

**SINGLE PHASE FULL WAVE DIRECT PWM MOTOR DRIVER****AM4962**

## General Description

The AM4962 is a full wave driver IC with direct PWM control function. It is used for single phase motor and is capable of speed control by PWM pulse.

The AM4962 is available in HTSSOP-14 and SSOP-16 packages.

## Features

- The Motor Speed is Controlled by PWM Pulse Directly
- Built-in Triangle Wave Circuit Without Extra Oscillation Capacitor
- Built-in Hall Bias Circuit
- Built-in Minimal Speed Setup Circuit
- Slope  $K^*$  Adjustable
- Rotation Speed Indication (FG)
- Rotation or Lock State Indication (RD)
- Built-in Thermal Shutdown Circuit
- Lock Protection and Auto-restart
- Output Current Limit

\* Slope K is the slope of output PWM duty vs. input PWM duty

## Applications

- CPU Cooler Fan in PC
- Brushless DC Motor Driver

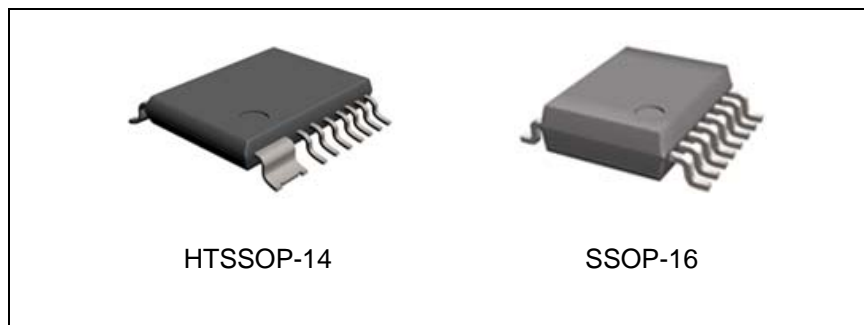


Figure 1. Package Types of AM4962

**Pin Configuration**

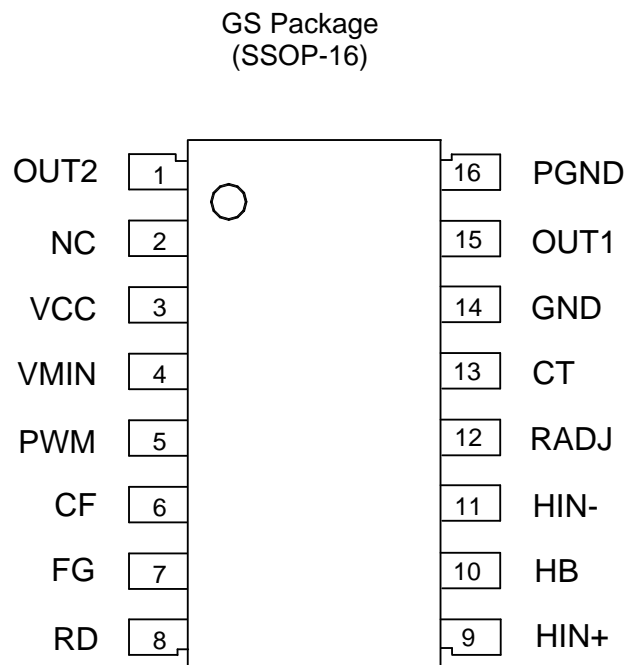
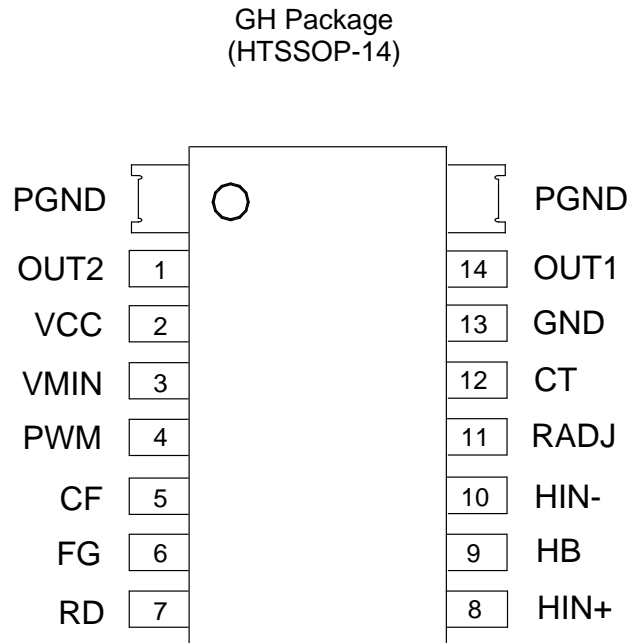
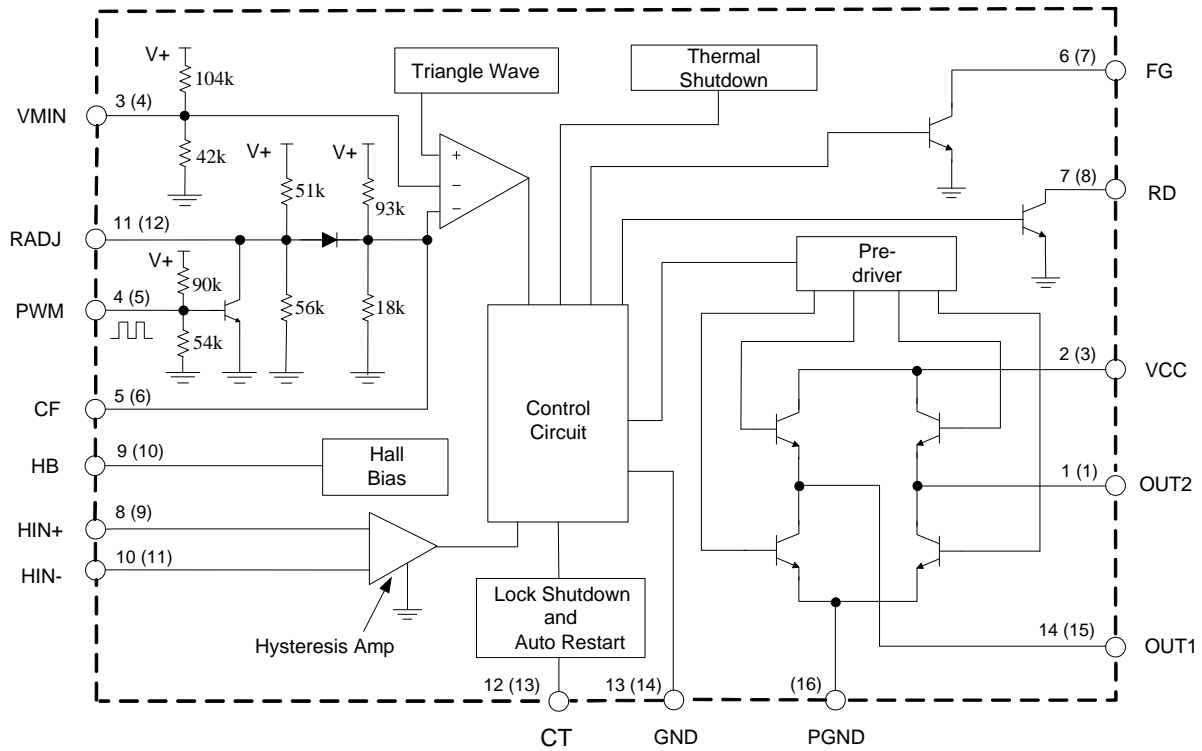


