One Channel H-Bridge Motor Driver AM2849

Features and Benefits

1) Lowest $R_{DS(ON)}$ 90mΩ for high efficient H-Bridge output
2) SOP-8 package for small size PCB layout
3) Maximum continuous current output 4A
4) Operation voltage range 3.6V to 30V
5) Absolute maximum voltage 34V
6) Over temperature protection
7) Over current protection
8) Low standby current
9) Low quiescent current

Application

- Robotic
- AI Home Appliances
- DC Brushed Motor Drive
- Industrial Equipment
- Other Mechatronic Applications
- Servo Motor

Description

The AM2849 output driver block consists of N-channel and P-channel power MOSFETs configured as an H-Bridge to drive DC motor.

AM2849 maximum operational voltage is 30V. It can supply up to 4A of continuous current and 6.5A of peak current. There are internal shutdown functions, thermal shutdown protection and overcurrent protection (I_{OCP} = 6.5 A).

Package material is Pb-Free Product & RoHS compliant for the purpose of environmental protection and for sustainable development of the Earth.

Ordering Information

Orderable Part Number	Package	Marking
AM2849	SOP-8	AM2849

Absolute Maximum Ratings (T_A=25℃)

Parameter	Symbol	Limits	Unit
Power Supply Voltage	VCC	34	V
Output Continuous Current	Io_{CONT}	4.0 (NOTE*)	A
Output Peak Current	Io_{peak}	6.5	A
Operate Temperature Range	T_{opr}	-20～+85	℃
Storage Temperature Range	T_{stg}	-40～+150	℃

Note *: Based on 25x25 mm^2 FR4 PCB (1 oz.) at single side PCB

Recommended Operating Conditions (T_A =25℃)

(Set the power supply voltage taking allowable dissipation into considering)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage	VCC	3.6		30	V
Signal Input IN_A and IN_B Voltage	V_{IN_X}	-0.3		6*	V
H-Bridge Output Continuous Current	I_{OUT}	0		4.0(Note**)	A
Externally Applied PWM Frequency	F_{IN_X}			30	KHz

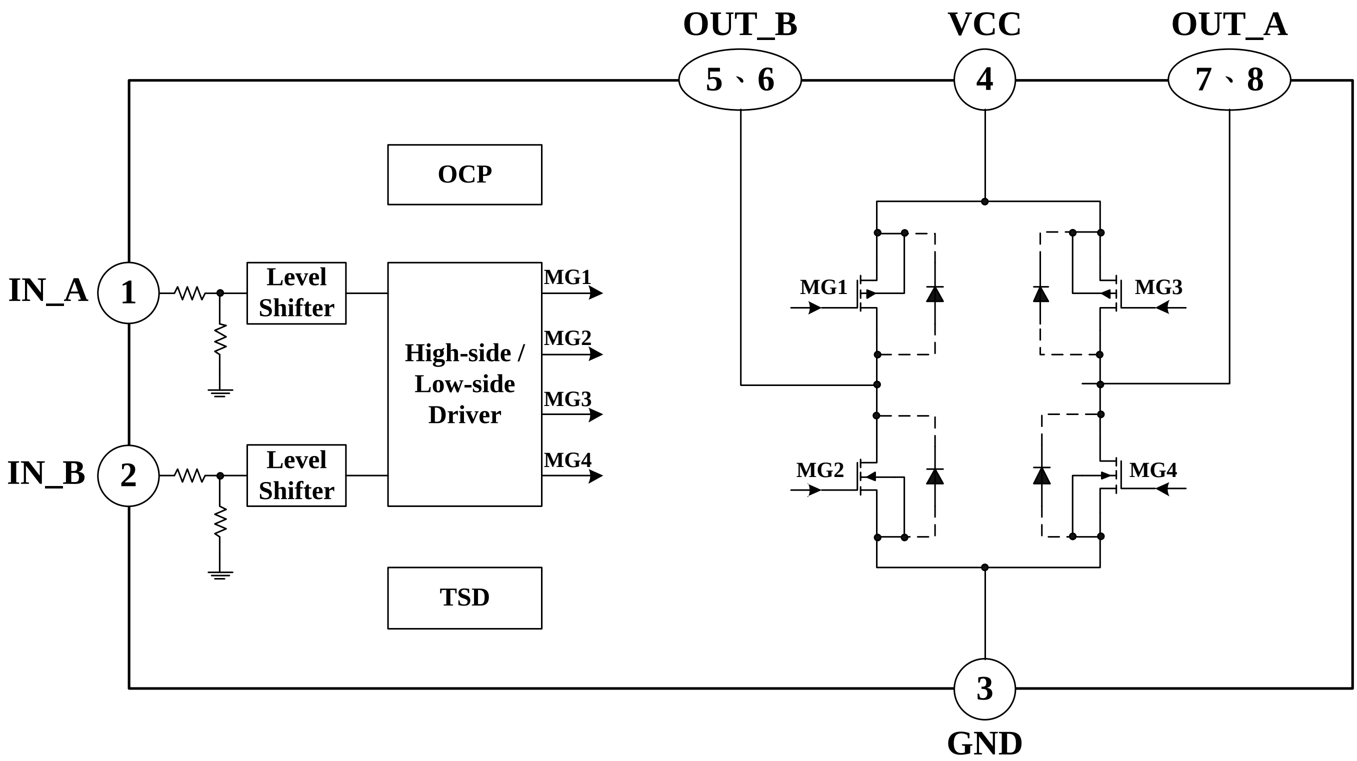
Note*: Input signal voltage is not higher VCC voltage.

