

## **1.6X Linear Fan Driver with VO Fully On**

### **Control**

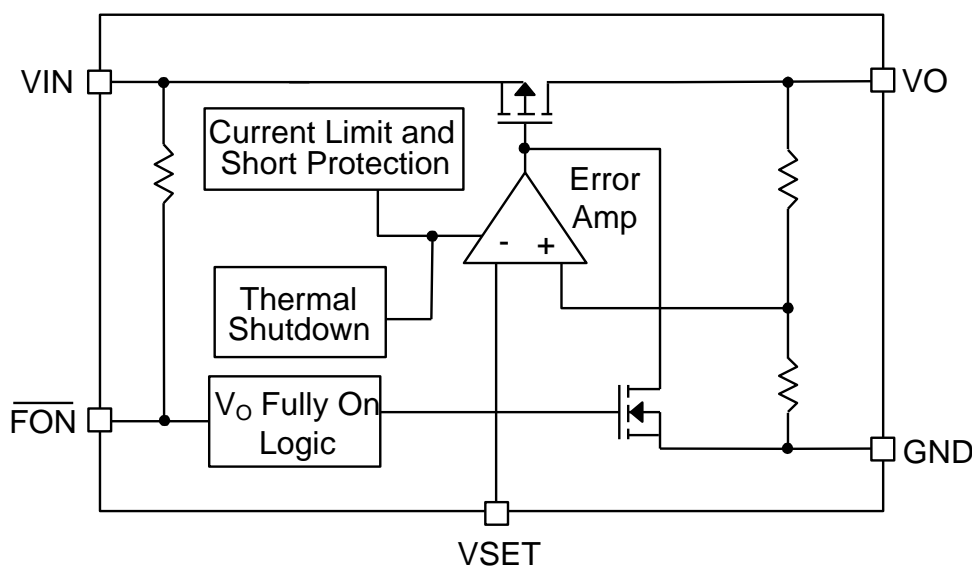
#### ❖ **GENERAL DESCRIPTION**

The AX995A is a low dropout linear regulator which is designed to power a DC fan and delivers up to 600mA output current. The output voltage follows the 1.6 times of VSET voltage and typical dropout voltage is only 200mV (typical) at 600mA output current. The VSET voltage can form 0.1V to 3.3V to guarantee  $V_O$  1.6 times of VSET. A  $\overline{FON}$  pin turns  $V_O$  output fully on when given low. The features of current limit (with fold back current) and over temperature protection protect the device against current over-loads and over temperature. The AX995A is available in a SOP-8L package.

#### ❖ **FEATURES**

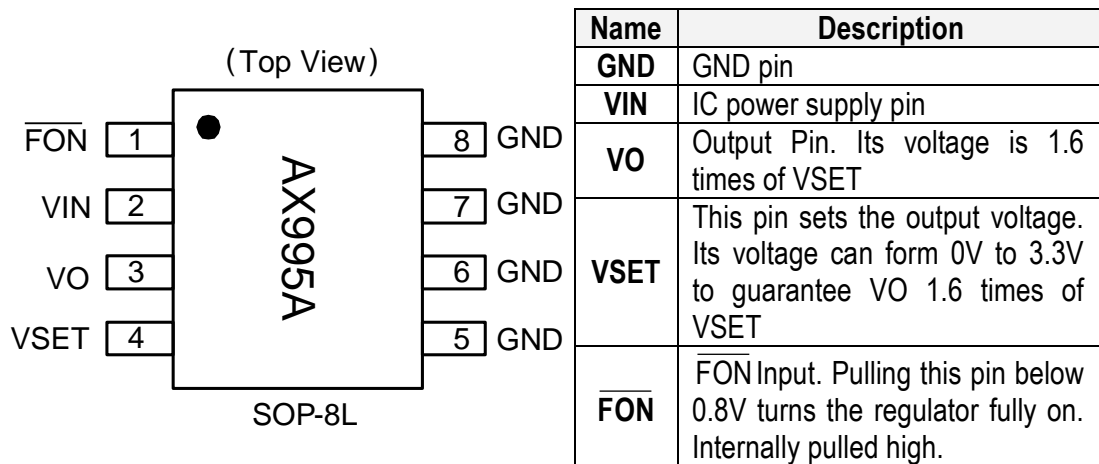
- Low Dropout Voltage: 200mV@0.6A
- $V_O$  Follows 1.6 times of VSET
- $\overline{FON}$  Pin to Turn  $V_O$  Fully On
- Stable with Low ESR Ceramic Capacitors
- Current-Limit and Thermal Shutdown Protection
- SOP-8L Pb-Free Package