Figure 2. Pin Configuration of AM4962 (Top View)

**Pin Description**

| Pin Number |         | Pin Name | Function                                     |
|------------|---------|----------|--|
| HTSSOP-14  | SSOP-16 |          |  |
| 1          | 1       | OUT2     | Driver output 2                              |
|            | 2       | NC       | No connection                                |
| 2          | 3       | VCC      | Power supply                                 |
| 3          | 4       | VMIN     | Minimum duty setting                         |
| 4          | 5       | PWM      | PWM pulse Input                              |
| 5          | 6       | CF       | PWM filter capacitor                         |
| 6          | 7       | FG       | Rotation speed indicator                     |
| 7          | 8       | RD       | Rotation/lock state indicator                |
| 8          | 9       | HIN+     | Hall sensor input +                          |
| 9          | 10      | HB       | Hall sensor bias regulator                   |
| 10         | 11      | HIN-     | Hall sensor input -                          |
| 11         | 12      | RADJ     | Slope K adjustable terminal                  |
| 12         | 13      | CT       | Lock and rotation setting capacitor terminal |
| 13         | 14      | GND      | Ground for control circuit                   |
| 14         | 15      | OUT1     | Driver output 1                              |
|            | 16      | PGND     | Power ground                                 |

**Functional Block Diagram**



A (B)  
 A HTSSOP-14  
 B SSOP-16

Figure 3. Functional Block Diagram of AM4962

**Truth Table (Note 1)**

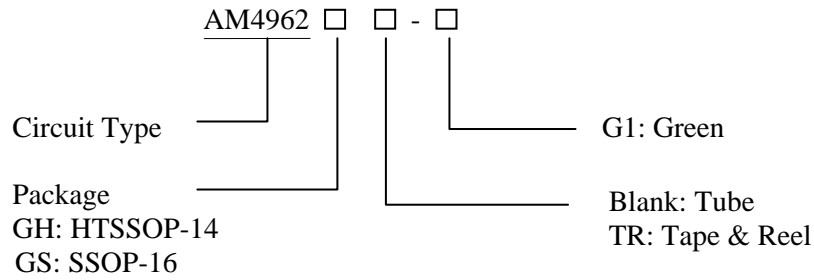
| Items | IN- | IN+ | CF | CT | OUT1 | OUT2 | FG  | Mode                 |
|-------|-----|-----|----|----|------|------|-----|----------------------|
| 1     | H   | L   | L  | L  | H    | L    | L   | Rotation             |
| 2     | L   | H   |    |    | L    | H    | Off | PWM off              |
| 3     | H   | L   | H  |    | Off  | L    | L   | Rotation Recirculate |
| 4     | L   | H   |    |    | L    | Off  | Off | PWM off              |
| 5     | H   | L   | L  | H  | H    | Off  | L   | Lock Protection      |
| 6     | L   | H   |    |    | Off  | H    | Off |                      |

Note 1:  $V_{CF(H)}=5V$ ,  $V_{CF(L)}=1V$ ,  $V_{CT(H)}=5V$ ,  $V_{CT(L)}=0$

**SINGLE PHASE FULL WAVE DIRECT PWM MOTOR DRIVER**

**AM4962**

**Ordering Information**



| Package   | Temperature Range | Part Number   | Marking ID  | Packing Type |
|-----------|-------------------|---------------|-------------|--------------|
| HTSSOP-14 | -30 to 90°C       | AM4962GH-G1   | AM4962GH-G1 | Tube         |
|           |                   | AM4962GHTR-G1 | AM4962GH-G1 | Tape & Reel  |
| SSOP-16   |                   | AM4962GS-G1   | AM4962GS-G1 | Tube         |
|           |                   | AM4962GSTR-G1 | AM4962GS-G1 | Tape & Reel  |

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and green.

