

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R****General Description**

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 available in HTSSOP-14 and SSOP-16 packages.

**Features**

- 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

**Applications**

- CPU Cooler Fan in PC
- Brushless DC Motor Driver

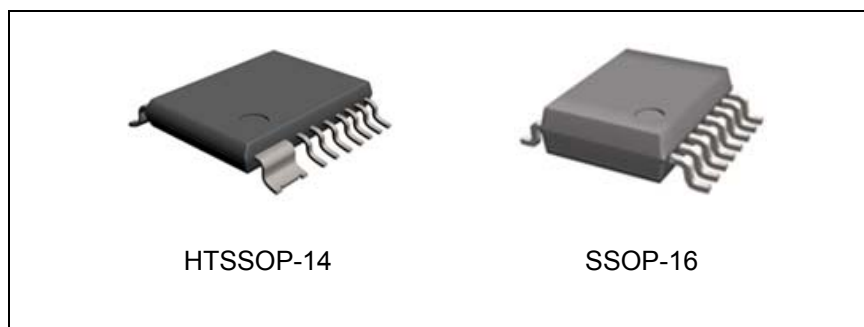


Figure 1. Package Types of AM4963/AM4963R

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R**

**Pin Configuration**

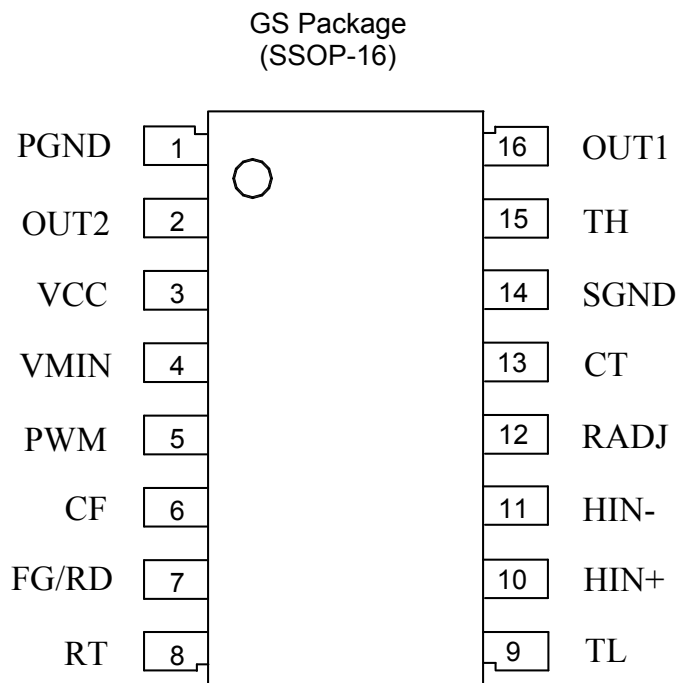
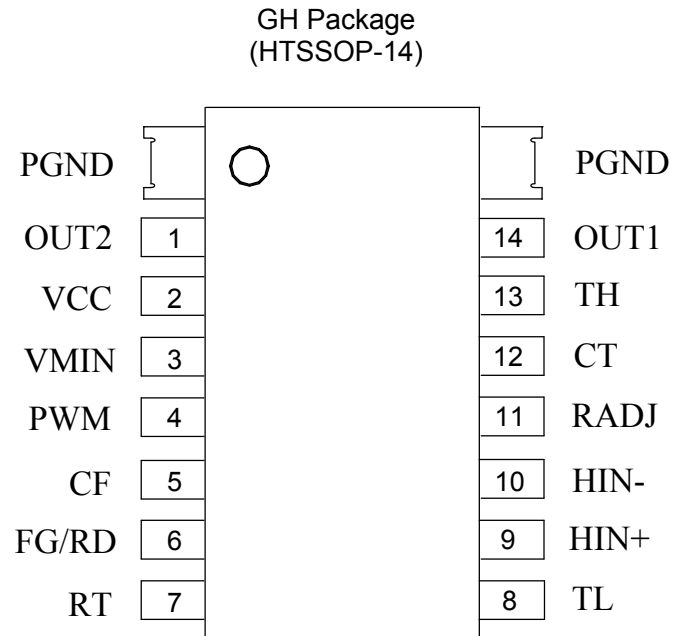


