

The Design Guide for AM4963/AM4963R

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1. Introduction

The AM4963/AM4963R is a full wave driver IC with direct PWM control function and thermal resistor control function. It is used for single phase motor and is capable of speed control by PWM pulse and thermal resistor at the same time. The AM4963/AM4963R is featured by:

- The Motor Speed is Controlled by PWM Pulse Directly and Thermal Resistor at The Same Time
- Low Corner Temperature (30°C) Adjustable
- High Corner Temperature (38°C) Adjustable
- Full Speed when Thermal Resistor Shorten
- Built-in Triangle Wave Circuit without Extra Oscillation Capacitor
- Built-in Minimal Speed Setup Circuit
- Alpha Slope Adjustable
- Rotation Speed Indicator (FG)
- Rotation/lock State Indicator (RD)
- Built-in Temperature Control Circuit
- Built-in Thermal Shutdown Circuit
- Lock Protection and Auto-restart

This application note involves the general description, recommended application steps and typical application examples, which may be helpful to designers in product development process.

2. General Description

The AM4963/AM4963R is capable of speed control by PWM pulse. It can be used in applications such as CPU cooler fan in PC and brushless DC motor driver.

The AM4963/AM4963R is available in HTSSOP-14 and SSOP-16 packages.

3. Recommended Application Steps

3.1 Set Up Specification

Create a specification for the fan rotating speed vs. input duty and temperature; draw a curve figure accordingly (Figure 2, 3).

3.2 Create PCB Drawing

Make a PCB drawing in accordance with the recommended application circuit, as shown in Figure 1. The soldering pad area contacted with the power ground pin should be as large as possible to ensure

good heat dissipation ability. D2 and D3 are recommended to be used when the average current in coil L1 is higher than 300mA. A typical PCB application example is shown in Figure 1.

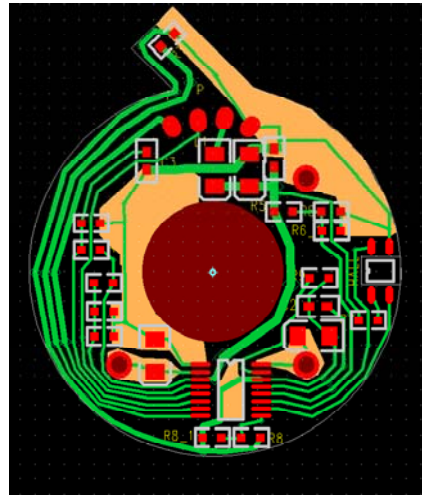


Figure 1. PCB Drawing

3.3 Measure Parameter

Solder D1, C1, C2, C3, R_T (TSM2A103F39H1RZ), R8 (8.03k for 30°C), R9(160k for 38°C), R7 (5.1k) Hall sensor onto the PCB (R1, R2, R3, R4, R5, R6 open); Measure the fan rotating speed vs. input duty and temperature. Draw a curve figure accordingly (Step=5%), as Figure 2, 3.

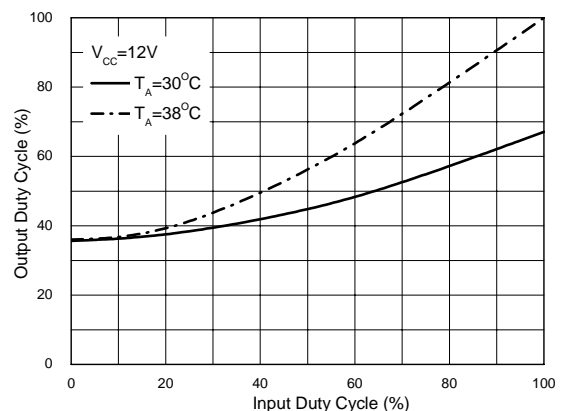


Figure 2. Output Duty Cycle vs. Input Duty Cycle ($V_{CC}=12\text{V}$; $T_A=30^\circ\text{C}$, 38°C)