**SINGLE PHASE FULL WAVE DIRECT PWM MOTOR DRIVER****AM4962****Absolute Maximum Ratings (Note 2)**

| Parameter                                   | Symbol        | Value      |     | Unit |
|---|---------------|------------|-----|------|
| Supply Voltage                              | $V_{CC}$      | 18         |     | V    |
| Output Current                              | $I_{OUT}$     | 1.0        |     | A    |
| Output Voltage                              | $V_{OUT}$     | 18         |     | V    |
| HB Output Current                           | $I_{HB}$      | 10         |     | mA   |
| RD Output Voltage                           | $V_{RD}$      | 18         |     | V    |
| FG Output Voltage                           | $V_{FG}$      | 18         |     | V    |
| RD Output Current                           | $I_{RD}$      | 10         |     | mA   |
| FG Output Current                           | $I_{FG}$      | 10         |     | mA   |
| Power Dissipation                           | $P_D$         | SSOP-16    | 0.8 | W    |
|   |               | HTSSOP-14  | 1.1 | W    |
| Storage Temperature Range                   | $T_{STG}$     | -55 to 150 |     | °C   |
| Thermal Resistance<br>(Junction to Ambient) | $\theta_{JA}$ | SSOP-16    | 156 | °C/W |
|   |               | HTSSOP-14  | 114 |      |
| ESD (Human Body Model)                      | ESD           | 2000       |     | V    |
| ESD (Machine Model)                         | ESD           | 250        |     | V    |

Note 2: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

**Recommended Operating Conditions**

| Parameter                     | Symbol    | Min | Typ | Max        | Unit |
|-------------------------------|-----------|-----|-----|------------|------|
| Supply Voltage                | $V_{CC}$  | 3.5 | 12  | 16         | V    |
| Hall Input Voltage + (Note 3) | $V_{IN+}$ | 0.2 |     | 3          | V    |
| Hall Input Voltage - (Note 3) | $V_{IN-}$ | 0.2 |     | 3          | V    |
| PWM High Level Voltage        | $V_{PWM}$ |     |     | $V_{CC}-1$ | V    |
| Ambient Temperature           | $T_A$     | -30 |     | 90         | °C   |

Note 3: Hall input voltage range includes the amplitude of signal.

**SINGLE PHASE FULL WAVE DIRECT PWM MOTOR DRIVER****AM4962****Electrical Characteristics**(V<sub>CC</sub>=12V, T<sub>A</sub>=25°C, unless otherwise specified.)

| Parameter                              | Symbol            | Conditions                         | Min   | Typ  | Max   | Unit |
|--|-------------------|------------------------------------|-------|------|-------|------|
| Quiescent Current                      | I <sub>Q1</sub>   | V <sub>CT</sub> =0                 | 10.18 | 15   | 18.76 | mA   |
|  | I <sub>Q2</sub>   | V <sub>CT</sub> =5V                | 5.38  | 8    | 10.55 |      |
| Output Saturation Voltage at High Side | V <sub>SATH</sub> | I <sub>SOURCE</sub> =200mA         |       | 1.0  | 1.17  | V    |
| Output Saturation Voltage at Low Side  | V <sub>SATL</sub> | I <sub>SINK</sub> =200mA           |       | 0.2  | 0.3   | V    |
| CPWM Frequency                         | f <sub>OSC</sub>  |                                    | 18    | 25   | 32    | kHz  |
| CF High Level Voltage                  | V <sub>CFH</sub>  | V <sub>PWM</sub> =0                | 3.2   | 3.6  | 3.75  | V    |
| CF Low Level Voltage                   | V <sub>CFL</sub>  | V <sub>PWM</sub> =5                | 1.83  | 1.95 | 2.15  | V    |
| V <sub>MIN</sub> Voltage               | V <sub>MIN</sub>  |                                    | 3.4   | 3.7  | 4.0   | V    |
| RADJ Pin Voltage                       | V <sub>ADJ</sub>  | V <sub>PWM</sub> =0                | 3.6   | 3.8  | 4.4   | V    |
| Hall Input Hysteresis                  | V <sub>HYS</sub>  |                                    |       | ±10  | ±20   | mV   |
| Hall Bias Voltage                      | V <sub>HB</sub>   | I <sub>HB</sub> =5mA               | 1.1   | 1.25 | 1.4   | V    |
| CT High Level Voltage                  | V <sub>CTH</sub>  |                                    | 3.55  | 3.7  | 3.88  | V    |
| CT Low Level Voltage                   | V <sub>CTL</sub>  |                                    | 1.55  | 1.7  | 1.85  | V    |
| CT Charge Current                      | I <sub>CHG</sub>  |                                    | 1.5   | 2    | 2.85  | μA   |
| CT Discharge Current                   | I <sub>DHG</sub>  |                                    | 0.14  | 0.2  | 0.285 | μA   |
| CT Charge and Discharge Ratio          | R <sub>CD</sub>   | I <sub>CHG</sub> /I <sub>DHG</sub> | 8.5   | 10   | 14.5  |      |
| FG Output Low Level Voltage            | V <sub>FGL</sub>  | I <sub>FG</sub> =5mA               |       | 0.2  | 0.3   | V    |
| FG Leakage Current                     | I <sub>LFG</sub>  | V <sub>FG</sub> =12V               |       |      | 30    | μA   |
| RD Output Low Level Voltage            | V <sub>RDL</sub>  | I <sub>RD</sub> =5mA               |       | 0.2  | 0.3   | V    |
| RD Leakage Current                     | I <sub>LRD</sub>  | V <sub>RD</sub> =12V               |       |      | 30    | μA   |

