

**INTEGRATED CIRCUITS**

# DATA SHEET

## **TDA8042M** Quadrature demodulator

Product specification  
File under Integrated Circuits, IC02

1997 Apr 11

## Quadrature demodulator

## TDA8042M

### FEATURES

- 5 V supply voltage
- Internal voltage reference
- 350 to 650 MHz input frequency range
- On-chip 0° and 90° phase shifter
- Symbol rate up to 45 Msymbols/s
- High input sensitivity
- Built-in voltage stabilizer
- AGC amplifier with 21 dB control range
- AGC detector.

### APPLICATION

- Binary Phase-Shift Keying (BPSK) and Quadrature Phase-Shift Keying (QPSK) demodulation.

### GENERAL DESCRIPTION

The TDA8042M is a monolithic bipolar IC dedicated for BPSK and QPSK demodulation. It is designed to be used together with the TDA8043 as part of a complete BPSK/QPSK satellite demodulator and decoder.

The bandwidth of the TDA8042M allows symbol rates up to 45 Msymbols/s. It includes two matched mixers, an IF gain controlled amplifier, a symmetrical oscillator, a 0°/90° phase shifter, two low-pass filters and two matched baseband amplifiers.

The high input sensitivity makes interfacing with various sources easy. The input sensitivity can be adjusted by means of an internal AGC amplifier.

The oscillator operates at half the IF frequency. The local oscillator signal driving the mixers is made by doubling the oscillator frequency by an internal frequency multiplier. The oscillator frequency can be set by the appropriate external LC tank circuit. The internal wideband phase shifter provides two oscillator signals which are 90 degrees out of phase to drive the mixers.

An AGC detector at the I and Q outputs makes it possible to keep the I and Q signals at a constant level to drive the analog-to-digital converters of the TDA8043.

### QUICK REFERENCE DATA

| SYMBOL                   | PARAMETER                                     | CONDITIONS              | MIN. | TYP. | MAX. | UNIT       |
|--------------------------|---|-------------------------|------|------|------|------------|
| $V_{CC}$                 | supply voltage                                |                         | 4.75 | 5.0  | 5.25 | V          |
| $I_{CC}$                 | supply current                                | $V_{CC} = 5.0\text{ V}$ | 54   | 67.5 | 81   | mA         |
| $V_{i(RF)}$              | operating input level                         |                         | –    | 57   | –    | dB $\mu$ V |
| $f_{i(RF)}$              | RF input signal frequency                     |                         | 350  | –    | 650  | MHz        |
| $V_{oI/Q(p-p)}$          | I and Q output voltage (peak-to-peak value)   |                         | –    | 0.8  | –    | V          |
| $\Delta E_{\Phi(I-Q)}$   | phase matching error between I and Q channels |                         | –    | 0.7  | 2    | deg        |
| $\Delta E_{G(I-Q)}$      | gain matching error between I and Q channels  |                         | –    | 0.15 | 0.8  | dB         |
| $\Delta G_{\text{tilt}}$ | gain tilt error between I and Q channels      |                         | –    | 0.3  | 0.5  | dB         |

### ORDERING INFORMATION

| TYPE NUMBER | PACKAGE |   |          |
|-------------|---------|---|----------|
|             | NAME    | DESCRIPTION   | VERSION  |
| TDA8042M    | SSOP20  | plastic shrink small outline package; 20 leads; body width 4.4 mm | SOT266-1 |

