

# DATA SHEET

## **TZA1045**

Photodiode and amplifier IC  
for CD and DVD applications

Preliminary specification  
Supersedes data of 2002 Mar 26

2002 Nov 27

## Photodiode and amplifier IC for CD and DVD applications

## TZA1045

### FEATURES

- High frequency RF amplifiers (typical bandwidth = 240 MHz)
- Suitable for all CD (785 nm) and DVD (655 nm) read/write applications
- Four high bandwidth central outputs (A, B, C, and D), four satellite outputs (E, F, G, and H) and one high bandwidth differential output (RFP, RFN)
- Internal current clamp and current fold back (power reduction)
- Versatile programmable gain switches (CD/DVD, H/L, and R/W)
- Single 5 V supply
- Current outputs for optimum signal transport over flex cable
- Small outline package SSOP16T with good positional tolerance.

### APPLICATIONS

- CD and DVD read/write applications.

### GENERAL DESCRIPTION

The TZA1045 is a single optical pick-up IC for read/write systems and is suitable for CD and DVD applications.

### ORDERING INFORMATION

| TYPE NUMBER | PACKAGE |  |          |
|-------------|---------|--|----------|
|             | NAME    | DESCRIPTION  | VERSION  |
| TZA1045TS   | SSOP16T | plastic shrink small outline package/transparent; 16 leads (straight); body width 4.4 mm | SOT734-1 |

The device contains eight RF amplifiers for the central and satellite diodes and one differential RF amplifier (RFP and RFN) which handles the sum of the four A, B, C, and D central diode signals.

Programming the gain is a very versatile way to optimize interfacing between the TZA1045 and the pre-amplifier. The gain can be programmed for CD or DVD media with the gain switch CD/DVD.

The H/L switch can be used for CD-R or CD-RW discs.

Gain switch R/W is used to reduce the gain during writing. During writing, the high peak signals for the central and satellite segments are clamped internally and the output currents of the A, B, C, D, E, F, G, and H segments are reduced to almost zero (fold back) to minimize the power consumption.

All outputs are current outputs that can supply a maximum of 8 mA. In CD-R writing mode, the clipping level of the output currents is between 5 and 8 mA.

The SSOP16T package has a low spread on the Z tolerance. The Z tolerance is measured between the diodes (chip surface) and the bottom of the leads. The diodes have an offset of 54  $\mu\text{m}$  in the 'y' direction with respect to the leadframe centre and a tolerance of  $\pm 50 \mu\text{m}$  in both 'x' and 'y' directions.

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**QUICK REFERENCE DATA**

| SYMBOL                   | PARAMETER                                      | CONDITIONS  | MIN. | TYP.   | MAX. | UNIT   |
|--------------------------|--|---|------|--|------|--|
| <b>Supplies</b>          |  |   |      |  |      |  |
| V <sub>DD1</sub>         | supply voltage front-end                       |   | 4.5  | 5.0  | 5.5  | V  |
| V <sub>DD2</sub>         | supply voltage back-end                        |   | 4.5  | 5.0  | 5.5  | V  |
| I <sub>DD1</sub>         | supply current front-end                       | dark conditions<br>writing DVD+R<br>writing CD-R<br>writing DVD+RW<br>writing CD-RW<br>reading DVD-ROM<br>reading CD-ROM<br>reading DVD+RW<br>reading CD-RW         | –    | 17.4<br>41.2<br>17.2<br>15.2<br>42.5<br>41.8<br>42.2<br>41.2 | –    | mA<br>mA<br>mA<br>mA<br>mA<br>mA<br>mA<br>mA         |
| I <sub>DD2</sub>         | supply current back-end                        | dark conditions   | –    | 6.0  | –    | mA   |
| <b>Temperature range</b> |  |   |      |  |      |  |
| T <sub>amb</sub>         | ambient temperature                            |   | 0    | –  | 70   | °C   |
| <b>RF bandwidth</b>      |  |   |      |  |      |  |
| B <sub>-3dB(cen)</sub>   | RF bandwidth central channels A, B, C, and D   | I <sub>o</sub> = 1.5 mA<br>writing DVD+R<br>writing CD-R<br>writing DVD+RW<br>writing CD-RW<br>reading DVD-ROM<br>reading CD-ROM<br>reading DVD+RW<br>reading CD-RW | –    | 170<br>205<br>360<br>150<br>211<br>128<br>205<br>109         | –    | MHz<br>MHz<br>MHz<br>MHz<br>MHz<br>MHz<br>MHz<br>MHz |
| B <sub>-3dB(dif)</sub>   | RF bandwidth differential channels RFP and RFN | I <sub>o</sub> = 1 mA<br>writing DVD+R<br>writing CD-R<br>writing DVD+RW<br>writing CD-RW<br>reading DVD-ROM<br>reading CD-ROM<br>reading DVD+RW<br>reading CD-RW   | –    | 171<br>289<br>360<br>148<br>191<br>130<br>188<br>110         | –    | MHz<br>MHz<br>MHz<br>MHz<br>MHz<br>MHz<br>MHz<br>MHz |