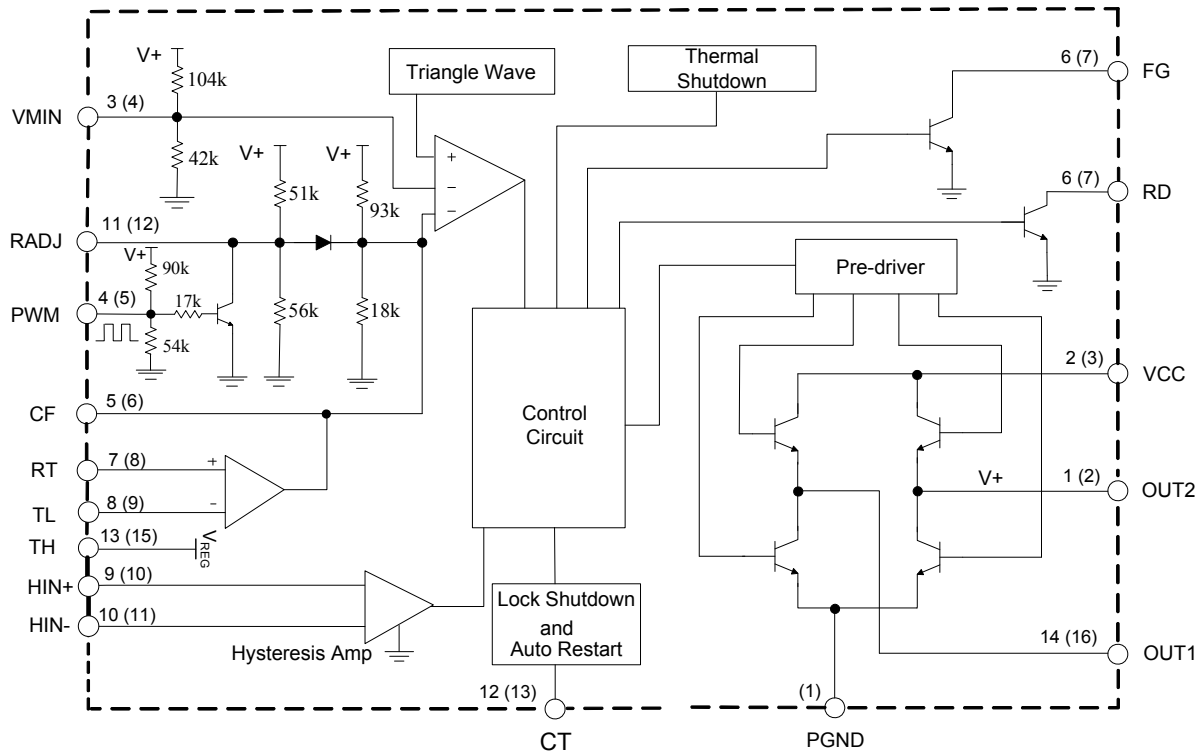
Figure 2. Pin Configuration of AM4963/AM4963R (Top View)

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R****Pin Description**

Pin Number		Pin Name	Function
HTSSOP-14	SSOP-16		
1	2	OUT2	Driver output2
2	3	VCC	Power
3	4	VMIN	Minimum duty setting
4	5	PWM	PWM pulse adjustable input
5	6	CF	PWM Filter capacitor input
6	7	FG/RD	Rotation speed indicator or Rotation/lock state indicator
7	8	RT	Thermal sensitive
8	9	TL	Low temperature set resistor
9	10	HIN+	Hall sensor input+
10	11	HIN-	Hall sensor input-
11	12	RADJ	Alpha slope adjustable
12	13	CT	Lock and rotation setting capacitor terminal
13	15	TH	High temperature set resistor
14	16	OUT1	Driver output1
	1	PGND	Power ground
	14	SGND	Signal ground

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R**

**Functional Block Diagram**



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

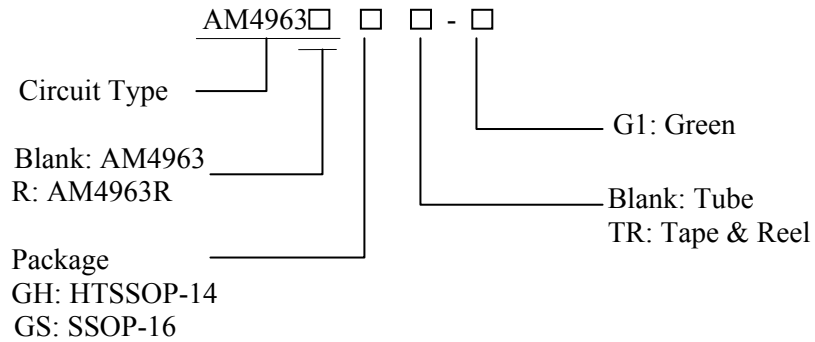
Figure 3. Functional Block Diagram of AM4963/AM4963R