# Quadrature demodulator

# TDA8042M

## BLOCK DIAGRAM

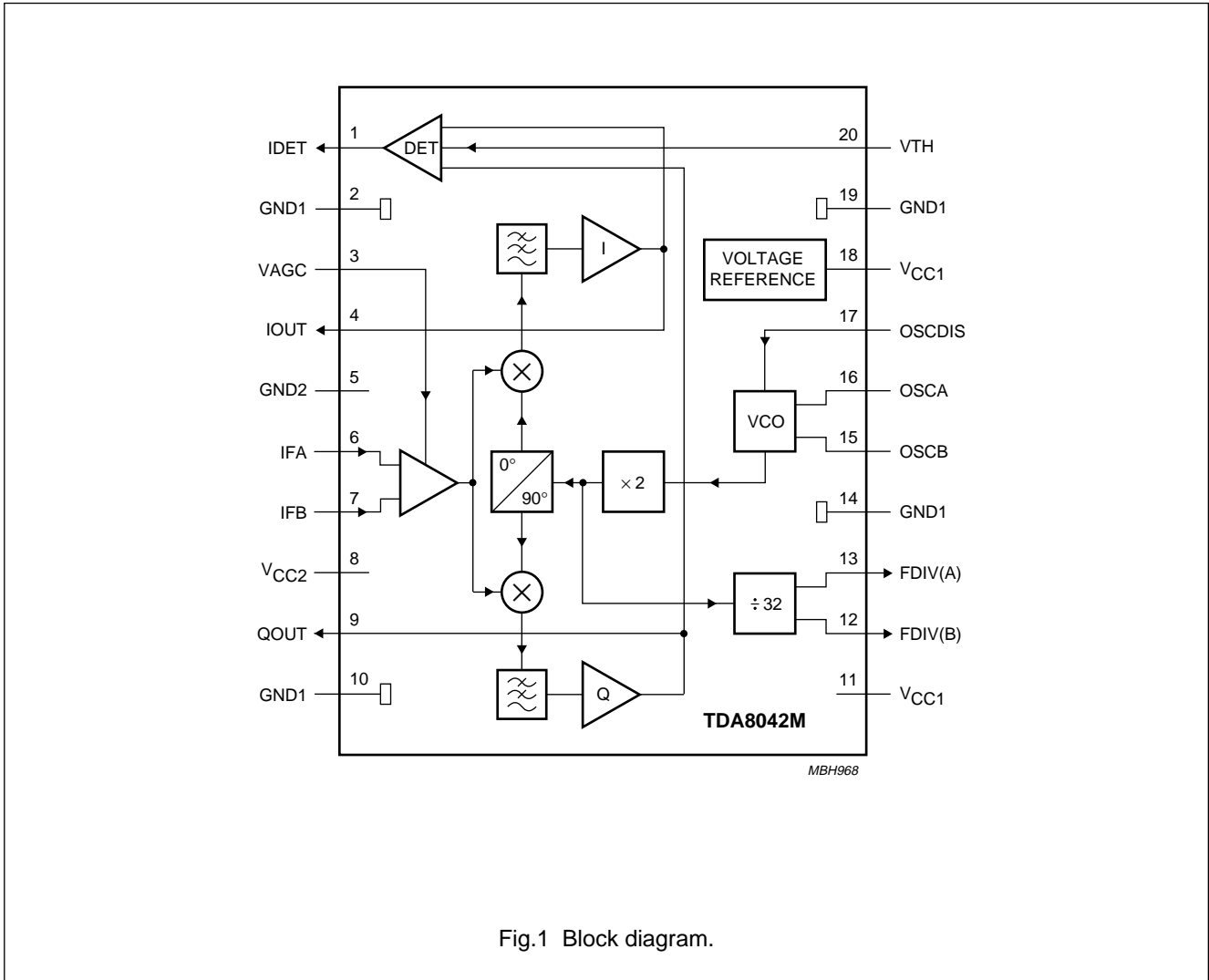


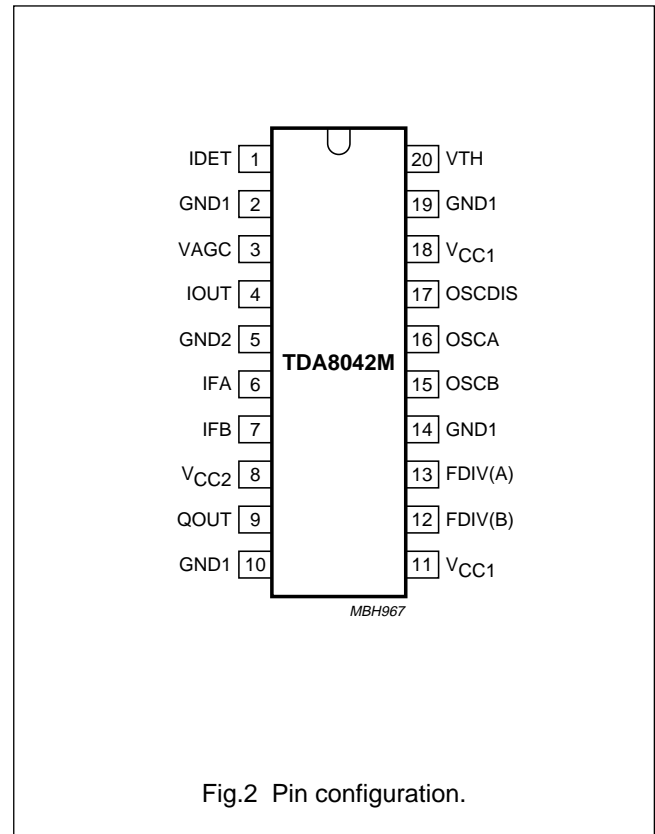
Fig.1 Block diagram.

