ A |
| B_{CAHF} | bandwidth | $C_i = 5$ pF | 72 | – | – | MHz |
| $t_{d(f)}$ | flatness delay | $C_i = 5$ pF; $f = 0.1$ to 32 MHz | – | 30 | 200 | ps |
| G_{SS} | servo satellite detector gain | HG = 1 | – | 32 | – | |
| | | HG = 0 | – | 8 | – | |
| T_{amb} | ambient temperature | | 0 | – | 70 | $^{\circ}$ C |

ORDERING INFORMATION

| TYPE NUMBER | PACKAGE | | |
|-------------|---------|--|----------|
| | NAME | DESCRIPTION | VERSION |
| TZA1027HL | LQFP32 | plastic low profile quad flat package; 32 leads; body 5 × 5 × 1.4 mm | SOT401-1 |

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BLOCK DIAGRAM

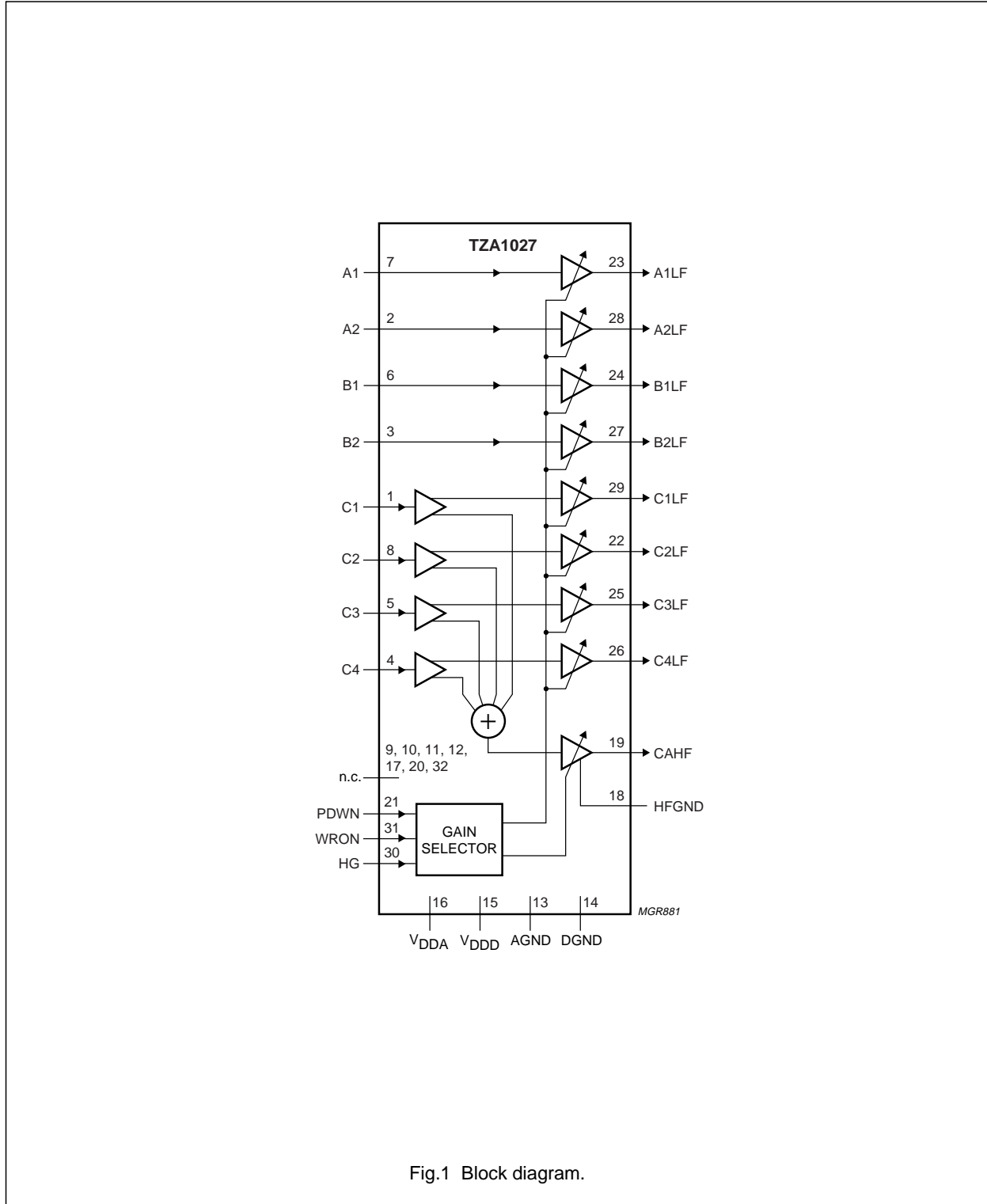


Fig.1 Block diagram.