**Truth Table**

Items	IN-	IN+	VCF	CT	OUT1	OUT2	FG	RD	Mode
1	H	L	L	L	H	L	L	L (ON)	Rotation
2	L	H			L	H	Off		Off
3	H	L	H		Off	L	L		Rotation Recirculation
4	L	H			L	Off	Off		Off
5	H	L	L	H	H	Off	L	H (OFF)	Lock Protection
6	L	H			L	Off	H		

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R**

**Ordering Information**



Package	Temperature Range	Part Number	Marking ID	Packing Type
HTSSOP-14	-30 to 90°C	AM4963GH-G1	AM4963GH-G1	Tube
		AM4963GHTR-G1	AM4963GH-G1	Tape & Reel
		AM4963RGH-G1	AM4963RGH-G1	Tube
		AM4963RGHTR-G1	AM4963RGH-G1	Tape & Reel
SSOP-16		AM4963GS-G1	AM4963GS-G1	Tube
		AM4963GSTR-G1	AM4963GS-G1	Tape & Reel
		AM4963RGS-G1	AM4963RGS-G1	Tube
		AM4963RGSTR-G1	AM4963RGS-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 AM4963/AM4963R****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value		Unit
Supply Voltage	$V_{CC}$	18		V
Output Current	$I_{OUT}$	1.0		A
Output Voltage	$V_{OUT}$	18		V
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 (Junction to Ambient)	$\theta_{JA}$	SSOP-16	156	°C/W
		HTSSOP-14	114	
ESD (Human Body Model)	ESD	3000		V
ESD (Machine Model)	ESD	300		V

Note 1: 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 2)	$V_{IN+}$	0.2		3	V
Hall Input Voltage - (Note 2)	$V_{IN-}$	0.2		3	V
Ambient Temperature	$T_A$	-30		90	°C

Note 2: Hall input voltage range includes the amplitude of signal.

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R****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> =L	10	15	18.8	mA
	I <sub>Q2</sub>	V <sub>CT</sub> =H	5.2	8	10.6	
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>PWM</sub>		18	25	32	kHz
CPWM High Level Voltage	V <sub>CPWMH</sub>		3.4	3.6	3.8	V
CPWM Low Level Voltage	V <sub>CPWML</sub>		1.8	2.1	2.3	V
CF High Level Voltage	V <sub>CFH1</sub>		2.9	3.1	3.4	V
	V <sub>CFH2</sub>		2.9	3.2	3.5	
CF Low Level Voltage	V <sub>CFL1</sub>		2.3	2.6	2.9	V
	V <sub>CFL2</sub>		1.7	2.0	2.3	
RADJ Pin Voltage	V <sub>ADJ1</sub>		3.6	3.9	4.2	V
	V <sub>ADJ2</sub>		3.7	4.0	4.3	
V <sub>MIN</sub> Voltage	V <sub>MIN</sub>		2.4	3.0	3.3	V
Hall Input Hysteresis	V <sub>HYS</sub>			±10	±20	mV
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>		1.11	2.3	3.6	μA
CT Discharge Current	I <sub>DHG</sub>		0.11	0.23	0.36	μA
CT Charge and Discharge Ratio	R <sub>CD</sub>	I <sub>CHG</sub> /I <sub>DHG</sub>	8.3	12	15.8	
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> =7V			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> =7V			30	μA