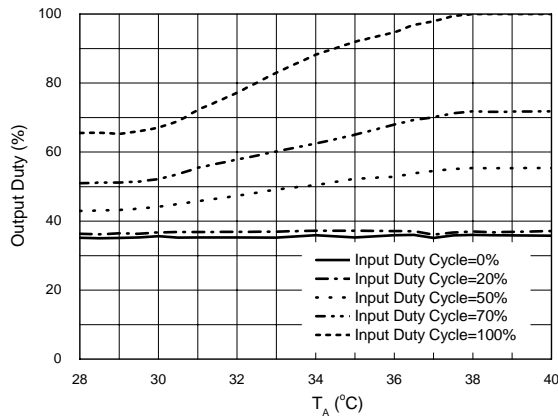


Figure 3. Output Duty Cycle vs. T_A

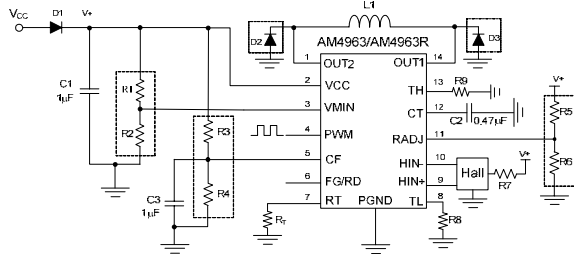


Figure 4. Typical Application of AM4963/AM4963R (Application Circuit for HTSSOP-14 Package)

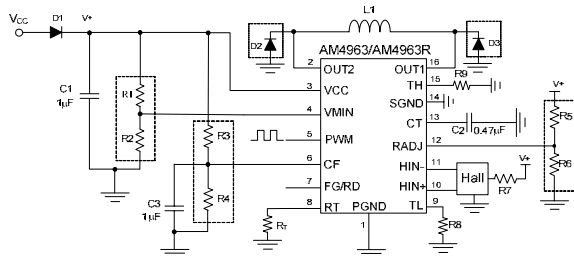


Figure 5. Typical Application of AM4963/AM4963R (Application Circuit for SSOP-16 Package)

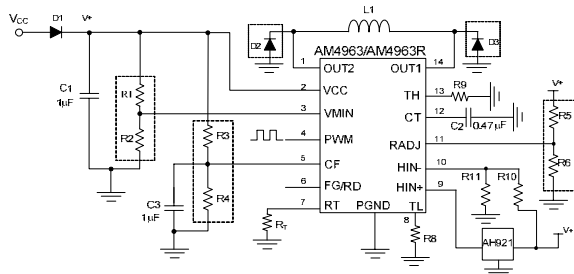


Figure 6. Typical Application of AM4963/AM4963R with AH921 Hall Sensor (Application Circuit for HTSSOP-14 Package)

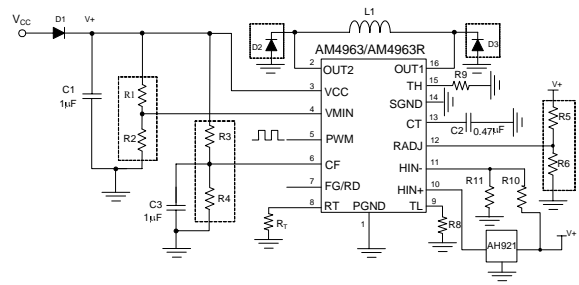


Figure 7. Typical Application of AM4963/AM4963R with AH921 Hall Sensor (Application Circuit for SSOP-16 Package)

Note 1: The package type of AH921 used here is SOT-23-3, if TO-92S-3 is used, please swap the connection of HIN- and HIN+.

3.4 Adjust Low Corner Temperature

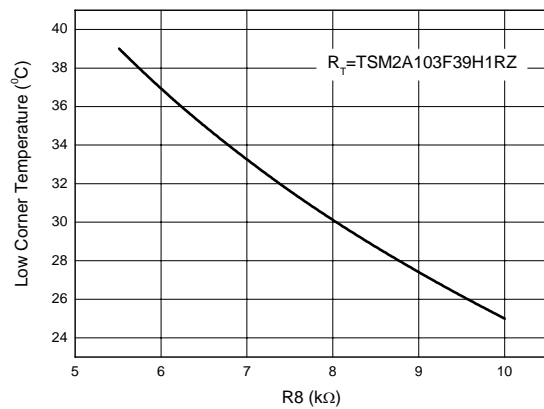


Figure 8. Low Corner Temperature vs. R₈

3.5 Adjust High Corner Temperature

T_H can be expressed as below: $T_H = T_L + 5 * R_9 / 100$.