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| SYMBOL                 | PARAMETER                                     | CONDITIONS  | MIN. | TYP. | MAX. | UNIT |  |
|------------------------|---|---|------|------|------|------|--|
| B <sub>-3dB(sat)</sub> | RF bandwidth satellite channels E, F, G and H | I <sub>o</sub> = 0.5 mA   |      |      |      |      |  |
|                        |   | writing DVD+R   | –    | 171  | –    | MHz  |  |
|                        |   | writing CD-R  | –    | 97   | –    | MHz  |  |
|                        |   | writing DVD+RW  | –    | 360  | –    | MHz  |  |
|                        |   | writing CD-RW   | –    | 148  | –    | MHz  |  |
|                        |   | reading DVD-ROM   | –    | 111  | –    | MHz  |  |
|                        |   | reading CD-ROM  | –    | 54   | –    | MHz  |  |
|                        |   | reading DVD+RW  | –    | 97   | –    | MHz  |  |
|                        |   | reading CD-RW   | –    | 48   | –    | MHz  |  |
| <b>Settling time</b>   |   |   |      |      |      |      |  |
| t <sub>set(cen)</sub>  | settling time central segment outputs         | CD-R write mode; 2% accuracy of read level (60 μA);<br>ΔI <sub>o</sub> = 3 mA to 60 μA; note 1    | –    | 15   | –    | ns   |  |
| t <sub>set(sat)</sub>  | settling time satellite segment outputs       | CD-R write mode; 2% accuracy of read level (15 μA);<br>ΔI <sub>o</sub> = 0.75 mA to 15 μA; note 1 | –    | 30   | –    | ns   |  |
| <b>Sensitivity</b>     |   |   |      |      |      |      |  |
| S <sub>DVD+R</sub>     | output current sensitivity for DVD+R          | writing; λ = 655 nm   |      |      |      |      |  |
|                        |   | I <sub>o(cen)</sub>   | –    | 1.47 | –    | A/W  |  |
|                        |   | I <sub>o(sat)</sub>   | –    | 5.63 | –    | A/W  |  |
|                        |   | I <sub>o(RFP)</sub>   | –    | 1.36 | –    | A/W  |  |
|                        |   | I <sub>o(RFN)</sub>   | –    | 1.39 | –    | A/W  |  |
| S <sub>CD-R</sub>      | output current sensitivity for CD-R           | writing; λ = 785 nm   |      |      |      |      |  |
|                        |   | I <sub>o(cen)</sub>   | –    | 37.5 | –    | A/W  |  |
|                        |   | I <sub>o(sat)</sub>   | –    | 142  | –    | A/W  |  |
|                        |   | I <sub>o(RFP)</sub>   | –    | 2.99 | –    | A/W  |  |
|                        |   | I <sub>o(RFN)</sub>   | –    | 3.14 | –    | A/W  |  |
| S <sub>DVD+RW</sub>    | output current sensitivity for DVD+RW         | writing; λ = 655 nm   |      |      |      |      |  |
|                        |   | I <sub>o(cen)</sub>   | –    | 2.89 | –    | A/W  |  |
|                        |   | I <sub>o(sat)</sub>   | –    | 11.1 | –    | A/W  |  |
|                        |   | I <sub>o(RFP)</sub>   | –    | 2.73 | –    | A/W  |  |
|                        |   | I <sub>o(RFN)</sub>   | –    | 2.78 | –    | A/W  |  |
|                        |   | reading; λ = 655 nm   |      |      |      |      |  |
|                        |   | I <sub>o(cen)</sub>   | –    | 42.8 | –    | A/W  |  |
|                        |   | I <sub>o(sat)</sub>   | –    | 163  | –    | A/W  |  |
| I <sub>o(RFP)</sub>    | –   | 48.3  | –    | A/W  |      |      |  |
|                        |   | I <sub>o(RFN)</sub>   | –    | 44.3 | –    | A/W  |  |

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| SYMBOL               | PARAMETER                              | CONDITIONS                  | MIN. | TYP. | MAX. | UNIT |  |
|----------------------|--|-----------------------------|------|------|------|------|--|
| S <sub>CD-RW</sub>   | output current sensitivity for CD-RW   | writing; $\lambda = 785$ nm |      |      |      |      |  |
|                      |  | $I_{o(cen)}$                | –    | 5.35 | –    | A/W  |  |
|                      |  | $I_{o(sat)}$                | –    | 20.4 | –    | A/W  |  |
|                      |  | $I_{o(RFP)}, I_{o(RFN)}$    | –    | 5.05 | –    | A/W  |  |
|                      |  | $I_{o(RFP)}, I_{o(RFN)}$    | –    | 5.13 | –    | A/W  |  |
|                      |  | reading; $\lambda = 785$ nm |      |      |      |      |  |
|                      |  | $I_{o(cen)}$                | –    | 151  | –    | A/W  |  |
|                      |  | $I_{o(sat)}$                | –    | 590  | –    | A/W  |  |
| S <sub>DVD-ROM</sub> | output current sensitivity for DVD-ROM | reading; $\lambda = 655$ nm |      |      |      |      |  |
|                      |  | $I_{o(cen)}$                | –    | 21.6 | –    | A/W  |  |
|                      |  | $I_{o(sat)}$                | –    | 83.6 | –    | A/W  |  |
|                      |  | $I_{o(RFP)}$                | –    | 21.0 | –    | A/W  |  |
|                      |  | $I_{o(RFN)}$                | –    | 21.0 | –    | A/W  |  |
| S <sub>CD-ROM</sub>  | output current sensitivity for CD-ROM  | reading; $\lambda = 785$ nm |      |      |      |      |  |
|                      |  | $I_{o(cen)}$                | –    | 74.8 | –    | A/W  |  |
|                      |  | $I_{o(sat)}$                | –    | 289  | –    | A/W  |  |
|                      |  | $I_{o(RFP)}$                | –    | 80.0 | –    | A/W  |  |
|                      |  | $I_{o(RFN)}$                | –    | 82.0 | –    | A/W  |  |