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R**

**Typical Performance Characteristics**

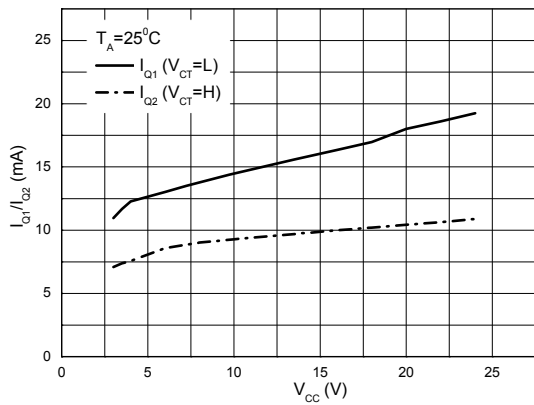


Figure 4. Quiescent Current vs. Supply Voltage

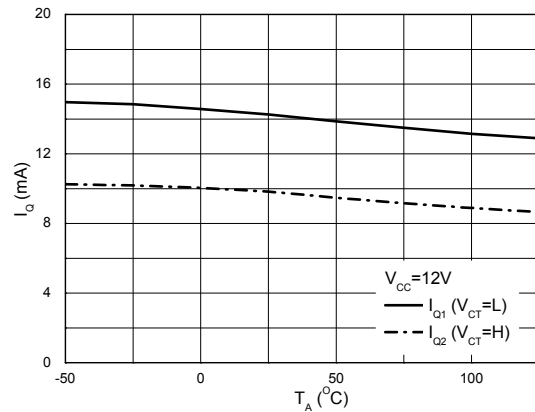


Figure 5. Quiescent Current vs. Ambient Temperature

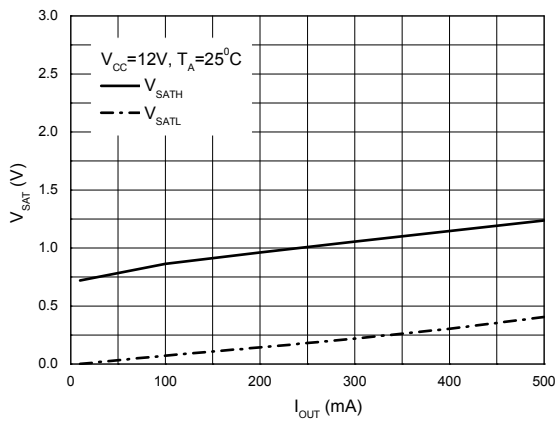


Figure 6. Output Saturation Voltage vs. Output Current

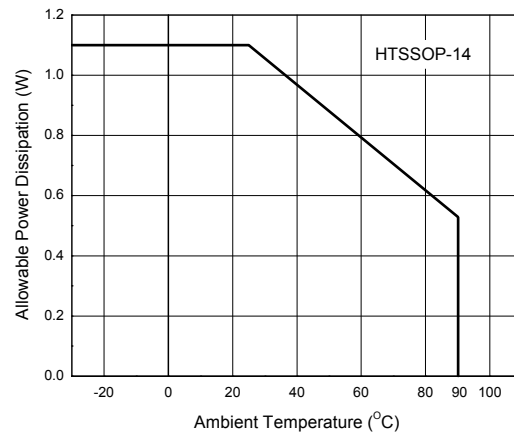


Figure 7. Allowable Power Dissipation vs. Ambient Temperature (For HTSSOP-14)



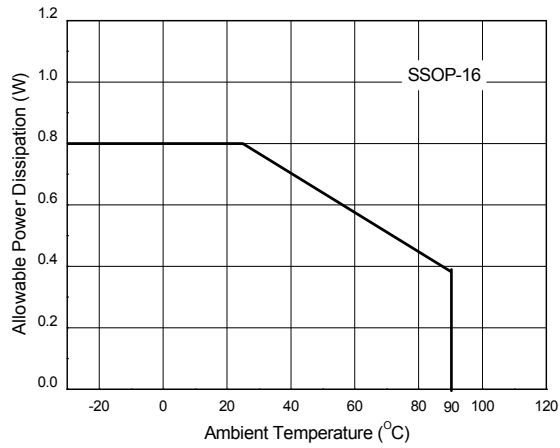
**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R****Typical Performance Characteristics (Continued)**

Figure 8. Allowable Power Dissipation vs. Ambient Temperature (For SSOP-16)

