Two Channel H-Bridge Power Driver AM1127S

Features and Benefits

- Wide supply voltage range up to 6.8V
- Output_F/B maximum continuous current output up to 1.6A
- Output_R/L maximum continuous current output up to 0.8A
- Low $R_{DS(ON)}$ for high efficient H-bridge output.
- Built-in LDO Regulator (3.3V/2.75V)
- LDO output driver current 60mA
- Over current protection
- Over temperature protection
- Low standby current
- Low quiescent current

Application

- Toys (R/C car)
- Robotics (Sweeping robot)
- Small Appliances (Reduce PCB surface area and perimeter)
- Any relevant DC motor applications.

Description

The AM1127S is two channel H-Bridge driver with a build in Low Dropout Regulator (LDO). It provides integrated motor-driver solution for high current power motion control applications. The output driver block consists of N-channel and P-channel power MOSFETs configured as H-Bridge to driver DC motor.

The AM1127S maximum operational voltage is 6.8V. Output_F/B can supply up to 1.6A of output continuous current and 3 A of output peak current. There are internal shutdown function for over-temperature protection and over-current protection (I_{OCP} = 3 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
AM1127S	SOP-16	AM1127S

● Absolute Maximum Ratings (T_A=25℃)

Parameter	Symbol	Limits	Unit
Power Supply voltage	PVCC/DVCC	7	V
Output_R/L continuous current	Iocont	0.8 (Note*)	A
Output_R/L peak current	Iomax	2.0	A
Output_F/B continuous current	Iocont	1.6 (Note*)	A
Output_F/B peak current	Iomax	3.0	A
Operate temperature range	T_{opr}	-20～+85	℃
Storage temperature range	T_{stg}	-40～+150	℃

Note *: Based on 40mm^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 for H-Bridge	PVCC	2.0(Note**)		6.8	V
IC operating voltage	DVCC	2.0(Note**)		6.8	V
Signal input IN_F/B/R/L voltage	V_{IN_x}	-0.3		Vcc+0.3	V
Output_F/B continuous current	I_{OUT}	0		0.8(Note*)	A
Output_R/L continuous current	I_{OUT}	0		1.6(Note*)	A
Externally applied PWM frequency	F_{IN_x}	0.02		65	KHz