Analog current buffer for CD-R and CD-RW systems

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PINNING

| SYMBOL | PIN | DESCRIPTION |
|------------------|-----|--|
| C1 | 1 | central photo diode current input |
| A2 | 2 | satellite diode current input |
| B2 | 3 | satellite diode current input |
| C4 | 4 | central photo diode current input |
| C3 | 5 | central photo diode current input |
| B1 | 6 | satellite diode current input |
| A1 | 7 | satellite diode current input |
| C2 | 8 | central photo diode current input |
| n.c. | 9 | not connected |
| n.c. | 10 | not connected |
| n.c. | 11 | not connected |
| n.c. | 12 | not connected |
| AGND | 13 | analog ground |
| DGND | 14 | digital ground |
| V _{DD} | 15 | digital power supply |
| V _{DDA} | 16 | analog power supply |
| n.c. | 17 | not connected |
| HFGND | 18 | ground connection of CAHF output stage |
| CAHF | 19 | central aperture high-frequency output |
| n.c. | 20 | not connected |
| PDWN | 21 | digital input power-down |
| C2LF | 22 | C2 central detector signal output |
| A1LF | 23 | A1 satellite detector signal output |
| B1LF | 24 | B1 satellite detector signal output |
| C3LF | 25 | C3 central detector signal output |
| C4LF | 26 | C4 central detector signal output |
| B2LF | 27 | B2 satellite detector signal output |
| A2LF | 28 | A2 satellite detector signal output |
| C1LF | 29 | C1 central detector signal output |
| HG | 30 | digital input high gain selection |
| WRON | 31 | digital input write on gain selection |
| n.c. | 32 | not connected |

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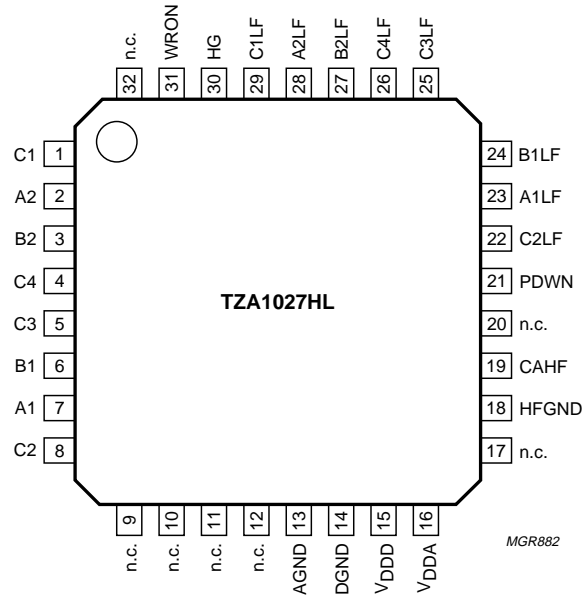


Fig.2 Pin configuration.

Analog current buffer for CD-R and CD-RW systems

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FUNCTIONAL DESCRIPTION

All detector signals are applied to wide-band amplifiers for servo and laser power calibration functions of the TZA1020. Signals from the central detector are added and amplified to suitable levels for the decoder circuit. Current gain can be selected for CD-R and CD-RW discs.