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R**

**Operating Diagram**

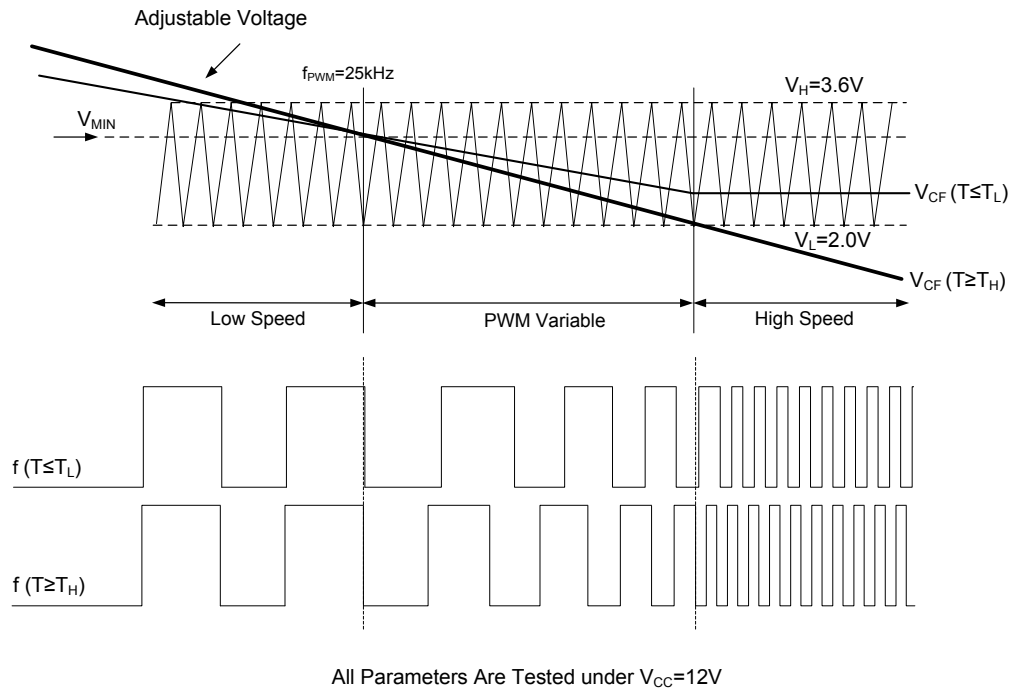
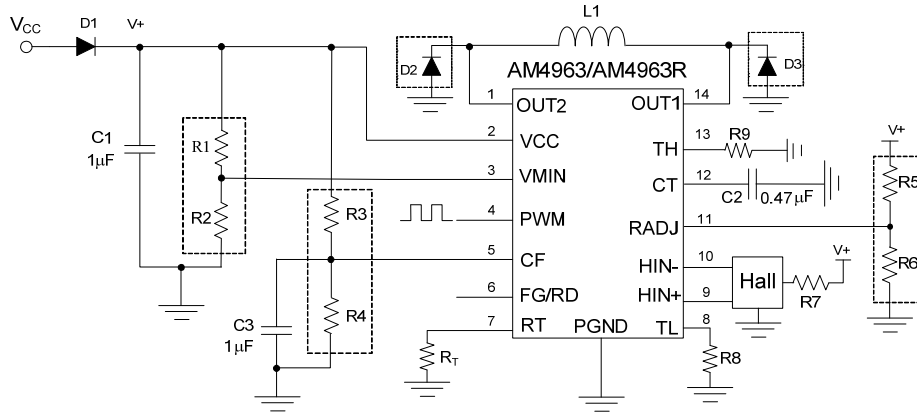


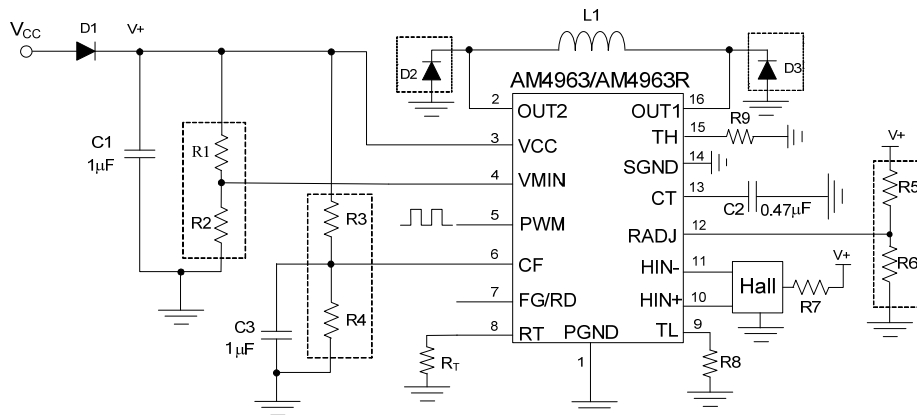
Figure 9. Operating Diagram of AM4963/AM4963R

