

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

**AM4951/R/2**

**General Description**

The AM4951/R/2 series 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 AM4951/R series is available in MSOP-8 (12V application only) or PSOP-8 (24V application only) package. The AM4952 is available in MSOP-10 package.

**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 24V)
- Low Saturation Output (High Side and Low Side Saturation Voltage):  $V_{SAT\_TOTAL}=1.2V$  (typical,  $I_{OUT}=200mA$ )
- Built-in Lock Protection and Automatic Restart Circuits
- Built-in FG/RD Output
- Built-in Hall Sensor Bias (AM4952 Only,  $V_{HB}=1.5V$ )
- Thermal Protection Circuit
- Small-sized, High Thermal Capacity Package
- FG Output (AM4951), RD Output (AM4951R), FG and RD Output (AM4952)

**Applications**

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

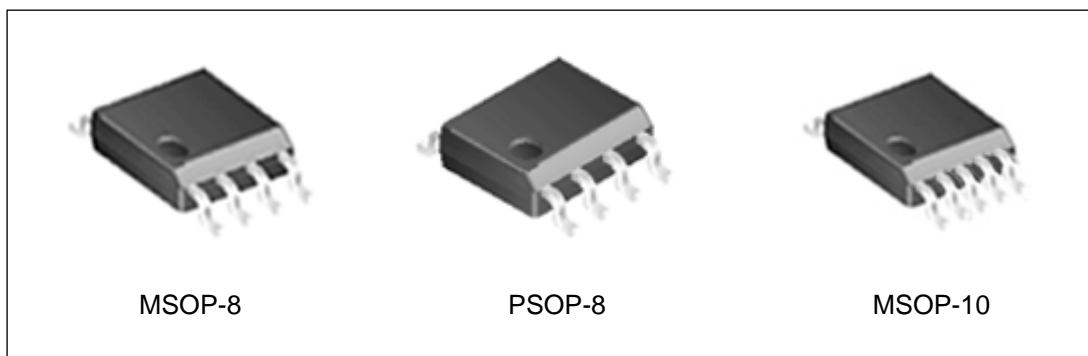


Figure 1. Package Types of AM4951/R/2

**Pin Configuration**

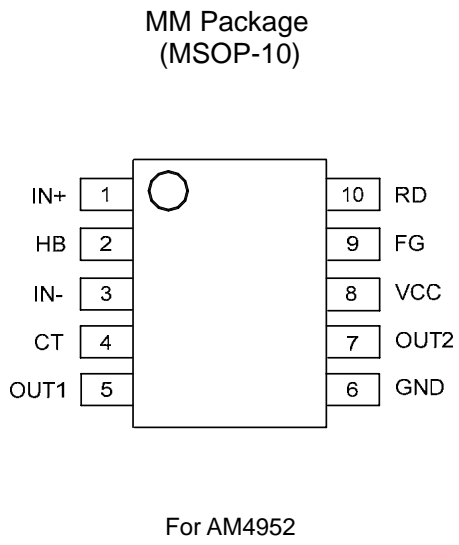
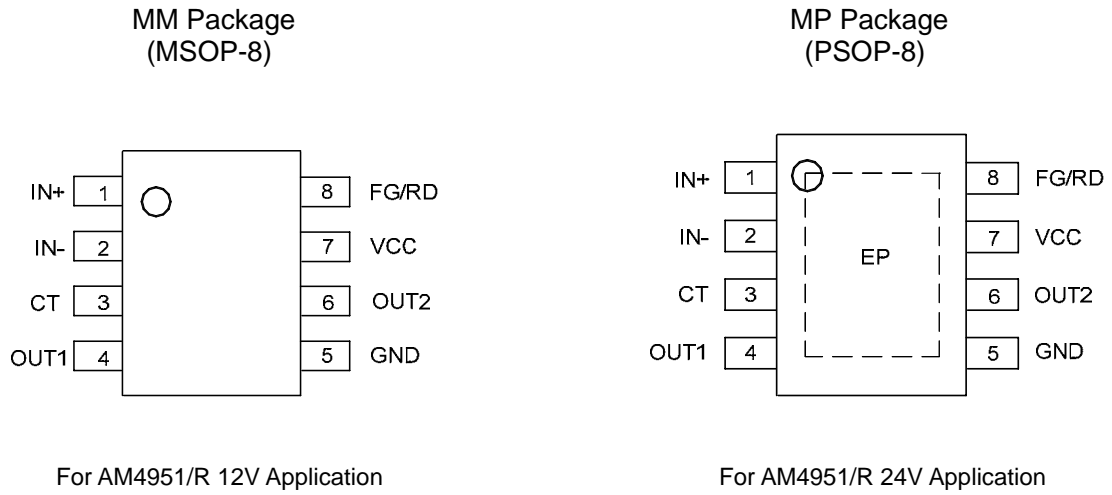
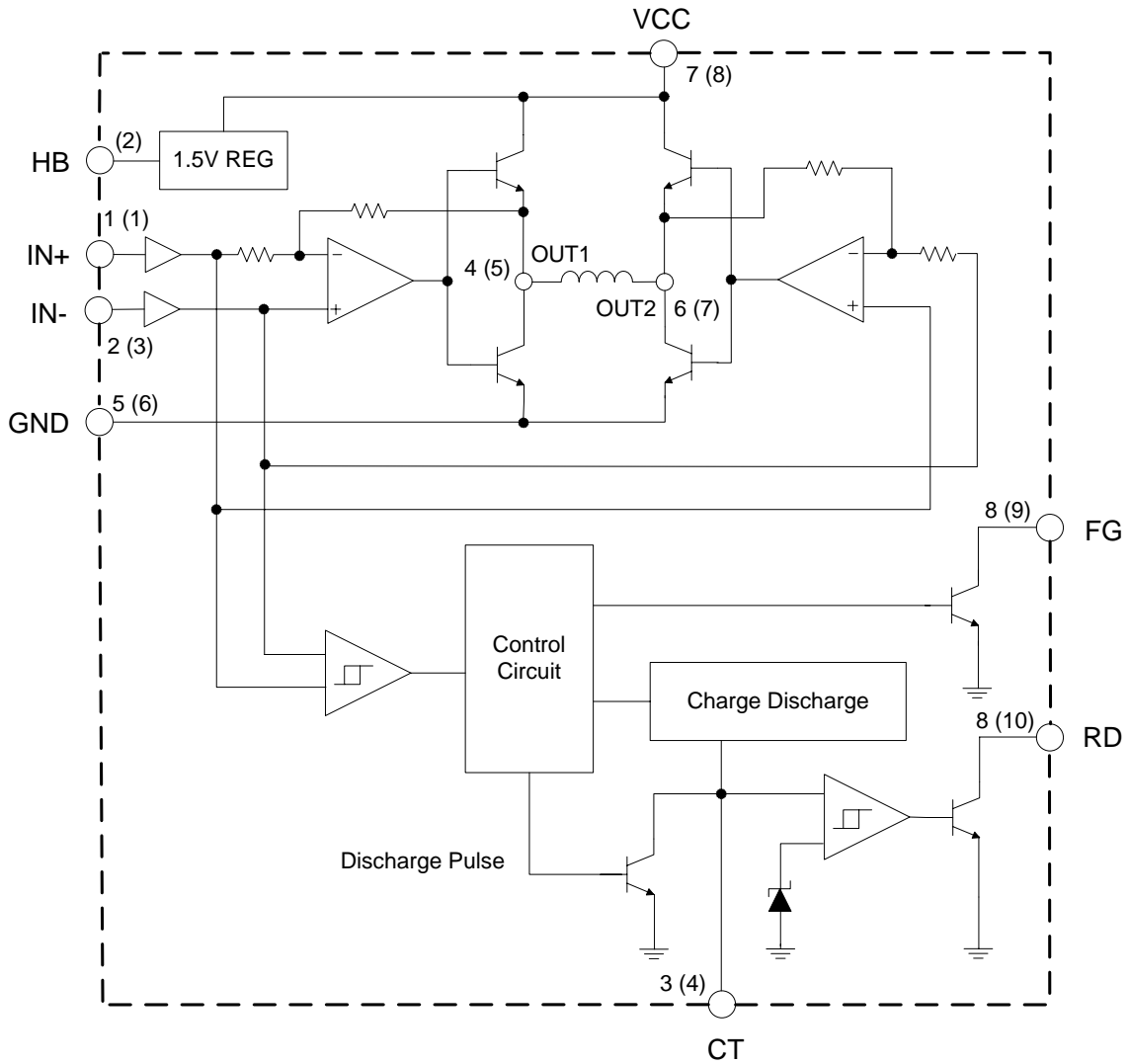


