BTL Drive Single-phase Full-wave Fan Motor Driver AM4953

General Description

The AM4953 is a single-phase BTL output fan motor driver designed by bipolar process. This IC features high efficiency, silent operation and includes lock shutdown and automatic restart functions. When the motor is under lock condition, the lock shutdown function turns off the output current. When the lock condition is removed, the IC will restart automatically and allow DC fan to run. It is applied for high reliability and low noise application, such as personal computers, notebook, car audio, CPU cooling systems and power supplies in consumer electronics systems.

The AM4953 is available in MSOP-10, SSOP-10, MSOP-8, SOIC-8 and PSOP-8 packages.

Features

- BTL Output Single-phase Full-wave Linear Drive (Gain Resistor=1k to 360kΩ, Gain=51dB)
- Support Low-voltage Drive and Feature a Wide Usable Voltage Range (2.2V to 16V)
- Low Saturation Output (High Side and Low Side Saturation Voltage): V_{SAT_TOTAL}=1.2V (typical, I_{OUT}=300mA)
- Built-in Lock Protection and Automatic Restart Circuits
- Built-in FG/RD Output
- Built-in Hall Sensor Bias (V_{HB}=1.45V)
- Thermal Protection Circuit
- Small-sized, High Thermal Capacity Package

Applications

- Notebook, Personal Computers
- Power Supplies in Consumer Electronics, Car Audio
- CPU Cooling Systems

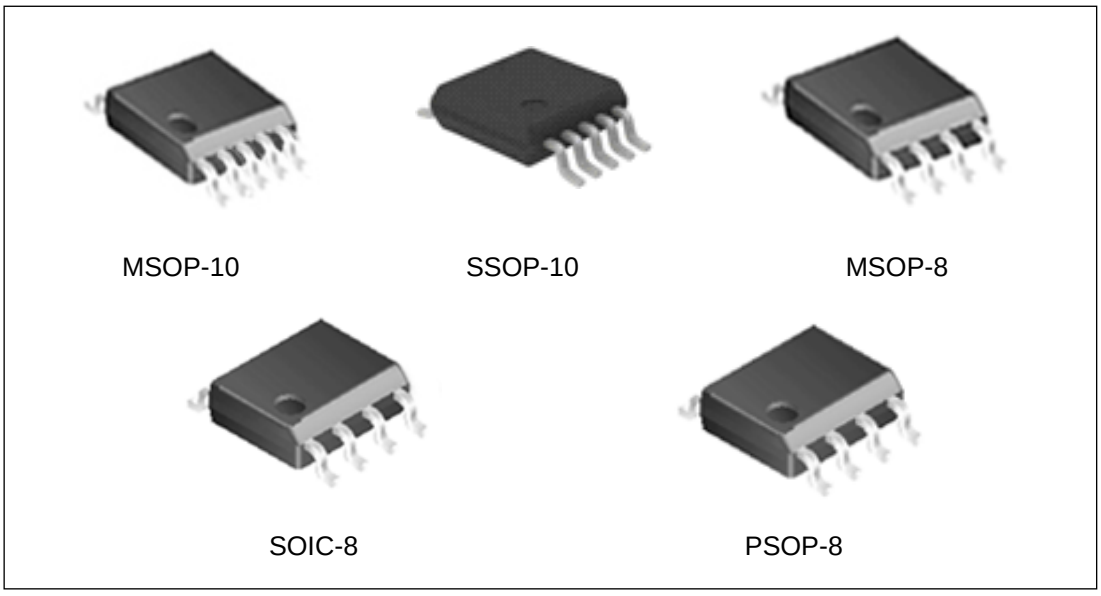
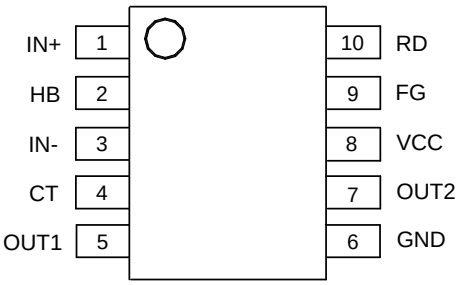


Figure 1. Package Types of AM4953

Pin Configuration

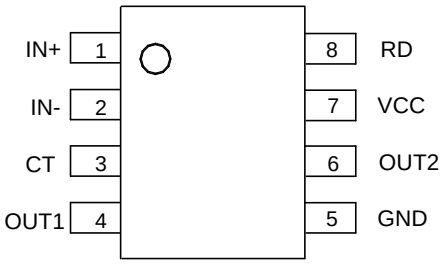
MM Package

(MSOP-10)



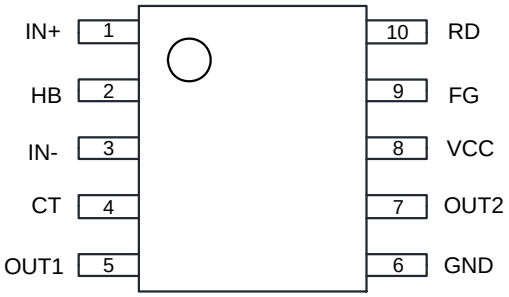
M8 Package

(MSOP-8)