Note**: Based on 25x25mm^2 FR4 PCB (1 oz.) at single side PCB

- **Electrical Characteristics (Unless otherwise specified, TA = 25℃, VCC=6V)**

Parameter	Symbol	Limit			Unit	Conditions
		Min.	Typ.	Max.		
Power Supplies						
Supply Current	I_{CC}		4		mA	Input signal IN_A/B= L/H or H/L or H/H No load on OUT_A/B,
Standby Current	I_{STB}			2	uA	Input signal IN_A/B= L/L
IN_X Inputs						
Input H level Voltage	V_{IN_XH}	2.0		6	V	
Input L level Voltage	V_{IN_XL}	-0.3		0.7	V	
Input H level Current	I_{IN_X}		100		μA	V_{CC} = 6V, V_{IN} = 3V
Input Frequency	F_{IN_X}			30	KHz	
Input Pull Down Resistance	R_{IN_X}		30		KΩ	
H-bridge FETs						
On-Resistance	$R_{ds(on)}$		90		mΩ	I_O = 1A Upper and Lower total
On-Resistance	$R_{ds(on)}$		100		mΩ	I_O = 3A Upper and Lower total
TSD Protections						
Thermal Shutdown Protection	TSD_P		160		℃	
Thermal Shutdown Release	TSD_R		105		℃	

