

**TWO PHASE HALL-EFFECT SMART FAN MOTOR CONTROLLER**

**Description**

The AH2984 is a single-chip solution for driving two-coil brushless direct current (BLDC) fans and motors. The device includes a Hall-effect sensor, dynamic offset correction and two complementary open-drain output drivers with internal Zener diode protection. It is optimized for low start-up voltage.

To help protect the motor coils, the AH2984 provides Rotor Lock Protection which shuts down output drives if rotor lock is detected. The device automatically re-starts when the rotor lock is removed. Over temperature shutdown provides thermal protection for the device.

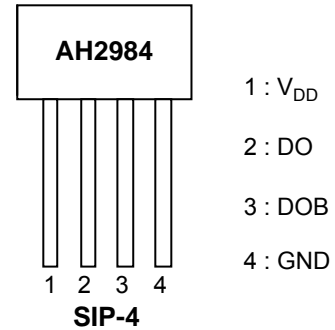
The AH2984 is available in SIP4 and SOT89-5 packages.

**Features**

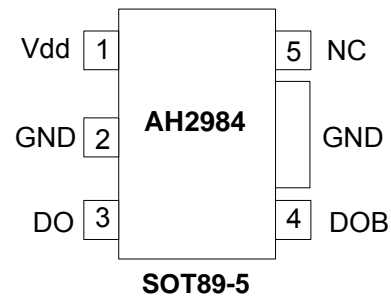
- Single-chip solution
- Operating Voltage: 2.5V to 15V
- Built-in Hall sensor and input amplifier
- Rotor Lock Protection (Lock detection, output shutdown and automatic re-start)
- Built-in reverse voltage protection diode
- Built-in Zener protection for output drivers
- Average output current up to 500mA
- Packages: SIP-4 and SOT89-5
- "Green" Molding Compound
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

**Pin Assignments**

(Top View)



(Top View)



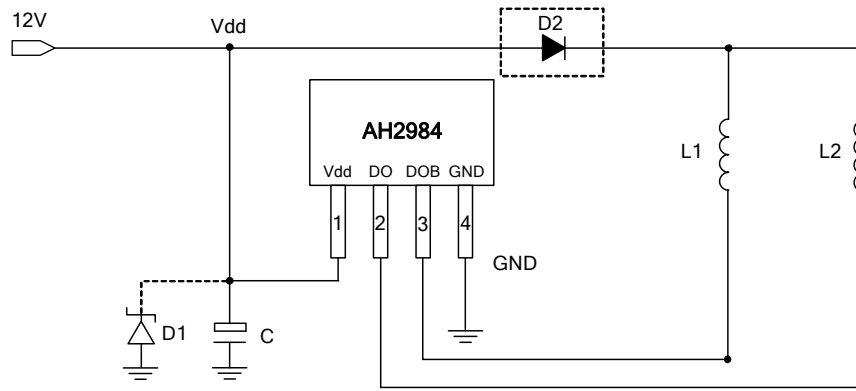
**Applications**

- Two-coil BLDC Cooling Fans
- Low Voltage/ Low Power BLDC Motors

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.  
 2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.  
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

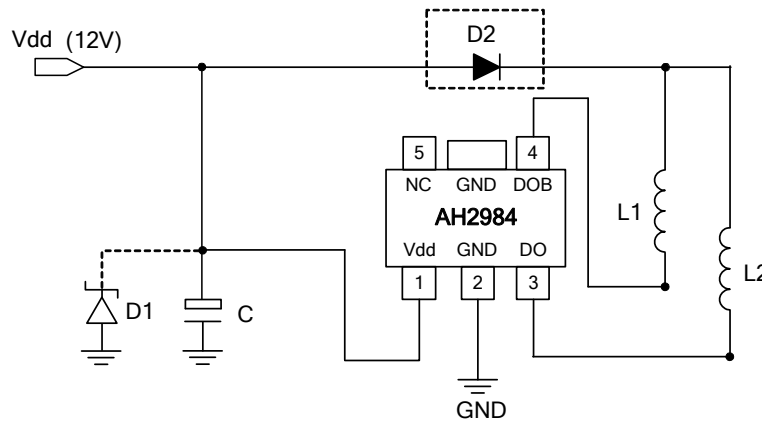
**Typical Applications Circuit** (Note 4)