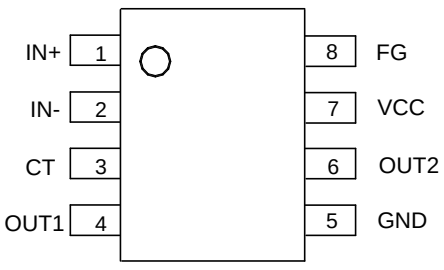
GS Package

(SSOP-10)



M Package

(SOIC-8)



MP Package

(PSOP-8)

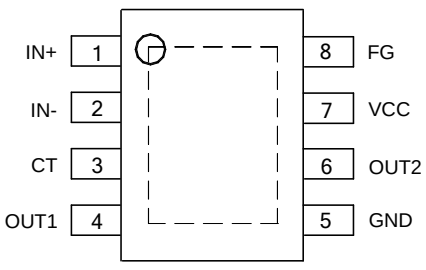
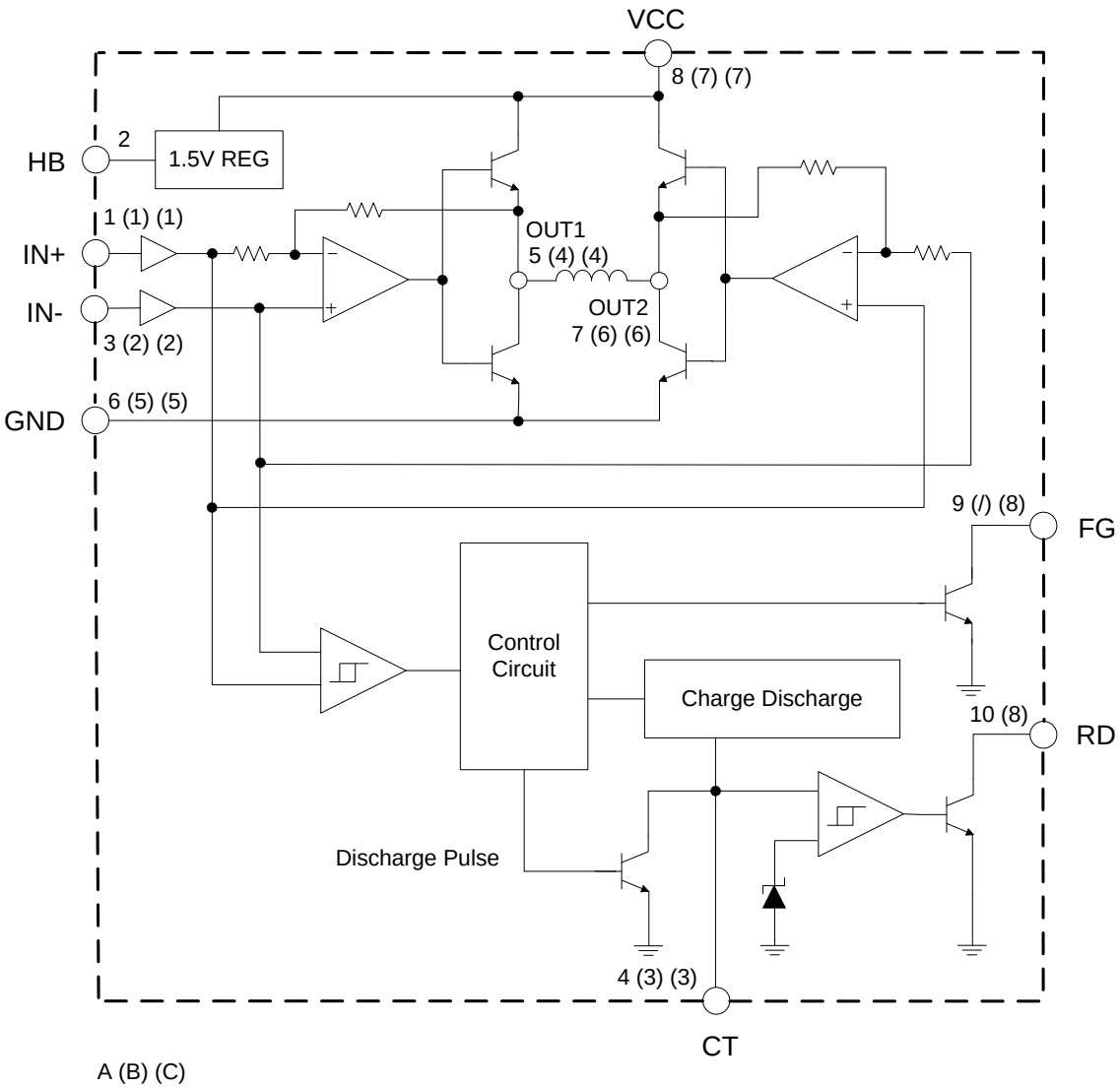


Figure 2. Pin Configuration of AM4953 (Top View)