Block Diagram

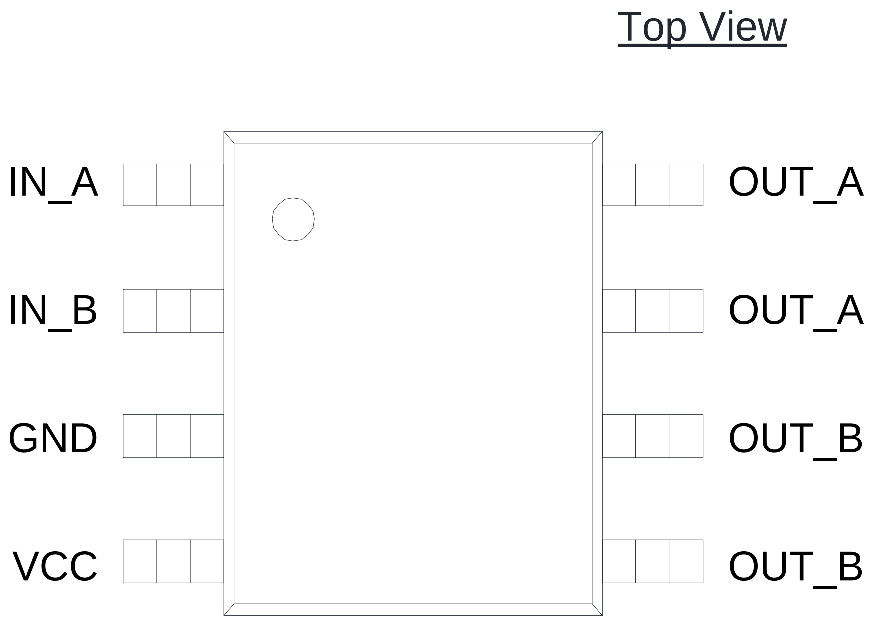


Input Logic Descriptions

Function Truth Table

IN_A	IN_B	OUT_A	OUT_B	Mode
L	L	Hi-Z	Hi-Z	Stop
L	H	L	H	Reverse
H	L	H	L	Forward
H	H	L	L	Brake

- **Pin configuration SOP-8**



- **Pin Descriptions**

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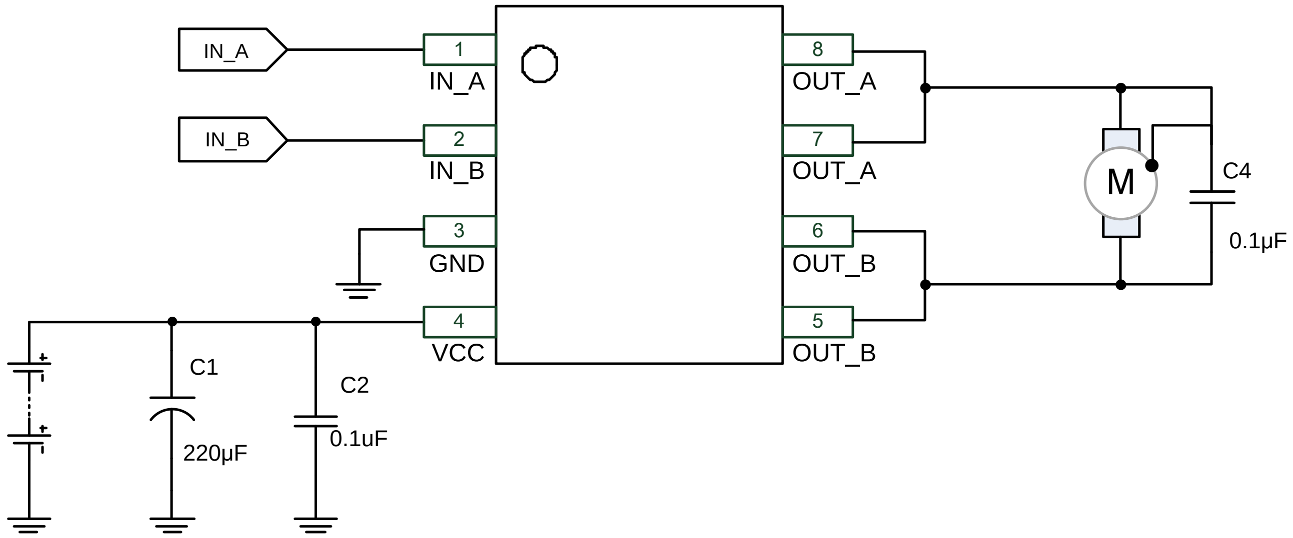
PIN No.	Pin Name	I/O	Description
1	IN_A	I	Input Half Bridge A
2	IN_B	I	Input Half Bridge B
3	GND	I	Ground Pin
4	VCC	I	Power Supply
5	OUT_B	O	Output Half Bridge B
6	OUT_B	O	Output Half Bridge B
7	OUT_A	O	Output Half Bridge A
8	OUT_A	O	Output Half Bridge A

- **Application:**



- **Circuit Descriptions**

1. C1、C2: Power supply VCC pin capacitor:
   a. The capacitor can reduce the power spike when the motor is in motion. To avoid the IC directly damaged by the VCC peak voltage. It also can stabilize the power supply voltage and reduce its ripples.
   b. The C1 capacitor can compensate power when motor starts running.
   c. The capacitor value (uF) determines the stability of the VCC during motor in motion. If the large voltage power or a heavy loading motor is used, then a larger capacitor would be needed.
   d. On the PCB configuration, the C1、C2 must be mounted as close as possible to VCC pin .