## Quadrature demodulator

## TDA8042M

## PINNING

| SYMBOL           | PIN | DESCRIPTION                 |
|------------------|-----|-----------------------------|
| IDET             | 1   | AGC detector output signal  |
| GND1             | 2   | ground                      |
| VAGC             | 3   | gain control input voltage  |
| IOUT             | 4   | I channel amplifier output  |
| GND2             | 5   | ground                      |
| IFA              | 6   | IF input A                  |
| IFB              | 7   | IF input B                  |
| V <sub>CC2</sub> | 8   | supply voltage 2            |
| QOUT             | 9   | Q channel amplifier output  |
| GND1             | 10  | ground                      |
| V <sub>CC1</sub> | 11  | supply voltage 1            |
| FDIV(B)          | 12  | prescaler output B          |
| FDIV(A)          | 13  | prescaler output A          |
| GND1             | 14  | ground                      |
| OSCB             | 15  | oscillator tank circuit B   |
| OSCA             | 16  | oscillator tank circuit A   |
| OSCDIS           | 17  | oscillator disable input    |
| V <sub>CC1</sub> | 18  | supply voltage 1            |
| GND1             | 19  | ground                      |
| VTH              | 20  | AGC threshold voltage input |



## Quadrature demodulator

## TDA8042M

**LIMITING VALUES**

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

| SYMBOL    | PARAMETER                     | MIN. | MAX.               | UNIT |
|-----------|-------------------------------|------|--------------------|------|
| $V_{CC}$  | supply voltage                | -0.3 | +6.0               | V    |
| $V_i$     | input voltage on all pins     | -0.3 | $V_{CC}$           | V    |
| $P_{tot}$ | total power dissipation       | -    | 470                | mW   |
| $T_{stg}$ | IC storage temperature        | -55  | +150               | °C   |
| $T_j$     | junction temperature          | -    | +150               | °C   |
| $T_{amb}$ | operating ambient temperature | 0    | +70 <sup>(1)</sup> | °C   |

**Note**

1. The operating ambient temperature can be extended up to +85 °C providing the supply voltage remains lower or equal to 5.2 V in order to maintain the junction temperature below 150 °C.

**QUALITY SPECIFICATION**

All pins withstand the ESD test in accordance with "UZW-BO/FQ-A302 (*human body model*)" and with "UZW-BO/FQ-B302 (*machine model*)". These numbers can be found in the "Quality reference Handbook". The handbook can be ordered using the code 9397 750 00192.

**THERMAL CHARACTERISTICS**

| SYMBOL        | PARAMETER   | VALUE | UNIT |
|---------------|---|-------|------|
| $R_{th\ j-a}$ | thermal resistance from junction to ambient in free air | 120   | K/W  |

## Quadrature demodulator

## TDA8042M

**CHARACTERISTICS**

$V_{CC} = 5\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $R_{L(IQ)} = 1\text{ k}\Omega$ ; measured in application circuit of Fig.4; unless otherwise specified.