**(1) For SIP-4**



**12V Brushless DC Fan**

**(2) For SOT89-5**



**12V Brushless DC Fan**

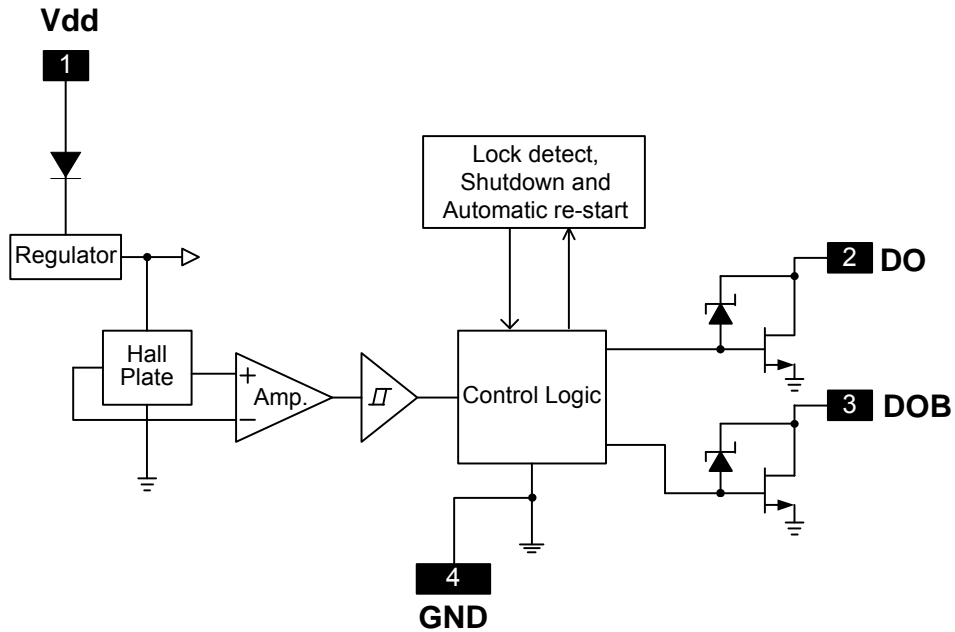
Note: 4. D1 (Zener Diode) and Capacitor C are for power stabilization. Recommended value of C is 1 $\mu$ F/ 50V (E-Cap). Diode D2 is optional and helps to protect the device and fan coils from reverse power conditions. The AH2984 also includes an internal reverse blocking diode at V<sub>DD</sub> pin.

**Pin Descriptions**

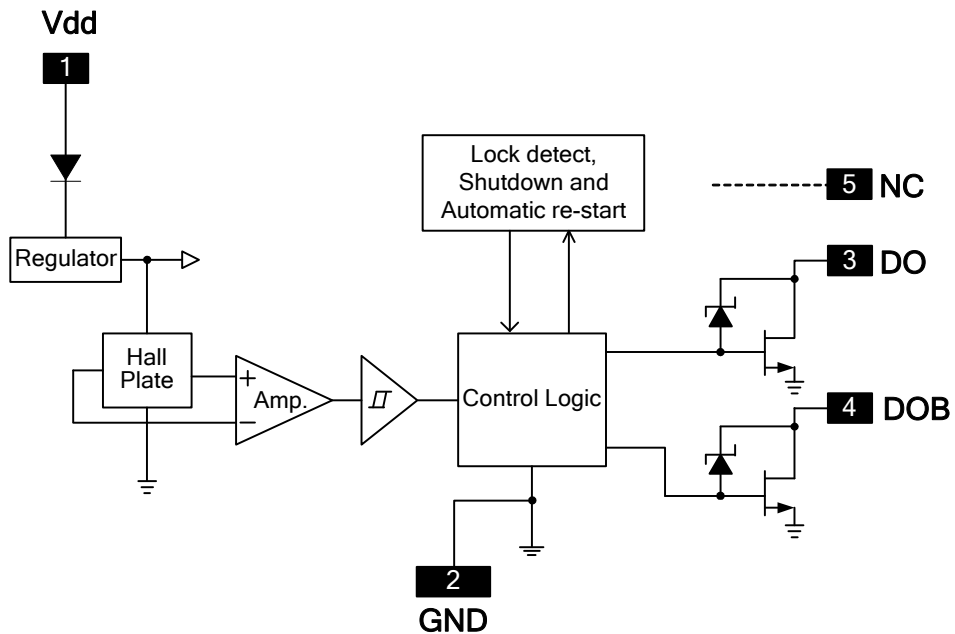
Pin Name	SIP-4	SOT89-5	Description
V <sub>DD</sub>	1	1	Input Power
DO	2	3	Output Pin
DOB	3	4	Output Pin
GND	4	2	Ground
NC	—	5	No Connection