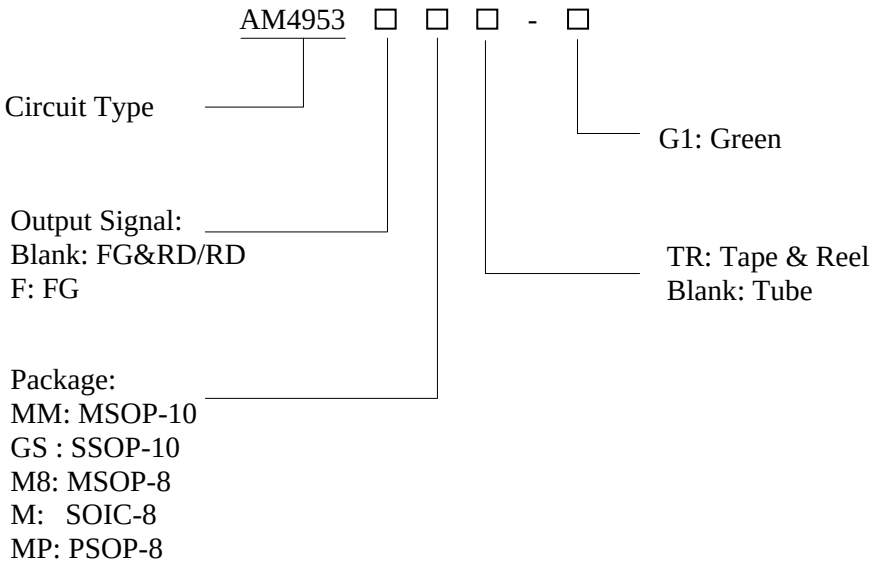
Functional Block Diagram



A (B) (C)
A for MSOP-10/SSOP-10
B for MSOP-8
C for SOIC-8/PSOP-8

Figure 3. Functional Block Diagram of AM4953

Ordering Information



Package	Temperature Range	Output Signal	Part Number	Marking ID	Packing Type
MSOP-10	-40 to 105ºC	FG & RD	AM4953MM-G1	4953MM-G1	Tube
			AM4953MMTR-G1	4953MM-G1	Tape & Reel
SSOP-10		FG & RD	AM4953GS-G1	4953GS-G1	Tube
			AM4953GSTR-G1	4953GS-G1	Tape & Reel
MSOP-8		RD	AM4953M8-G1	4953M8-G1	Tube
			AM4953M8TR-G1	4953M8-G1	Tape & Reel
SOIC-8		FG	AM4953FM-G1	4953FM-G1	Tube
			AM4953FMTR-G1	4953FM-G1	Tape & Reel
PSOP-8		FG	AM4953FMP-G1	4953FMP-G1	Tube
			AM4953FMPTR-G1	4953FMP-G1	Tape & Reel

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

Absolute Maximum Ratings (Note 1, T_A=25ºC)

Parameter	Symbol	Value		Unit
Supply Voltage	V_{CC}	20		V
Peak Output Current	I_{OUT}	800		mA
FG/RD Pull-up Voltage	V_{FG}/V_{RD}	15		V
FG/RD Output Current	I_{FG}/I_{RD}	10		mA
Power Dissipation	P_D	MSOP-10	585	mW
		MSOP-8		
		SSOP-10	800	
		SOIC-8	780	
		PSOP-8	960	
Operating Temperature	T_{OP}	-40 to 125		ºC
Storage Temperature	T_{STG}	-55 to 150		ºC
ESD (Human Body Model)	ESD	4000		V
ESD (Machine Model)	ESD	200		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	Max	Unit
Supply Voltage	V_{CC}	2.2	16	V
Hall Input Voltage	V_{ICM}	0	V_{CC}-1.5	V
Operating Ambient Temperature	T_A	-40	105	ºC

Electrical Characteristics

V_{CC}=12V, T_A=25°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Current	I_{CC1}	V_{CT}=L	6	8	9.6	mA
	I_{CC2}	V_{CT}=H	2	4	6	mA
CT Charge Current	I_{CHG}		1	1.7	2.5	μA
CT Discharge Current	I_{DHG}		0.15	0.27	0.36	μA
CT Charge/Discharge Current Ratio	R_{CT}	I_{CHG} / I_{DHG}	5	7	10	
CT Clamp Voltage	V_{CL}		1.25	1.45	1.65	V
CT Comparator Voltage	V_{CP}		0.25	0.45	0.65	V
OUT Low Saturation Voltage	V_{SAT_L}	I_{OUT}=300mA		0.25	0.45	V
OUT High Saturation Voltage	V_{SAT_H}	I_{OUT}=300mA		0.95	1.3	V
Hall Input Sensitivity	V_{HN}			8	20	mV
FG Low Level Voltage	V_{FG}	I_{FG}=5mA		0.15	0.3	V
FG Leakage Current	I_{FGL}	V_{FG}=15V		1	10	μA
RD Low Level Voltage	V_{RD}	I_{RD}=5mA		0.15	0.3	V
RD Leakage Current	I_{RDL}	V_{RD}=15V		1	10	μA
HB Voltage	V_{HB}	I_{HB}=5mA	1.3	1.45	1.6	V