LIMITING VALUES

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

| SYMBOL | PARAMETERS | MIN. | MAX. | UNIT |
|-----------|--|--------------|--------------|--------|
| V_{DD} | supply voltage | 0 | 5.5 | V |
| T_{stg} | storage temperature | -6.5 | +150 | °C |
| T_{amb} | ambient temperature | 0 | 70 | °C |
| V_{es} | electrostatic handling: Machine model Human body model | -100 -500 | +100 +500 | V V |

THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITION | VALUE | UNIT |
|---------------|---|-------------|-------|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | 95 | K/W |

LOGIC FUNCTIONS

| PDWN | WRON | HG | MODE |
|------|-----------|-----------|-------------|
| 1 | X; note 1 | X; note 1 | power-down |
| 0 | 0 | 0 | CD-R read |
| 0 | 0 | 1 | CD-RW read |
| 0 | 1 | 0 | CD-R write |
| 0 | 1 | 1 | CD-RW write |

Note

1. X = don't care.

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CHARACTERISTICS

$V_{DDA} = V_{DDD} = 5\text{ V}$; $T_{amb} = 25\text{ °C}$; $I_{i(cd)} = 25\text{ }\mu\text{A}$ with $x = 1\text{LF to } 4\text{LF}$; $I_{i(sd)} = 4\text{ }\mu\text{A}$ with $y = \text{A or B}$ and $z = 1\text{LF or } 2\text{LF}$; $\text{PDWN} = 0$; $\text{WRON} = 0$; $\text{HG} = 0$ and $C_{cd} = C_{sd} = 5\text{ pF}$; the given maximum and minimum values are 4σ values; unless otherwise specified. Signals available on the IC pins are upper case. Signals not visible on the IC pins are lower case.

| SYMBOL | PARAMETERS | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---------------------------|--|--|-------|------|-------|---------------|
| Supplies | | | | | | |
| V_{DDA} | analog supply voltage | | 4.5 | 5.0 | 5.5 | V |
| V_{DDD} | digital supply voltage | | 4.5 | 5.0 | 5.5 | V |
| ΔV_{DD} | difference between V_{DDA} and V_{DDD} | | -0.3 | - | +0.3 | V |
| I_{DDA} | analog supply current | PDWN = 1 | - | 0.1 | - | mA |
| | | | - | 13 | - | mA |
| I_{DDD} | digital supply current | PDWN = 1 | - | 0 | - | mA |
| | | | - | 14 | - | mA |
| Detector inputs | | | | | | |
| INPUT CURRENT RANGE | | | | | | |
| $I_{i(cd)}$ | central diode input current | | 1.0 | - | 75 | μA |
| | | WRON = 1 | 0 | - | 3400 | μA |
| $I_{i(sd)}$ | satellite diode input current | | 0.6 | - | 9 | μA |
| | | WRON = 1 | 0 | - | 520 | μA |
| INPUT VOLTAGE LEVEL | | | | | | |
| $V_{i(cd)}$ | central diode input voltage level | | 2.5 | 2.9 | 3.3 | V |
| | | WRON = 1 | 2.6 | 3.0 | 3.4 | V |
| $V_{i(sd)}$ | satellite diode input voltage level | | 1.6 | 1.9 | 2.2 | V |
| | | WRON = 1 | 1.7 | 2.0 | 2.3 | V |
| INPUT RESISTANCE | | | | | | |
| $R_{i(cd)}$ | central diode input resistance | | - | 420 | - | Ω |
| | | WRON = 1; $I_{i(cd)} = 1\text{ mA}$ | - | 220 | - | Ω |
| $R_{i(sd)}$ | satellite diode input resistance | | - | 620 | - | Ω |
| | | WRON = 1; $I_{i(cd)} = 200\text{ }\mu\text{A}$ | - | 370 | - | Ω |
| Transfer functions | | | | | | |
| SERVO OUTPUTS CD | | | | | | |
| G_{cd} | servo central detector gain | | -0.93 | -1 | -1.07 | |
| | | HG = 1 | -2.8 | -3 | -3.2 | |
| | | WRON = 1 | -0.94 | -1 | -1.06 | |
| | | WRON = 1; HG = 1 | -0.93 | -1 | -1.07 | |
| G_{mm} | gain mismatch | 3σ | - | - | 3 | % |
| B_{cd} | bandwidth | | 33 | 44 | - | MHz |
| | | HG = 1; $I_{i(cd)} = 6\text{ }\mu\text{A}$ | 18 | 22 | - | MHz |
| | | WRON = 1; $I_{i(cd)} = 1000\text{ }\mu\text{A}$ | 150 | 230 | - | MHz |
| | | WRON = 1; HG = 1; $I_{i(cd)} = 250\text{ }\mu\text{A}$ | 100 | 130 | - | MHz |