**Functional Block Diagram**

(1) For SIP-4

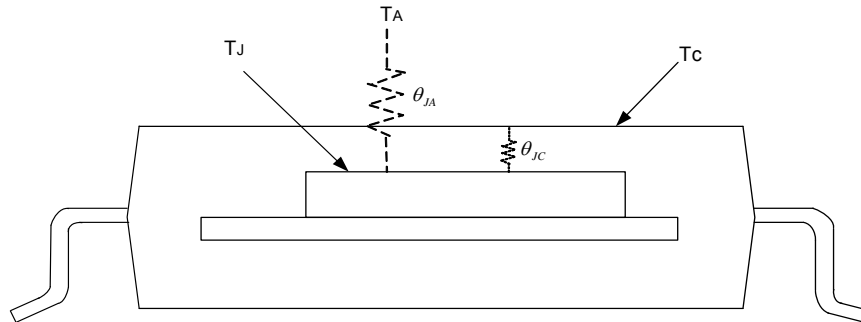


(2) For SOT89-5



**Absolute Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Conditions	Rating	Unit	
V <sub>DD</sub>	Supply Voltage	18	V	
V <sub>RDD</sub>	Reverse V <sub>DD</sub> Polarity Voltage	-15	V	
I <sub>O(AVE)</sub>	Output Current (Note 5)	500	mA	
I <sub>O(peak as hold)</sub>		800		
P <sub>D</sub>	Power Dissipation	SIP-4	550	mW
		SOT89-5	800	mW
T <sub>ST</sub>	Storage Temperature	-55 to +150	°C	
T <sub>J</sub>	Maximum Junction Temperature	+150	°C	
θ <sub>JA</sub>	Thermal Resistance (Note 6)	SIP-4	227	°C/W
		SOT89-5	168	°C/W
θ <sub>JC</sub>	Thermal Resistance (Note 6)	SIP-4	49	°C/W
		SOT89-5	36	°C/W



**Recommended Operating Conditions** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>DD</sub>	Supply Voltage	Operating	2.5	15	V
T <sub>A</sub>	Operating Ambient Temperature (Note 5)	Operating	-40	+105	°C

**Electrical Characteristics** (@T<sub>A</sub> = +25°C; V<sub>DD</sub> = 12V; unless otherwise specified, Note 4)

Symbol	Characteristics	Conditions	Min	Typ.	Max	Unit
I <sub>DD</sub>	Supply Current	Operating, V <sub>DD</sub> = 12V	2.0	3.5	5.0	mA
T <sub>on</sub>	Locked Protection On Time	—	—	0.25	—	s
T <sub>off</sub>	Locked Protection Off Time	—	—	3.25	—	s
R <sub>duty</sub>	Locked Protection Duty Ratio	T <sub>off</sub> /T <sub>on</sub>	—	13	—	—
R <sub>DS(ON)</sub>	Output On Resistance	I <sub>O</sub> = 300mA	—	1	1.67	Ω
		I <sub>O</sub> = 500mA	—	1.25	1.8	
V <sub>Z</sub>	Output Zener-Breakdown Voltage	(Note 7)	24	33	42	V

- Notes:
5. Shall not exceed P<sub>D</sub> and Safety Operation Area.
  6. θ<sub>JA</sub> should be confirmed with heat sink thermal resistance. SOT89 exposed pad soldered to minimum recommended landing pads (see Package Outline Dimension section) on 2"x2" two-layer 2oz.copper FR4 PCB with thermal vias in the exposed pad connecting to the copper flood on the bottom layer.
  7. The V<sub>Z</sub> value is in D.C voltage measurement. The V<sub>Z</sub> may vary with coils in A.C. voltage measurements.