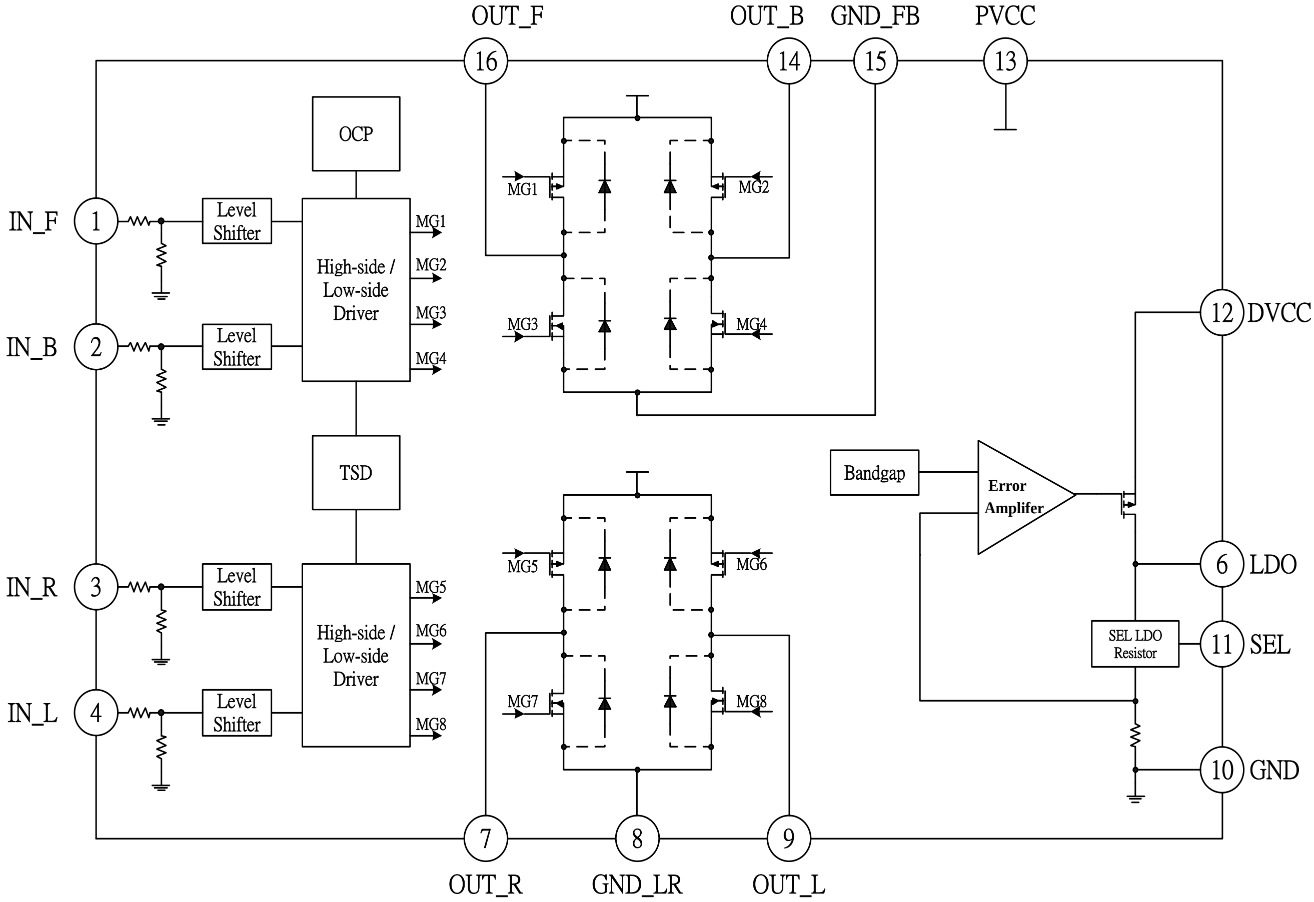
Note *: Based on 40mm^2 FR4 PCB (1 oz.) at single side PCB

Note **: The DVCC should be considered when using LDO.

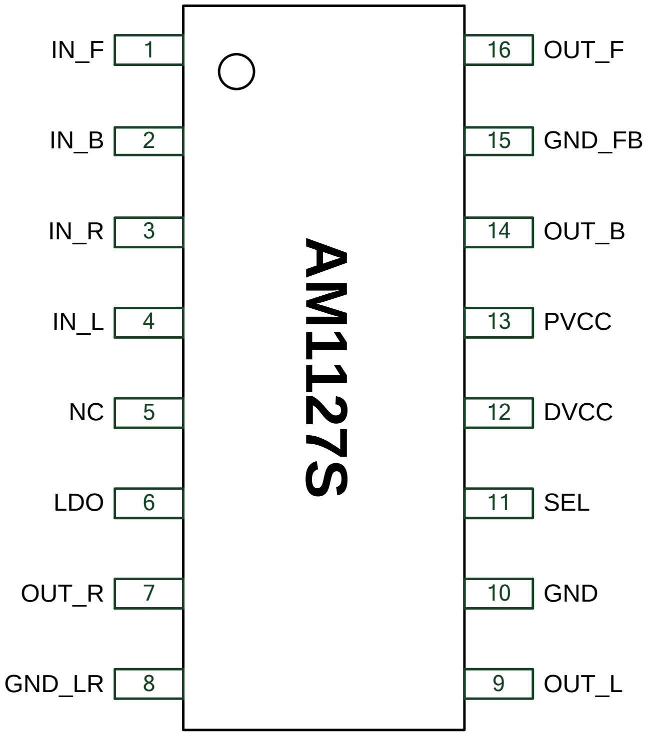
- **Electrical Characteristics (Unless otherwise specified, TA = 25℃, PVCC=DVCC=5V)**