Figure 2. Pin Configuration of AM4951/R/2 (Top View)

**Functional Block Diagram**



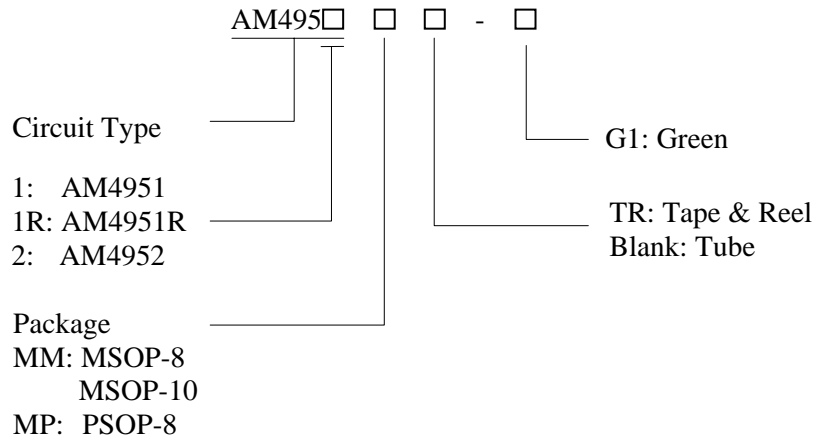
A (B)  
 A for AM4951/R  
 B for AM4952

Figure 3. Functional Block Diagram of AM4951/R/2

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

**AM4951/R/2**

**Ordering Information**



Package	Temperature Range	Output Signal	Part Number	Marking ID	Packing Type
MSOP-8	-40 to 105°C	FG	AM4951MM-G1	4951MM-G1	Tube
			AM4951MMTR-G1	4951MM-G1	Tape & Reel
		RD	AM4951RMM-G1	4951RMM-G1	Tube
			AM4951RMMTR-G1	4951RMM-G1	Tape & Reel
PSOP-8		FG	AM4951MP-G1	4951MP-G1	Tube
			AM4951MPTR-G1	4951MP-G1	Tape & Reel
		RD	AM4951RMP-G1	4951RMP-G1	Tube
			AM4951RMPTR-G1	4951RMP-G1	Tape & Reel
MSOP-10	FG & RD	AM4952MM-G1	4952MM-G1	Tube	
		AM4952MMTR-G1	4952MM-G1	Tape & Reel	

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

**BTL Drive Single-phase Full-wave Fan Motor Driver****AM4951/R/2****Absolute Maximum Ratings (Note 1, T<sub>A</sub>=25°C)**

Parameter	Symbol	Value		Unit
Supply Voltage	V <sub>CC</sub>	28		V
Peak Output Current	I <sub>OUT</sub>	500		mA
FG/RD Pull-up Voltage	V <sub>FG</sub> /V <sub>RD</sub>	28		V
FG/RD Output Current	I <sub>FG</sub> /I <sub>RD</sub>	10		mA
Thermal Resistance (Junction to Ambient)	θ <sub>JA</sub>	MSOP-8	205	°C/W
		PSOP-8	110	
		MSOP-10	195	
Thermal Resistance (Junction to Case)	θ <sub>JC</sub>	MSOP-8	48	°C/W
		PSOP-8	36	
		MSOP-10	46	
Power Dissipation	P <sub>D</sub>	MSOP-8	585	mW
		PSOP-8	960	mW
		MSOP-10	585	mW
Operating Temperature	T <sub>OP</sub>	-40 to 125		°C
Storage Temperature	T <sub>STG</sub>	-55 to 150		°C

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 <sub>CC</sub>	2.2	24	V
Hall Input Voltage	V <sub>ICM</sub>	0	V <sub>CC</sub> -1.5	V
Operating Ambient Temperature	T <sub>A</sub>	-40	105	°C

