LDO ICs

Low Noise, Low Voltage, High PSRR Low-Dropout 300mA Linear Regulator

AS9103/A

General Description

The AS9103/A is a CMOS low dropout, low noise, high PSRR, low quiescent current positive linear regulator with input voltage down to about 1.20V. The AS9103/A can deliver a guaranteed 300mA load current with a low dropout voltage at 250mV that optimized for battery-powered systems or portable wireless devices such as mobile phones. The shutdown function can provide remote control for the external signal to decide the on/off state of AS9103/A that consumes less than 0.1uA during shutdown mode.

The device is suitable for portable application such as cellular handsets or PDA. The AS9103/A is designed and optimized to work with low cost ceramic capacitors 1.0uF, which consumes less than 0.1μA during shutdown mode. Besides, its current limit protection and on-chip thermal shutdown function provide protection against any combination of over-load or ambient temperature which could cause junction temperature exceeding maximum rating. The AS9103/A includes a reference bypass pin in order to reduce output noise and a logic control shut-down input.

The space-saving tiny SOT23-3L, SOT23-5L and DFN1010-4L packages are attractive for hand-held applications. The device is specified over an ambient temperature range of -40˚C to 125˚C.

Features

- Output Current Up to 300mA
- Low Voltage V_{IN} Range: 1.20V to 5.5V
- Very Low Input Voltage at 1.20V (Min.)
- Very Low Quiescent Current at 20uA
- Low Dropout voltage of 250mV at 300mA
- Output Voltage Accuracy at ±2.0%
  - AS9103A Accuracy at ±1.0%
  - AS9103 Accuracy at ±2.0%
- PSRR 75dB at 1.0KHz
- Needs Only 1.0uF Capacitor for Stability
- Current Limit Protection
- Current Fold-back Protection
- Less than 1uA Shutdown Current
- Without EMI and Switch Noise
- Low ESR Ceramic Capacitor for Output Stability
- RoHS and Green Compliant
- SOT23-3L, DFN1010-4L and SOT23-5L Packages
- -40℃ to +125 ℃ Temperature Range

Applications

- PDAs and Digital Camera
- White LED Biasing
- Mobil Handsets
- Tablet PCs and Laptops/Netbooks
- Camcorder Video Light (Movie Light)

Ordering Information

AS9103XXXXX

Accuracy:
A: ±1.0%
Blank: ±2.0%

Output Voltage:
1J: 1.05V 12:1.2V
18:1.8V 28: 2.8V
30:3.0V 33: 3.3V
36:3.6V 40: 4.0V
42:4.2V

Package:
D:DFN1010-4L
ST: SOT23-5L
S3: SOT23-3L

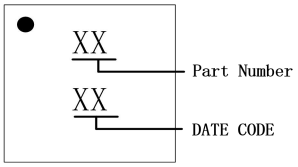
Packing:
R:Tape&Reel

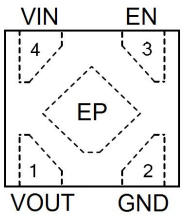
Temperature Grade:
N: -40°C~85°C
Y: -40°C~125°C

Part Number	Accuracy	Driver Capability	Package Type	Package Qty	Temperature	Eco Plan
AS9103-XXDRN	±2.0%	300mA	DFN1010-4L	7-in reel 10000pcs/reel	-40～85℃	RoHS
AS9103-XXSTRN	±2.0%	300mA	SOT23-5L	7-in reel 3000pcs/reel	-40～85℃	RoHS
AS9103-XXS3RN	±2.0%	300mA	SOT23-3L	7-in reel 3000pcs/reel	-40～85℃	RoHS
AS9103-XXDRY	±2.0%	300mA	DFN1010-4L	7-in reel 10000pcs/reel	-40～125℃	RoHS
AS9103-XXSTRY	±2.0%	300mA	SOT23-5L	7-in reel 3000pcs/reel	-40～125℃	RoHS
AS9103-XXS3RY	±2.0%	300mA	SOT23-3L	7-in reel 3000pcs/reel	-40～125℃	RoHS
AS9103A-XXDRN	±1.0%	300mA	DFN1010-4L	7-in reel 10000pcs/reel	-40～85℃	RoHS
AS9103A-XXSTRN	±1.0%	300mA	SOT23-5L	7-in reel 3000pcs/reel	-40～85℃	RoHS
AS9103A-XXS3RN	±1.0%	300mA	SOT23-3L	7-in reel 3000pcs/reel	-40～85℃	RoHS
AS9103A-XXDRY	±1.0%	300mA	DFN1010-4L	7-in reel 10000pcs/reel	-40～125℃	RoHS
AS9103A-XXSTRY	±1.0%	300mA	SOT23-5L	7-in reel 3000pcs/reel	-40～125℃	RoHS
AS9103A-XXS3RY	±1.0%	300mA	SOT23-3L	7-in reel 3000pcs/reel	-40～125℃	RoHS