Parameter	Symbol	Limit			Unit	Conditions
		Min	Typ	Max		
Power Supplies						
Supply current	I_{CC}		25		uA	Input signal IN_F/B(R/L)= L/H or H/L, No load on OUT_ F/B(R/L), no load on LDO
Standby current	I_{STB}		5		uA	Input signal IN_ F/B(R/L)= L, No load on OUT_ F/B(R/L), no load on LDO
IN_x Inputs						
Input H level voltage	V_{IN_xH}	2.0		Vcc	V	
Input L level voltage	V_{IN_xL}	0		0.7	V	
Input pull down resistance	R_{IN_X}		100		KΩ	
Input frequency	F_{IN_x}	0.02		65	KHz	
H-bridge FETs						
Output_R/L On-resistance	$R_{ds(on)}$		0.53		Ω	I_O = 600mA Upper and Lower total
Output_F/B On-resistance	$R_{ds(on)}$		0.33		Ω	I_O = 1000mA Upper and Lower total
TSD Protections						
Thermal shutdown protection	TSD_p		130		℃	
Thermal shutdown release	TSD_r		100		℃	
LDO parameter (SEL=L)						
LDO output voltage	V_{LDO}	2.5	2.75	3	V	I_{Load} = 60mA
Load regulation	$\triangle V_{RL}$			50	mV	I_{Load}= 0~60mA
Dropout voltage	$\triangle V_{DO}$			300	mV	I_{Load}= 60mA
LDO parameter (SEL=H)						
LDO output voltage	V_{LDO}	3.0	3.3	3.6	V	I_{Load} = 60mA
Load regulation	$\triangle V_{RL}$			50	mV	I_{Load}= 0~60mA
Dropout voltage	$\triangle V_{DO}$			300	mV	I_{Load}= 60mA