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| SYMBOL | PARAMETERS | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--|-----------------------------------|--|-------|-------|------------------------|------------------|
| t_r | rise time | WRON = 1; $30 \mu\text{A} < I_{i(\text{cd})} < 520 \mu\text{A}$ | – | 2 | – | ns |
| t_d | delay time | WRON = 1; $30 \mu\text{A} < I_{i(\text{cd})} < 520 \mu\text{A}$ | – | 2.5 | – | ns |
| SERVO OUTPUTS SD | | | | | | |
| G_{SS} | servo satellite detector gain | HG = 1 | –2.85 | –3.05 | –3.25 | |
| | | WRON = 0; HG = 0 | –0.96 | –1.02 | –1.08 | |
| | | WRON = 1; HG = 0 | –0.88 | –0.95 | –1.02 | |
| | | WRON = 1; HG = 1 | –0.88 | –0.95 | –1.02 | |
| B_{S} | bandwidth | HG = 1; $I_{i(\text{cd})} = 1 \mu\text{A}$ | 24 | – | – | MHz |
| | | WRON = X; note 1; HG = X; note 1 | 46 | – | – | MHz |
| t_r | rise time | WRON = 1; $4 \mu\text{A} < I_{i(\text{cd})} < 65 \mu\text{A}$ | – | 3.6 | – | ns |
| t_d | delay time | WRON = 1; $4 \mu\text{A} < I_{i(\text{cd})} < 65 \mu\text{A}$ | – | 4.5 | – | ns |
| DATA OUTPUT; PIN CAHF | | | | | | |
| G_{SS} | servo satellite detector gain | | 7.5 | 8.1 | 8.7 | |
| | | HG = 1 | 29 | 32 | 35 | |
| | | WRON = 1; HG = X; note 1 | – | 0 | – | |
| B_{CAHF} | bandwidth | | 80 | – | – | MHz |
| | | HG = 1; $I_{i(\text{cd})} = 6 \mu\text{A}$ | 72 | – | – | MHz |
| $t_{d(f)}$ | flatness delay | | – | 30 | 200 | ps |
| | | HG = 1; $I_{i(\text{cd})} = 6 \mu\text{A}$ | – | 170 | – | ps |
| I_n | noise current | | – | 1.4 | – | μA |
| | | HG = 1; $I_{i(\text{cd})} = 6 \mu\text{A}$ | – | 2 | – | μA |
| Output pins | | | | | | |
| $V_{o(\text{cd})}$ | central diode output voltage | | –0.2 | – | $V_{\text{DDD}} - 1$ | V |
| $V_{o(\text{sd})}$ | satellite diode output voltage | | –0.2 | – | $V_{\text{DDD}} - 1$ | V |
| $V_{o(\text{CAHF})}$ | data output voltage | | 1 | – | $V_{\text{DDD}} + 0.2$ | V |
| $R_{o(\text{cd})}$ | central diode output resistance | | – | 1 | – | $\text{M}\Omega$ |
| $R_{o(\text{sd})}$ | satellite diode output resistance | | – | 5 | – | $\text{M}\Omega$ |
| R_{CAHF} | data output resistance | | – | 40 | – | $\text{k}\Omega$ |
| Digital control signals | | | | | | |
| INPUT VOLTAGE LEVELS; PINS PDWN, WRON AND HG | | | | | | |
| V_{IL} | LOW-level input voltage | | –0.2 | – | +1.2 | V |
| V_{IH} | HIGH-level input voltage | | 1.8 | – | $V_{\text{DDD}} + 0.2$ | V |
| INPUT CURRENT | | | | | | |
| I_{LI} | input leakage current | | –1 | – | +1 | μA |
| DELAY TIME | | | | | | |
| t_d | delay time | | – | 0.3 | – | μs |

Note

1. X = don't care.

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TEST AND APPLICATION INFORMATION