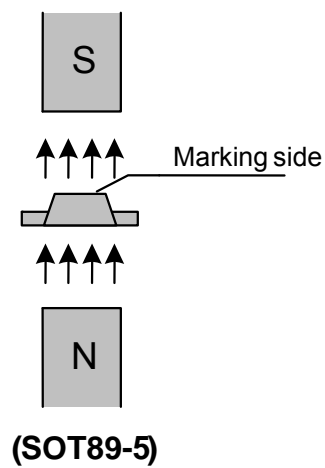
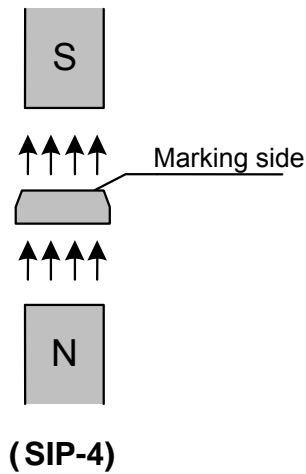
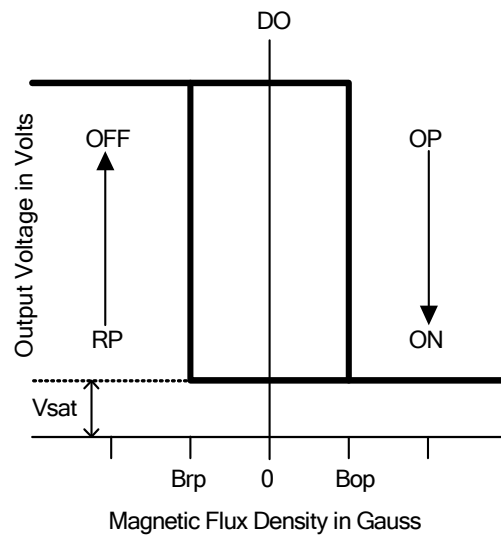
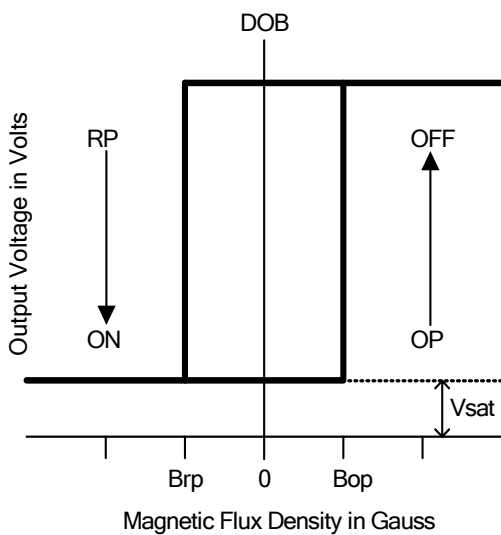
**Magnetic Characteristics** ( $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 2.5\text{V to }15\text{V}$ , Note 8)

(1mT=10 Gauss)

Symbol	Characteristics	Min	Typ.	Max	Unit
B <sub>OP</sub>	Operate Point	5	30	60	Gauss
B <sub>RP</sub>	Release Point	-60	-30	-5	Gauss
B <sub>HY</sub>	Hysteresis	20	60	120	Gauss

Note: 8. The magnetic characteristics may vary with supply voltage, operating temperature and after soldering.