**Typical Performance Characteristics**

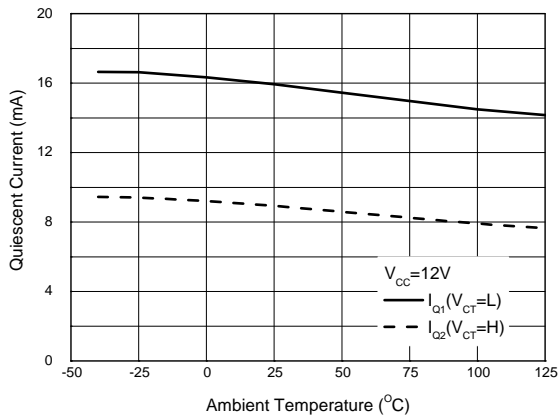


Figure 4. Quiescent Current vs. Ambient Temperature

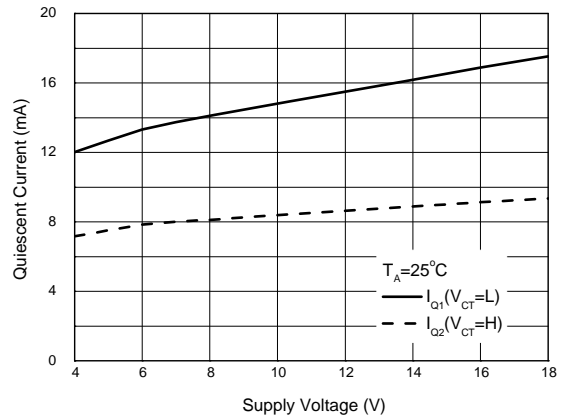


Figure 5. Quiescent Current vs. Supply Voltage

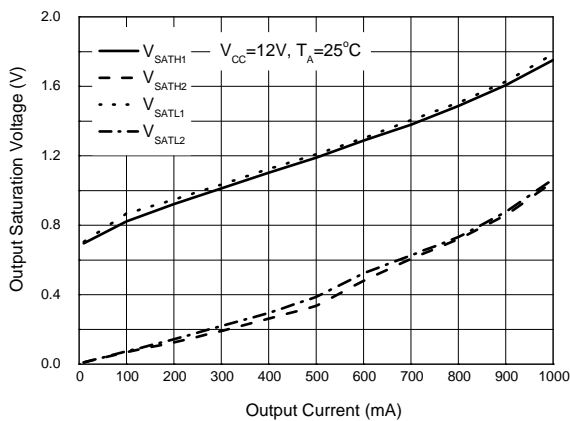


Figure 6. Output Saturation Voltage vs. Output Current

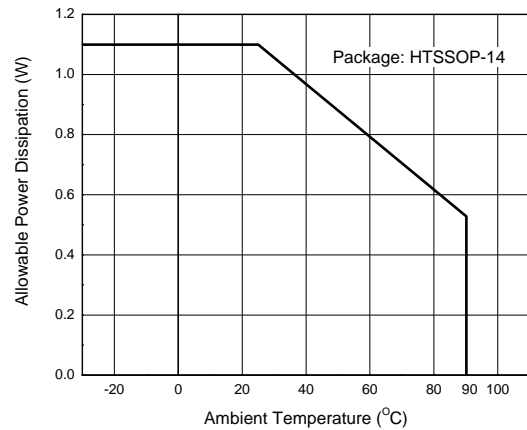


Figure 7. Power Dissipation vs. Ambient Temperature