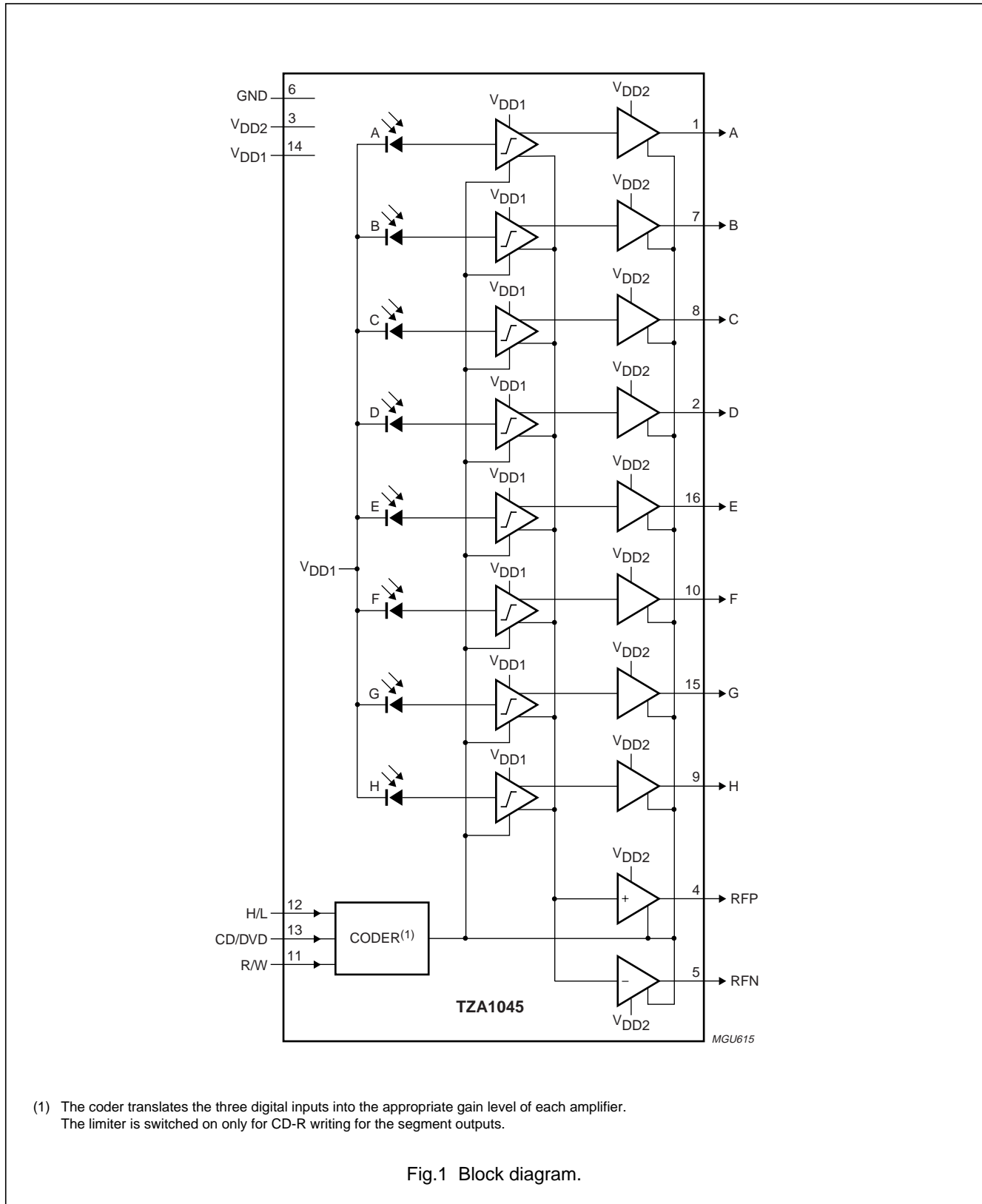
**Note**

1. The settling time includes the recovery time.

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BLOCK DIAGRAM



(1) The coder translates the three digital inputs into the appropriate gain level of each amplifier. The limiter is switched on only for CD-R writing for the segment outputs.

Fig.1 Block diagram.

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**PINNING**

| SYMBOL           | PIN | DESCRIPTION   |
|------------------|-----|---|
| A                | 1   | central segment output A                            |
| D                | 2   | central segment output D                            |
| V <sub>DD2</sub> | 3   | supply voltage back-end                             |
| RFP              | 4   | positive RF output                                  |
| RFN              | 5   | negative RF output                                  |
| GND              | 6   | ground  |
| B                | 7   | central segment output B                            |
| C                | 8   | central segment output C                            |
| H                | 9   | satellite segment output H                          |
| F                | 10  | satellite segment output F                          |
| R/W              | 11  | gain select switch for reading or writing           |
| H/L              | 12  | gain select switch for high or low reflective media |
| CD/DVD           | 13  | gain select switch for CD or DVD                    |
| V <sub>DD1</sub> | 14  | supply voltage front-end                            |
| G                | 15  | satellite segment output G                          |
| E                | 16  | satellite segment output E                          |

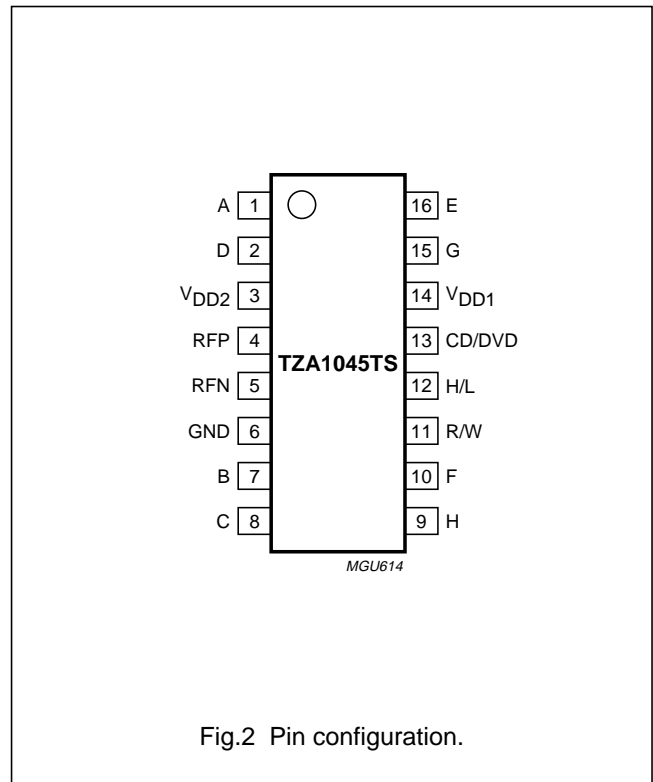


Fig.2 Pin configuration.