#### ❖ **BLOCK DIAGRAM**



### ❖ PIN ASSIGNMENT

The package of AX995A is SOP-8L; the pin assignment is given by:



### ❖ ORDER/MARKING INFORMATION

Order Information	Top Marking
<p><b>AX995A X X</b></p> <p>Package Type      Packing</p> <p>S : SOP-8L      Blank : Tube</p> <p>A : Taping</p>	<p>Logo ← <b>AX</b> 9 9 5 → Part number</p> <p>A Y Y W W X → ID code:internal</p> <p>AX995A      WW: 01~52</p> <p>Year: 10=2010</p> <p>11=2011</p>

### ❖ ABSOLUTE MAXIMUM RATINGS (at T<sub>A</sub>=25°C)

Characteristics	Symbol	Rating	Unit
VIN Supply Voltage	V <sub>IN</sub>	-0.3 to 6.5	V
FON Input Voltage	V <sub>FON</sub>	-0.3 to VIN	V
VSET Voltage	V <sub>SET</sub>	-0.3 to VIN	V
Power Dissipation	PD	Internally limited	W
Storage Temperature Range	T <sub>ST</sub>	-65 to +150	°C
Junction Temperature Range	T <sub>J</sub>	-40 to 125	°C
Operating Temperature Range	T <sub>OP</sub>	-40 to +85	°C
Thermal Resistance from Junction to case	θ <sub>JC</sub>	20	°C/W
Thermal Resistance from Junction to ambient	θ <sub>JA</sub>	60	°C/W

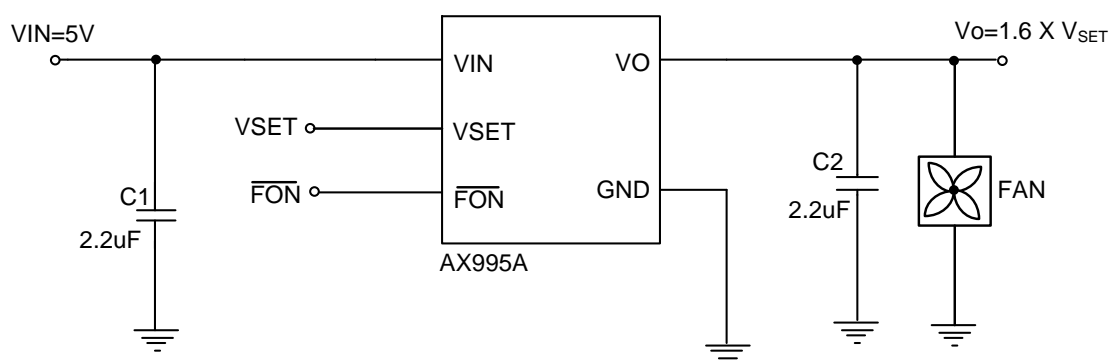
Note: θ<sub>JA</sub> is measured with the PCB copper area approximately 1.5 in<sup>2</sup> (Multi-layer) that connect to GND Pins.

## ❖ ELECTRICAL CHARACTERISTICS

( $V_{SET} = 2V$ ,  $V_{IN} = 5V$ ,  $I_{OUT} = 0.5A$ ,  $C_{IN}=C_{OUT}=2.2\mu F$ ,  $T_A=25^\circ C$  unless otherwise specified)

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
VIN Supply Voltage Range	$V_{IN}$		4.5	-	6	V
Quiescent Current	$I_{CCQ}$	No Load	-	50	80	$\mu A$
Output Voltage/ $V_{SET}$ Voltage	$V_O/V_{SET}$	$V_{IN}=5.5V$ , $V_{SET}=1V\sim 3.3V$	1.552	1.6	1.648	V/V
Line Regulation		$V_{IN}=4.5V$ to $5.5V$	-	0.2	0.5	%
Load Regulation		$I_{OUT} = 10mA \sim 0.6A$	-	30	60	mV
Dropout Voltage	$V_{Drop}$	$I_{OUT} = 0.6A$ , $V_{SET}=3.3V$	-	200	320	mV
Current Limit	$I_{Limt}$		700	-	-	mA
Short Circuit Current	$I_{Short}$	$V_O < 0.6V$	-	250	-	mA
$V_{SET}$ Voltage Range	$V_{SET}$		0.1	-	3.3	V
$V_{SET}$ Pin Current	$I_{SET}$	$V_{SET}=5V$	-	80	200	nA
$\overline{FON}$ Pin Logic Threshold Voltage	$V_{FON-H}$	Normal Operating	2.0	-	-	V
	$V_{FON-L}$	Regulator Fully On	-	-	0.8	V
$\overline{FON}$ Pin Bias Current	$I_{FONH}$	$\overline{FON}=V_{IN}$	-	0.003	0.1	$\mu A$
	$I_{FONL}$	$\overline{FON}=0V$	-	1	5	
Thermal shutdown Temp	$T_{SD}$		-	150	-	$^\circ C$
Thermal Shutdown Hysteresis			-	30	-	$^\circ C$