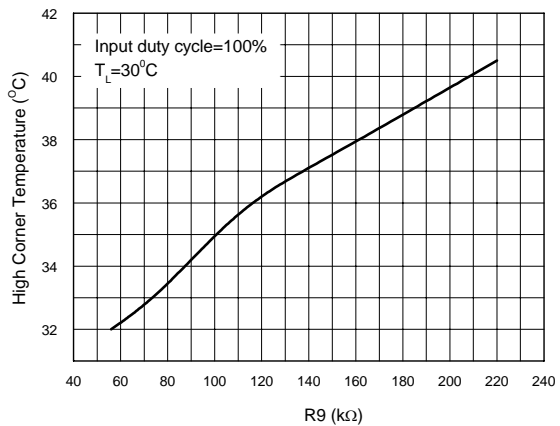


Figure 9. High Corner Temperature vs. R₉ (Note 2)

Note 2:

- 1) Low corner temperature (T_L) is set by thermal resistor R_T and R_8 ; $R_T=R_8$ when at temperature T_L .
- 2) High corner temperature (T_H) can be expressed as: $T_H \approx T_L + 5 * R_9 / 100k$.
- 3) First, set T_L , then T_H .

3.6 Adjust Maximum Speed

(1) First, adjust the maximum speed vs. input duty to approximately match the target specification via R_3 and R_4 at low temperature ($T < T_L$, $V_{RT} < V_{FG/RD}$); Measure the fan rotating speed vs. input duty. And draw a curve figure accordingly (Step=5%).

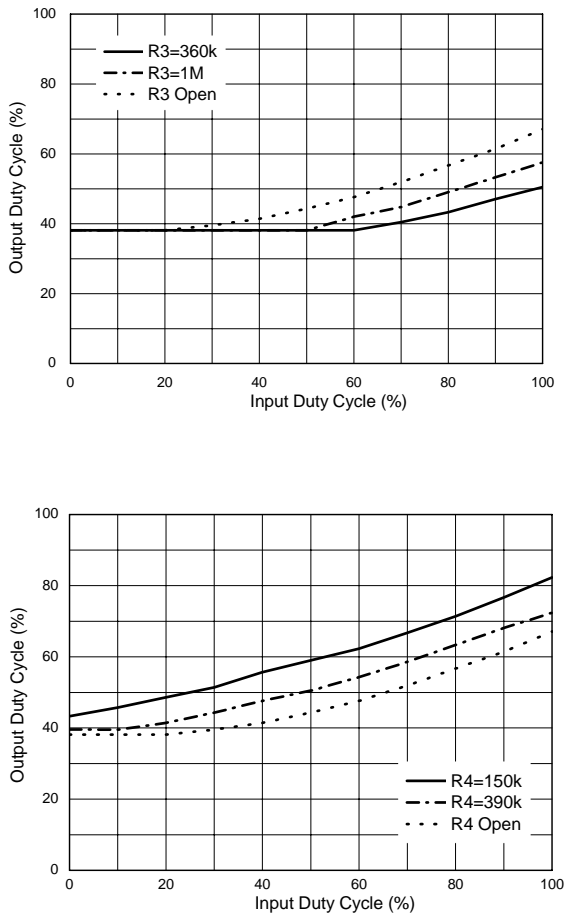


Figure 10. Output Duty Cycle vs. Input Duty Cycle at Low Temperature ($R_3=360k$, $1M$, Open; $R_4=150k$, $390k$, Open)

- (2) Adjust the maximum speed vs. input duty to approximately match the target specification via R_3 and R_4 at high temperature ($T > T_H$, $V_{RT} > V_{FG/RD} + 0.7V$)