**MODE SELECTION**

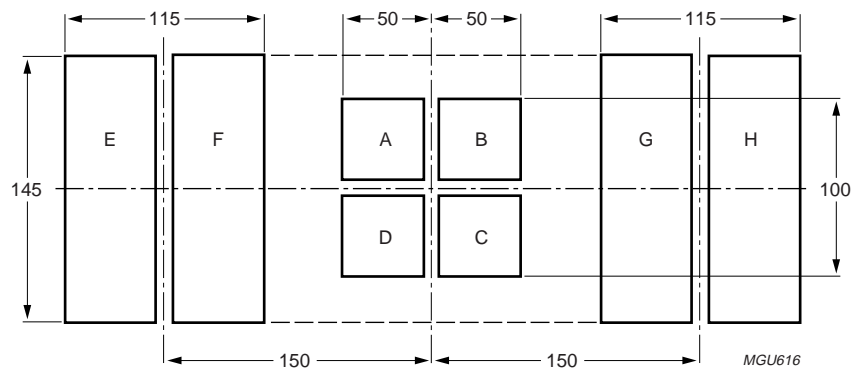
**Table 1** Coder switching

| PIN LEVEL |      |        | MODE             |
|-----------|------|--------|------------------|
| R/W       | H/L  | CD/DVD |                  |
| LOW       | LOW  | LOW    | DVD+R; writing   |
| LOW       | LOW  | HIGH   | CD-R; writing    |
| LOW       | HIGH | LOW    | DVD+RW; writing  |
| LOW       | HIGH | HIGH   | CD-RW; writing   |
| HIGH      | LOW  | LOW    | DVD-ROM; reading |
| HIGH      | LOW  | HIGH   | CD-ROM; reading  |
| HIGH      | HIGH | LOW    | DVD+RW; reading  |
| HIGH      | HIGH | HIGH   | CD-RW; reading   |

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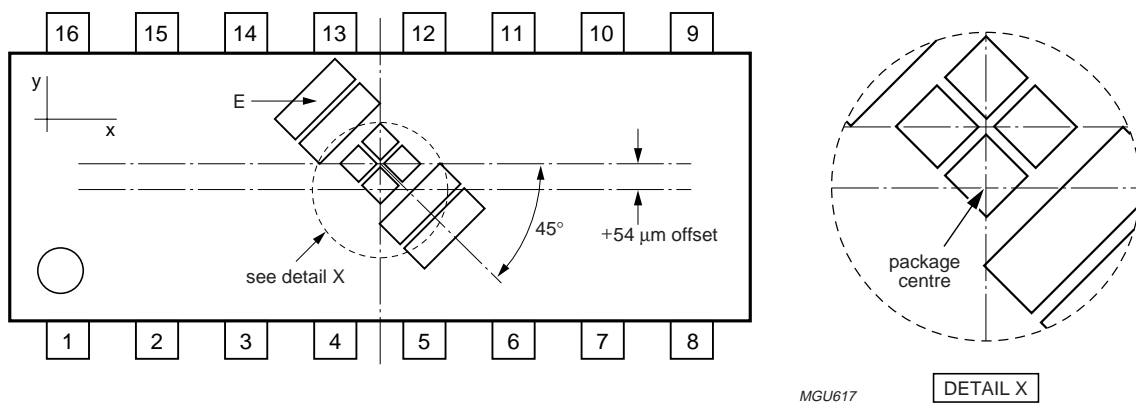
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MECHANICAL DATA



Dimensions in μm.  
Space between central segments: <1 μm.  
Space between satellite segments: <1 μm.

Fig.3 Photodiode configuration.



45° angle is with respect to the leadframe.  
Drawing is not to scale.  
Package window is not shown.

Fig.4 Diagram showing position of the photodiode array with respect to the package (top view).



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## LIMITING VALUES

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

| SYMBOL           | PARAMETER   | MIN.            | MAX.                               | UNIT   |
|------------------|---|-----------------|------------------------------------|--------|
| $V_{DD1}$        | supply voltage front-end  | -0.3            | +5.5                               | V      |
| $V_{DD2}$        | supply voltage back-end   | -0.3            | +5.5                               | V      |
| $\Delta V_{DD1}$ | supply voltage difference with respect to $V_{DD2}$                           | $V_{DD2} - 0.3$ | $V_{DD2} + 0.3$                    | V      |
| $\Delta V_{DD2}$ | supply voltage difference with respect to $V_{DD1}$                           | $V_{DD1} - 0.3$ | $V_{DD1} + 0.3$                    | V      |
| $V_n$            | voltage at pins<br>A, B, C, D, E, F, G, H, RFP and RFN<br>CD/DVD, H/L and R/W | -0.3<br>-0.3    | $V_{DD2} + 0.3$<br>$V_{DD1} + 0.3$ | V<br>V |

## CHARACTERISTICS

$V_{DD1} = V_{DD2} = 5$  V; pin R/W = LOW; pin H/L = LOW; pin CD/DVD = HIGH;  $V_A$  to  $V_H = 2.5$  V;  $V_{RFP} = V_{RFN} = 2.5$  V; measured in dark conditions;  $T_{amb} = 25$  °C; unless otherwise specified.

| SYMBOL  | PARAMETER                              | CONDITIONS  | MIN.   | TYP.   | MAX.   | UNIT   |
|---|--|---|--|--|--|--|
| <b>Supplies</b>                                     |  |   |  |  |  |  |
| $V_{DD1}$   | supply voltage front-end               | note 1  | 4.5  | 5.0  | 5.5  | V  |
| $V_{DD2}$   | supply voltage back-end                | note 1  | 4.5  | 5.0  | 5.5  | V  |
| $I_{DD1}$   | supply current front-end               | dark conditions; note 2<br>writing DVD+R<br>writing CD-R<br>writing DVD+RW<br>writing CD-RW<br>reading DVD-ROM<br>reading CD-ROM<br>reading DVD+RW<br>reading CD-RW | 12.8<br>30.9<br>12.9<br>11.4<br>31.9<br>31.3<br>31.7<br>30.9 | 17.4<br>41.2<br>17.2<br>15.2<br>42.5<br>41.8<br>42.2<br>41.2 | 21.3<br>51.5<br>21.5<br>19.0<br>53.1<br>52.2<br>52.8<br>51.5 | mA<br>mA<br>mA<br>mA<br>mA<br>mA<br>mA<br>mA         |
| $I_{DD2}$   | supply current back-end                | dark conditions;<br>$T_{amb} = 0$ to $70$ °C; note 2  | 4.5  | 6.0  | 7.5  | mA   |
| <b>Temperature range</b>                            |  |   |  |  |  |  |
| $T_{amb}$   | ambient temperature                    |   | 0  | -  | 70   | °C   |
| <b>Central segment outputs; pins A, B, C, and D</b> |  |   |  |  |  |  |
| $B_{-3dB}$  | channel A, B, C, and D<br>RF bandwidth | $I_o = 1.5$ mA<br>writing DVD+R<br>writing CD-R<br>writing DVD+RW<br>writing CD-RW<br>reading DVD-ROM<br>reading CD-ROM<br>reading DVD+RW<br>reading CD-RW          | 140<br>170<br>300<br>125<br>195<br>110<br>170<br>90          | 170<br>205<br>360<br>150<br>211<br>128<br>205<br>109         | 200<br>235<br>420<br>175<br>245<br>150<br>235<br>130         | MHz<br>MHz<br>MHz<br>MHz<br>MHz<br>MHz<br>MHz<br>MHz |