## ❖ APPLICATION CIRCUIT



## ❖ FUNCTION DESCRIPTIONS

### Output Voltage Regulation

The Output Voltage is set by VSET voltage. VO output voltage follows the 1.6 times of VSET voltage until it reaches VIN voltage.

### Fully-On Control

If the  $\overline{\text{FON}}$  pin logic level smaller than 0.8V, the output voltage can be promoted near to VIN voltage. Otherwise,  $V_{\text{OUT}}$  is normal operating by  $\overline{\text{FON}}$  larger than 2.0V.

### Current-Limit

The AX995A monitors the current via the output PMOS and limits the maximum current to prevent load and AX995A from damages during overload or short circuit conditions.

### Short Current Protection

When the output voltage drops below 0.6V (typical), which is caused by over load or short circuit, the fold back current limit circuitry limits the output current to 250mA. The fold back current limit is used to reduce the power dissipation during short circuit condition.

### Thermal Shutdown

A thermal shutdown circuit limits the junction temperature of AX995A. When the junction temperature exceeds +150°C, a thermal sensor turns off the output PMOS, allowing the device to cool down. The regulator regulates the output again through initiation of a new soft-start cycle after the junction temperature cools by 30°C, resulting in a pulsed output during continuous thermal overload conditions.

## ❖ APPLICATION INFORMATION

### Capacitor Selection

Normally, use a 2.2μF capacitor on the input and a 2.2μF capacitor on the output of the AX995A. In order to insure the circuit stability, the proper output capacitor value should be larger than 1uF. With X5R and X7R dielectrics, 2.2uF is sufficient at all operating temperatures.

### Thermal Considerations

The AX995A series can deliver a current of up to 600mA over the full operating junction temperature range. However, the maximum output current must be dated at higher ambient temperature to ensure the junction temperature does not exceed 125°C. With all possible conditions, the junction temperature must be within the range specified under operating conditions. Power dissipation can be calculated based on the output current and the voltage drop across regulator.

$$PD = (V_{IN} - V_O) I_O$$

The final operating junction temperature for any set of conditions can be estimated by the following thermal equation:

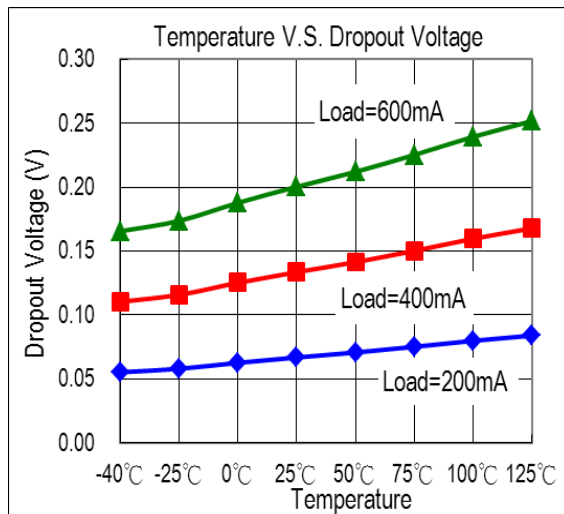
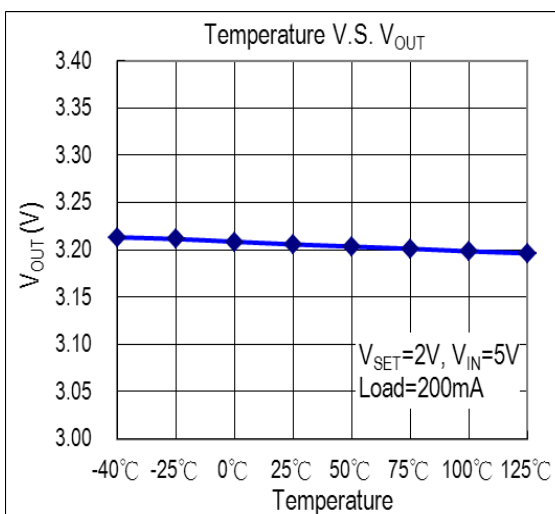
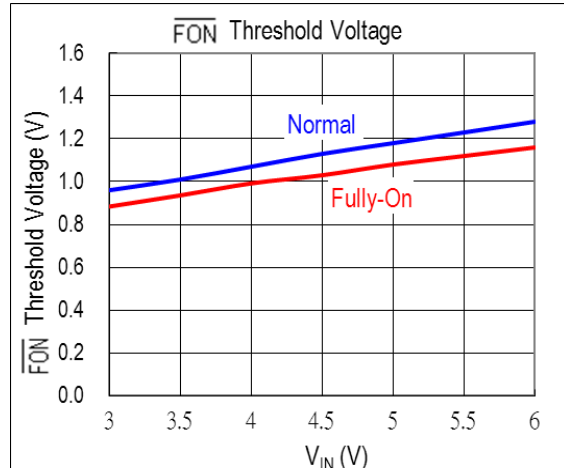
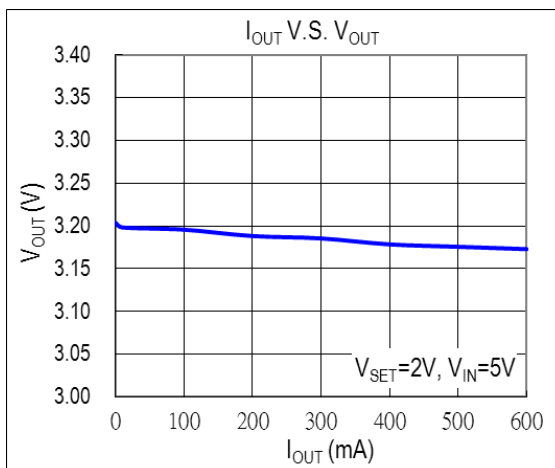
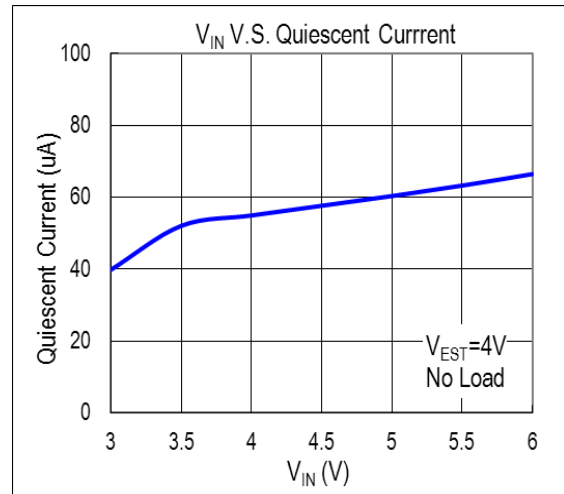
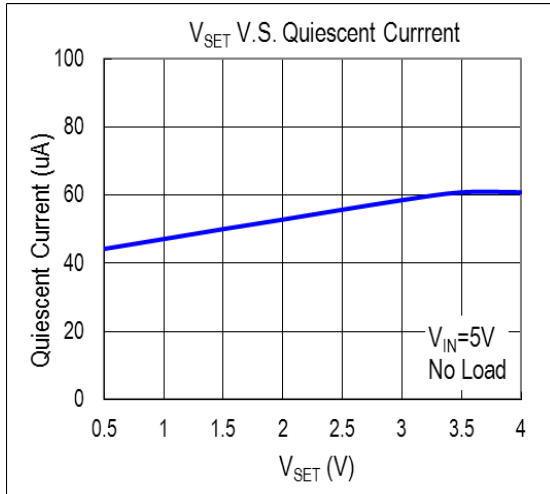
$$PD (MAX) = (T_{J (MAX)} - T_A) / \theta_{JA}$$

Where  $T_{J (MAX)}$  is the maximum junction temperature of the die (125°C) and  $T_A$  is the maximum ambient temperature. The junction to ambient thermal resistance ( $\theta_{JA}$ ) for SOP-8L package at recommended minimum footprint is 60°C/W.