Marking Information & Pin Assignment

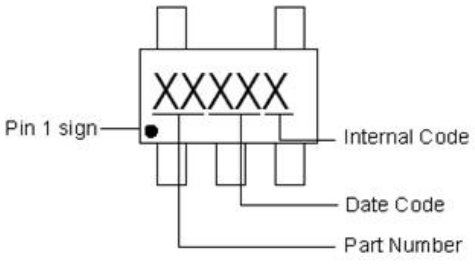
DFN1010-4L

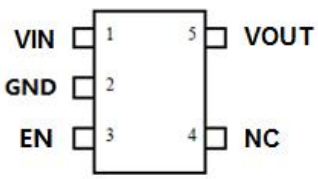




Pin Name	Pin No. DFN1010-4L	I/O	Pin Function
VOUT	1	O	Output Pin
GND	2	P	Ground
EN	3	I	Pull this pin high to enable IC, pull this pin low to shutdown IC. Floating this pin will shutdown due to the built-in pull low resistor.
VIN	4	P	Input Power Supply
EP	-	-	Please Connected to GND.

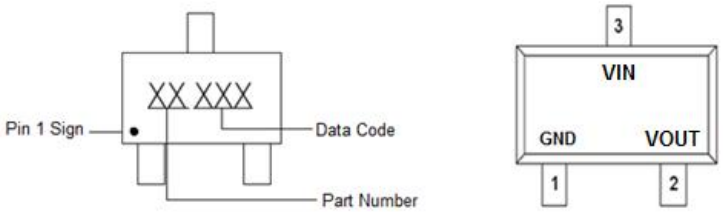
SOT23-5L





Pin Name	Pin No. TSOT23-5L	I/O	Pin Function
VIN	1	P	Input Power Supply
GND	2	P	Ground
EN	3	I	Pull this pin high to enable IC, pull this pin low to shutdown IC. Floating this pin will shutdown due to the built-in pull low resistor.
NC	4	-	Not Connected.
VOUT	5	O	Output Pin

SOT23-3L



Pin Name	Pin No. SOT23-3L	I/O	Pin Function
VIN	3	P	Input Power Supply
GND	1	P	Ground
VOUT	2	O	Output Pin

● Typical Application Circuit

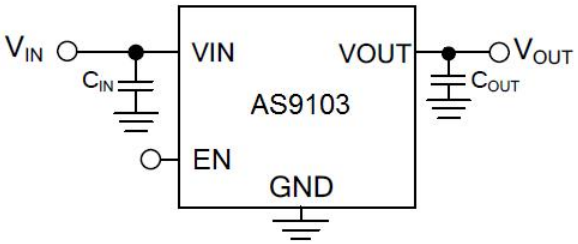


Figure 1, Typical Application Circuit of AS9103

Note: To prevent oscillation, it is recommended to use 1μF X7R or X5R dielectric capacitors if ceramics are used as input/output capacitors (please refer to application information).