| SYMBOL                  | PARAMETER  | CONDITIONS                                 | MIN. | TYP. | MAX. | UNIT       |
|-------------------------|--|--|------|------|------|------------|
| <b>Supply</b>           |  |  |      |      |      |            |
| $V_{CC1}$               | supply voltage   |  | 4.75 | 5.0  | 5.25 | V          |
| $V_{CC2}$               | supply voltage   |  | 4.75 | 5.0  | 5.25 | V          |
| $I_{CC1}$               | supply current   | $V_{CC1} = V_{CC2} = 5.0\text{ V}$         | 41   | 51   | 61   | mA         |
| $I_{CC2}$               | supply current   | $V_{CC1} = V_{CC2} = 5.0\text{ V}$         | 13   | 16.5 | 20   | mA         |
| <b>AGC</b>              |  |  |      |      |      |            |
| $G_{CR}$                | gain control range   |  | 21   | 29   | –    | dB         |
| $G_{VAGC}$              | voltage gain control at pin 3<br>input level = $V_{i(RF)min}$<br>input level = $V_{i(RF)max}$  | note 1                                     | 0.5  | –    | 2    | V          |
|                         |  |  | 3.5  | –    | 4.5  | V          |
| $R_{iVAGC}$             | input resistance at pin 3  |  | –    | 20   | –    | k $\Omega$ |
| $V_{th}$                | AGC threshold voltage<br>$V_o = 1.6\text{ V}$ (peak-to-peak value)<br>$V_o = 0.8\text{ V}$ (peak-to-peak value)<br>$V_o = 0.4\text{ V}$ (peak-to-peak value) | note 2                                     | –    | 3.6  | –    | V          |
|                         |  |  | –    | 2.4  | –    | V          |
|                         |  |  | –    | 1.8  | –    | V          |
| $R_{iVTH}$              | VTH input resistance   |  | –    | 10   | –    | k $\Omega$ |
| $ I_{det} $             | maximum AGC detector output current (absolute value)   | note 3                                     | –    | 1    | –    | mA         |
| <b>QPSK demodulator</b> |  |  |      |      |      |            |
| $f_{i(RF)}$             | RF input signal frequency  |  | 350  | –    | 650  | MHz        |
| $R_{i(RF)}$             | RF input impedance (resistive part)  | $f_{i(RF)} = 480\text{ MHz}$               | –    | 50   | –    | $\Omega$   |
| $X_{i(RF)}$             | RF input impedance (reactive part)   | $f_{i(RF)} = 480\text{ MHz}$               | –    | 19   | –    | $\Omega$   |
| $V_{i(RF)}$             | operating RF input level   | note 1                                     | 57   | –    | 78   | dB $\mu$ V |
| $\Delta E_{\Phi(I-Q)}$  | phase matching error between I and Q channels  | note 4                                     | –    | 0.7  | 2    | deg        |
| $\Delta E_{G(I-Q)}$     | gain matching error between I and Q channels   | note 5                                     | –    | 0.15 | 0.8  | dB         |
| $\Delta G_{tilt}$       | gain tilt error between I and Q channels   | note 6                                     | –    | 0.3  | 0.5  | dB         |
| F                       | DSB noise figure   | source impedance = 50 $\Omega$ ;<br>note 7 | –    | 13   | 17   | dB         |
| $d_{3(IQ)}$             | third-order intermodulation distortion in I and Q channels   | note 8                                     | –    | 50   | –    | dB         |

## Quadrature demodulator

## TDA8042M

| SYMBOL                           | PARAMETER  | CONDITIONS                               | MIN. | TYP. | MAX. | UNIT     |
|----------------------------------|--|--|------|------|------|----------|
| <b>Oscillator</b>                |  |  |      |      |      |          |
| $f_{osc}$                        | oscillator frequency                                 | note 9                                   | 175  | –    | 325  | MHz      |
| $\Delta f_{osc}$                 | frequency drift                                      | note 10                                  | –    | –    | 500  | kHz      |
|                                  |  | $\Delta V_{CC} = \pm 5\%$                | –    | –    | 100  | kHz      |
| $N_{osc}$                        | oscillator phase noise                               | measured 10 kHz from $f_{osc}$ ; note 11 | –    | –    | 91   | dBc/Hz   |
| $V_{osc(dis)}$                   | oscillator disable voltage at pin 17                 |  |      |      |      |          |
|                                  | oscillator disabled                                  |  | –    | –    | 1.0  | V        |
|                                  | oscillator enabled                                   |  | 4.0  | –    | –    | V        |
| <b>Prescaler</b>                 |  |  |      |      |      |          |
| $V_{OH}$                         | HIGH level output voltage                            | note 12                                  | 4.0  | –    | –    | V        |
| $V_{OL}$                         | LOW level output voltage                             | note 12                                  | –    | –    | 3.35 | V        |
| $\delta$                         | output duty cycle                                    |  | 40   | 50   | 60   | %        |
| $DIV_{spu(IQ)}$                  | output spurious voltage at I and Q outputs           | note 13                                  | –    | –50  | –    | dB       |
| <b>I and Q internal filters</b>  |  |  |      |      |      |          |
| $B_{-1}$                         | bandwidth for 1 dB attenuation                       |  | 30   | –    | –    | MHz      |
| $B_{-30}$                        | bandwidth for 30 dB attenuation                      |  | –    | 450  | –    | MHz      |
| <b>I and Q output amplifiers</b> |  |  |      |      |      |          |
| $V_{O(IQ)(DC)}$                  | I and Q channels DC output voltage                   |  | –    | 2.45 | –    | V        |
| $V_{O(IQ)(p-p)}$                 | I and Q channels output voltage (peak-to-peak value) | note 14                                  | –    | 0.8  | –    | V        |
| $V_{clip(p-p)}$                  | I and Q output clipping level (peak-to-peak value)   |  | 1.8  |      |      | V        |
| $R_{L(IQ)}$                      | I and Q channels output load resistance              | note 15                                  | 500  | –    | –    | $\Omega$ |
| $R_{O(IQ)}$                      | I and Q channels output resistance                   |  | –    | 67   | –    | $\Omega$ |
| $\alpha_{ct(I-Q)}$               | crosstalk between I and Q channels                   |  | 30   | –    | –    | dB       |