- **Block Diagram**



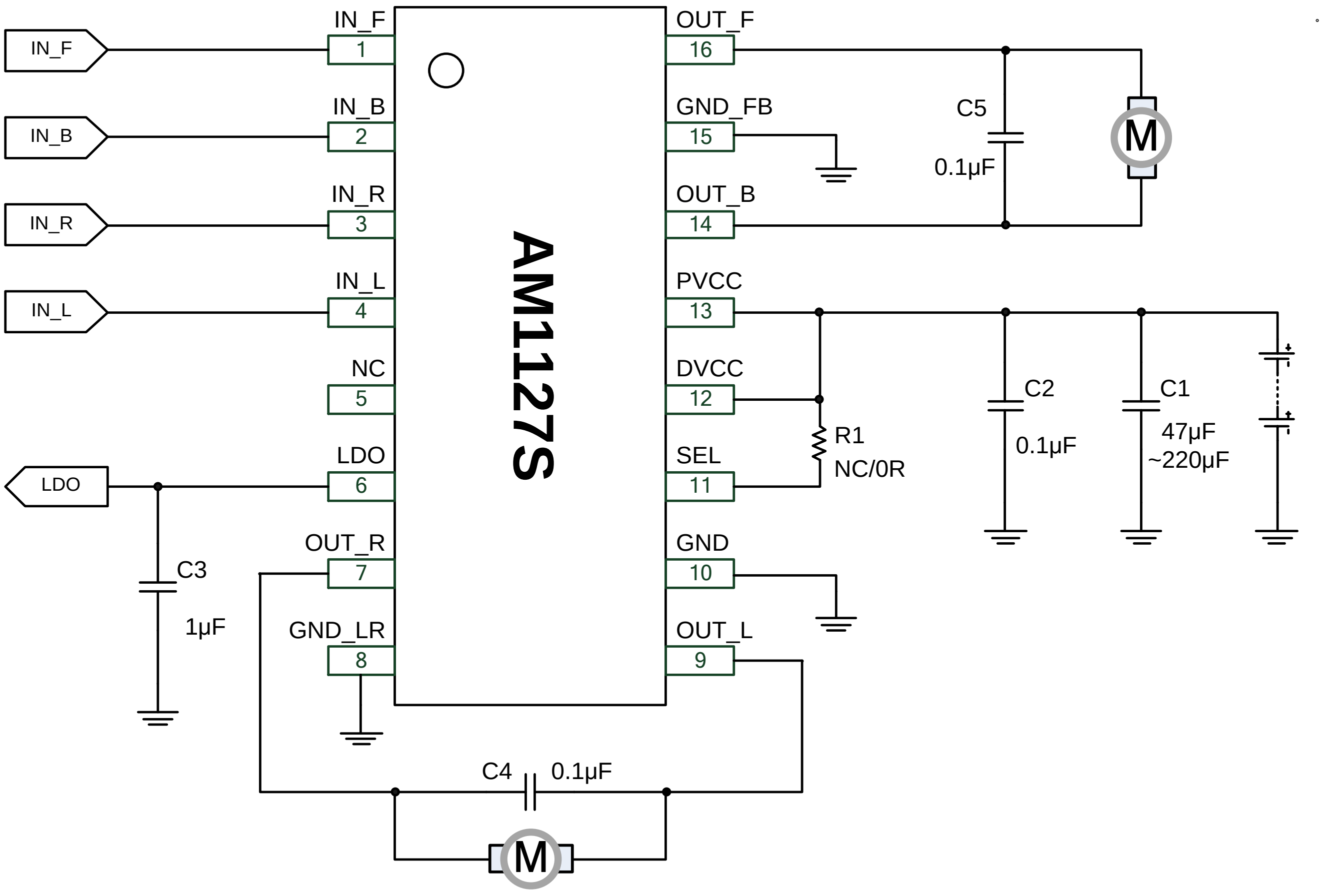
- **Pin configuration SOP-16**



- **Pin Descriptions**

編號	名稱	輸入/出	功能敘述
1	IN_F	I	Input Signal F
2	IN_B	I	Input Signal B
3	IN_R	I	Input Signal R
4	IN_L	I	Input Signal L
5	NC		No Connector
6	LDO	O	Low Dropout Regulator
7	OUT_R	O	Output R
8	GND_LR	-	Ch_LR Ground Pin
9	OUT_L	O	Output L
10	GND	-	Ground Pin
11	SEL		Selection LDO output Voltage pin
12	DVCC	-	Power Supply
13	PVCC	-	Power Supply for H-bridge
14	OUT_B	O	Output B
15	GND_FB	-	Ch_FB Ground Pin
16	OUT_F	O	Output F

- **Application**



LDO	SEL Function	R1
2.75V	L	NC
3.30V	H	0R

Circuit Descriptions

1. The function descriptions of capacitors on the application circuit:

C1、C2: Power supply PVCC/DVCC pin capacitor:

1) The capacitor can reduce the power spike when the motor is in motion. To avoid the IC directly damaged by the PVCC/DVCC peak voltage. It also can stabilize the power supply voltage and reduce its ripples.
2) The C1 capacitor can compensate power when motor starts running.
3) The capacitor value (μF) determines the stability of the PVCC/DVCC during motor in motion. In general, 47μF capacitor is enough in low voltage power. If the large voltage power or a heavy loading motor is used, then a larger capacitor would be needed.
4) On the PCB configuration, the C1、C2 must be mounted as close as possible to PVCC/DVCC.

C3: The LDO output capacitor

1) The capacitor can reduce the power spike while motor is in motion; it also can stabilize the LDO output voltage and reduce its ripples.

C4、C5: The across-output capacitor

2) The capacitors can reduce the power spike of motor when operating. Therefore, a 0.1μF capacitor is recommended.
3) On the PCB configuration, the C4、C5 must be mounted as close as possible to output pin.
4) The C4、C5 capacitor must be added to the general application.

Input Logic Descriptions

Function truth table CH_L/R

IN_L	IN_R	OUT_L	OUT_R	Mode
L	L	Z	Z	Stop
L	H	L	H	Reverse
H	L	H	L	Forward
H	H	L	L	Brake

Function truth table CH_F/B

IN_F	IN_B	OUT_F	OUT_B	Mode
L	L	Z	Z	Stop
L	H	L	H	Reverse
H	L	H	L	Forward
H	H	L	L	Brake