**Operating Characteristics**

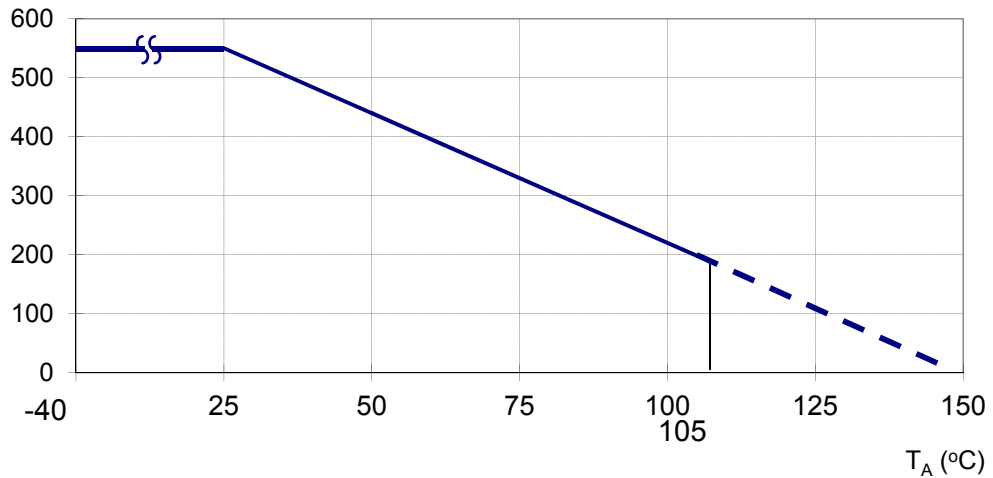


**Performance Characteristics**

(1) SIP-4

$T_A(^{\circ}\text{C})$	25	50	60	70	80	85	90	95	100
$P_D(\text{mW})$	550	440	396	352	308	286	264	242	220
$T_A(^{\circ}\text{C})$	105	110	115	120	125	130	135	140	150
$P_D(\text{mW})$	198	176	154	132	110	88	66	44	0

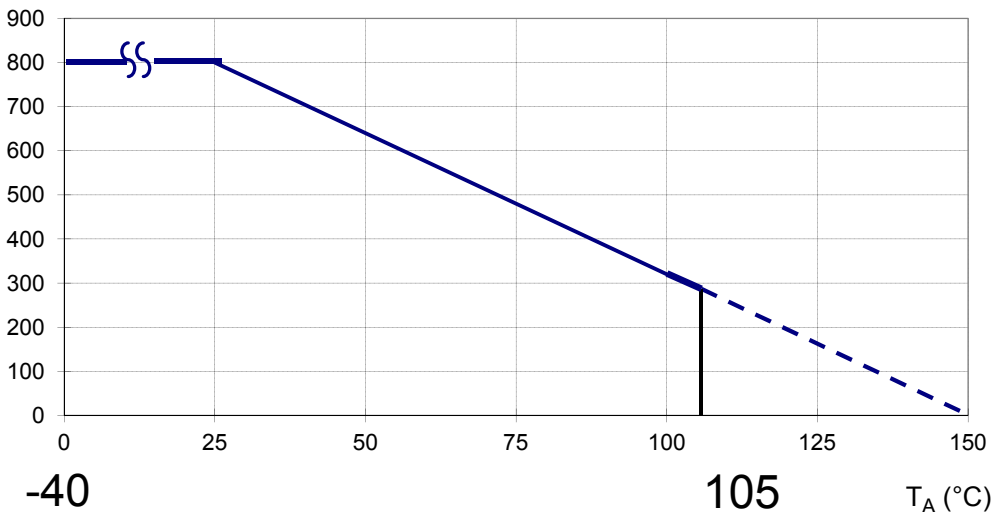
$P_D$  (mW) Power Dissipation Curve



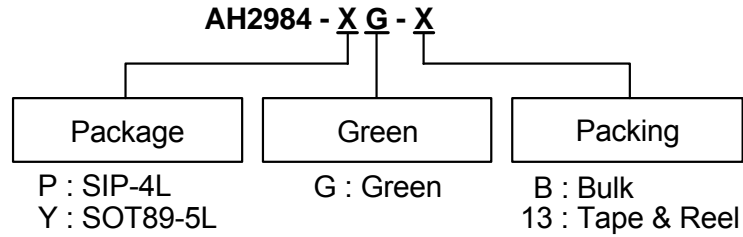
(2) SOT89-5

$T_A(^{\circ}\text{C})$	25	50	60	70	75	80	85	90	95	100
$P_D(\text{mW})$	800	640	576	512	480	448	416	384	352	320
$T_A(^{\circ}\text{C})$	105	110	115	120	125	130	135	140	145	150
$P_D(\text{mW})$	288	256	224	192	160	128	96	64	32	0