**Notes**

- The voltage gain control range ( $G_{VAGC}$ ) is defined as the DC voltage to be applied on pin 3 to get a signal level of 800 mV (peak-to-peak value) at I and Q outputs.  
The lowest control voltage corresponds to the highest sensitivity and gain.
- $V_{th}$  is the level of voltage to be applied at pin 20 to get a current  $I_{det}$  of 0.5 mA at pin 1. This voltage depends on the amplitude of the signal at I and Q outputs.  
The AGC threshold voltage can be set by a resistive voltage divider connected at pin 20. Without the external resistors  $V_{th}$  is set at a value close to 2.35 V.
- The current  $I_{det}$  increases when the output level (at pins 4 and 9) increases above the value set by the adjustment of  $V_{th}$ .
- The phase error is defined as the phase quadrature imbalance between I and Q channels.
- The gain error is defined as the phase quadrature imbalance between I and Q channels.
- The tilt is defined as the difference between the maximum and the minimum channel gain measured in a frequency band of  $\pm 30$  MHz around  $f_{i(RF)}$ . The specified tilt is the maximum tilt value found in one of the I and Q channels.

## Quadrature demodulator

## TDA8042M

7. The specified noise figure is the maximum value obtained from I and Q channels noise measurement. The figure holds for the maximum gain ( $G_{VAGC} = 0.5$  V).
8. The specified intermodulation distortion is the minimum value obtained from intermodulation measurements in I and Q channels. The specified value is the minimum distance between wanted signal and intermodulation products measured at the output for a wanted output level of 0.8 V (peak-to-peak value).
9. The oscillator is tuned with an appropriate tank circuit designed for each frequency limit.
10. The drift of the oscillator frequency with temperature is defined for  $\Delta T_{amb} = 25$  °C. It is measured in the application circuit (see Fig.4) with a temperature compensated tank circuit. The temperature compensation used for this measurement is realized using the application which is depicted in Fig.3.
11. The phase noise is measured at the oscillator frequency (= 240 MHz). Due to the internal frequency doubler the phase noise at the input of the mixers will be 6 dB worse.
12. Measured with a high impedance load ( $R_L > 5$  k $\Omega$ ) connected at pins 12 and 13.
13. The prescaler output spurious voltage at I and Q outputs are measured with respect to an output level of 800 mV (peak-to-peak value).
14. Measured with an input signal  $f_{i(RF)} + 500$  kHz (i.e. 480.5 MHz).
15. The load should be AC-coupled.

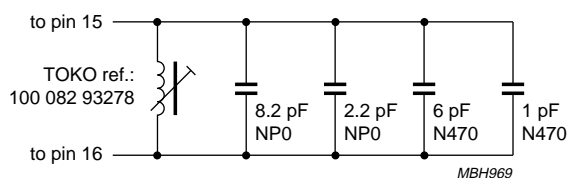


Fig.3 Temperature compensation circuit.