2. C4: The across-motor capacitor
   a. The C4 capacitors can reduce the power spike when motor is running. 0.1μF capacitor is recommended.
   b. The C4 capacitor must be added to the general application.

3. It’s not allowed INA, INB input remain floating status, because there is a minor leakage current between P-N junction when temperature rising, the leakage current will go through internal pull- low resistor which causes INA or INB floating level abnormal pull high and output abnormal working.

Operating Mode Descriptions

H-Bridge basic operating mode：

a) Forward mode

Definition：When IN_A=H，IN_B=L，then OUT_A=H，OUT_B=L

b) Reverse mode

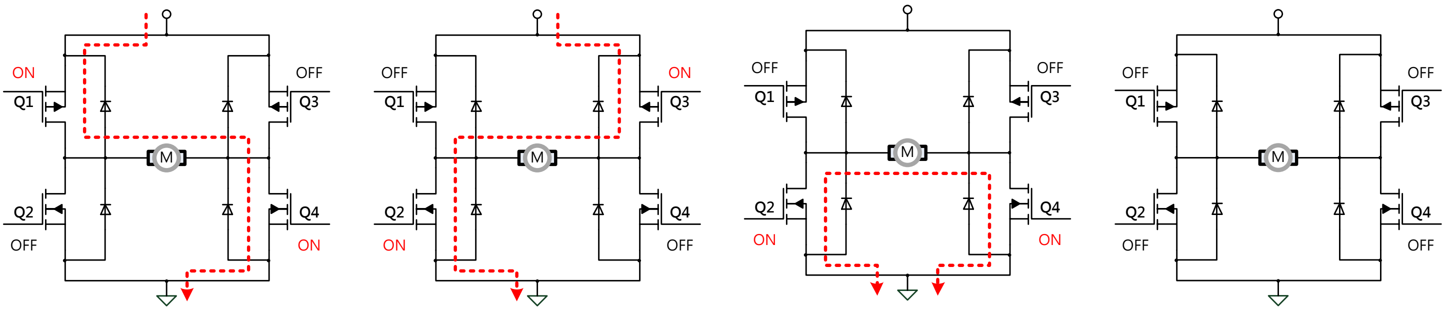
Definition：When IN_A=L，IN_B=H，then OUT_A=L，OUT_B=H

c) Brake mode

Definition：When IN_A=IN_B= H，then OUT_A=OUT_B=L

d) Stop mode

Definition：When IN_A=IN_B= L，then OUT_A=OUT_B=Hi-Z



a) Forward mode b) Reverse mode c) Brake mode d) Stop mode

Protection Mechanisms Descriptions

1) Over-current protection (OCP)

When the IC conducts a large current, 6.5A (Typ), the internal over-current protection function will be triggered. The device enter protection mode of auto-recover to avoid damaging IC and system.

2) Over-temperature protection

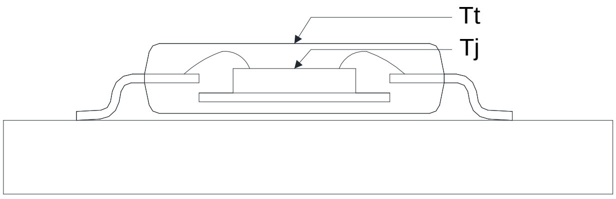
If the IC junction temperature exceeds 160° C (Typ.), the internal over-temperature protection function will be triggered, partial FETs in the H-bridge are disabled, that will ensure the safety of customers' products. If the IC junction temperature falls to 105° C(Typ.), the IC resumes automatically.