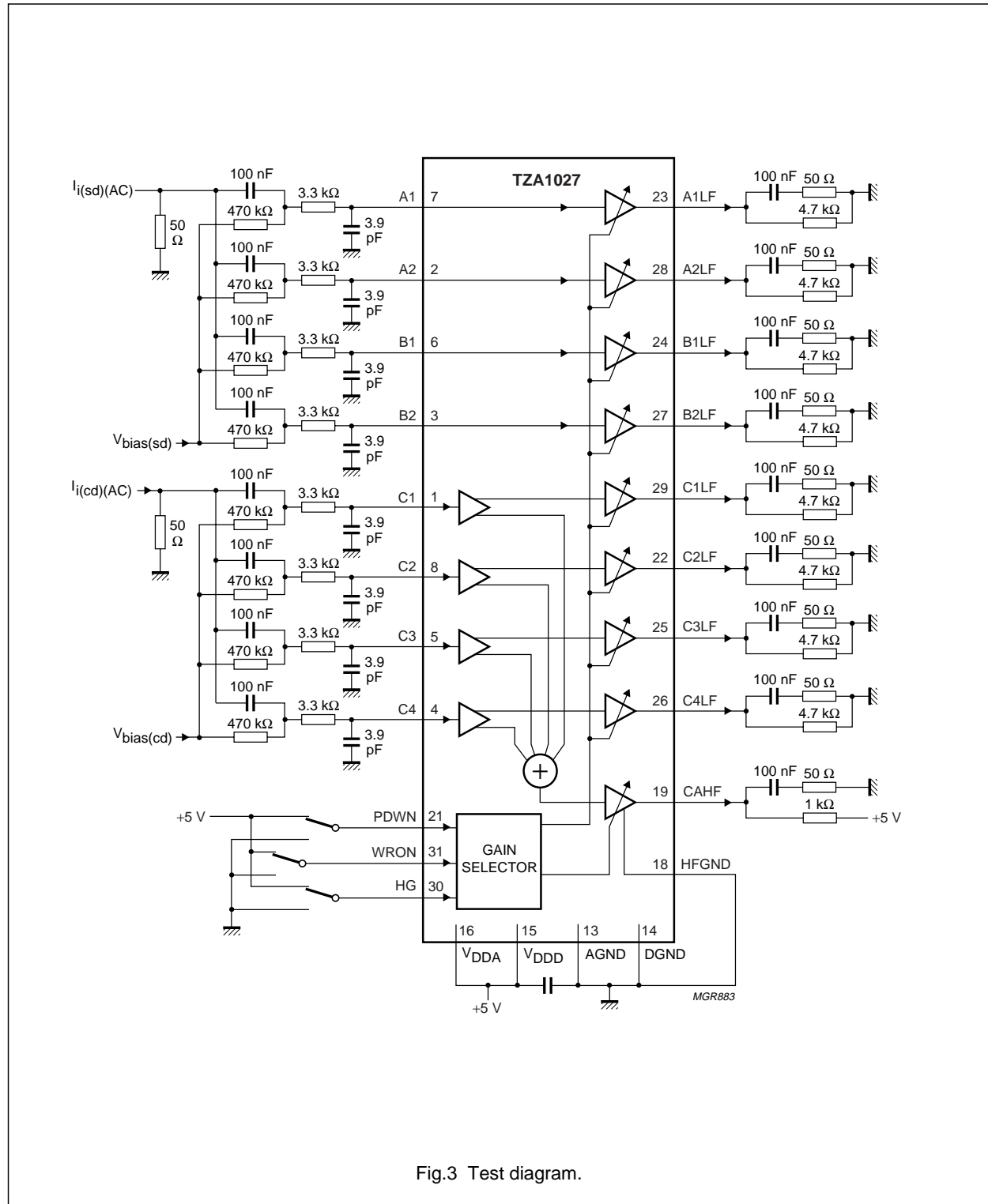


Fig.3 Test diagram.