● Block Diagram

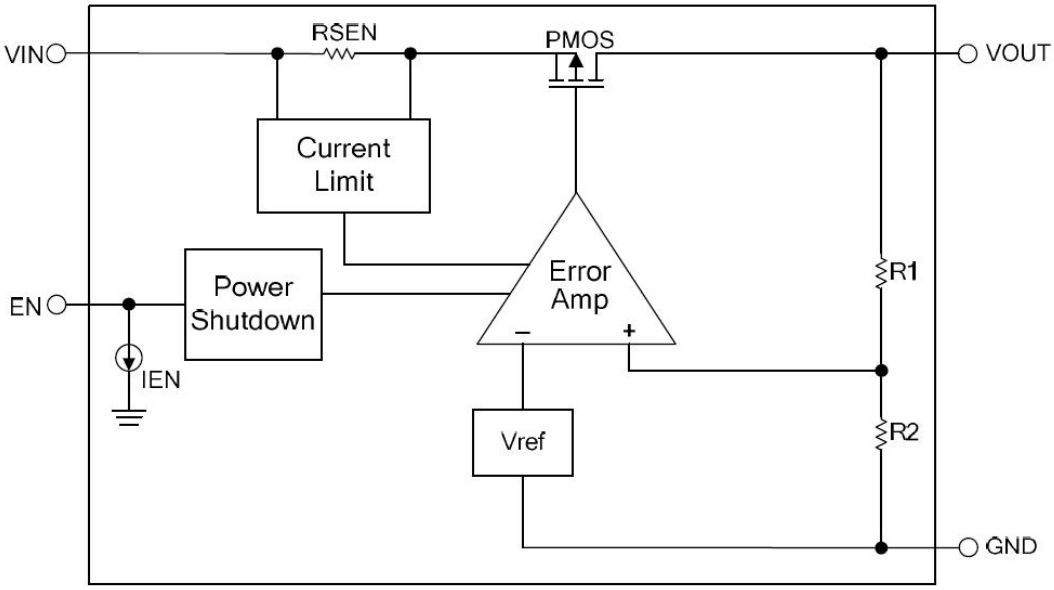


Figure 2, Block Diagram of AS9103

● Absolute Maximum Ratings[1] (T_A=25°C, unless otherwise noted)

Parameter	Symbol	Rating	Unit
V_{IN} Pin to GND	V_{IN}	-0.3 to +6.5	V
All Other Pins to GND	-	-0.3 to V_{IN} + 0.3	V
Storage Temperature Range	T_S	-55 to +150	℃
Operating Junction Temperature Range	T_J	-40 to +150	℃
Maximum Soldering Temperature (at leads, 10 sec)	T_{LEAD}	260	℃

● Recommended Operating Conditions[2]

Parameter		Symbol	Rating	Unit
V_{IN} Pin Voltage to GND		V_{IN}	+1.20 to +5.5	V
Output Current		I_{OUT}	Up to 300	mA
Operating Temperature Range		T_{OP}	-40 to +125	℃
Maximum Thermal Resistance	DFN1010-4L	Θ_{JA}	130	℃/W
	SOT23-5L/3L	Θ_{JA}	200	℃/W
Maximum Power Dissipation	T_A<25°C	P_D	0.50	W

Note: 1: Stresses above those listed in absolute maximum ratings may cause permanent damage to the device. Functional operation at conditions other than the operating conditions specified is not implied. Only one absolute maximum rating should be applied at any one time.

2: The device is not guaranteed to function outside of its operating conditions.

● Electrical Characteristics

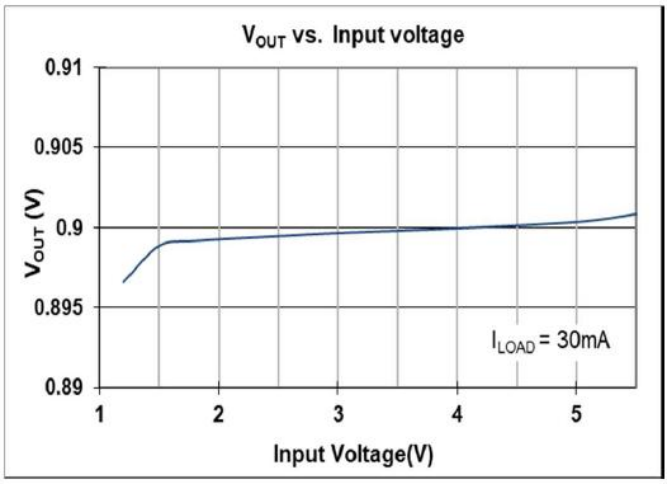
(T_A = -40 to +125℃ unless otherwise noted. Typical values are at T_A = +25℃, V_{IN} = V_{OUT}+1.0V, C_{IN}=1.0uF=C_{OUT})