Operating Mode Descriptions

1) H-Bridge basic operating mode：

a) Forward mode

Definition：When IN_L/F=H，IN_R/B=L，then OUT_ L/F=H，OUT_ R/B=L

b) Reverse mode

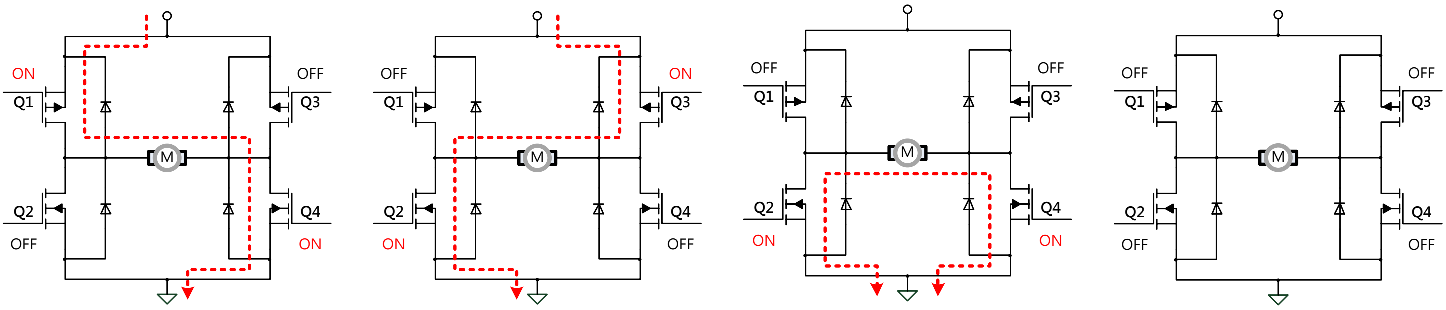
Definition：When IN_L/F=L，IN_R/B=H，then OUT_ R/B=H，OUT_ L/F=L

c) Brake mode

Definition：When IN_L/F =IN_R/B= H，then OUT_ L/F=OUT_ R/B=L

d) Stop mode

Definition：When IN_L/F=IN_R/B= L，then OUT_ L/F=OUT_ R/B=Hi-Z



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

Protection Mechanisms Descriptions

1) Over-temperature protection

If the IC junction temperature exceeds 130° C (Typ.), the internal over-temperature protection function will be triggered, all FETs in the H-bridge are disabled, that will ensure the safety of customers' products. If the IC junction temperature falls to 100° C(Typ.), the IC resumes automatically.

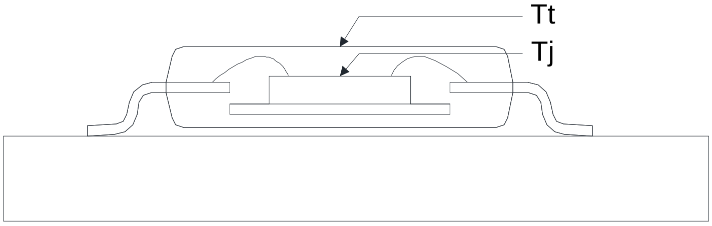
2) Over-current protection (OCP)

While the IC conducts a large current, 3A (Typ), the internal over-current protection function will be triggered. The device enter protection mode of auto-recover to avoid damaging IC and system.

- **Thermal Information**

θja	junction-to-ambient thermal resistance	80.13℃/W
Ψjt	junction-to-top characterization parameter	4.31℃/W

- **Θja** is obtained in a simulation on a JEDEC-standard 1s0p board as specified inJESD-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:



DEFINITIONS : $\psi_{jt} = (T_j - T_t) / P_d$

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

$$\mathbf{P \cong (VCC - |Vo\_{Hi} - Vo\_{Lo}|) \times I_{out} + VCC \times Icc}$$