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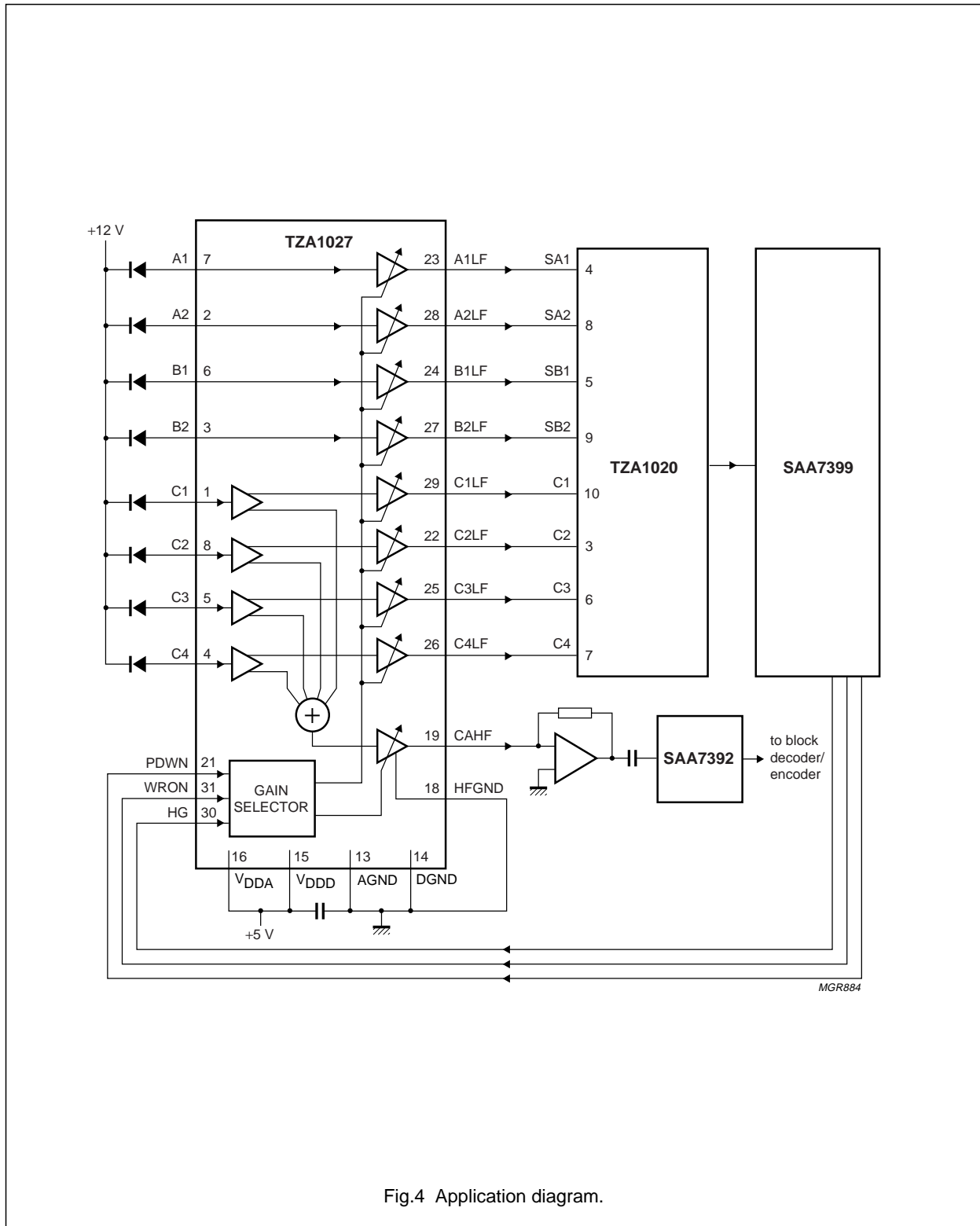


Fig.4 Application diagram.