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Supply						
V_{IN}	Input Voltage		1.20	-	5.5	V
I_Q	Supply Current		-	20	-	uA
I_{SHDN}	Supply Current Shutdown	V_{EN} = 0V	-	0.1	1	μA
Output Current						
△V_{OUT}	Output Voltage Accuracy	I_O=1mA, V_{OUT}>1.8V	-2.0	-	2.0	%
		I_O=1mA, V_{OUT}≤1.8V	-2.0	-	2.0	%
I_{OUT}	Output Current		-	300	-	mA
I_{LIMIT}	Output Current Limit		320	-	-	mA
V_{DROP}	Dropout Voltage	I_O=300mA, V_{OUT}=1.0V	-	600	-	mV
		I_O=300mA, V_{OUT}=1.2V	-	460	-	mV
		I_O=300mA, V_{OUT}=1.8V	-	300	-	mV
		I_O=300mA, V_{OUT}=2.8V	-	250	-	mV
		I_O=300mA, V_{OUT}=3.0V	-	250	-	mV
		I_O=300mA, V_{OUT}=3.3V	-	220	-	mV
$V_{Temp.}$	Temperature Coefficient	I_O=1mA, V_{IN} =5.0V,	-	80	-	ppm/℃
△V_{LOAD}	Load Regulation	I_O=1mA to 300mA	-	6	30	mV
△V_{LINE}	Line Regulation	I_O=1mA, V_{IN}=V_{OUT}+1V to 5V	-	1.0	8.0	mV
PSRR	Ripple Rejection	f_{RIPPLE}=1KHz	-	75	-	dB
V_{NOISE}	Output Noise Voltage	I_{OUT}=30mA, BW=10HZ~100KHZ	-	45	-	uV_{RMS}
I_{CFB}	Current Foldback	R_{LOAD}=1.0Ω	-	60	-	mA
R_{DIS}	Output Discharge Resistance	V_{EN}=0V	-	60	-	Ω
Enable (/SHDN)						
V_{ENL}	EN OFF Threshold	V_{IN} = 5V, V_{EN} Falling	0	-	0.4	V
V_{ENH}	EN ON Threshold	V_{IN} = 5V, V_{EN} Rising	1.1	-	V_{IN}	V
I_{EN}	EN Pin Bias Current		-	0.1	1	μA

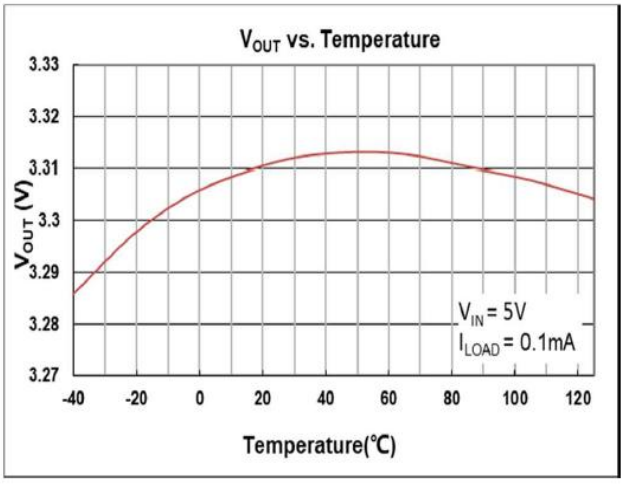
Typical Characteristics—AS9103

(T_A = -40 to +125℃ unless otherwise noted. Typical values are at T_A= +25℃, V_{IN} = V_{EN}=5.0V, C_{IN}=1.0uF=C_{OUT})

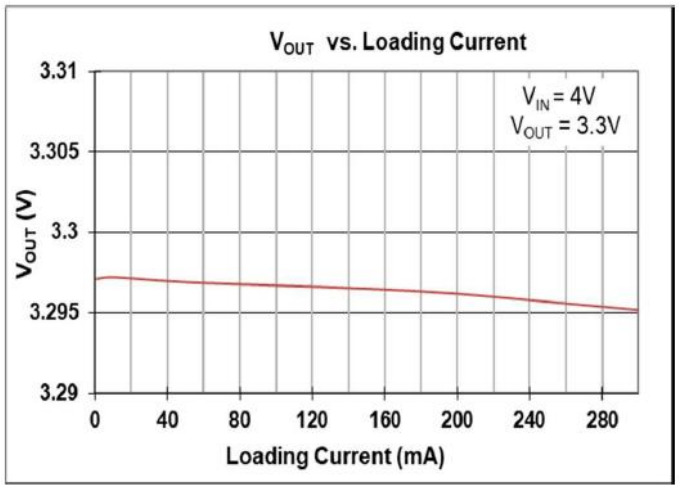
Output Voltage vs. Input Voltage
(I_{LOAD}=30mA)