Quadrature demodulator

TDA8042M

APPLICATION INFORMATION

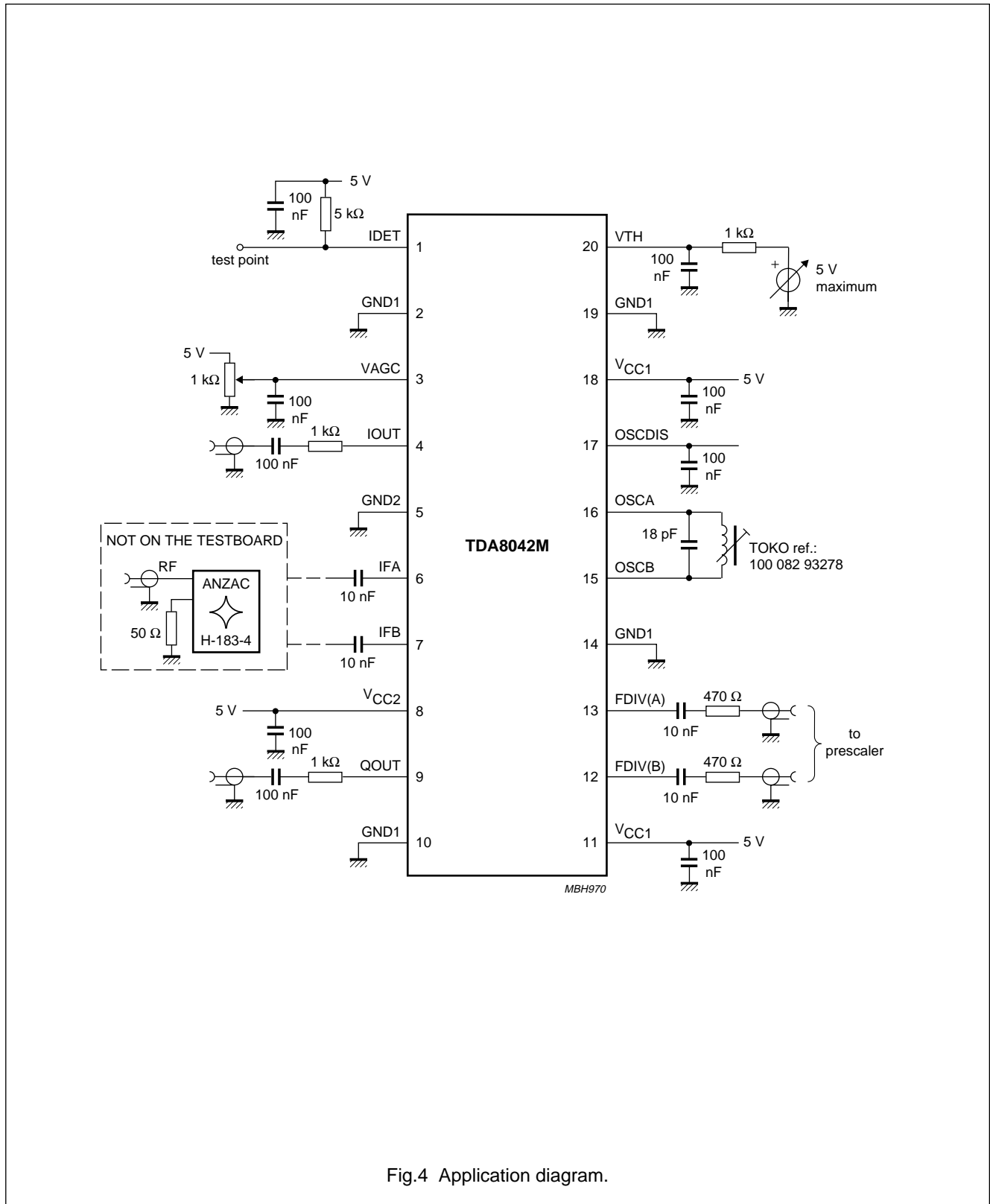


Fig.4 Application diagram.

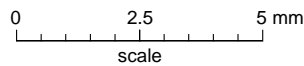
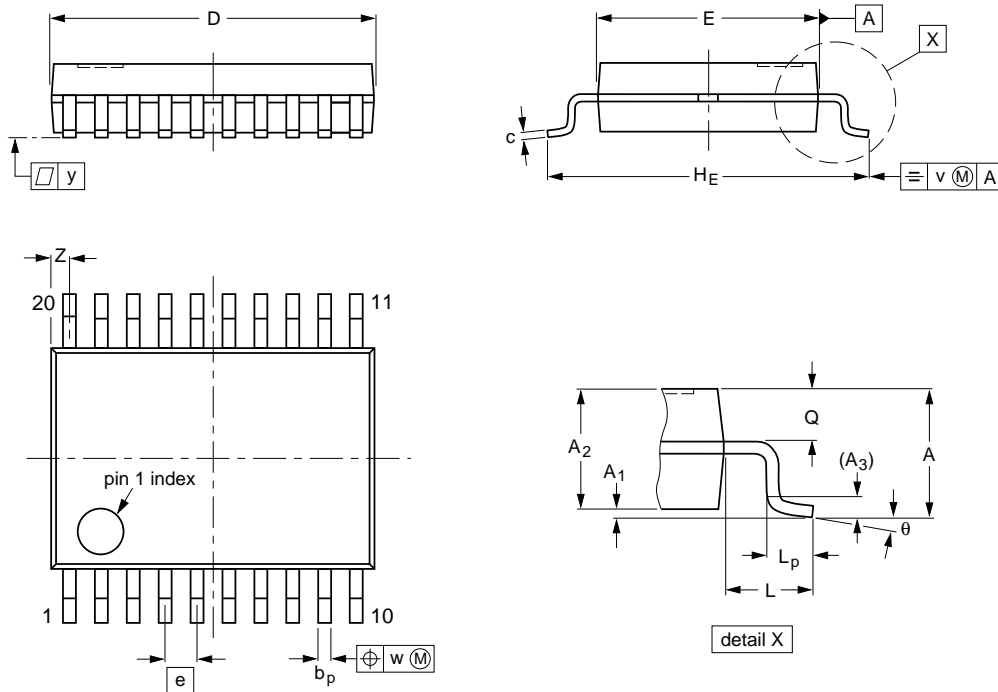
Quadrature demodulator