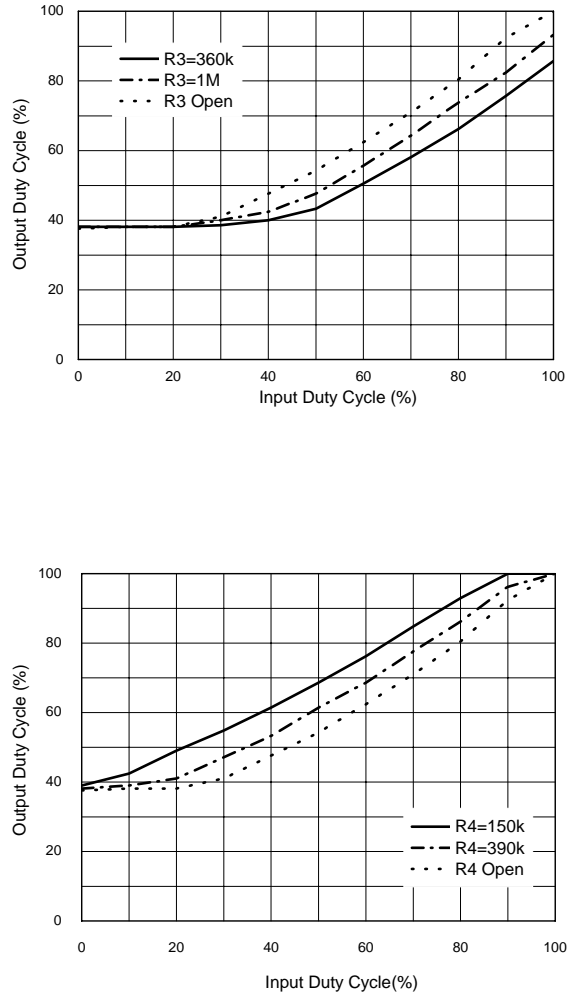


Figure 11. Output Duty Cycle vs. Input Duty Cycle at High Temperature ($R_3=360k$, $1M$, Open; $R_4=150k$, $390k$, Open)

3.7 Adjust Slope k

Adjust slope k of the fan rotating speed vs. input duty to approximately match the target specification via R5 and R6; Measure the fan rotating speed vs. input duty. And draw a curve figure accordingly, as shown in Figure 12.

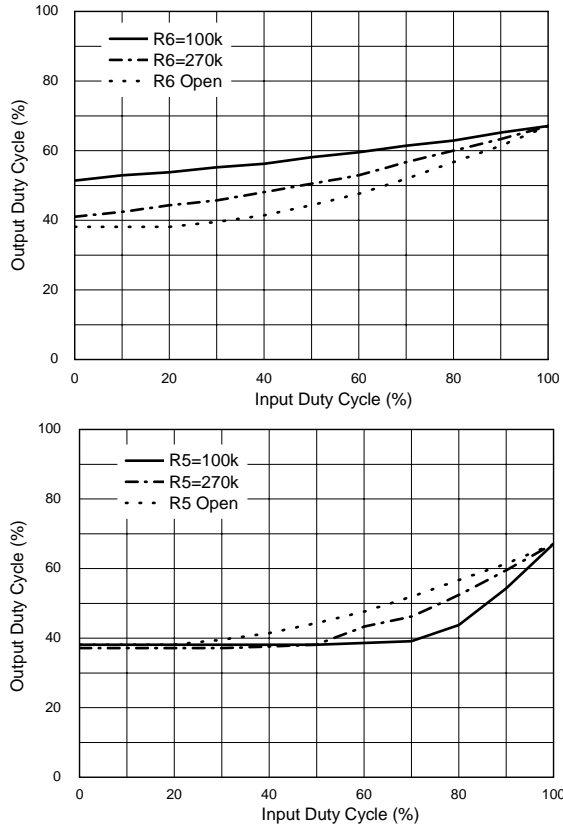


Figure 12. Output Duty Cycle vs. Input Duty Cycle (R5, R6=100k, 270k, Open)

3.8 Adjust Minimum Speed

Adjust the minimum speed vs. input duty to approximately match the target specification via R2 (R1=15kΩ). Measure the fan rotating speed and the input duty, as shown in Figure 13.

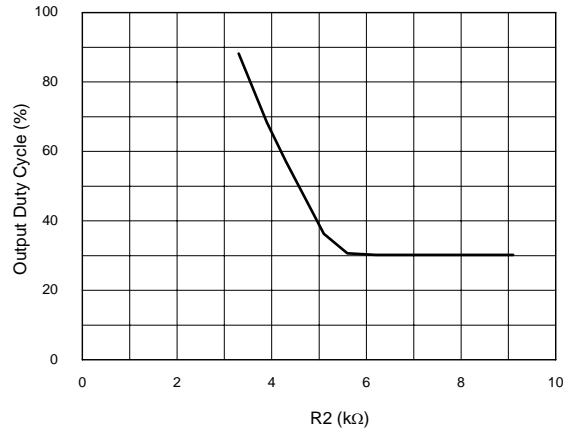


Figure 13. Output Duty Cycle vs. R2