Typical Performance Characteristics

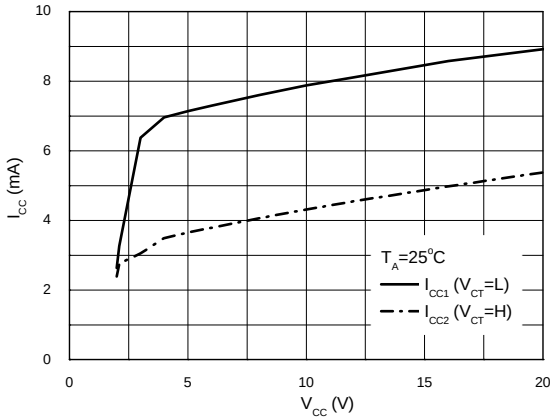


Figure 4. I_{CC} vs. V_{CC}

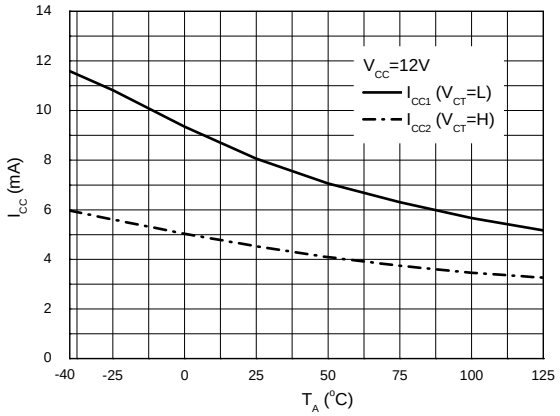


Figure 5. I_{CC} vs. T_A

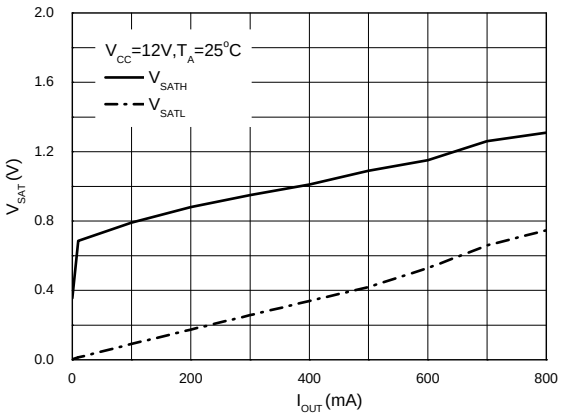


Figure 6. V_{SAT} vs. I_{OUT}

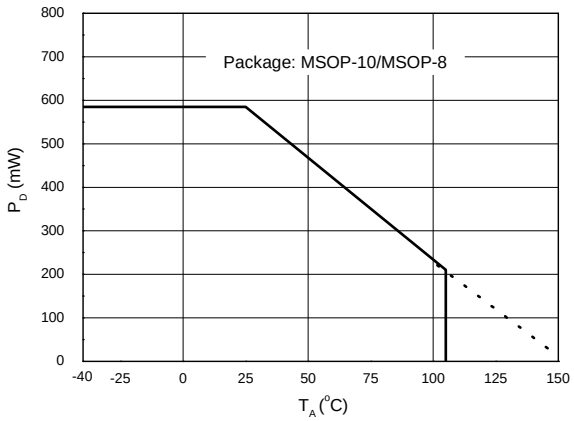


Figure 7. P_D vs.T_A

Typical Performance Characteristics (Continued)