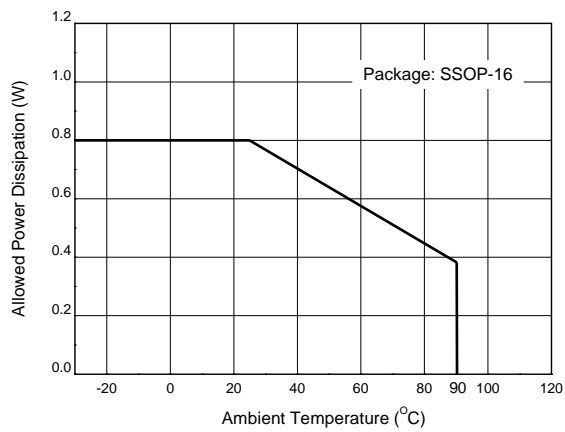
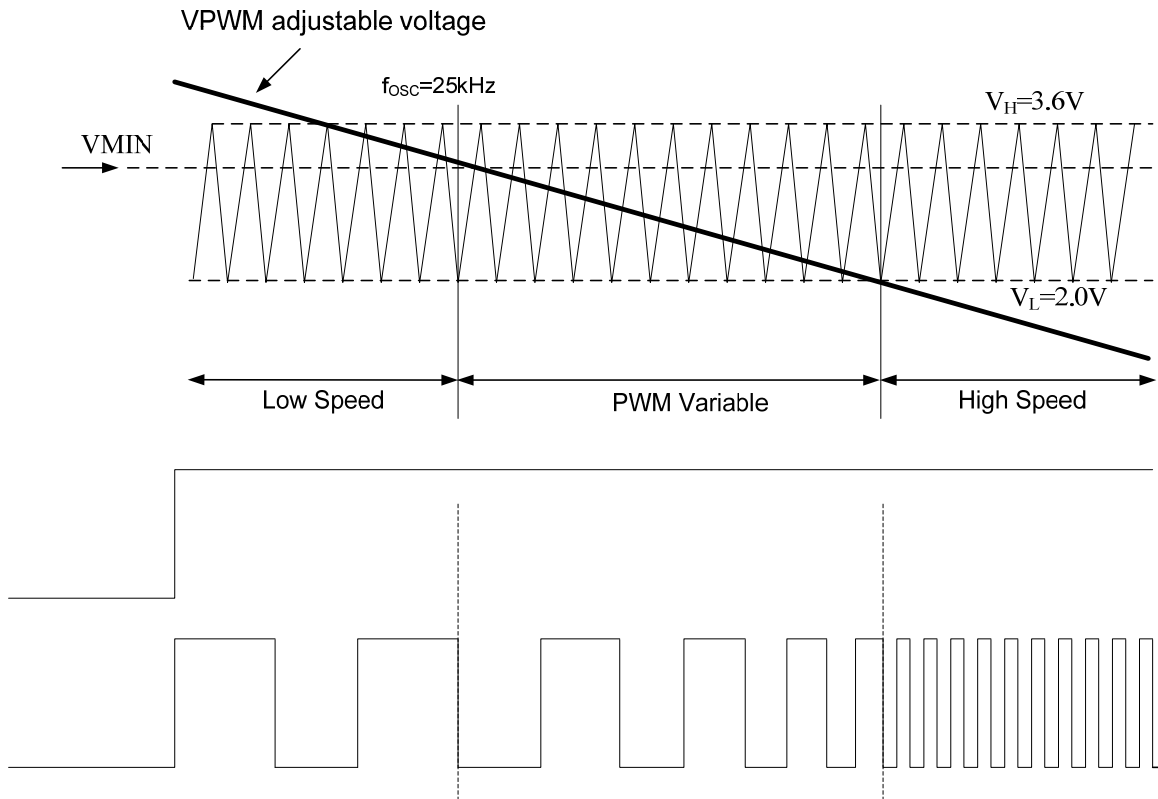
**Typical Performance Characteristics (Continued)**

Figure 8. Power Dissipation vs. Ambient Temperature

**Operating Diagram**



All parameters are tested under  $V_{CC}=12V$

Figure 9. Operating Diagram of AM4962

**Typical Application (Note 4)**

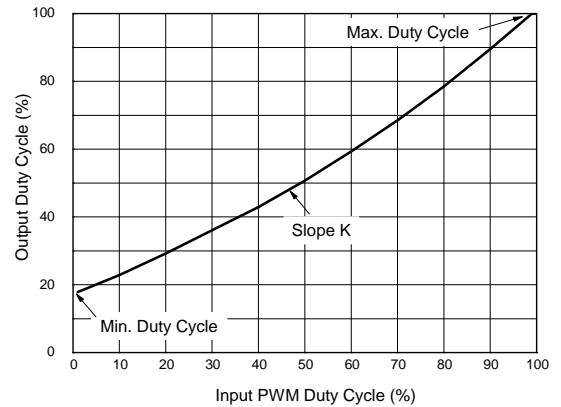
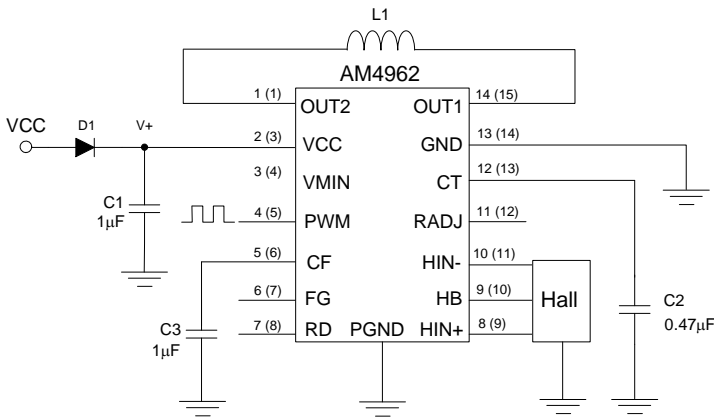
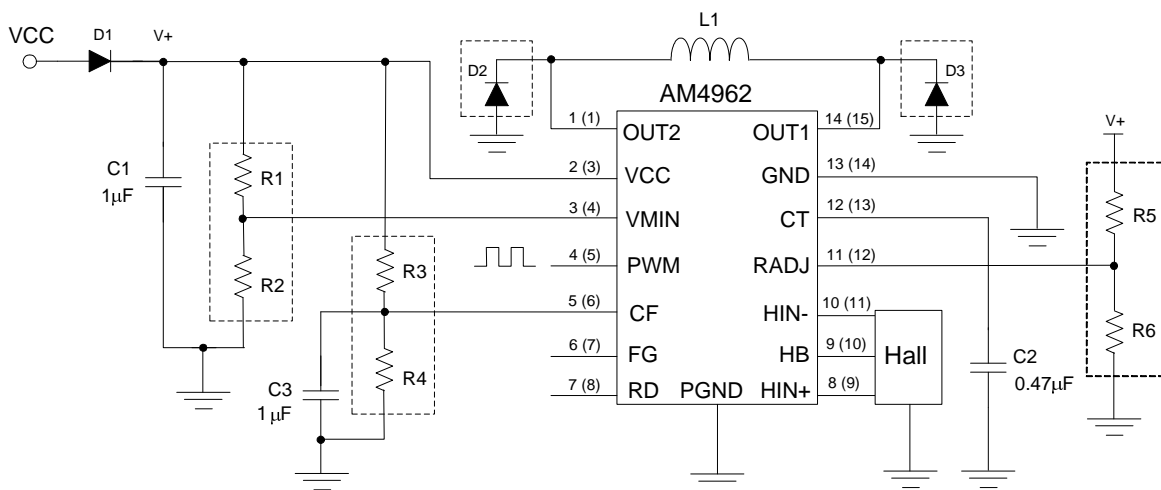