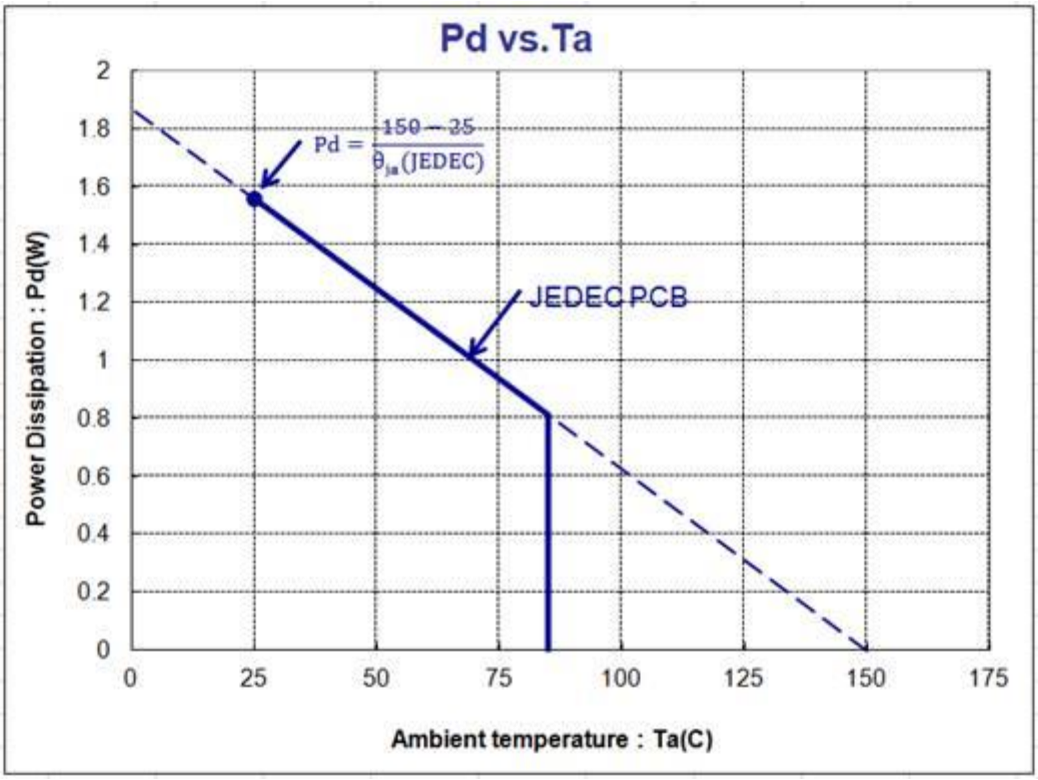
Step 4 : Estimate **Tj** value by

$$\mathbf{Tj = \Psi jt \times P + Tt}$$

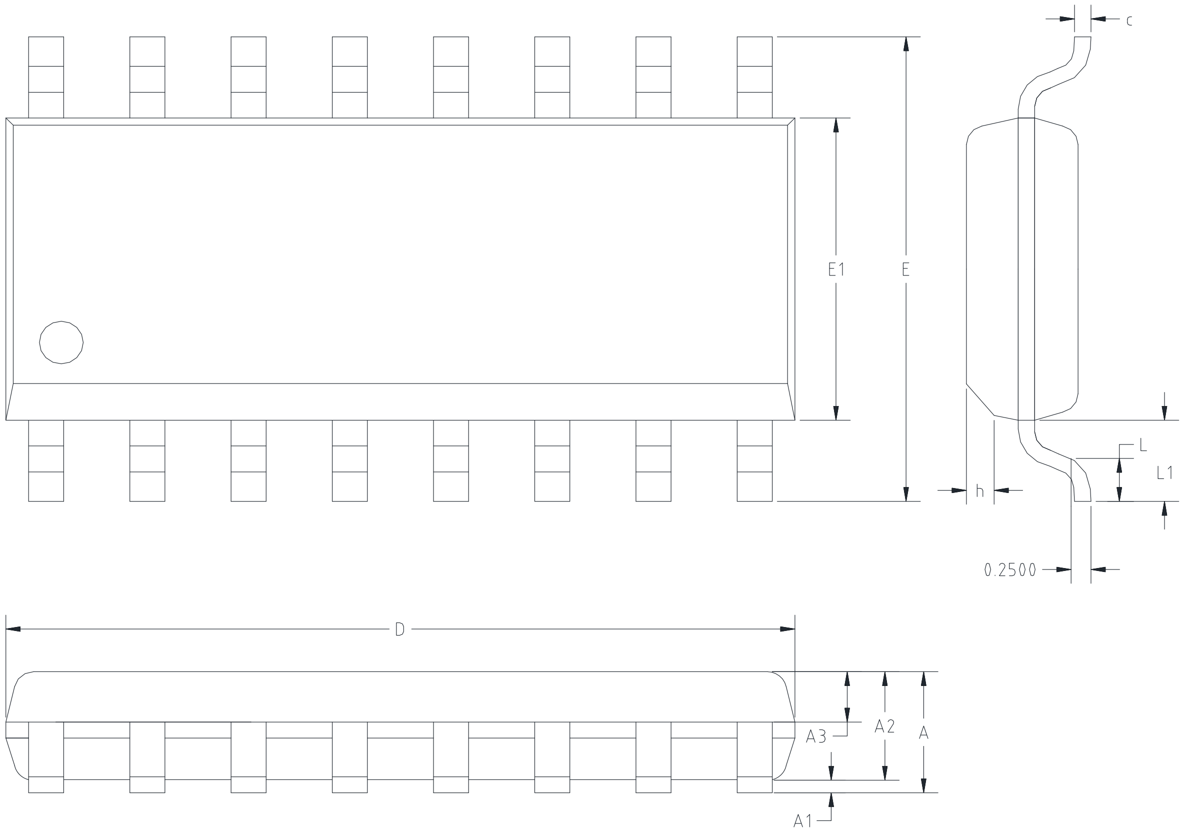
Step 5: Calculated Θja value of actual PCB by the known **Tj**