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R**

**Typical Application**



Application Circuit for HTSSOP-14 Package

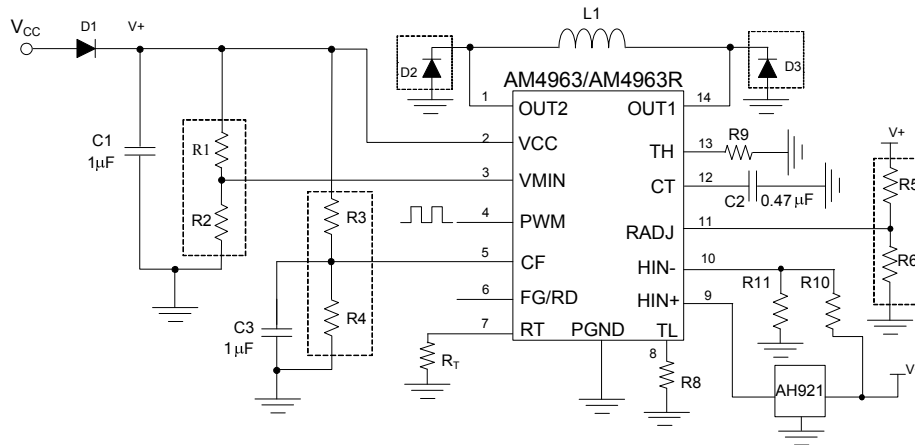


Application Circuit for SSOP-16 Package

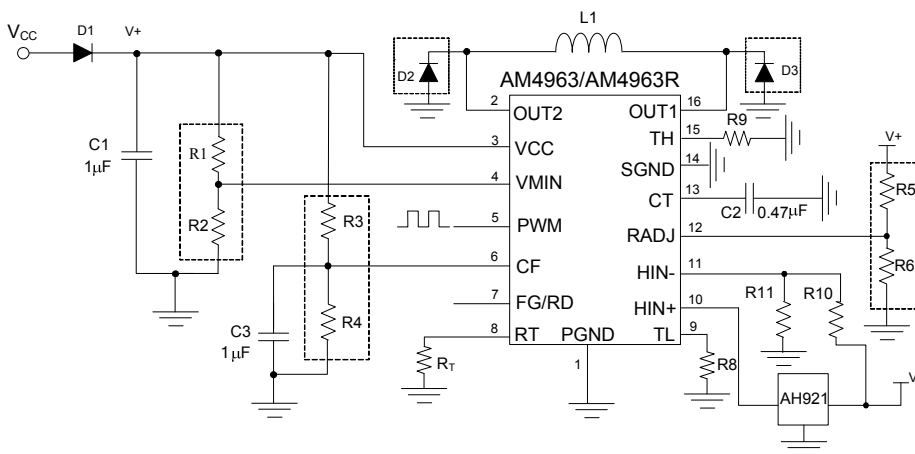
Figure 10. Typical Applications of AM4963/AM4963R

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R**

**Typical Application (Note 3, continued)**



Application Circuit for HTSSOP-14 Package



Application Circuit for SSOP-16 Package

Figure 11. Typical Applications of AM4963/AM4963R with AH921 Hall Sensor

Note 3: 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+.

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R**

**Typical Application (Note 4, Continued)**

Note 4: Some typical performance curves of applications based on circuits above (Figure 10, 11) are shown as below (R1 to R6 open, R8=8kΩ, R9=150kΩ).