Figure 10

**Application 1 (Default)**



**Application 2 (Slope K and Minimum/Maximum Duty Adjustable)**

Note: D2 and D3 are recommended to be used when the current in coil L1 is higher than 300mA.

Figure 11. Typical Applications of AM4962

### Typical Application (Note 4, Continued)

Note 4 (Refer to application circuit 2 unless otherwise noted.):

Adjust slope K of output PWM's duty vs. input PWM's duty

1. The default K is about 0.8 (application circuit 1).
2. Adding R5 can increase K (see Figure 12).
3. Adding R6 can decrease K (see Figure 13).

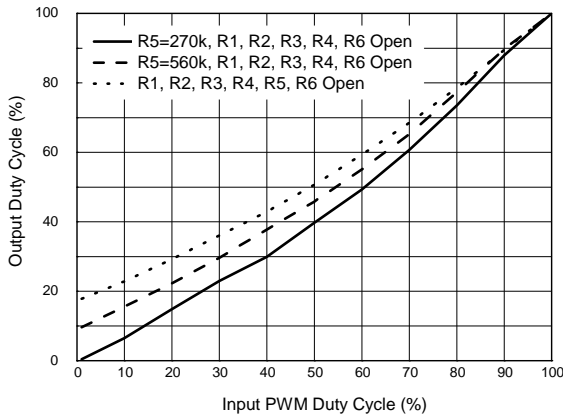


Figure 12

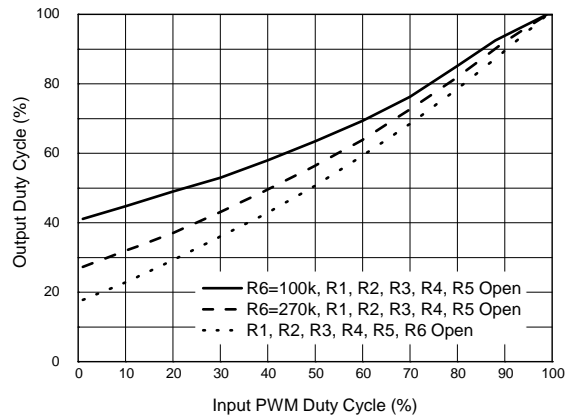


Figure 13

Adjust minimum duty of output PWM:

1. The default minimum duty of output PWM is about 20% (application circuit 1, Figure 10).
2. Decreasing R2 can increase minimum output PWM duty (see Figure 14).
3. Adding R5 can decrease minimum output PWM duty (see Figure 15).

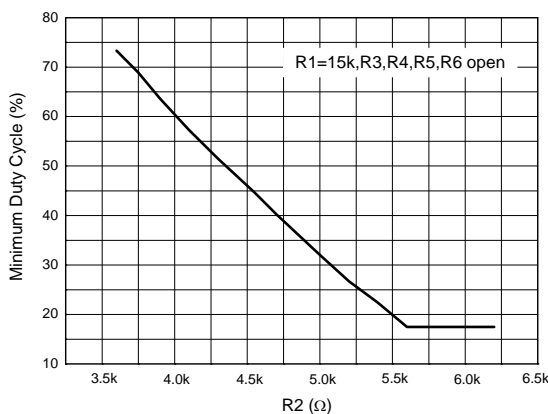


Figure 14

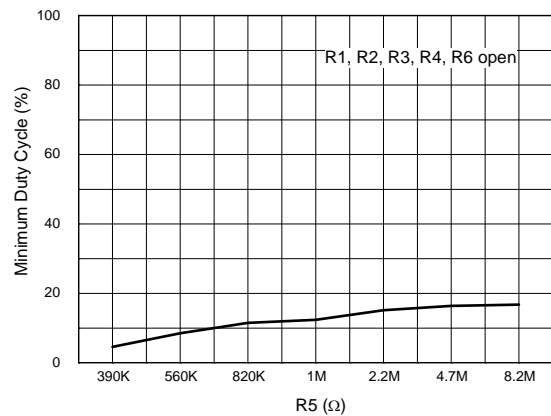


Figure 15

### Typical Application (Note 4, Continued)

Adjust maximum duty of output PWM:

1. The default maximum output PWM duty is 100% (application circuit 1).
2. Adding R3 can decrease maximum output PWM duty (see Figure 16).
3. Adding R4 can increase maximum output PWM duty (see Figure 17).