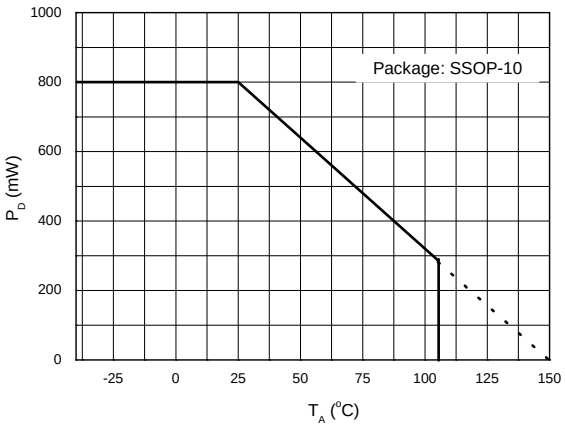


Figure 8. P_D vs.T_A

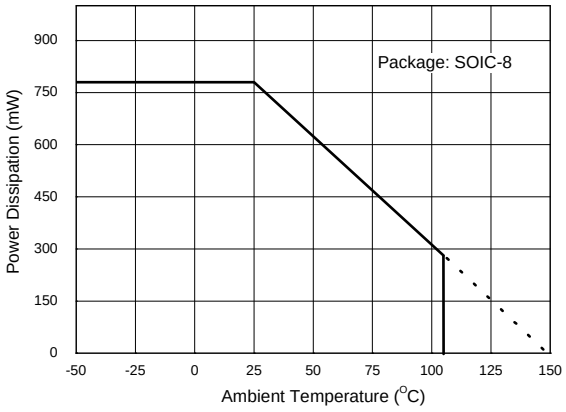


Figure 9. P_D vs.T_A

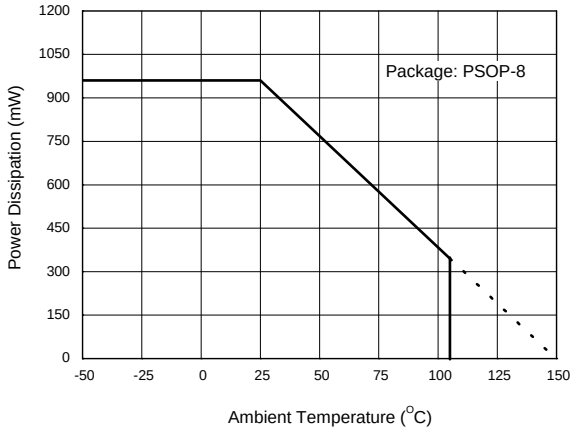
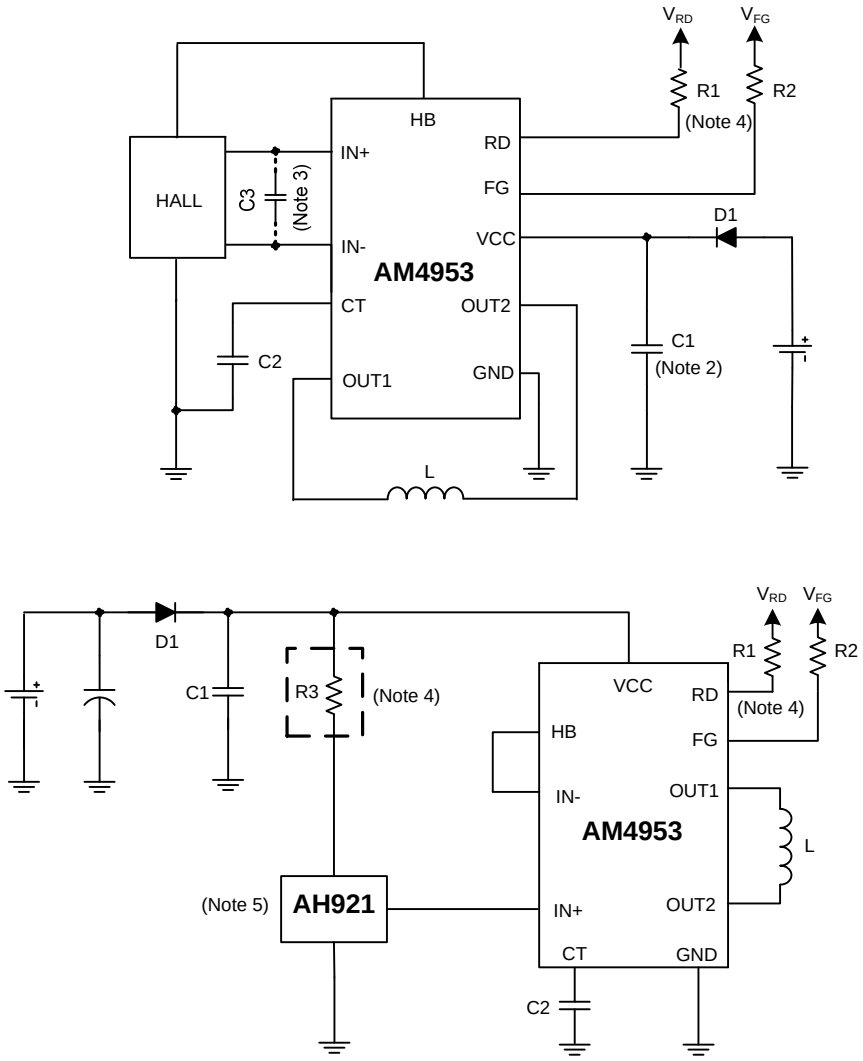


Figure 10. P_D vs.T_A

Truth Table

Items	IN-	IN+	CT	OUT1	OUT2	FG	RD	Mode
1	H	L	L	H	L	L	L	Purring Rotation
2	L	H		L	H	H		
3			H	Off	OFF		H	Lock Protection

Typical Application



Note 2: Adding D1 can protect the IC from destruction by reverse connection. If D1 is used, it is necessary to insert a capacitor C1 to provide a regenerative current route. Similarly, if there is no nearby capacitor on the fan power supply line, C1 will also be necessary to improve reliability. Its capacity should be larger than 2.2μF.

Note 3: If the line between Hall sensor output and Hall sensor input of IC is long, the noise may occur in this line. But it can be eliminated by adding a capacitor C3.