$P_D$  (mW) Power Dissipation Curve



**Ordering Information** (Note 9)

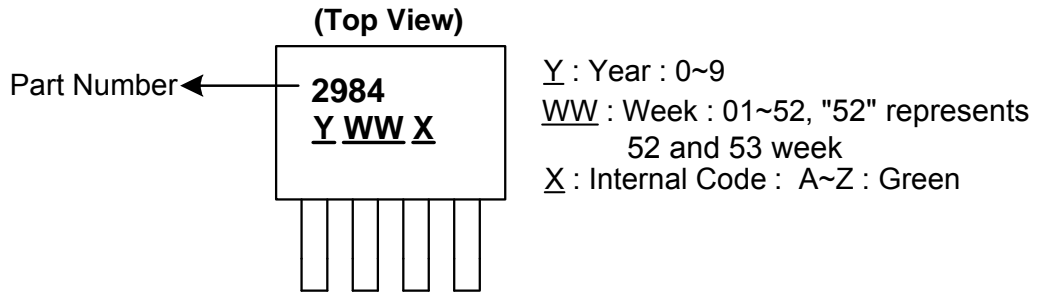


Device	Package Code	Packaging (Note 9)	Bulk		13" Tape and Reel	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix
AH2984-PG-B	P	SIP-4	1000	-B	NA	NA
AH2984-YG-13	Y	SOT89-5	NA	NA	2500/Tape & Reel	-13

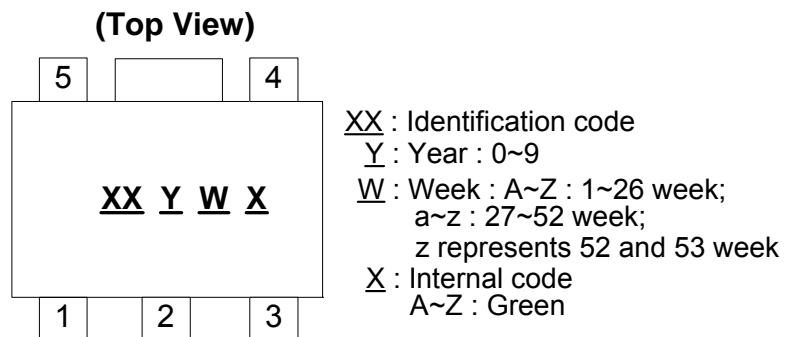
Note: 9. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>