Thermal Information

Θja	junction-to-ambient thermal resistance	89.2℃/W
Ψjt	junction-to-top characterization parameter	10.6℃/W

- **Θja** is obtained in a simulation on a JEDEC-standard 2s2p board as specified in JESD-51.
- The **Θja** number listed above gives an estimate of how much temperature rise is expected if the device was mounted on a standard JEDEC board.
- When mounted on the actual PCB, the **Θja** value of JEDEC board is totally different than the **Θja** value of actual PCB.
- **Ψjt** is extracted from the simulation data to obtain **Θja** using a procedure described in JESD-51, which estimates the junction temperature of a device in an actual PCB.

- The thermal characterization parameter, **Ψjt**, is proportional to the temperature difference between the top of the package and the junction temperature. Hence, it is useful value for an engineer verifying device temperature in an actual PCB environment as described in JEDEC JESD-51-12.
- When Greek letters are not available, **Ψjt** is written Psi-jt.
- Definition:



定義 ： $\Psi_{jt} = (T_j - T_t) / P_d$

Where :

Ψjt (Psi-jt) = Junction-to-Top(of the package) °C/W
Tj = Die Junction Temp. °C
Tt = Top of package Temp at center. °C
Pd = Power dissipation. Watts

- Practically, most of the device heat goes into the PCB, there is a very low heat flow through top of the package, So the temperature difference between **Tj** and **Tt** shall be small, that is any error caused by PCB variation is small.

- This constant represents that **Ψjt** is completely PCB independent and could be used to predict the **Tj** in the environment of the actual PCB if **Tt** is measured properly.

How to predict Tj in the environment of the actual PCB

Step 1 : Used the simulated **Ψjt** value listed above.

Step 2 : Measure **Tt** value by using

- **Thermocouple Method**

  We recommend use of a small ~40 gauge(3.15mil diameter) thermocouple. The bead and thermocouples wires should touch the top of the package and be covered with a minimal amount of thermally conductive epoxy. The wires should be heat-insulated to prevent cooling of the bead due to heat loss into wires. This is important towards preventing “too cool” **Tt** measurements, which would lead to the calculated **Tj** also being too cool.

- **IR Spot Method**

  An IR Spot method should be utilized only when using a tool with a small enough spot area to acquire the true top center “hot spot”.
  Many so-called “small spot size” tools still have a measurement area of 0~100+mils at “zero” distance of the tool from the surface. This spot area is too big for many smaller packages and likely would result in cooler readings than the small thermocouple method. Consequently, to match between spot area and package surface size is important while measuring **Tt** with IR sport method.