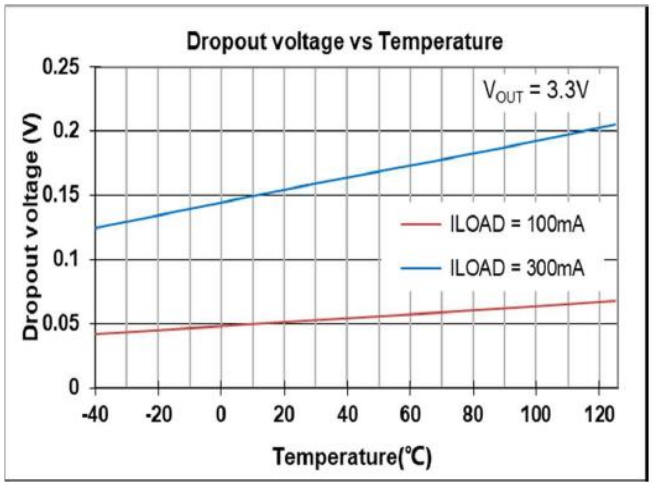
Output Voltage vs. Temperature
(V_{IN} =5.0V, I_{LOAD}=0.1mA)



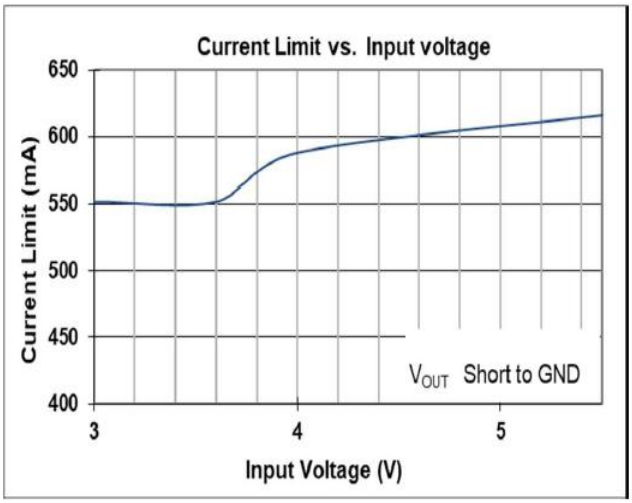
Output Voltage vs. Load Current
(V_{IN} =4.0V, V_{OUT}=3.3V)



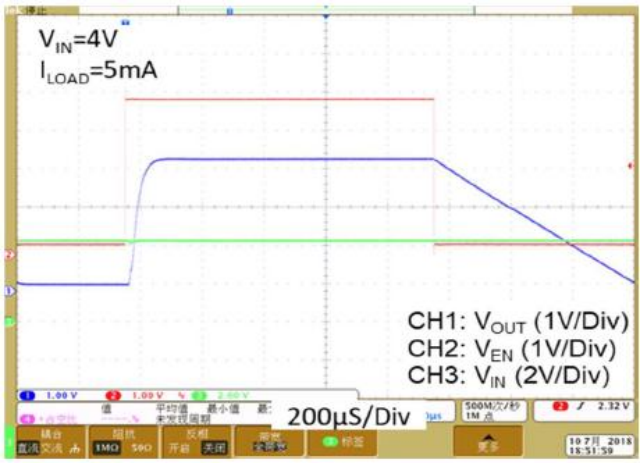
Drop Output Voltage vs. Temperature
(V_{IN} =5.0V, V_{OUT}=3.3V, I_{LOAD}=100mA/300mA)



Current Limit vs. Input Voltage
(V_{OUT}=3.3V, output short to GND)