$$\mathbf{\Theta ja(_{actual}) = (Tj - Ta)/P}$$

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

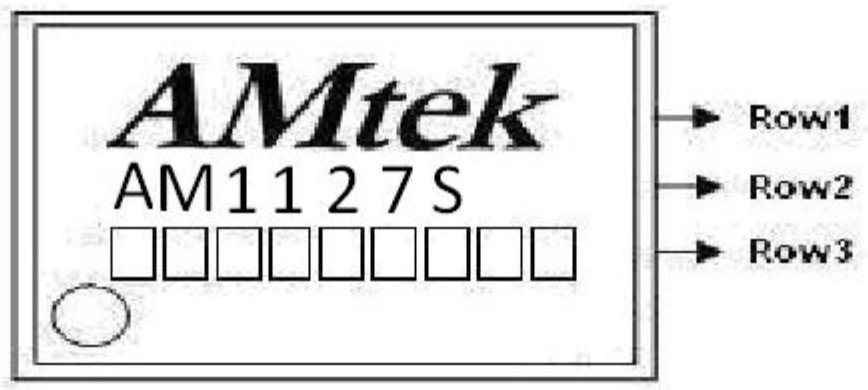


- **Packaging outline --- SOP-16** **Unit : mm**



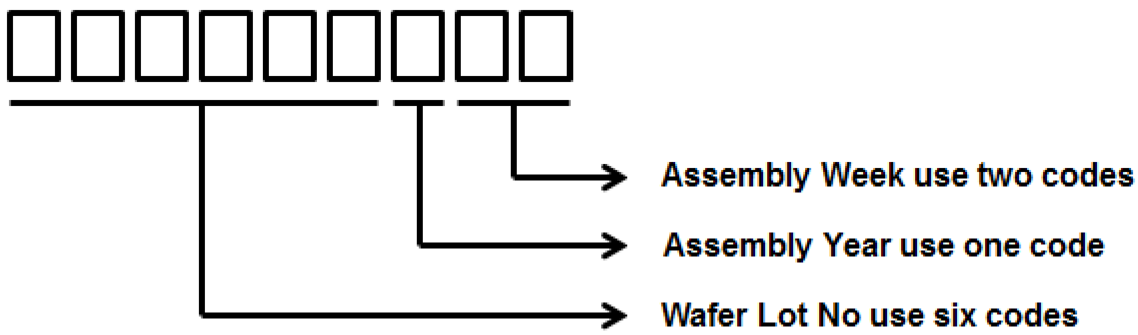
SYMBOL	MILLIMETERS		INCHES	
	Min.	Max.	Min.	Max.
A	--	1.75	--	0.069
A1	0.05	0.225	0.002	0.009
A2	1.30	1.50	0.051	0.059
A3	0.60	0.70	0.024	0.028
b	0.39	0.48	0.015	0.019
c	0.21	0.26	0.008	0.010
D	9.70	10.10	0.382	0.398
E	5.80	6.20	0.228	0.244
E1	3.70	4.10	0.146	0.161
e	1.27 TYP.		0.05 TYP.	
h	0.25	0.50	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 six codes + Assembly Year use one code + Assembly Week use two codes



Example: Wafer lot no is GE8888 + Year 2015 is F + Week 28 is 28，we type 〝GE8888F28〞
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 2015=F)