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| SYMBOL   | PARAMETER                                     | CONDITIONS  | MIN. | TYP. | MAX.          | UNIT                         |
|--|---|---|------|------|---------------|------------------------------|
| $t_{set}$  | settling time                                 | CD-R write mode;<br>$\Delta I_o = 3 \text{ mA to } 60 \text{ } \mu\text{A}$ ; 2%<br>accuracy of read level (60 $\mu\text{A}$ );<br>note 3 | –    | 15   | –             | ns                           |
| $\Delta t_{d(g)}$                                | group delay variation                         | $I_o = 1.5 \text{ mA}$ ; $f_o = 13 \text{ to } 130 \text{ MHz}$<br>reading DVD-ROM  | –    | 0.5  | –             | ns                           |
|  |   | reading CD-ROM  | –    | 0.75 | –             | ns                           |
|  |   | reading DVD+RW  | –    | 0.5  | –             | ns                           |
|  |   | reading CD-RW   | –    | 0.9  | –             | ns                           |
| $M_{sens}$                                       | channel A, B, C and D<br>matching sensitivity | note 4  | –5   | –    | +5            | %                            |
| $V_o$  | output voltage range                          |   | 1    | –    | $V_{DD2} - 1$ | V                            |
| $I_o$  | output current                                |   | 0    | 3    | 8             | mA                           |
| $I_{o(offset)}$                                  | output offset current                         | dark conditions;<br>$T_{amb} = 0 \text{ to } 70 \text{ } ^\circ\text{C}$  | –15  | –    | +7            | $\mu\text{A}$                |
| $I_{o(clip)}$                                    | output current clipping<br>level              | CD-R writing; note 5  | 5    | –    | 8             | mA                           |
| $I_{n(o)}$                                       | spot noise output current                     | $I_o = 2.0 \text{ mA}$ ; $f_o = 50 \text{ MHz}$<br>reading DVD-ROM  | –    | 480  | –             | $\text{pA}/\sqrt{\text{Hz}}$ |
|  |   | reading CD-ROM  | –    | 1660 | –             | $\text{pA}/\sqrt{\text{Hz}}$ |
|  |   | reading DVD+RW  | –    | 685  | –             | $\text{pA}/\sqrt{\text{Hz}}$ |
|  |   | reading CD-RW   | –    | 2500 | –             | $\text{pA}/\sqrt{\text{Hz}}$ |
| <b>Differential RF outputs; pins RFP and RFN</b> |   |   |      |      |               |                              |
| $B_{-3dB}$                                       | channel RFP and RFN<br>RF bandwidth           | $I_o = 1 \text{ mA}$<br>writing DVD+R   | 140  | 171  | 200           | MHz                          |
|  |   | writing CD-R  | 240  | 289  | 340           | MHz                          |
|  |   | writing DVD+RW  | 300  | 360  | 420           | MHz                          |
|  |   | writing CD-RW   | 125  | 148  | 175           | MHz                          |
|  |   | reading DVD-ROM   | 160  | 191  | 220           | MHz                          |
|  |   | reading CD-ROM  | 110  | 130  | 150           | MHz                          |
|  |   | reading DVD+RW  | 160  | 188  | 220           | MHz                          |
| reading CD-RW                                    | 90  | 110   | 130  | MHz  |               |                              |
| $t_{set}$  | settling time                                 | CD-R write mode;<br>$\Delta I_o = 2 \text{ mA to } 40 \text{ } \mu\text{A}$ ; 2%<br>accuracy of read level (40 $\mu\text{A}$ );<br>note 3 | –    | 15   | –             | ns                           |
| $\Delta t_{d(g)}$                                | group delay variation                         | $I_o = 1 \text{ mA}$ ; $f_i = 13 \text{ to } 130 \text{ MHz}$<br>reading DVD-ROM  | –    | 0.5  | –             | ns                           |
|  |   | reading CD-ROM  | –    | 0.75 | –             | ns                           |
|  |   | reading DVD+RW  | –    | 0.5  | –             | ns                           |
|  |   | reading CD-RW   | –    | 0.9  | –             | ns                           |