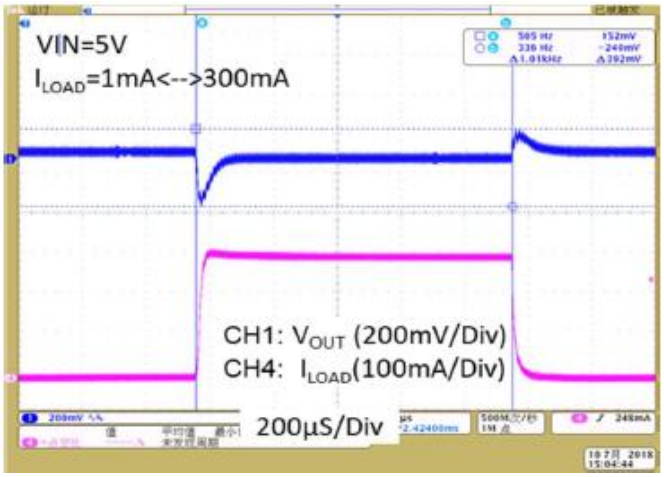
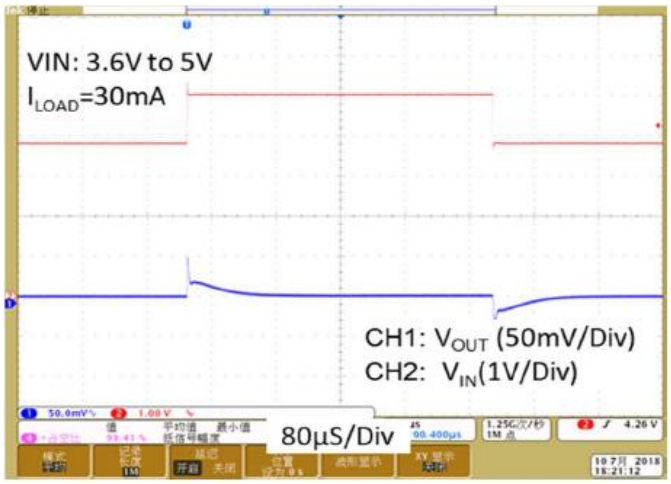


On Off Waveform
(V_{IN} =4V, V_{OUT}=3.3V, I_{LOAD}=5mA)



● Typical Characteristics—AS9103

(T_A = -40 to +125℃ unless otherwise noted. Typical values are at T_A = +25℃, V_{IN} = V_{EN}=5.0V, C_{IN}=1.0uF=C_{OUT})

Load Transient Response (V_{IN} =5.0V, V_{OUT}=3.3V, I_{LOAD}=1mA~300mA)	**Linear Transient Response** (V_{IN} =3.6V~5.0V, V_{OUT}=3.3V, I_{LOAD}=30mA)
	

Application Information

Typical Application Circuits

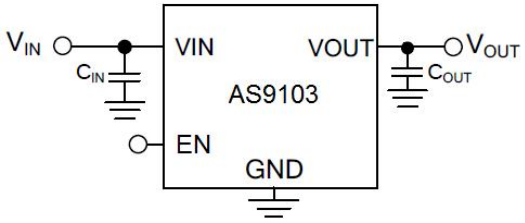


Figure 3, Typical Application Circuit of AS9103

The AS9103/A series are low dropout linear regulators that could provide 300mA output current at low input voltage. Besides, current limit and on chip thermal shutdown features provide protection against any combination of over-load or ambient temperature which could cause junction temperature exceeding maximum rating.

Output and Input Capacitor

The AS9103/A regulator is designed to be stable with a wide range of output capacitors. The ESR of the output capacitor affects stability. Larger value of the output capacitor decreases the peak deviations and improves transition response for larger current changes.

The capacitor types (aluminum, ceramic and tantalum) have different characterizations such as temperature and voltage coefficients. All ceramic capacitors are manufactured with a variety of dielectrics, each with different behavior across temperature and applications. Common dielectrics used are X5R, X7R and Y5V. It is recommended to use 1μF to 10μF X5R or X7R dielectric ceramic capacitors with 30mΩ to 50mΩ E R range between device outputs to ground for transient stability. The AS9103/A is designed to be stable with low ESR ceramic capacitors and higher values of capacitors, and ESR could improve output stability. So the ESR of output capacitor is very important because it generates a zero to provide phase lead for loop stability.

There are no requirements for the ESR on the input capacitor, but its voltage and temperature coefficient have to be considered for device application environment.

Protection Feature

In order to prevent overloading or thermal condition from damaging the device, AS9103/A regulator has internal thermal and current limit functions designed to protect the device. It will rapidly shut off PMOS pass element during over-loading or over-temperature condition.