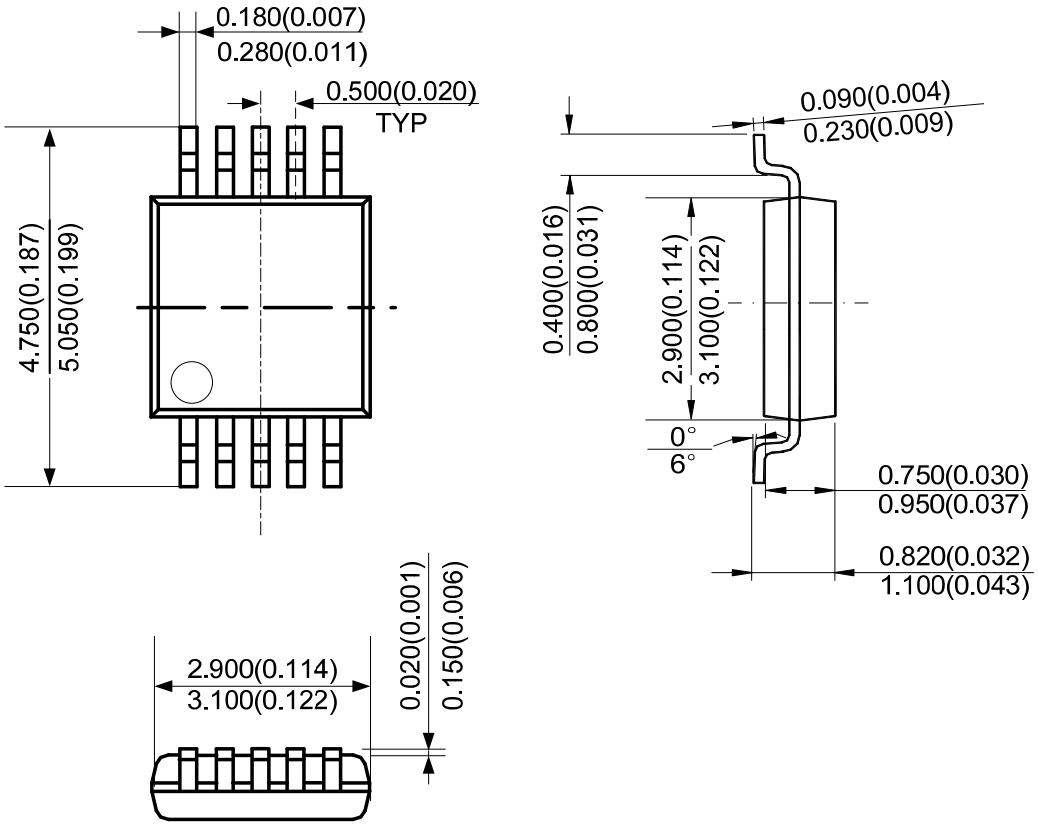
Note 4: Each of R1 and R2 is recommended to be 51kΩ typical. R3 is recommended to be 2k and must be added when V_{CC} is larger than 20V.

Note 5: The package of AH921 is SOT-23-3. If it is packaged in TO-92S-3，please exchange IN- with IN+.