Step 3 : calculating power dissipation by

$$P \cong (VCC - |Vo_{\_Hi} - Vo_{\_Lo}|) \times I_{out} + VCC \times Icc$$

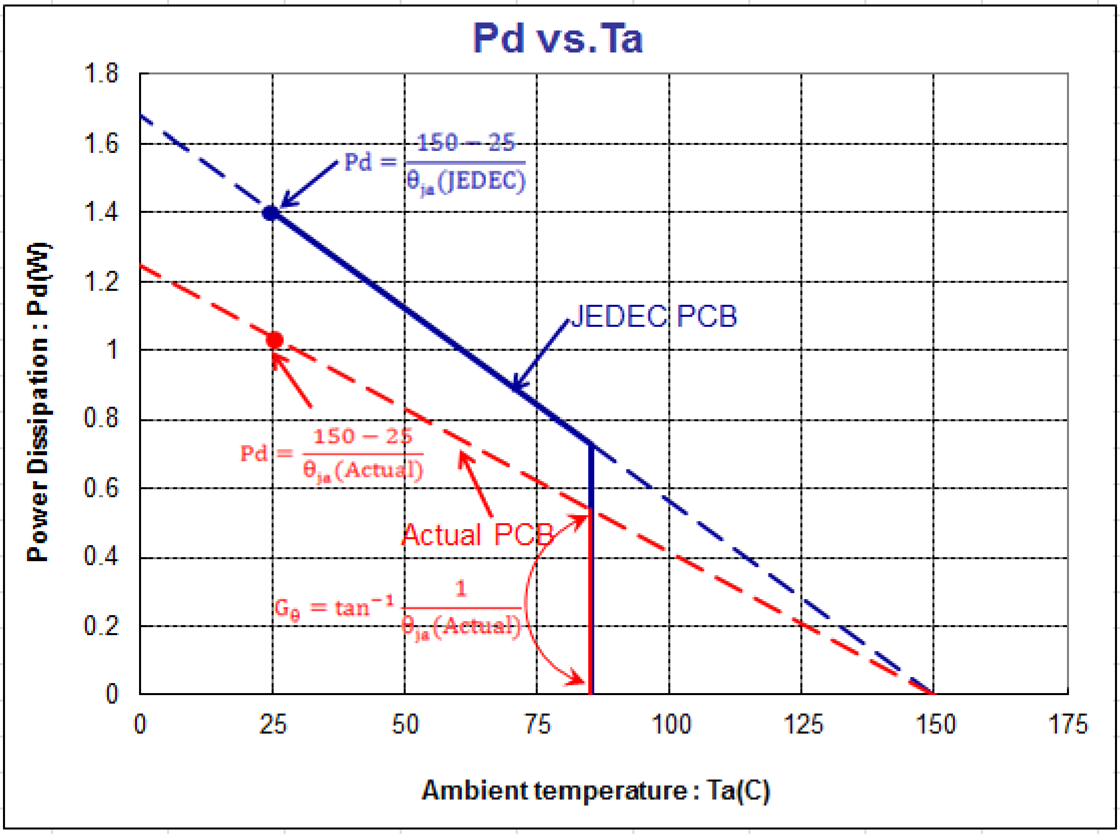
Step 4 : Estimate **Tj** value by

$$Tj = \Psi jt \times P + Tt$$

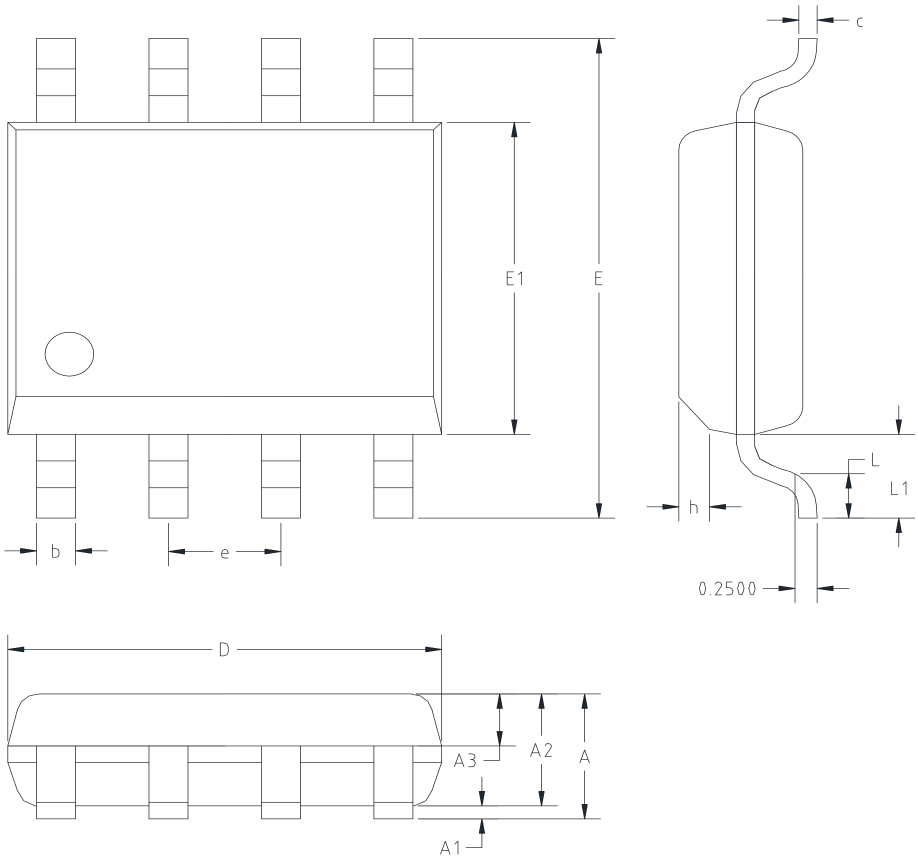
Step 5: Calculated Θja value of actual PCB by the known **Tj**