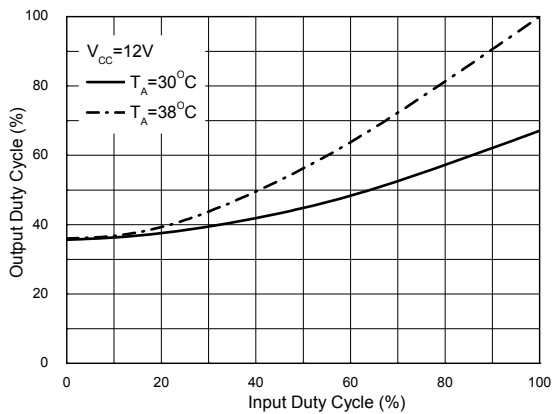


Figure 12. Output Duty Cycle vs. Input Duty Cycle

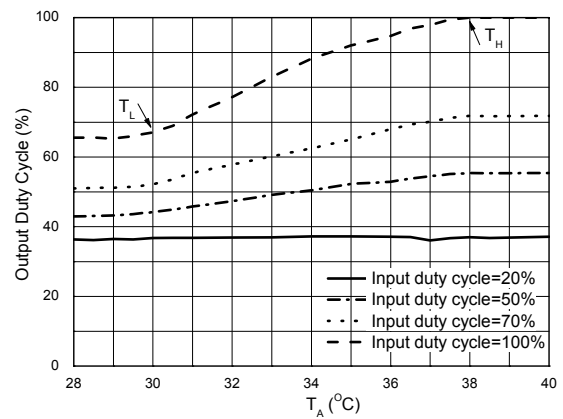


Figure 13. Output Duty Cycle vs. TA

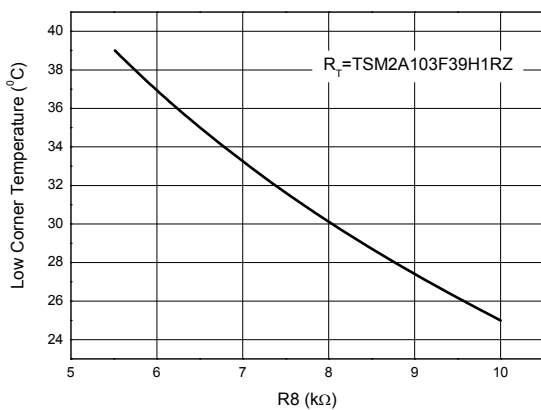


Figure 14. Low Corner Temperature vs. R8

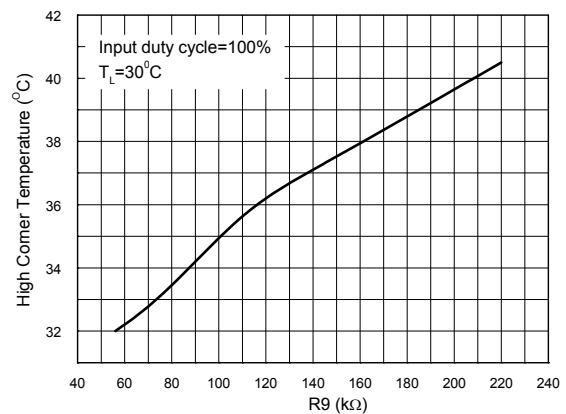


Figure 15. High Corner Temperature vs. R9 (Note 5)

Note 5:

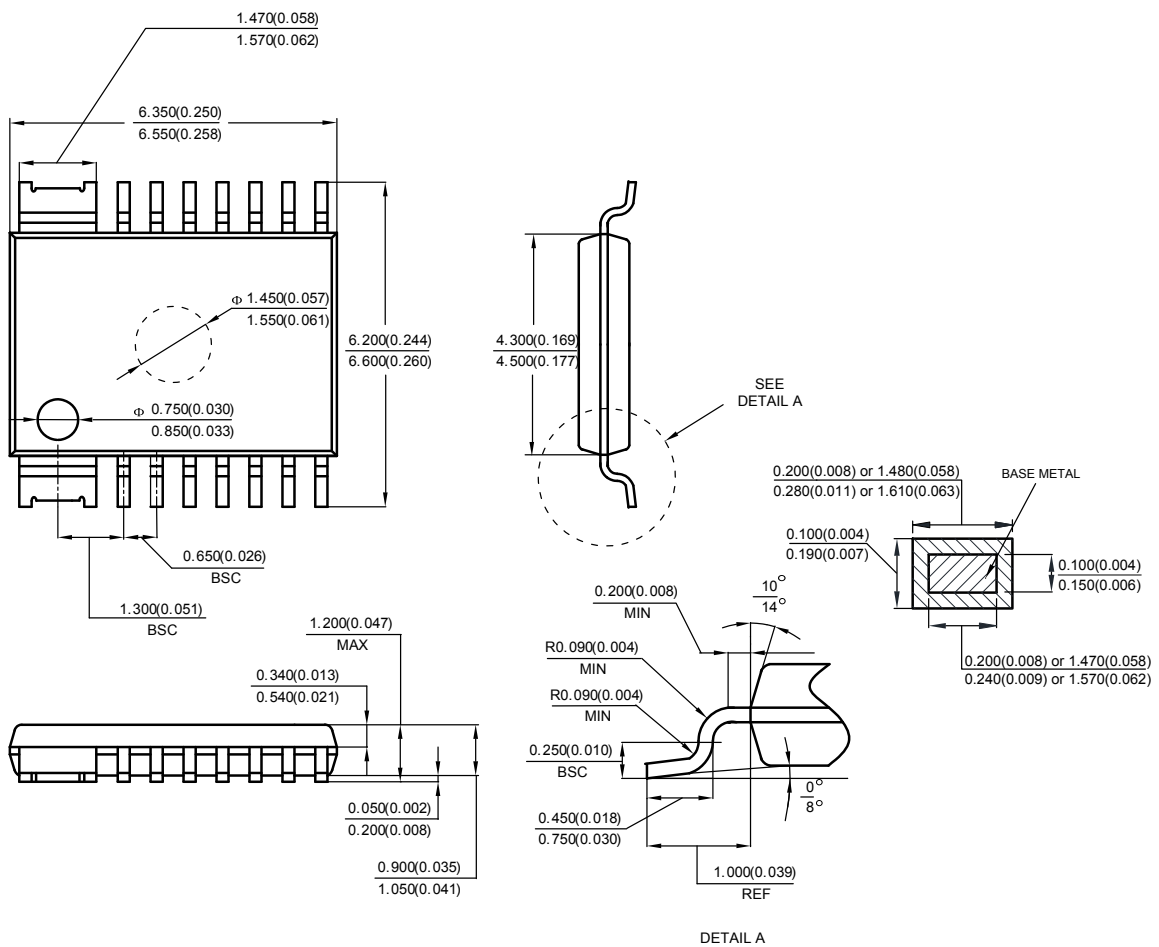
- 1) Low corner temperature ( $T_L$ ) is set by thermal resistor  $R_T$  and  $R_8$ ;  $R_T=R_8$  when at temperature  $T_L$ .
- 2) High corner temperature ( $T_H$ ) can be expressed as:  $T_H \approx T_L + 5 * R_9 / 100k$ .
- 3) First, set  $T_L$ , then  $T_H$ .