Figure 11. Typical Application of AM4953

Mechanical Dimensions

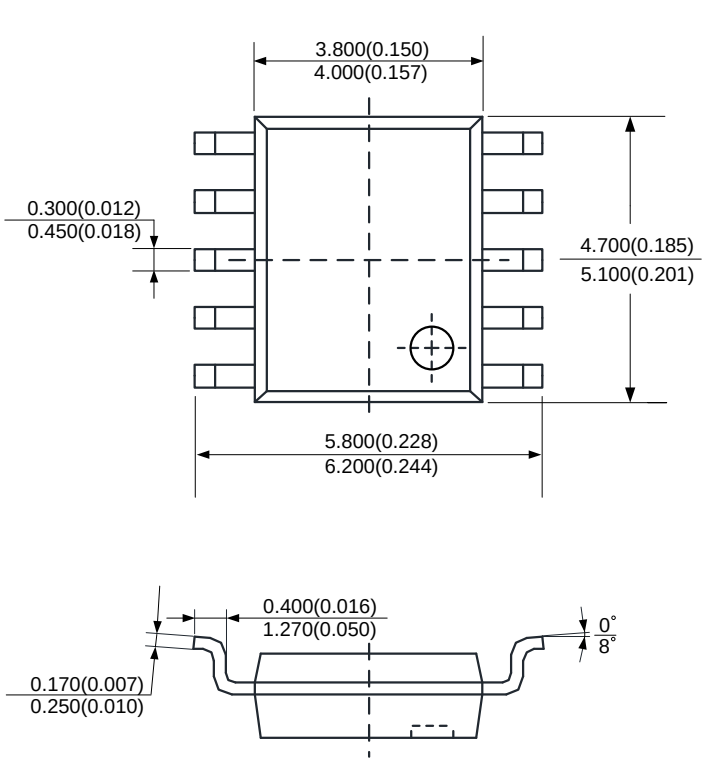
MSOP-10 **Unit: mm(inch)**



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

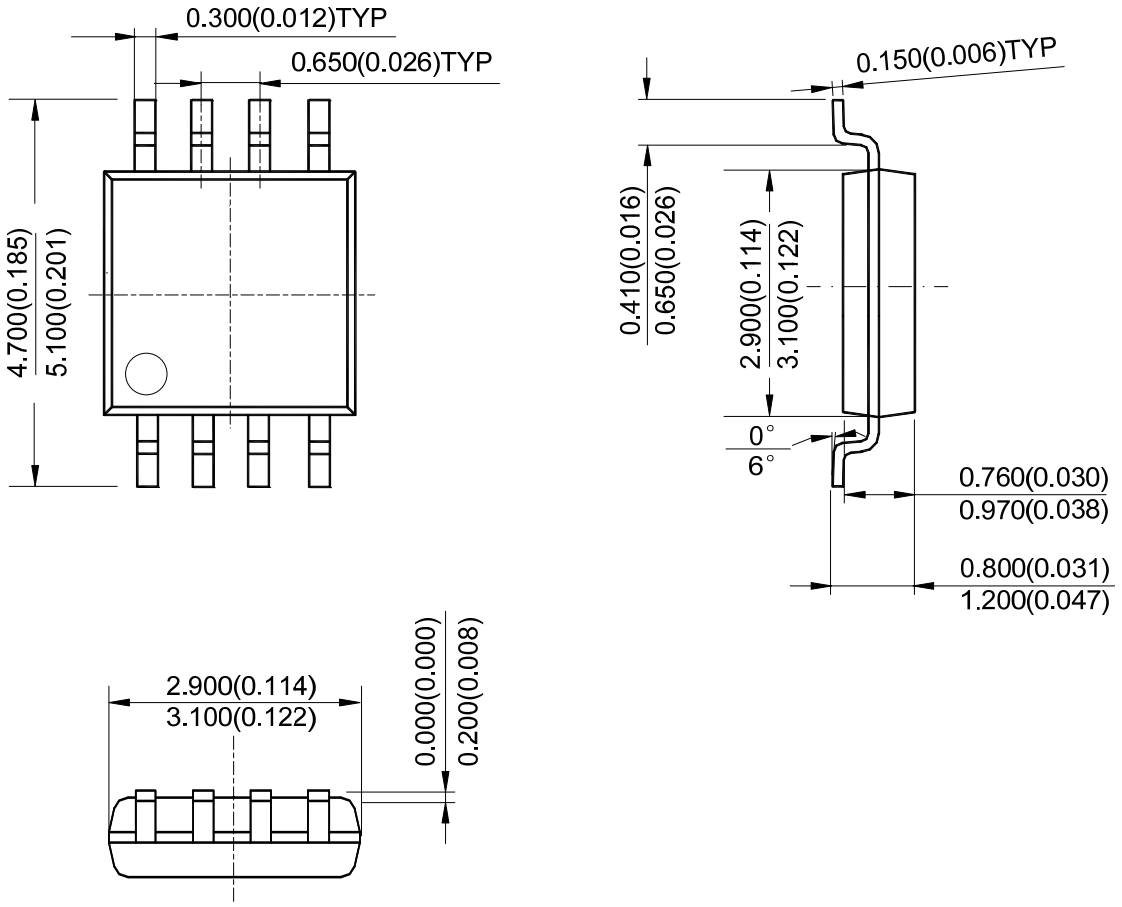
Mechanical Dimensions (Continued)

SSOP-10 **Unit: mm(inch)**



Mechanical Dimensions (Continued)