**BTL Drive Single-phase Full-wave Fan Motor Driver****AM4951/R/2****Electrical Characteristics** $V_{CC}=12V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Current	$I_{CC1}$	$V_{CT}=L$	3	6	9	mA
	$I_{CC2}$	$V_{CT}=H$	2.5	5	7.5	mA
CT Charge Current	$I_{CHG}$		0.9	1.3	1.5	$\mu A$
CT Discharge Current	$I_{DHG}$		0.1	0.15	0.25	$\mu A$
CT Charge/Discharge Current Ratio	$R_{CT}$	$I_{CHG} / I_{DHG}$	6	8	10	
CT Clamp Voltage	$V_{CL}$		1.3	1.5	1.7	V
CT Comparator Voltage	$V_{CP}$		0.3	0.5	0.7	V
OUT Low Saturation Voltage	$V_{SAT\_L}$	$I_{OUT}=200mA$		0.25	0.45	V
OUT High Saturation Voltage	$V_{SAT\_H}$	$I_{OUT}=200mA$		0.95	1.2	V
Hall Input Sensitivity	$V_{HN}$			7	15	mV
FG Low Level Voltage (For AM4951/2)	$V_{FG}$	$I_{FG}=5mA$		0.15	0.3	V
FG Leakage Current (For AM4951/2)	$I_{FGL}$	$V_{FG}=15V$		1	30	$\mu A$
RD Low Level Voltage (For AM4951R/2)	$V_{RD}$	$I_{RD}=5mA$		0.15	0.3	V
RD Leakage Current (For AM4951R/2)	$I_{RDL}$	$V_{RD}=15V$		1	30	$\mu A$
HB Voltage (For AM4952)	$V_{HB}$	$I_{HB}=1mA$	1.35	1.5	1.65	V