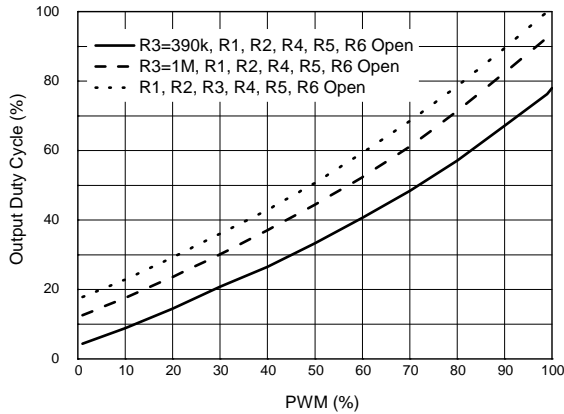


Figure 16

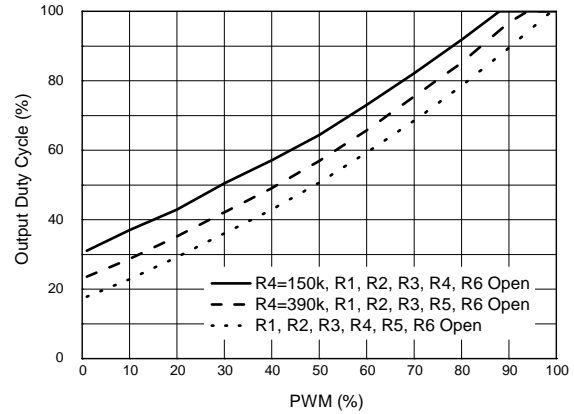
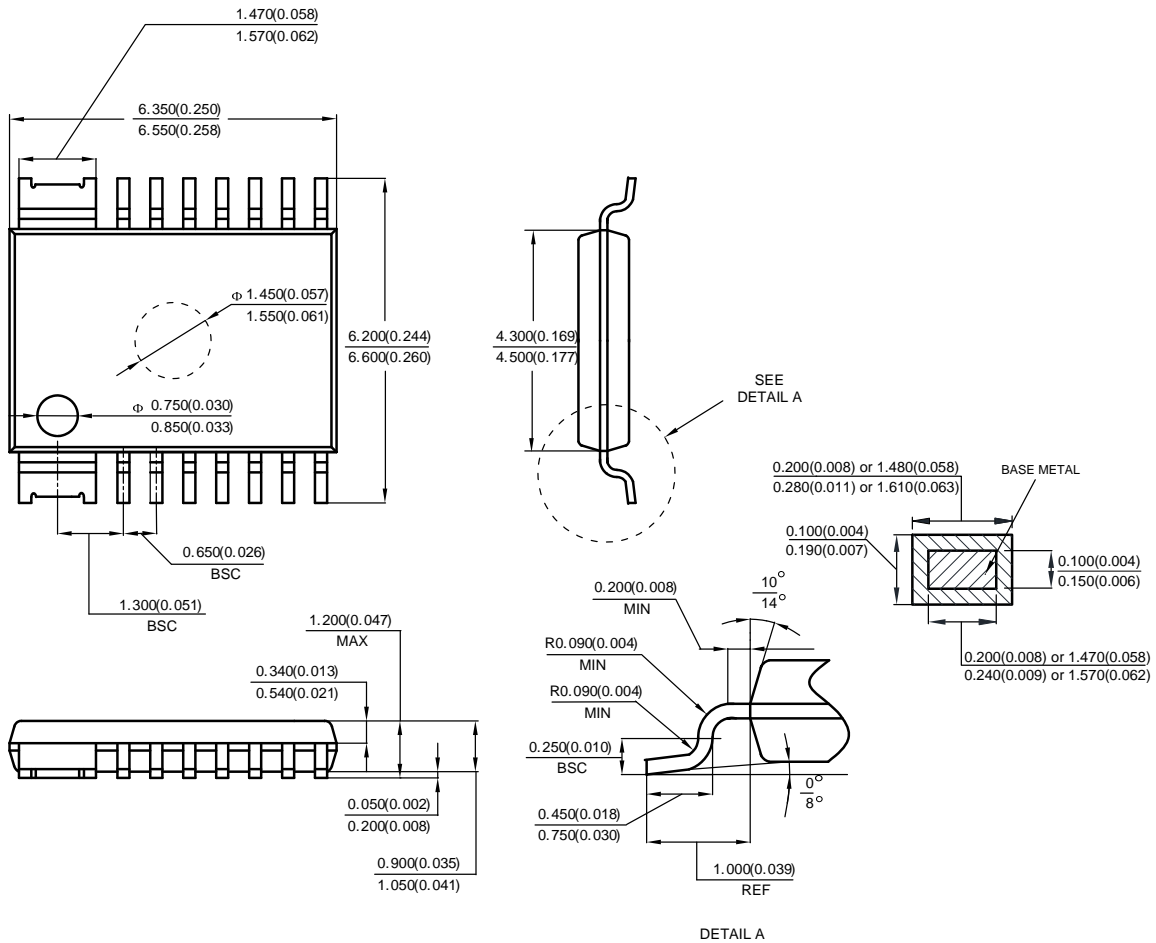