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R**

**Mechanical Dimensions**

**HTSSOP-14**

**Unit: mm(inch)**



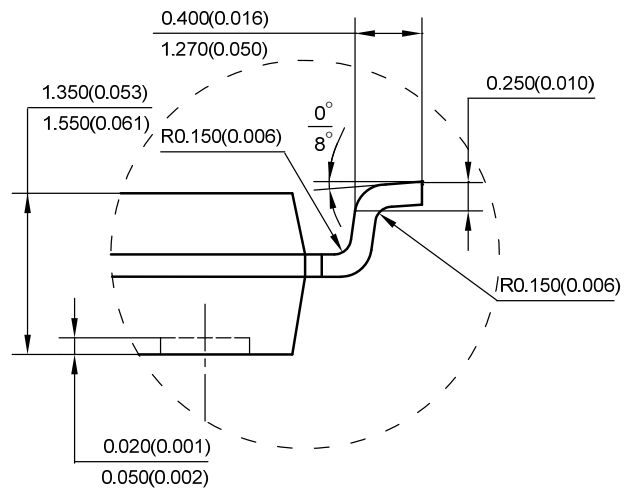
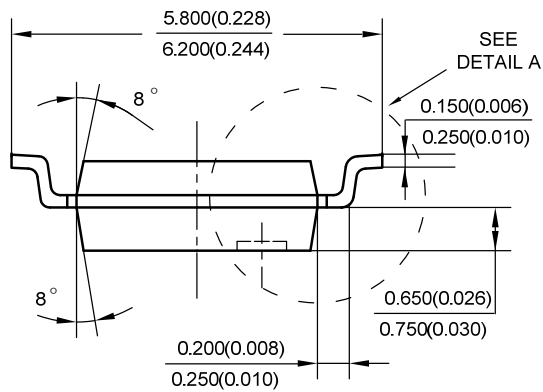
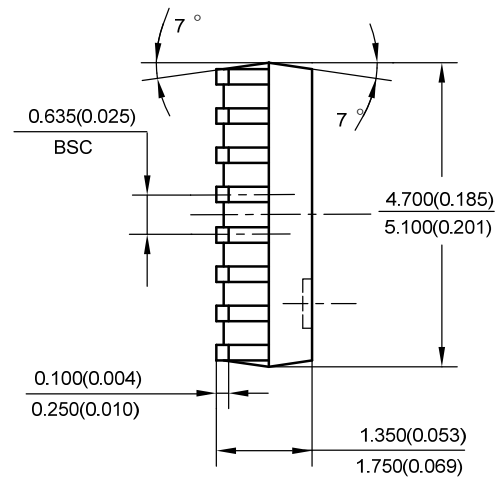
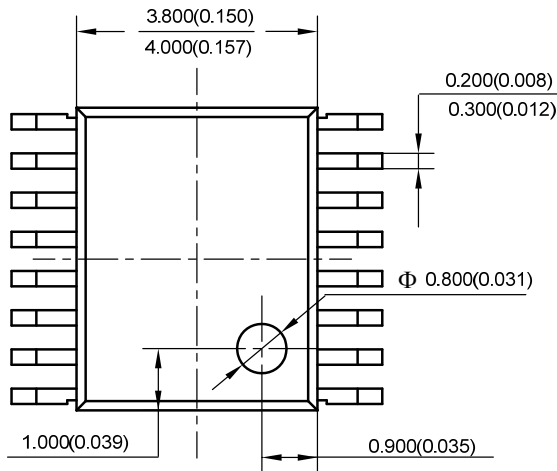
Note: Eject hole, oriented hole and mold mark is optional.

**Single Phase Full Wave Direct PWM Motor Driver AM4963/AM4963R**

**Mechanical Dimensions (Continued)**

**SSOP-16**

**Unit: mm(inch)**



DETAIL A

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



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#### **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