**Typical Performance Characteristics**

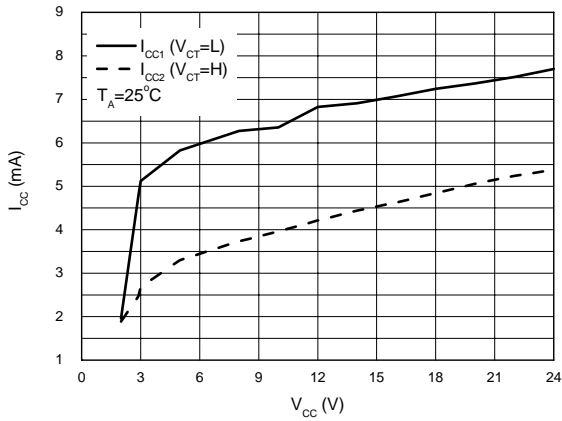


Figure 4. Supply Current vs. Supply Voltage

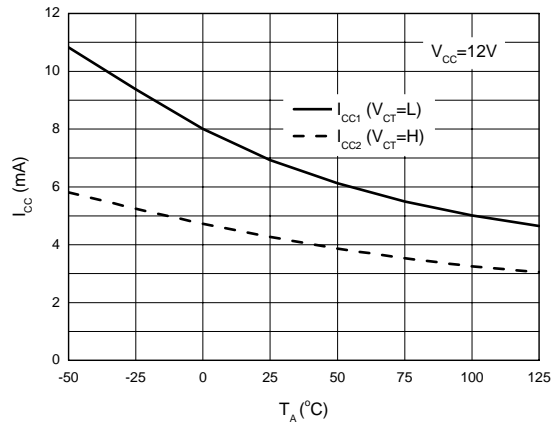


Figure 5. Supply Current vs. Ambient Temperature

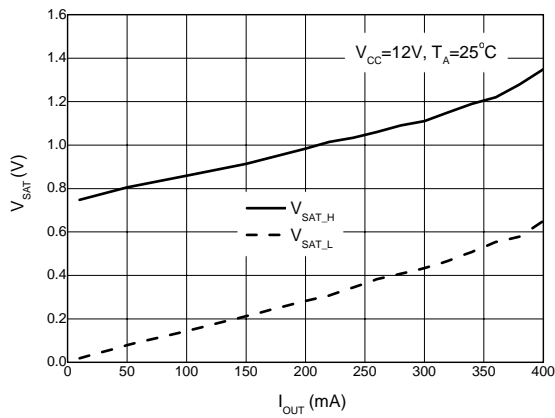


Figure 6. Saturation Voltage vs. Output Current

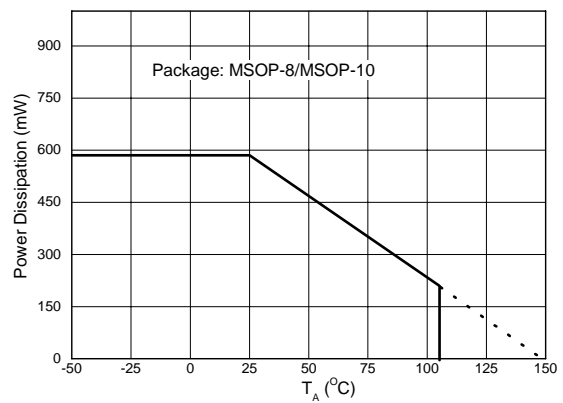


Figure 7. Power Dissipation vs. Ambient Temperature

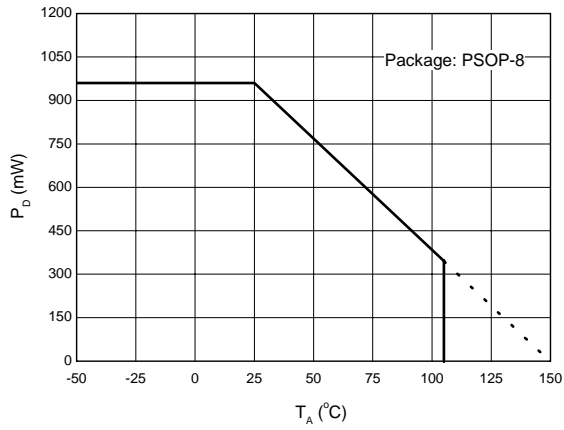
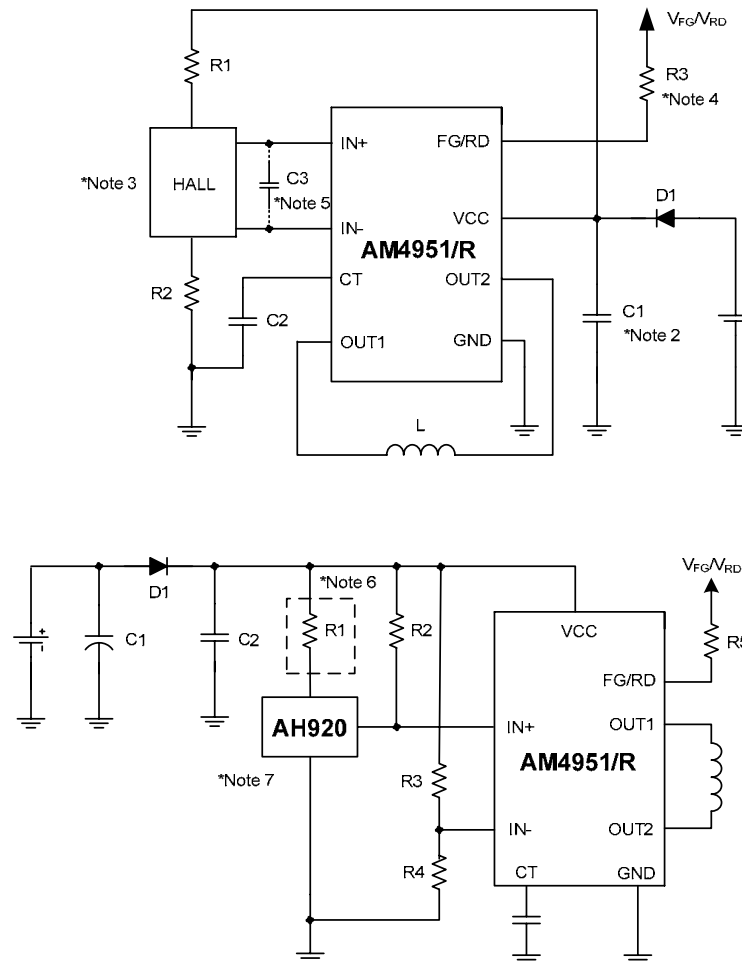
**Typical Performance Characteristics (Continued)**

Figure 8. Power Dissipation vs. Ambient Temperature



## 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 2.2 $\mu$ F.

Note 3: If the Hall sensor bias is taken from V<sub>CC</sub>, A 1/2 V<sub>CC</sub> bias, as shown in the figure must be used. Adjusting the value of R1 and R2 may achieve better startup characteristics and efficiency, even quiet operation.

Note 4: This pin must be left open if unused.

Note 5: 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 6: Each of R2, R3, R4 and R5 (AM4951/R only) is recommended to be 51k $\Omega$  typical. R1 is recommended to be 2k and must be added when V<sub>CC</sub> is larger than 20V.