Figure 17

**Mechanical Dimensions**

**HTSSOP-14**

**Unit: mm(inch)**

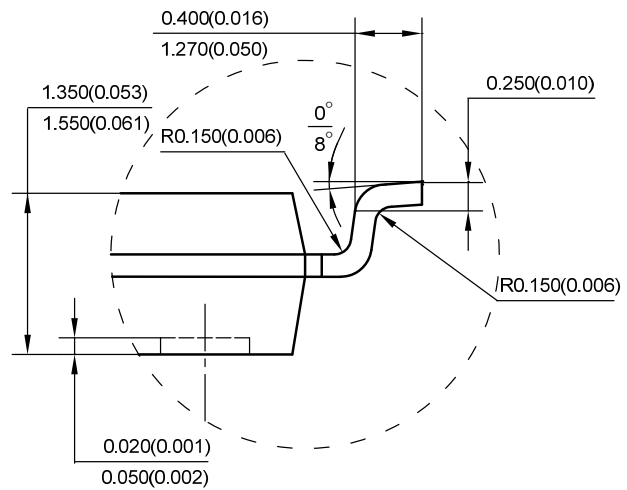
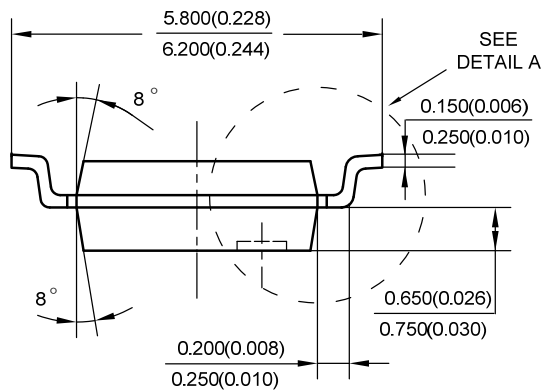
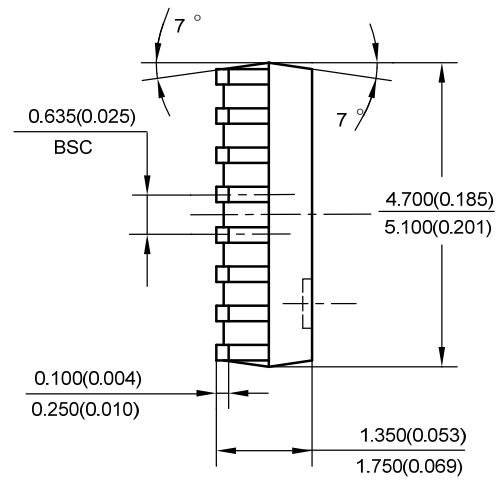
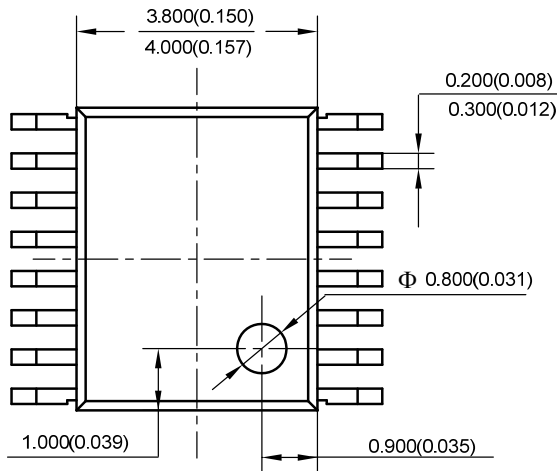


Note: Eject hole, oriented hole and mold mark is optional.

**Mechanical Dimensions (Continued)**

**SSOP-16**

**Unit: mm(inch)**



DETAIL A

Note: Eject hole, oriented hole and mold mark is optional.



## **BCD Semiconductor Manufacturing Limited**

<http://www.bcdsemi.com>

### **IMPORTANT NOTICE**

BCD Semiconductor Manufacturing Limited reserves the right to make changes without further notice to any products or specifications herein. BCD Semiconductor Manufacturing Limited does not assume any responsibility for use of any its products for any particular purpose, nor does BCD Semiconductor Manufacturing Limited assume any liability arising out of the application or use of any its products or circuits. BCD Semiconductor Manufacturing Limited does not convey any license under its patent rights or other rights nor the rights of others.

---

#### **MAIN SITE**

##### **- Headquarters**

##### **BCD Semiconductor Manufacturing Limited**

No. 1600, Zi Xing Road, Shanghai Zizhu Science-based Industrial Park, 200241, China  
Tel: +86-21-24162266, Fax: +86-21-24162277

##### **- Wafer Fab**

##### **Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd.**

800 Yi Shan Road, Shanghai 200233, China  
Tel: +86-21-6485 1491, Fax: +86-21-5450 0008

#### **REGIONAL SALES OFFICE**

##### **Shenzhen Office**

##### **Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd., Shenzhen Office**

Unit A Room 1203, Skyworth Bldg., Gaoxin Ave. 1.S., Nanshan District, Shenzhen, China  
Tel: +86-755-8826 7951  
Fax: +86-755-8826 7865

##### **Taiwan Office**

##### **BCD Semiconductor (Taiwan) Company Limited**

4F, 298-1, Rui Guang Road, Nei-Hu District, Taipei, Taiwan  
Tel: +886-2-2656 2808  
Fax: +886-2-2656 2806

##### **USA Office**

##### **BCD Semiconductor Corp.**

30920 Huntwood Ave. Hayward, CA 94544, USA  
Tel : +1-510-324-2988  
Fax: +1-510-324-2788





Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.