TDA8042M

PACKAGE OUTLINE

SSOP20: plastic shrink small outline package; 20 leads; body width 4.4 mm

SOT266-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A max. | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c            | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | H <sub>E</sub> | L   | L <sub>p</sub> | Q            | v   | w    | y   | z <sup>(1)</sup> | θ         |
|------|--------|----------------|----------------|----------------|----------------|--------------|------------------|------------------|------|----------------|-----|----------------|--------------|-----|------|-----|------------------|-----------|
| mm   | 1.5    | 0.15<br>0      | 1.4<br>1.2     | 0.25           | 0.32<br>0.20   | 0.20<br>0.13 | 6.6<br>6.4       | 4.5<br>4.3       | 0.65 | 6.6<br>6.2     | 1.0 | 0.75<br>0.45   | 0.65<br>0.45 | 0.2 | 0.13 | 0.1 | 0.48<br>0.18     | 10°<br>0° |

Note

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES |       |      |  | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|-------|------|--|---------------------|----------------------|
|                 | IEC        | JEDEC | EIAJ |  |                     |                      |
| SOT266-1        |            |       |      |  |                     | 90-04-05<br>95-02-25 |

---

## Quadrature demodulator

TDA8042M

---

### SOLDERING

#### Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

#### Reflow soldering

Reflow soldering techniques are suitable for all SSOP packages.

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 techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating 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 minutes at 45 °C.

#### Wave soldering

Wave soldering is **not** recommended for SSOP packages. This is because of the likelihood of solder bridging due to closely-spaced leads and the possibility of incomplete solder penetration in multi-lead devices.

If wave soldering cannot be avoided, the following conditions must be observed:

- **A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.**
- **The longitudinal axis of the package footprint must be parallel to the solder flow and must incorporate solder thieves at the downstream end.**

**Even with these conditions, only consider wave soldering SSOP packages that have a body width of 4.4 mm, that is SSOP16 (SOT369-1) or SSOP20 (SOT266-1).**

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.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. 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.

#### Repairing soldered joints

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

---

 Quadrature demodulator
TDA8042M

---

**DEFINITIONS**

|   |   |
|---|---|
| <b>Data sheet status</b>  |   |
| 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.                                |
| <b>Limiting values</b>  |   |
| 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. |   |
| <b>Application information</b>  |   |
| 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.

Quadrature demodulator

TDA8042M

---

**NOTES**

Quadrature demodulator

TDA8042M

---

**NOTES**

Quadrature demodulator

TDA8042M

---

**NOTES**

# Philips Semiconductors – a worldwide company

**Argentina:** see South America

**Australia:** 34 Waterloo Road, NORTH RYDE, NSW 2113,  
Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

**Austria:** Computerstr. 6, A-1101 WIEN, P.O. Box 213,  
Tel. +43 1 60 101, Fax. +43 1 60 101 1210

**Belarus:** Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6,  
220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

**Belgium:** see The Netherlands

**Brazil:** see South America

**Bulgaria:** Philips Bulgaria Ltd., Energoproject, 15th floor,  
51 James Bourchier Blvd., 1407 SOFIA,  
Tel. +359 2 689 211, Fax. +359 2 689 102

**Canada:** PHILIPS SEMICONDUCTORS/COMPONENTS,  
Tel. +1 800 234 7381

**China/Hong Kong:** 501 Hong Kong Industrial Technology Centre,  
72 Tat Chee Avenue, Kowloon Tong, HONG KONG,  
Tel. +852 2319 7888, Fax. +852 2319 7700