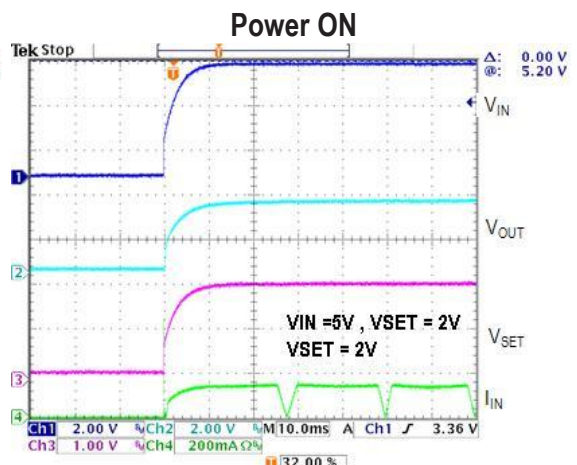
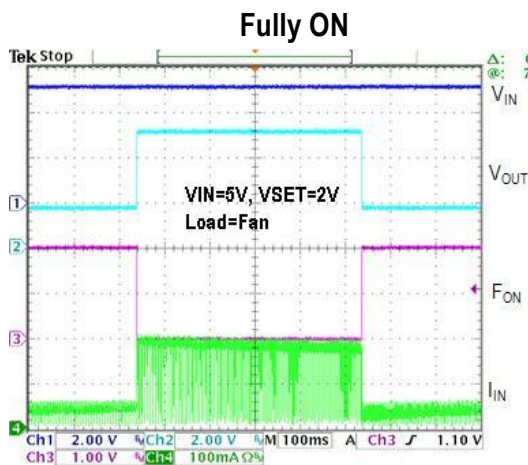
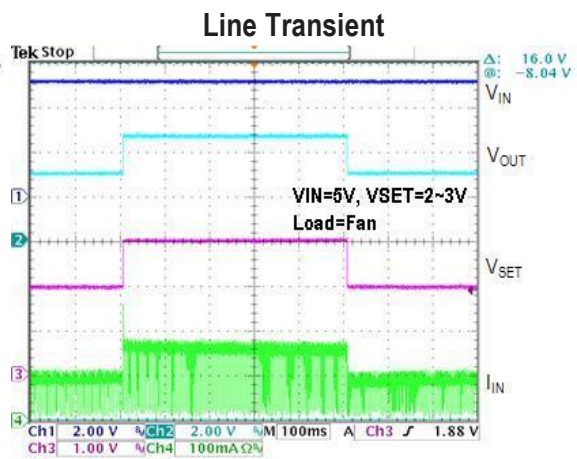
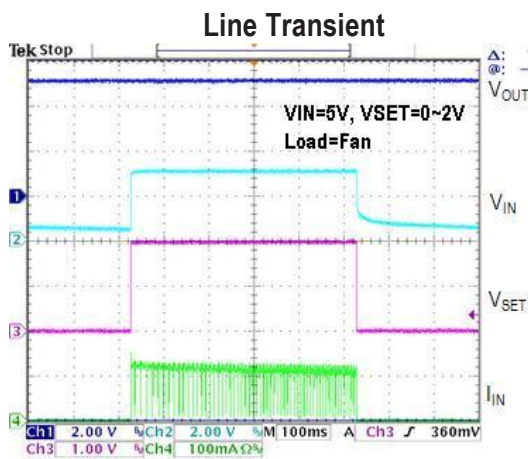
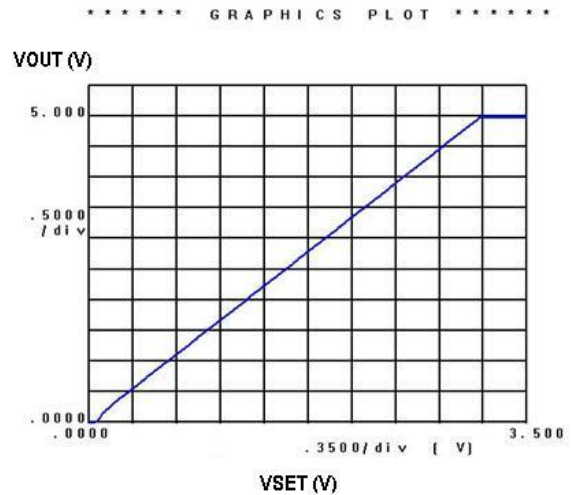
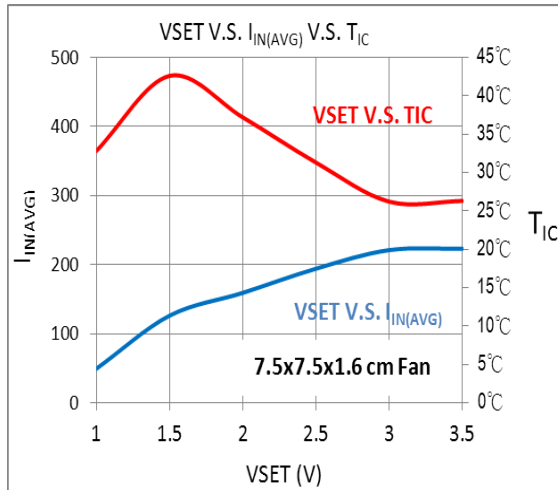
### PCB Layout