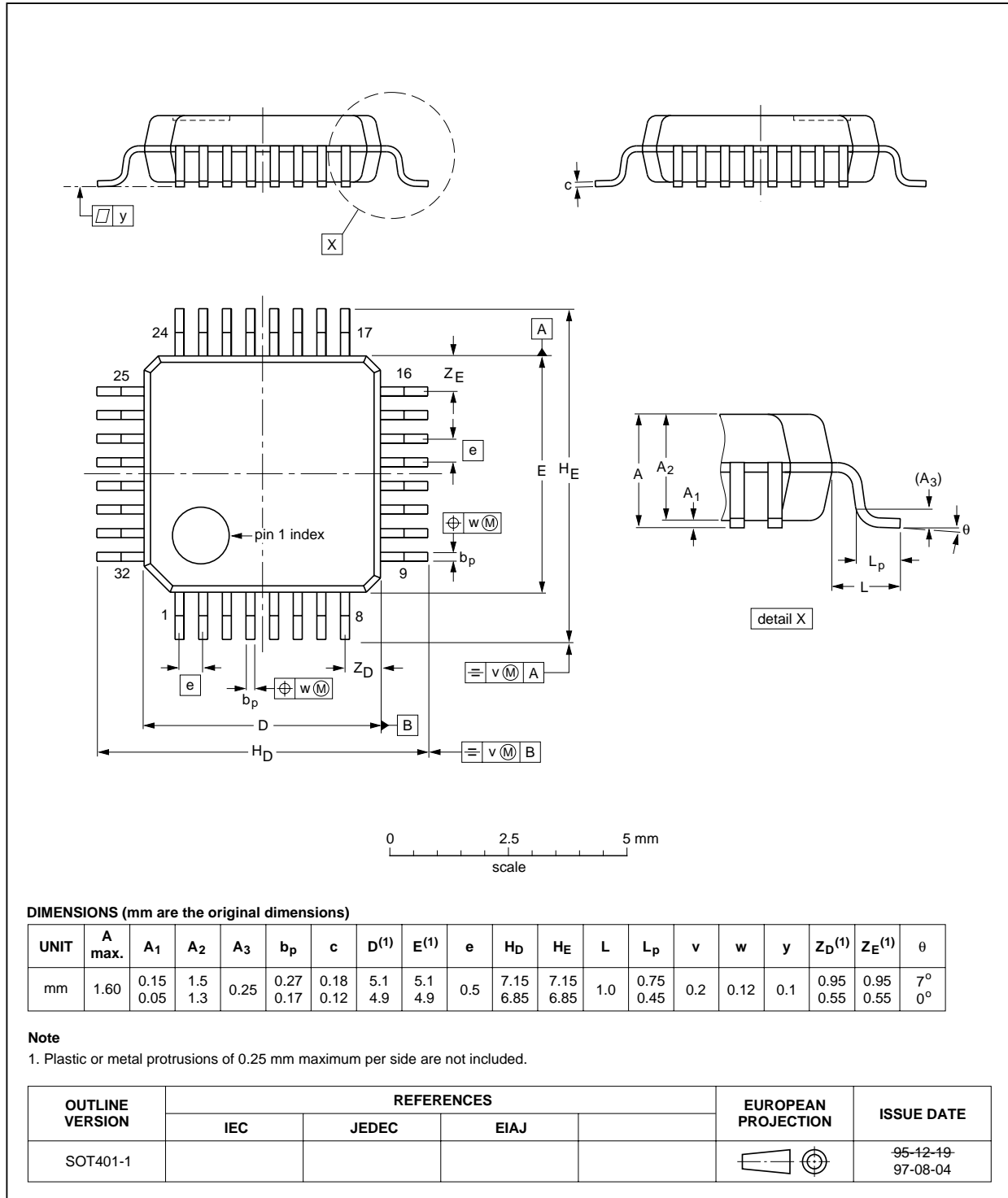
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PACKAGE OUTLINE

LQFP32: plastic low profile quad flat package; 32 leads; body 5 x 5 x 1.4 mm

SOT401-1



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SOLDERING

Introduction to soldering surface mount packages

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 surface mount IC packages. Wave soldering is not always suitable for surface mount ICs, or for printed-circuit boards with high population densities. In these situations reflow soldering is often used.

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, infrared/convection 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 250 °C. The top-surface temperature of the packages should preferably be kept below 230 °C.

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 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.
- 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.

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.

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.

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.

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Suitability of surface mount IC packages for wave and reflow soldering methods

| PACKAGE | SOLDERING METHOD | |
|---------------------------------|-----------------------------------|-----------------------|
| | WAVE | REFLOW ⁽¹⁾ |
| BGA, SQFP | not suitable | suitable |
| HLQFP, HSQFP, HSOP, HTSSOP, SMS | not suitable ⁽²⁾ | suitable |
| PLCC ⁽³⁾ , SO, SOJ | suitable | suitable |
| LQFP, QFP, TQFP | not recommended ⁽³⁾⁽⁴⁾ | suitable |
| SSOP, TSSOP, VSO | not recommended ⁽⁵⁾ | suitable |

Notes

1. 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".
2. These packages are not suitable for wave soldering as a solder joint between the printed-circuit board and heatsink (at bottom version) can not be achieved, and as solder may stick to the heatsink (on top version).
3. 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.
4. Wave soldering is only suitable for LQFP, TQFP and QFP packages with a pitch (e) equal to or larger than 0.8 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.65 mm.
5. Wave soldering is only suitable for SSOP and TSSOP 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.

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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NOTES

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