Note 7: The package of AH920 is SOT-23-3. If it is packaged in TO-92S-3, please exchange IN- with IN+.

Figure 9. Typical Application of AM4951/R

**Typical Application (Continued)**

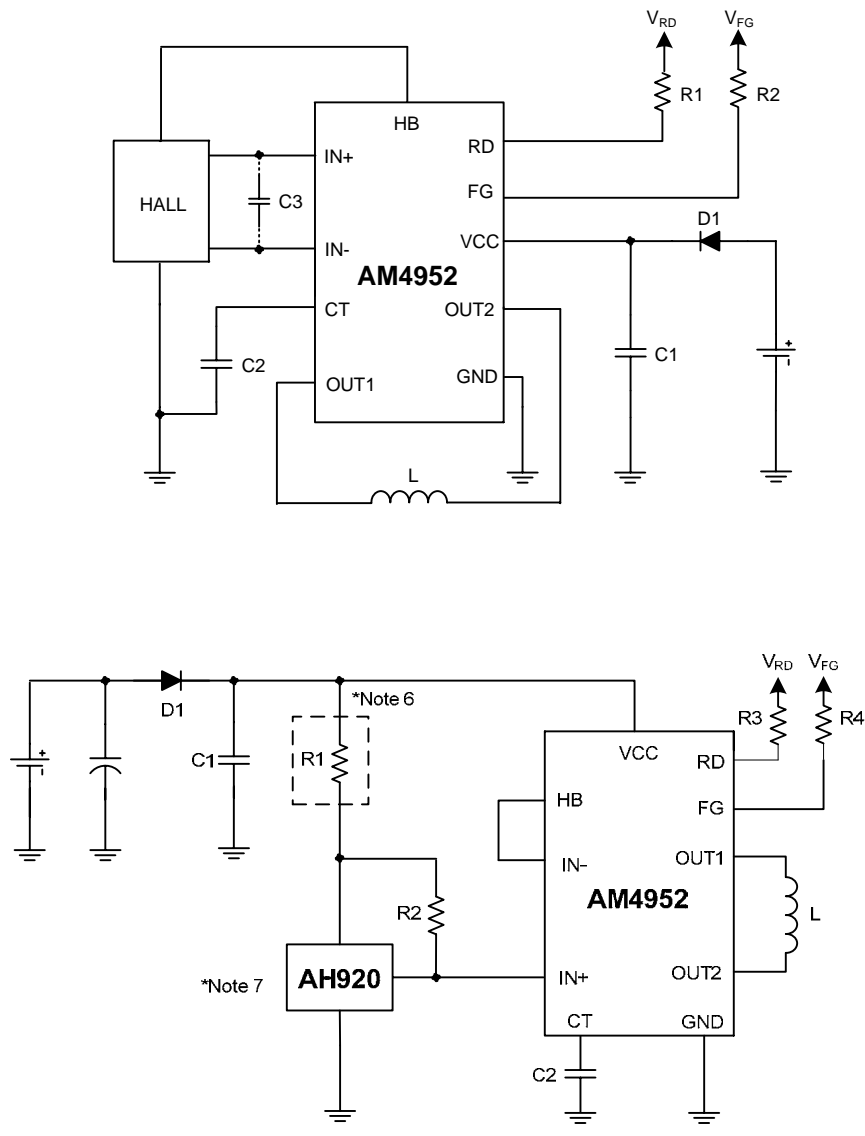
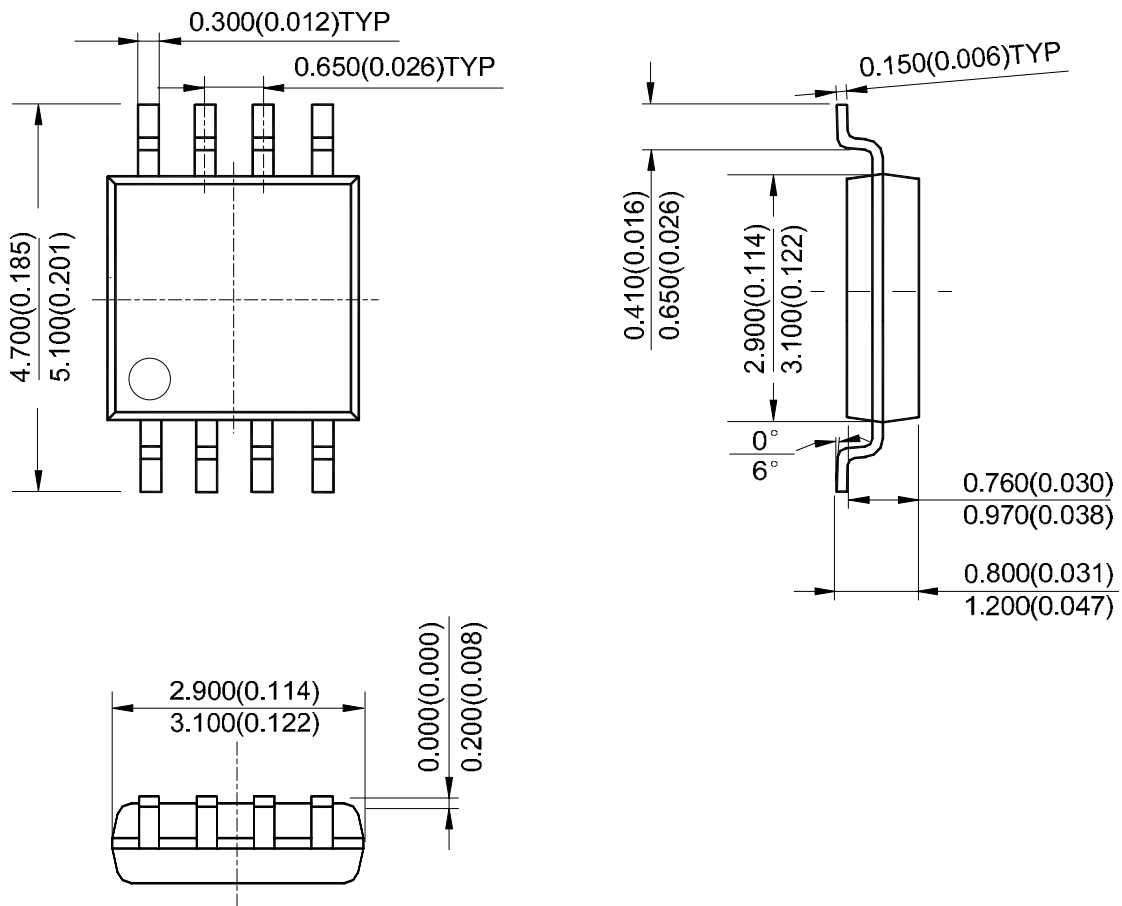