**Colombia:** see South America

**Czech Republic:** see Austria

**Denmark:** Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S,  
Tel. +45 32 88 2636, Fax. +45 31 57 0044

**Finland:** Sinikalliontie 3, FIN-02630 ESPOO,  
Tel. +358 9 615800, Fax. +358 9 61580920

**France:** 4 Rue du Port-aux-Vins, BP317, 92156 SURESNES Cedex,  
Tel. +33 1 40 99 6161, Fax. +33 1 40 99 6427

**Germany:** Hammerbrookstraße 69, D-20097 HAMBURG,  
Tel. +49 40 23 53 60, Fax. +49 40 23 536 300

**Greece:** No. 15, 25th March Street, GR 17778 TAVROS/ATHENS,  
Tel. +30 1 4894 339/239, Fax. +30 1 4814 240

**Hungary:** see Austria

**India:** Philips INDIA Ltd, Shivsagar Estate, A Block, Dr. Annie Besant Rd.  
Worli, MUMBAI 400 018, Tel. +91 22 4938 541, Fax. +91 22 4938 722

**Indonesia:** see Singapore

**Ireland:** Newstead, Clonskeagh, DUBLIN 14,  
Tel. +353 1 7640 000, Fax. +353 1 7640 200

**Israel:** RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053,  
TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

**Italy:** PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3,  
20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

**Japan:** Philips Bldg 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108,  
Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

**Korea:** Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL,  
Tel. +82 2 709 1412, Fax. +82 2 709 1415

**Malaysia:** No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR,  
Tel. +60 3 750 5214, Fax. +60 3 757 4880

**Mexico:** 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905,  
Tel. +9-5 800 234 7381

**Middle East:** see Italy

**Netherlands:** Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB,  
Tel. +31 40 27 82785, Fax. +31 40 27 88399

**New Zealand:** 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,  
Tel. +64 9 849 4160, Fax. +64 9 849 7811

**Norway:** Box 1, Manglerud 0612, OSLO,  
Tel. +47 22 74 8000, Fax. +47 22 74 8341

**Philippines:** Philips Semiconductors Philippines Inc.,  
106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI,  
Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

**Poland:** Ul. Lukiska 10, PL 04-123 WARSZAWA,  
Tel. +48 22 612 2831, Fax. +48 22 612 2327

**Portugal:** see Spain

**Romania:** see Italy

**Russia:** Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW,  
Tel. +7 095 755 6918, Fax. +7 095 755 6919

**Singapore:** Lorong 1, Toa Payoh, SINGAPORE 1231,  
Tel. +65 350 2538, Fax. +65 251 6500

**Slovakia:** see Austria

**Slovenia:** see Italy

**South Africa:** S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale,  
2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000,  
Tel. +27 11 470 5911, Fax. +27 11 470 5494

**South America:** Rua do Rocio 220, 5th floor, Suite 51,  
04552-903 São Paulo, SÃO PAULO - SP, Brazil,  
Tel. +55 11 821 2333, Fax. +55 11 829 1849

**Spain:** Balmes 22, 08007 BARCELONA,  
Tel. +34 3 301 6312, Fax. +34 3 301 4107

**Sweden:** Kottbygatan 7, Akalla, S-16485 STOCKHOLM,  
Tel. +46 8 632 2000, Fax. +46 8 632 2745

**Switzerland:** Allmendstrasse 140, CH-8027 ZÜRICH,  
Tel. +41 1 488 2686, Fax. +41 1 481 7730

**Taiwan:** Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1,  
TAIPEI, Taiwan Tel. +886 2 2134 2865, Fax. +886 2 2134 2874

**Thailand:** PHILIPS ELECTRONICS (THAILAND) Ltd.,  
209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260,  
Tel. +66 2 745 4090, Fax. +66 2 398 0793

**Turkey:** Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL,  
Tel. +90 212 279 2770, Fax. +90 212 282 6707

**Ukraine:** PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7,  
252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

**United Kingdom:** Philips Semiconductors Ltd., 276 Bath Road, Hayes,  
MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

**United States:** 811 East Arques Avenue, SUNNYVALE, CA 94088-3409,  
Tel. +1 800 234 7381

**Uruguay:** see South America

**Vietnam:** see Singapore

**Yugoslavia:** PHILIPS, Trg N. Pasica 5/v, 11000 BEOGRAD,  
Tel. +381 11 625 344, Fax. +381 11 635 777

**For all other countries apply to:** Philips Semiconductors, Marketing & Sales Communications,  
Building BE-p, P.O. Box 218, 5600 MD EINDHOVEN, The Netherlands, Fax. +31 40 27 24825

**Internet:** <http://www.semiconductors.philips.com>

© Philips Electronics N.V. 1997

SCA54

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Printed in The Netherlands

547047/1200/01/pp16

Date of release: 1997 Apr 11

Document order number: 9397 750 00909

*Let's make things better.*