1. Please place the input capacitors close to the VIN
2. Ceramic capacitors for load must be placed near the load as close as possible
3. To place AX995A and output capacitors near the load is good for performance.
4. Large current paths that VIN and Output lines must have wide tracks.
5. GND connect large copper area can reduced IC temperature.

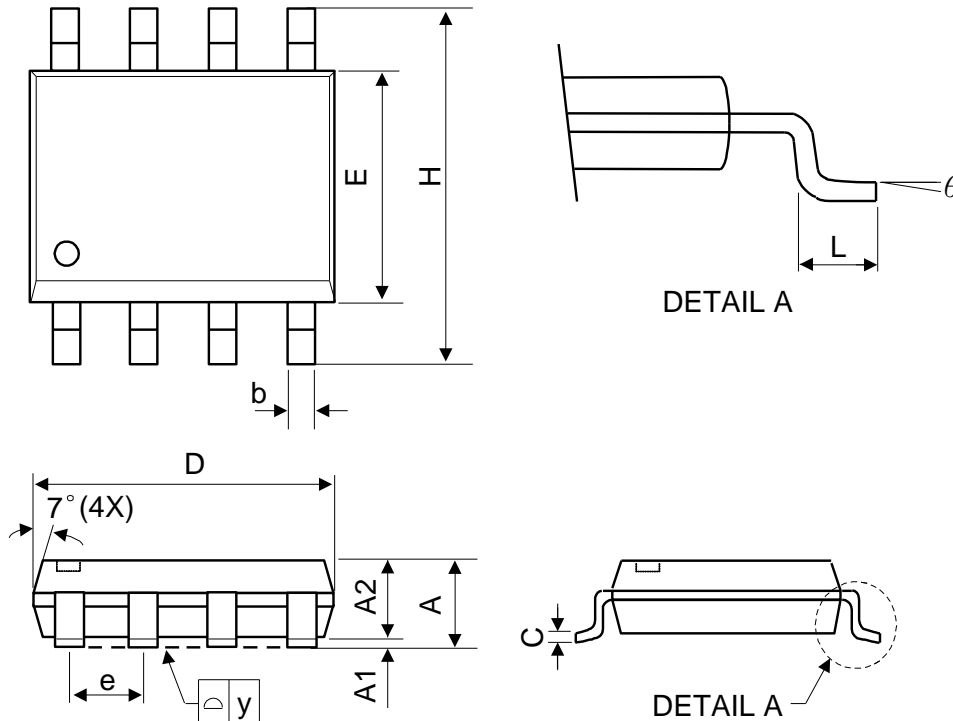
❖ TYPICAL CHARACTERISTICS



❖ TYPICAL CHARACTERISTICS (CONTINUES)



❖ PACKAGE OUTLINES



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.75	-	-	0.069
A1	0.1	-	0.25	0.04	-	0.1
A2	1.25	-	-	0.049	-	-
C	0.1	0.2	0.25	0.0075	0.008	0.01
D	4.7	4.9	5.1	0.185	0.193	0.2
E	3.7	3.9	4.1	0.146	0.154	0.161
H	5.8	6	6.2	0.228	0.236	0.244
L	0.4	-	1.27	0.015	-	0.05
b	0.31	0.41	0.51	0.012	0.016	0.02
e	1.27 BSC			0.050 BSC		
y	-	-	0.1	-	-	0.004
θ	0°	-	8°	0°	-	8°

Mold flash shall not exceed 0.25mm per side

JEDEC outline: MS-012 AA