Figure 10. Typical Application of AM4952

**Mechanical Dimensions**

**MSOP-8**

**Unit: mm(inch)**

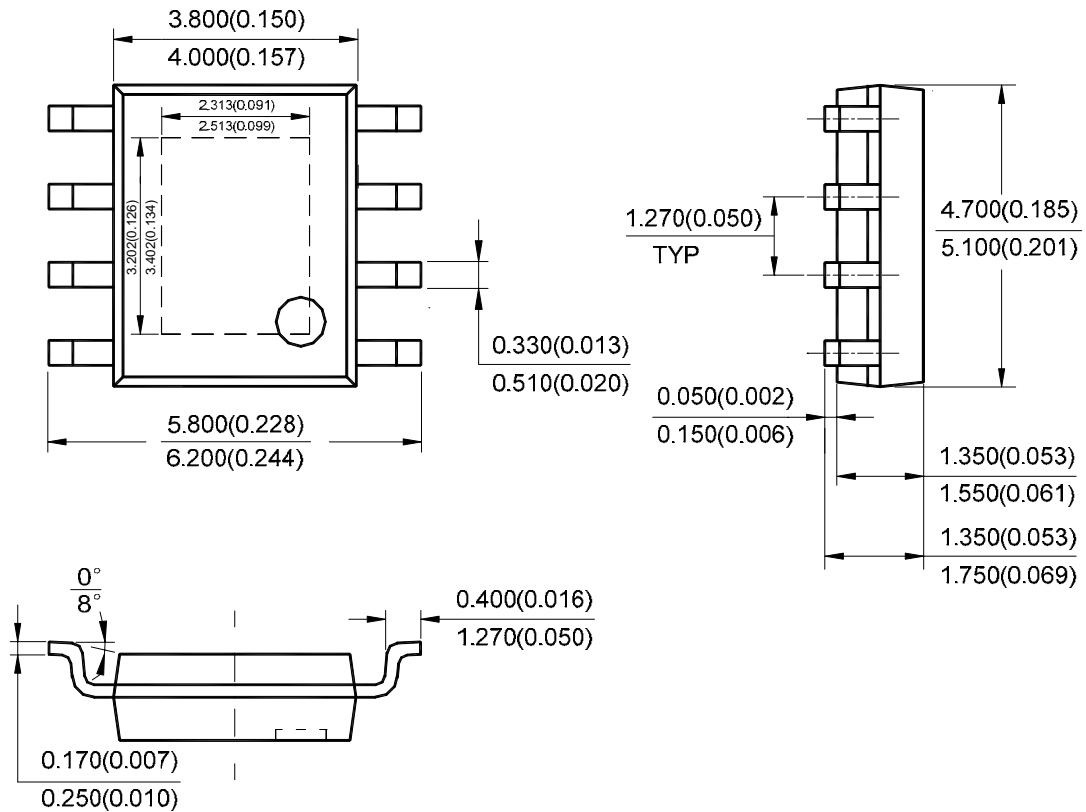


Note: Eject hole, oriented hole and mold mark is optional.

**Mechanical Dimensions (Continued)**

**PSOP-8**

**Unit: mm(inch)**

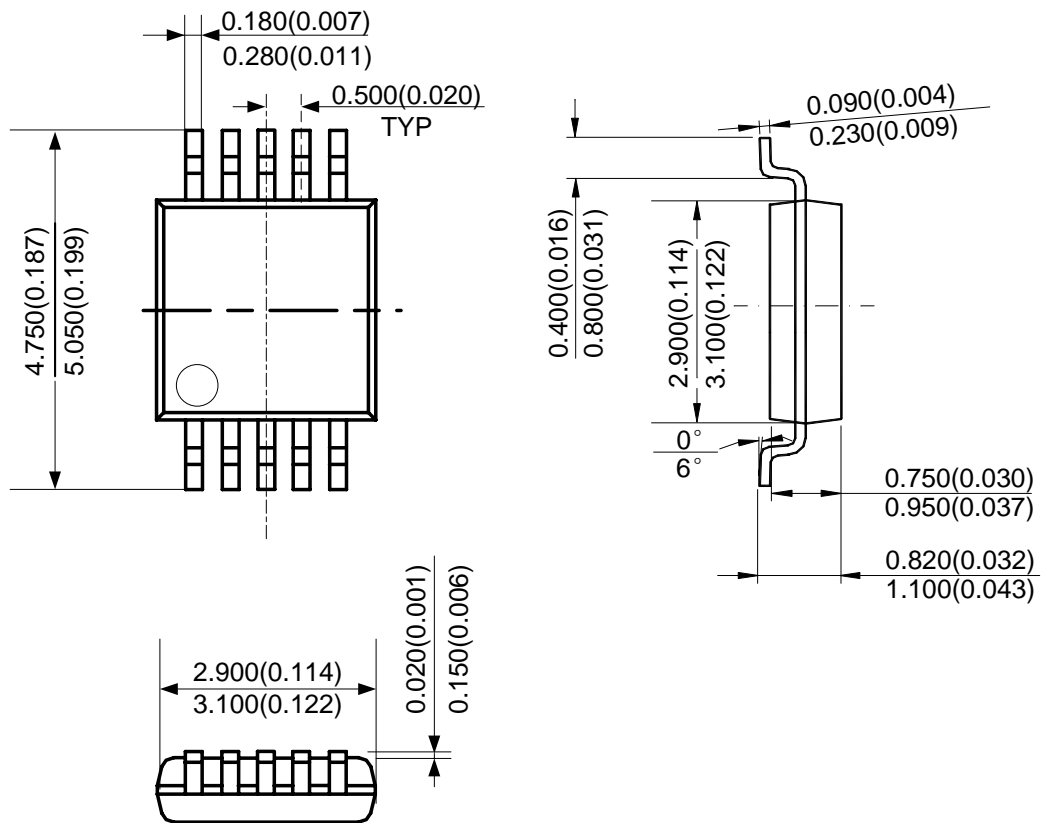


Note: Eject hole, oriented hole and mold mark is optional.

**Mechanical Dimensions (Continued)**

**MSOP-10**

**Unit: mm(inch)**



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



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