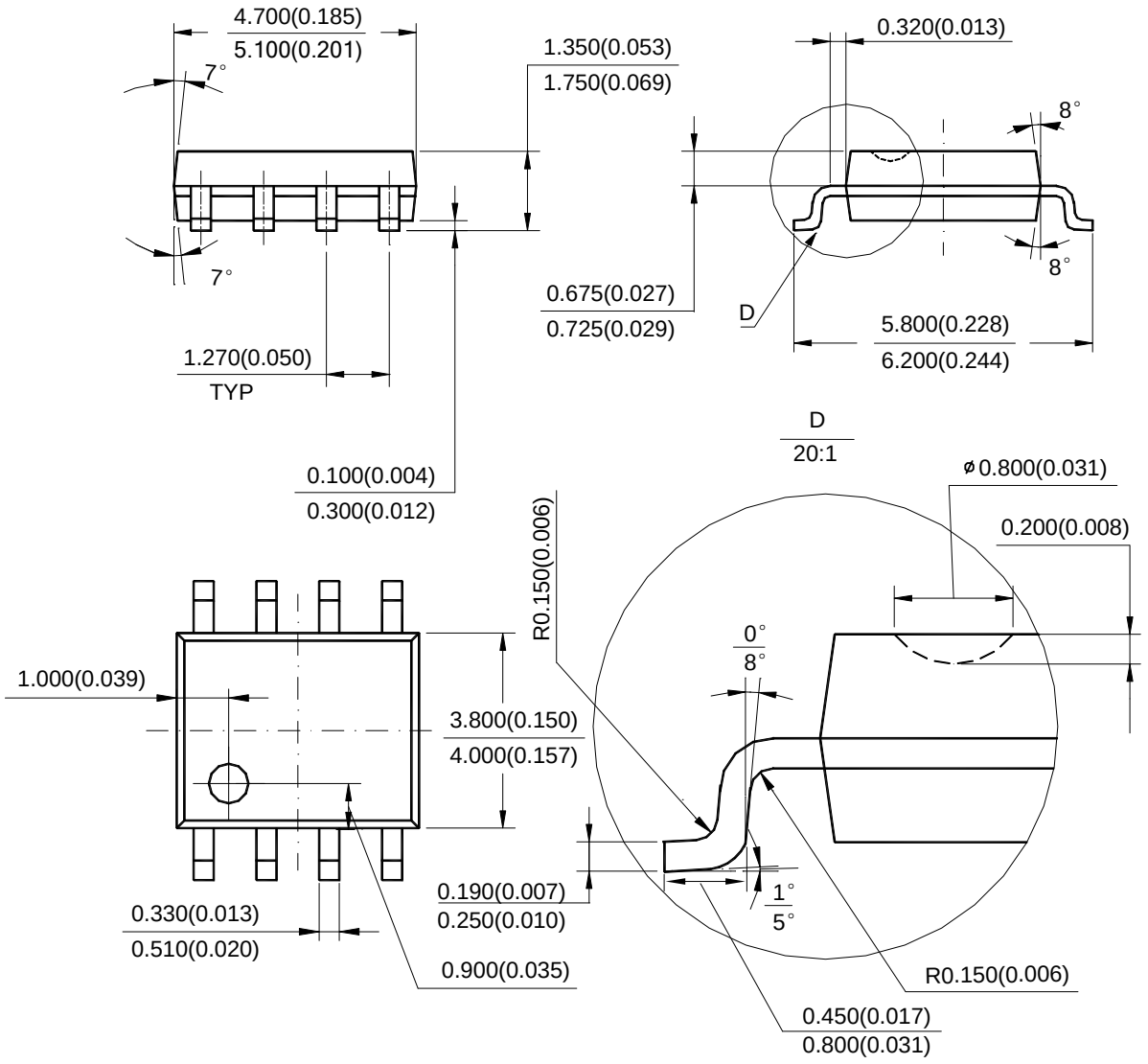
MSOP-8 **Unit: mm(inch)**



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

Mechanical Dimensions (Continued)

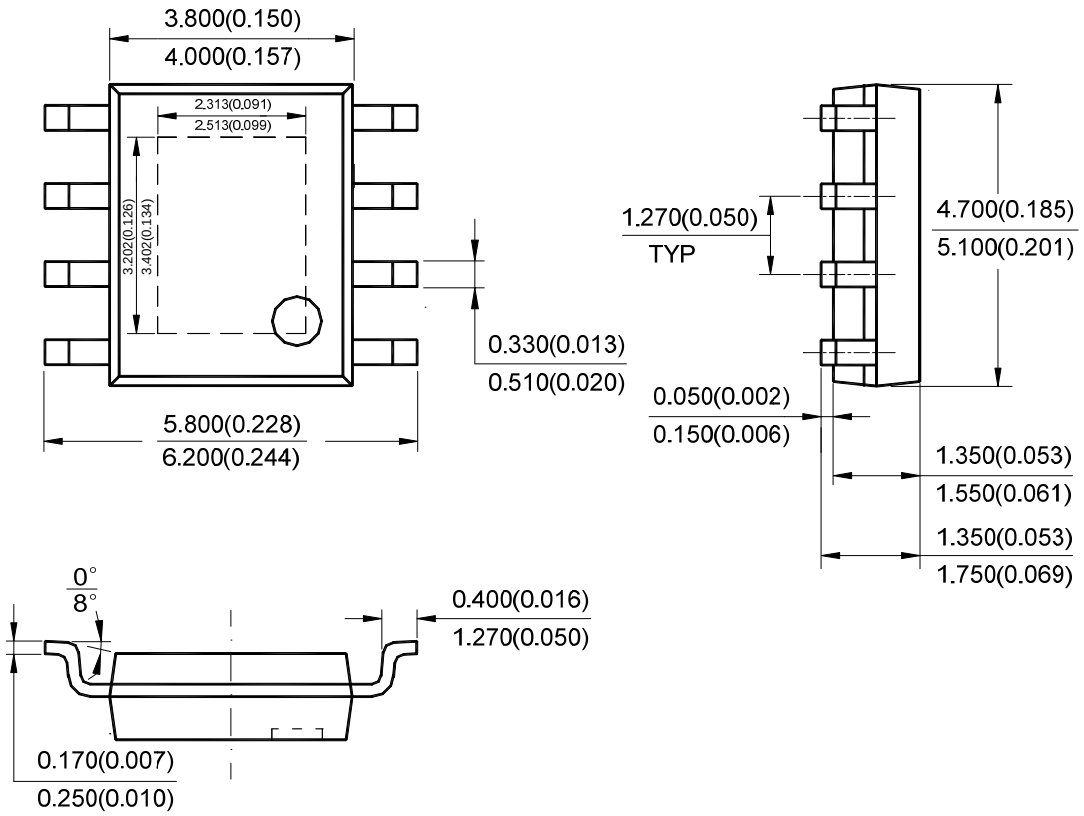
SOIC-8 **Unit: mm(inch)**



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

Mechanical Dimensions (Continued)

PSOP-8 **Unit: mm(inch)**



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

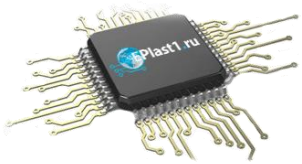
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Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)
Факс: 8 (812) 320-02-42
Электронная почта: org@eplast1.ru
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.