**Marking Information**

(1) SIP-4



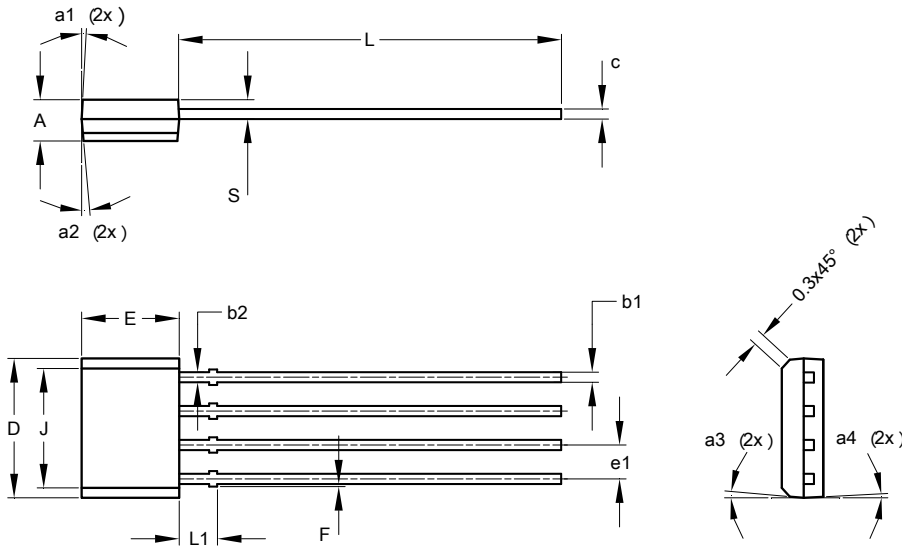
(2) SOT89-5



Device	Package	Identification Code
AH2984	SOT89-5	K1

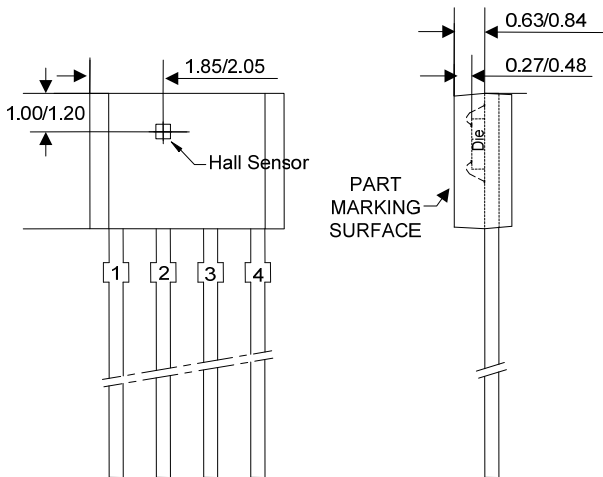
**Package Outline Dimensions** (All dimensions in mm.)

**(1) Package type: SIP-4L**



SIP-4			
Dim	Min	Max	Typ
A	1.45	1.65	1.55
b1	0.38	0.44	0.40
b2	—	—	0.48
c	0.35	0.45	0.40
D	5.12	5.32	5.22
e1	1.24	1.30	1.27
E	3.55	3.75	3.65
F	0.00	0.20	—
J	4.10	4.30	4.20
L	14.00	14.60	14.30
L1	1.32	1.52	1.42
S	0.63	0.83	0.73
a1	—	5°	3°
a2	4°	7°	5°
a3	4°	7°	5°
a4	—	5°	3°
All Dimensions in mm			

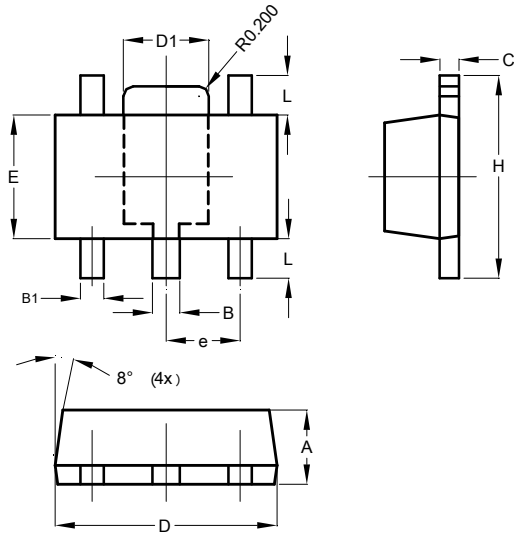
Min/Max (in mm)



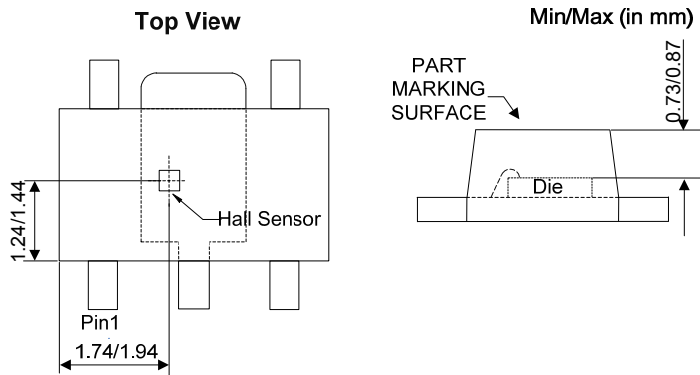


**Package Outline Dimensions** (All dimensions in mm.)

**(2) Package type: SOT89-5L**



SOT89-5			
Dim	Min	Max	Typ
A	1.40	1.60	1.50
B	0.50	0.62	0.56
B1	0.44	0.54	0.48
C	0.35	0.43	0.38
D	4.40	4.60	4.50
D1	1.62	1.83	1.733
E	2.40	2.60	2.50
e	—	—	1.50
H	3.95	4.25	4.10
L	0.65	0.95	0.80
All Dimensions in mm			



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