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| SYMBOL   | PARAMETER                                  | CONDITIONS   | MIN.  | TYP.   | MAX.   | UNIT   |
|--|--|--|---|--|--|--|
| CMR  | common mode ripple                         | $I_o = 2 \text{ mA}$ (peak); up to 130 MHz; note 6   | –   | –30  | –  | dB   |
| $V_o$  | output voltage range                       |  | 1   | –  | $V_{DD2} - 1$                                      | V  |
| $I_o$  | output current                             |  | 0   | 2  | 8  | mA   |
| $I_{o(\text{offset})}$                               | output offset current                      | dark conditions;<br>$T_{\text{amb}} = 0 \text{ to } 70 \text{ }^\circ\text{C}$<br>pin RFP<br>pin RFN   | –13<br>+14                                      | –<br>–   | 0<br>0   | $\mu\text{A}$<br>$\mu\text{A}$   |
| $I_{n(o)}$   | spot noise differential output current     | $I_o = 3 \text{ mA}$ ; $f_o = 50 \text{ MHz}$<br>reading DVD-ROM<br>reading CD-ROM<br>reading DVD+RW<br>reading CD-RW  | –<br>–<br>–<br>–                                | 360<br>1250<br>515<br>1850                       | –<br>–<br>–<br>–                                   | $\text{pA}/\sqrt{\text{Hz}}$<br>$\text{pA}/\sqrt{\text{Hz}}$<br>$\text{pA}/\sqrt{\text{Hz}}$<br>$\text{pA}/\sqrt{\text{Hz}}$ |
| <b>Satellite segment outputs; pins E, F, G and H</b> |  |  |   |  |  |  |
| $B_{-3\text{dB}}$                                    | channel E, F, G and H RF bandwidth         | $I_o = 0.5 \text{ mA}$<br>writing DVD+R<br>writing CD-R<br>writing DVD+RW<br>writing CD-RW<br>reading DVD-ROM<br>reading CD-ROM<br>reading DVD+RW<br>reading CD-RW | 140<br>80<br>300<br>125<br>90<br>45<br>80<br>40 | 171<br>97<br>360<br>148<br>111<br>54<br>97<br>48 | 200<br>115<br>420<br>175<br>130<br>65<br>115<br>55 | MHz<br>MHz<br>MHz<br>MHz<br>MHz<br>MHz<br>MHz<br>MHz   |
| $t_{\text{set}}$                                     | settling time                              | CD-R write mode;<br>$\Delta I_o = 0.75 \text{ mA to } 15 \text{ } \mu\text{A}$ ; 2% accuracy of read level (15 $\mu\text{A}$ ); note 3                             | –   | 30   | –  | ns   |
| $M_{\text{sens}}$                                    | channel E, F, G and H matching sensitivity | note 7   | –5  | –  | +5   | %  |
| $V_o$  | output voltage range                       |  | 1   | –  | $V_{DD2} - 1$                                      | V  |
| $I_o$  | output current                             |  | 0   | 0.75   | 8  | mA   |
| $I_{o(\text{offset})}$                               | output offset current                      | dark conditions;<br>$T_{\text{amb}} = 0 \text{ to } 70 \text{ }^\circ\text{C}$   | –31   | –  | +25  | $\mu\text{A}$  |
| $I_{o(\text{clip})}$                                 | current clipping level                     | CD-R writing; note 5   | 5   | –  | 8  | mA   |
| <b>Control inputs; pins R/W, H/L and CD/DVD</b>      |  |  |   |  |  |  |
| $Z_{i(\text{pd})}$                                   | pull-down input impedance                  |  | –   | 230  | –  | $\text{k}\Omega$   |
| $V_{\text{IL}}$                                      | LOW-level input voltage                    |  | –0.2  | –  | +1   | V  |
| $V_{\text{IH}}$                                      | HIGH-level input voltage                   |  | 2.1   | –  | $V_{DD2} + 0.2$                                    | V  |
| $t_{\text{t(G)}}$                                    | gain transition time                       |  | –   | 2  | –  | $\mu\text{s}$  |

# Photodiode and amplifier IC for CD and DVD applications

TZA1045

| SYMBOL                     | PARAMETER                              | CONDITIONS                           | MIN. | TYP.                     | MAX. | UNIT |   |     |
|----------------------------|--|--------------------------------------|------|--------------------------|------|------|---|-----|
| <b>Sensitivity; note 8</b> |  |                                      |      |                          |      |      |   |     |
| S <sub>DVD+R</sub>         | output current sensitivity for DVD+R   | writing; $\lambda = 655$ nm; note 9  |      |                          |      |      |   |     |
|                            |  | $I_{o(cen)}$                         | –    | 1.47                     | –    | A/W  |   |     |
|                            |  | $I_{o(sat)}$                         | –    | 5.63                     | –    | A/W  |   |     |
|                            |  | $I_{o(RFP)}$                         | –    | 1.36                     | –    | A/W  |   |     |
|                            |  | $I_{o(RFN)}$                         | –    | 1.39                     | –    | A/W  |   |     |
| S <sub>CD-R</sub>          | output current sensitivity for CD-R    | writing; $\lambda = 785$ nm; note 10 |      |                          |      |      |   |     |
|                            |  | $I_{o(cen)}$                         | –    | 37.5                     | –    | A/W  |   |     |
|                            |  | $I_{o(sat)}$                         | –    | 142                      | –    | A/W  |   |     |
|                            |  | $I_{o(RFP)}$                         | –    | 2.99                     | –    | A/W  |   |     |
|                            |  | $I_{o(RFN)}$                         | –    | 3.14                     | –    | A/W  |   |     |
| S <sub>DVD+RW</sub>        | output current sensitivity for DVD+RW  | writing; $\lambda = 655$ nm; note 9  |      |                          |      |      |   |     |
|                            |  | $I_{o(cen)}$                         | –    | 2.89                     | –    | A/W  |   |     |
|                            |  | $I_{o(sat)}$                         | –    | 11.1                     | –    | A/W  |   |     |
|                            |  | $I_{o(RFP)}$                         | –    | 2.73                     | –    | A/W  |   |     |
|                            |  |                                      |      | $I_{o(RFN)}$             | –    | 2.78 | – | A/W |
|                            |  | reading; $\lambda = 655$ nm; note 11 |      |                          |      |      |   |     |
|                            |  | $I_{o(cen)}$                         | –    | 42.8                     | –    | A/W  |   |     |
|                            |  | $I_{o(sat)}$                         | –    | 163                      | –    | A/W  |   |     |
|                            |  | $I_{o(RFP)}$                         | –    | 48.3                     | –    | A/W  |   |     |
|                            |  | $I_{o(RFN)}$                         | –    | 44.3                     | –    | A/W  |   |     |
| S <sub>CD-RW</sub>         | output current sensitivity for CD-RW   | writing; $\lambda = 785$ nm; note 9  |      |                          |      |      |   |     |
|                            |  | $I_{o(cen)}$                         | –    | 5.35                     | –    | A/W  |   |     |
|                            |  | $I_{o(sat)}$                         | –    | 20.4                     | –    | A/W  |   |     |
|                            |  | $I_{o(RFP)}, I_{o(RFN)}$             | –    | 5.05                     | –    | A/W  |   |     |
|                            |  |                                      |      | $I_{o(RFP)}, I_{o(RFN)}$ | –    | 5.13 | – | A/W |
|                            |  | reading; $\lambda = 785$ nm; note 11 |      |                          |      |      |   |     |
|                            |  | $I_{o(cen)}$                         | –    | 151                      | –    | A/W  |   |     |
|                            |  | $I_{o(sat)}$                         | –    | 590                      | –    | A/W  |   |     |
|                            |  | $I_{o(RFP)}, I_{o(RFN)}$             | –    | 164                      | –    | A/W  |   |     |
|                            |  | $I_{o(RFP)}, I_{o(RFN)}$             | –    | 168                      | –    | A/W  |   |     |
| S <sub>DVD-ROM</sub>       | output current sensitivity for DVD-ROM | reading; $\lambda = 655$ nm; note 11 |      |                          |      |      |   |     |
|                            |  | $I_{o(cen)}$                         | –    | 21.6                     | –    | A/W  |   |     |
|                            |  | $I_{o(sat)}$                         | –    | 83.6                     | –    | A/W  |   |     |
|                            |  | $I_{o(RFP)}$                         | –    | 21.0                     | –    | A/W  |   |     |
|                            |  | $I_{o(RFN)}$                         | –    | 21.0                     | –    | A/W  |   |     |