Θja(actual) = (Tj-Ta)/P

- **Maximum Power Dissipation (de-rating curve) under JEDEC PCB & actual PCB**

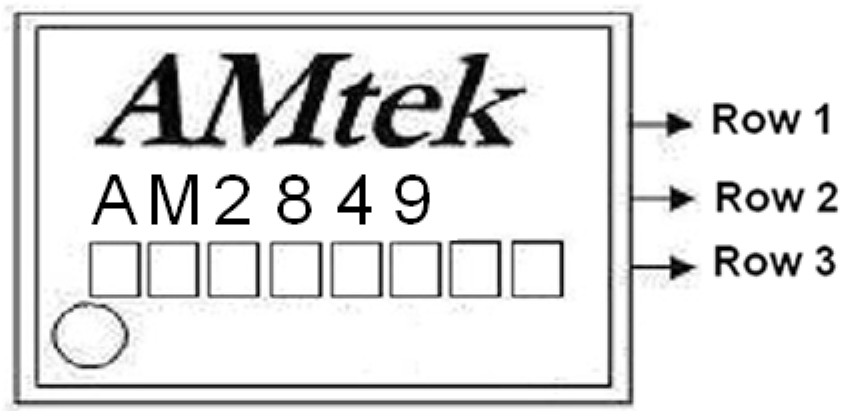


- **Packaging outline --- SOP-8** **Unit : mm**



SYMBOL	MILLIMETERS		INCHES	
	Min.	Max.	Min.	Max.
A	--	1.75	--	0.069
A1	0.10	0.225	0.004	0.009
A2	1.30	1.50	0.051	0.059
A3	0.60	0.70	0.024	0.028
b	0.39	0.48	0.015	0.019
c	0.21	0.26	0.008	0.010
D	4.70	5.10	0.185	0.201
E	5.80	6.20	0.228	0.244
E1	3.70	4.10	0.146	0.161
e	1.27 TYP.		0.05 TYP.	
h	0.25	0.50	0.010	0.020
L	0.50	0.80	0.020	0.031
L1	1.05 TYP		0.041 TYP.	

- **Marking Identification**

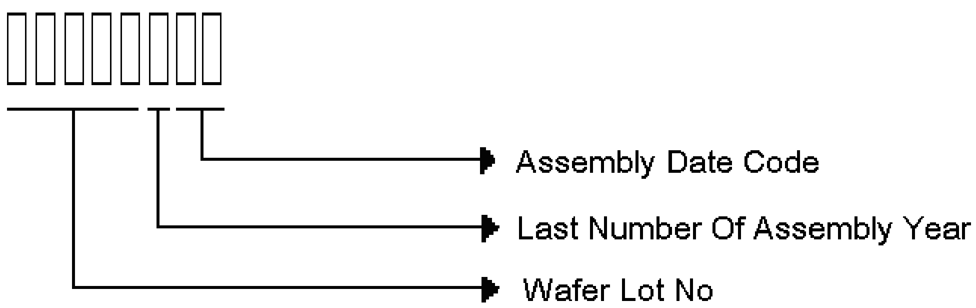


NOTE:

Row1 ： Logo

Row2 ： Device Name

Row3 ： Wafer Lot No use five codes + Assembly Year use one code + Assembly Week use two codes



Example: Wafer Lot No is EB168 + Year 2017 is H + Week 08 is 08，then mark 〝EB168H08〞

The last code of assembly year, explanation as below:：

(Year： A=0,B=1,C=2,D=3,E=4,F=5,G=6,H=7,I=8,J=9. For example: year 2017=H)