# Photodiode and amplifier IC for CD and DVD applications

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| SYMBOL              | PARAMETER                             | CONDITIONS                                    | MIN. | TYP.  | MAX. | UNIT |
|---------------------|---------------------------------------|---|------|-------|------|------|
| S <sub>CD-ROM</sub> | output current sensitivity for CD-ROM | reading; $\lambda = 785 \text{ nm}$ ; note 11 |      |       |      |      |
|                     |                                       | $I_{o(\text{cen})}$                           | –    | 74.8  | –    | A/W  |
|                     |                                       | $I_{o(\text{sat})}$                           | –    | 289   | –    | A/W  |
|                     |                                       | $I_{o(\text{RFP})}$                           | –    | 80.0  | –    | A/W  |
|                     |                                       | $I_{o(\text{RFN})}$                           | –    | 82.02 | –    | A/W  |

## Notes

- The supplies are connected internally by diodes. Differences between the supply voltages should not exceed 0.3 V.
- Estimated average power consumption (typical value):  
 $P = V_{DD} \times (1.4 \times I_{o(\text{AV})} \times 9 + I_{DD1} + I_{DD2})$  where  $I_{o(\text{AV})}$  is the average output current.  
 Conditions:  $V_{DD} = V_{DD1} = V_{DD2}$  and  $I_o < 8 \text{ mA}$ .
- The settling time includes the recovery time.
- Outputs A, B, C, and D:  $I_o = 3 \text{ mA}$  output current. Definition of matching: 
$$\frac{I_{o(\text{max})} - I_{o(\text{min})}}{(I_A + I_B + I_C + I_D) \times \frac{1}{4}}$$
- The clipping function is active in the CD-R write mode for the segment outputs (not for outputs RFP and RFN) and in the read mode for all outputs. In the read mode, the clipping level is increased to 8 mA.
- Definition: 
$$20 \log \times \frac{I_{\text{RFP}} + I_{\text{RFN}}}{I_{\text{RFP}} - I_{\text{RFN}}}$$
- Outputs E, F, G, and H outputs:  $I_o = 1.5 \text{ mA}$  output current. Definition of matching: 
$$\frac{I_{o(\text{max})} - I_{o(\text{min})}}{(I_E + I_F + I_G + I_H) \times \frac{1}{4}}$$
- The sensitivity of the TZA1045 is specified in A/W because it has current outputs. In the application diagram (see Fig.5) the resistors of  $150 \Omega$  convert the currents into voltages (V/W). The maximum absolute spread is  $\pm 10\%$ .
- Writing without clipping.
- Writing with clipping in CD-R mode for all segment outputs (not outputs RFP and RFN).
- Reading with clipping active and switched to a level of typ. 8 mA.

Photodiode and amplifier IC  
for CD and DVD applications

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APPLICATION INFORMATION

An application example for the TZA1045 is shown in Fig.5. The satellite segment pins are cross-coupled to be suitable for rewritable applications.

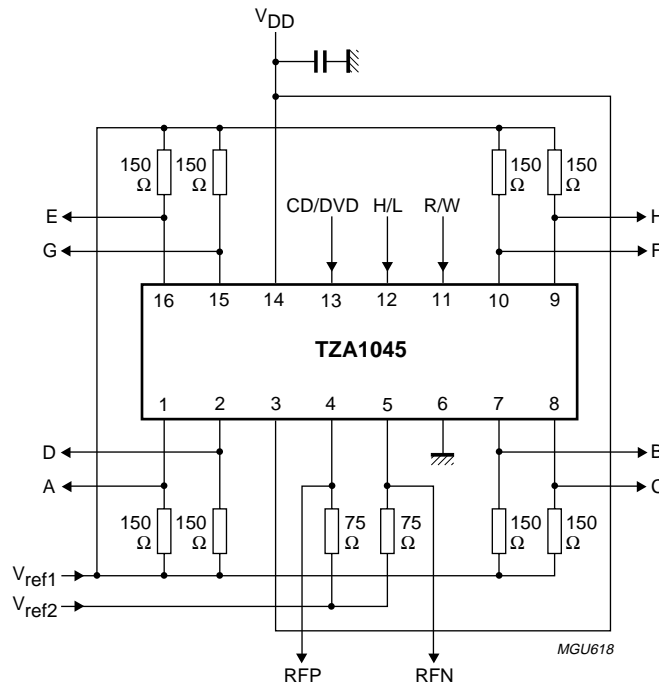


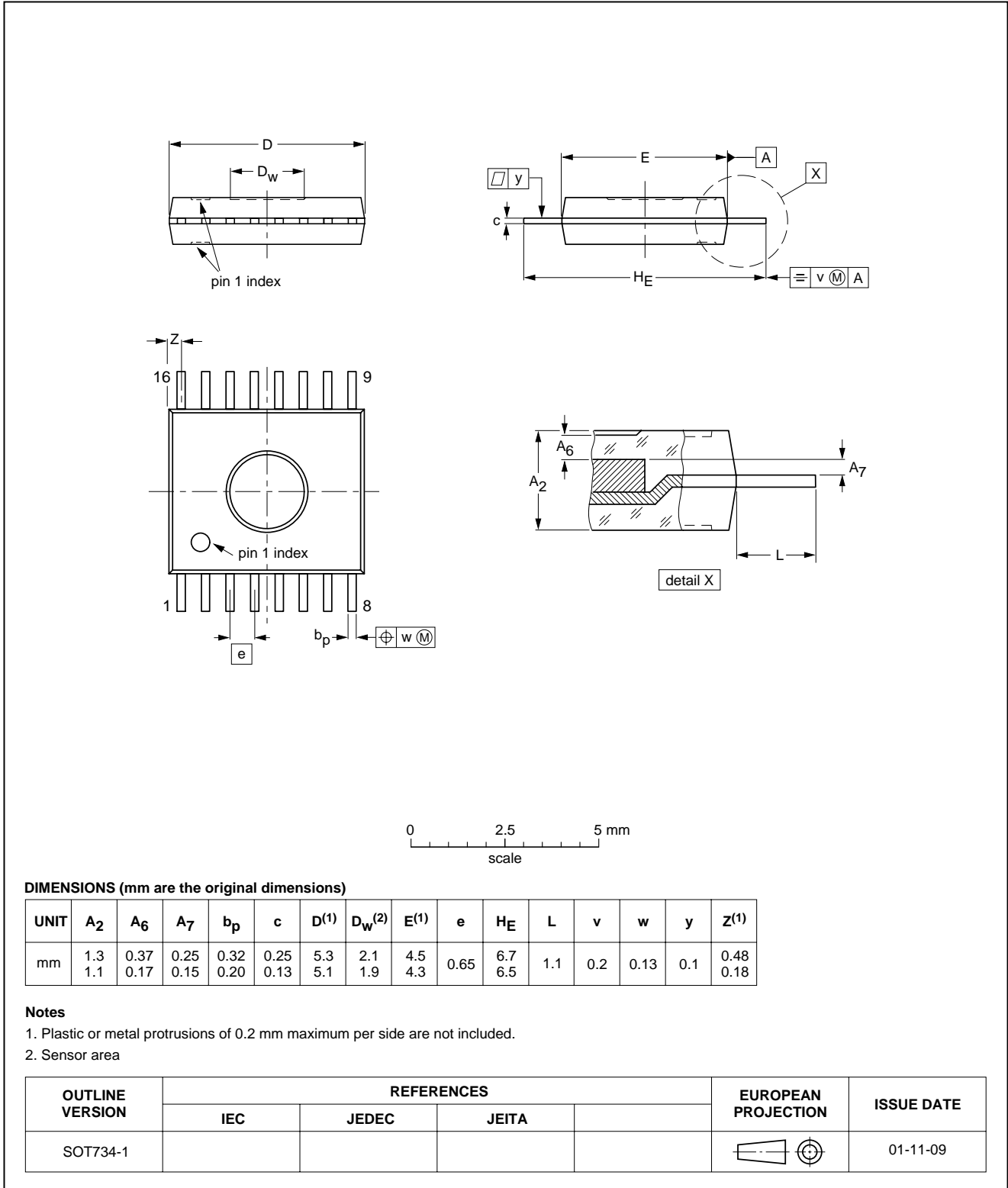
Fig.5 Application example.

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PACKAGE OUTLINE

SSOP16T: plastic shrink small outline package/transparent; 16 leads (straight); body width 4.4 mm SOT734-1



## Photodiode and amplifier IC for CD and DVD applications

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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 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.

#### 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 250 °C. The top-surface temperature of the packages should preferably be kept below 220 °C for thick/large packages, and below 235 °C for small/thin packages.

#### 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 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.



# Photodiode and amplifier IC for CD and DVD applications

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

| PACKAGE <sup>(1)</sup>   | SOLDERING METHOD                  |                       |
|--|-----------------------------------|-----------------------|
|  | WAVE                              | REFLOW <sup>(2)</sup> |
| BGA, LBGA, LFBGA, SQFP, TFBGA, VFBGA                             | not suitable                      | suitable              |
| HBCC, HBGA, HLQFP, HSQFP, HSOP, HTQFP, HTSSOP, HVQFN, HVSON, SMS | not suitable <sup>(3)</sup>       | suitable              |
| PLCC <sup>(4)</sup> , SO, SOJ                                    | suitable                          | suitable              |
| LQFP, QFP, TQFP  | not recommended <sup>(4)(5)</sup> | suitable              |
| SSOP, TSSOP, VSO   | not recommended <sup>(6)</sup>    | suitable              |

### Notes

1. For more detailed information on the BGA packages refer to the “(LF)BGA Application Note” (AN01026); order a copy from your Philips Semiconductors sales office.
2. 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”.
3. 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.
4. 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.
5. Wave soldering is suitable for LQFP, TQFP and QFP 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.
6. Wave soldering is 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.

# Photodiode and amplifier IC for CD and DVD applications

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## DATA SHEET STATUS

| LEVEL | DATA SHEET STATUS <sup>(1)</sup> | PRODUCT STATUS <sup>(2)(3)</sup> | DEFINITION   |
|-------|----------------------------------|----------------------------------|--|
| I     | Objective data                   | Development                      | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.  |
| II    | Preliminary data                 | Qualification                    | This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.             |
| III   | Product data                     | Production                       | This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). |

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3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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.

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**NOTES**

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