Thermal Consideration

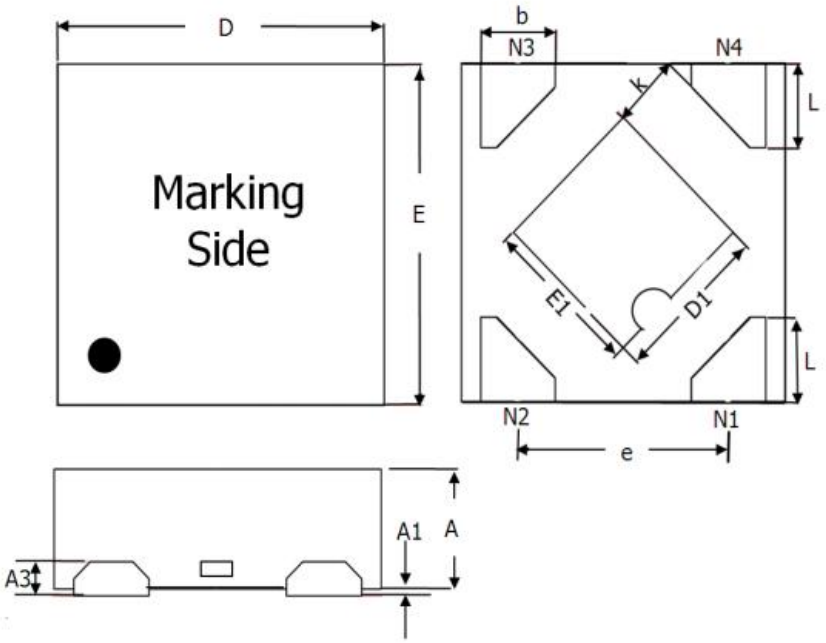
The power handling capability of the device will be limited by allowable operation junction temperature (125℃). The power dissipated by the device will be estimated by $P_D = I_{OUT}(V_{IN}-V_{OUT})$. The power dissipation should be lower than the maximum power dissipation listed in “Absolute Maximum Ratings” section.

Active / Shutdown Input Operation

The AS9103/A is turned off by pulling the EN pin low and turned on by pulling it high. If this feature is not used, the EN pin should be connected to V_{IN} to keep the regulator output available all the time.

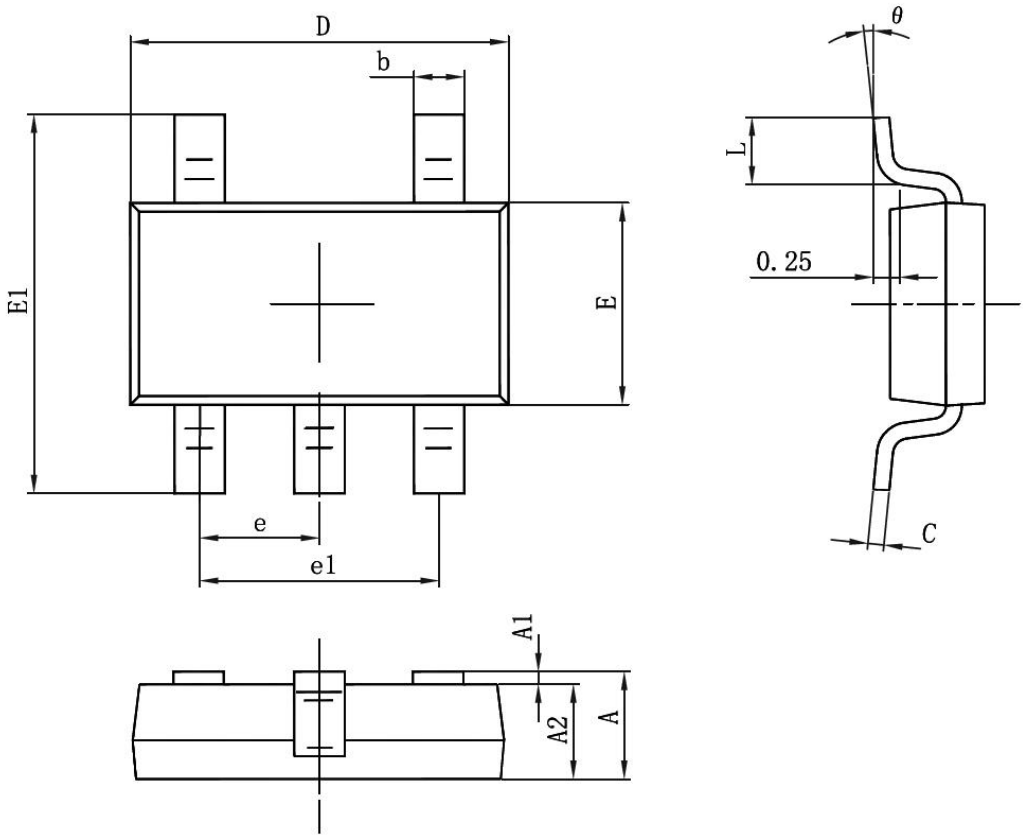
Package Information

DFN1010-4L:



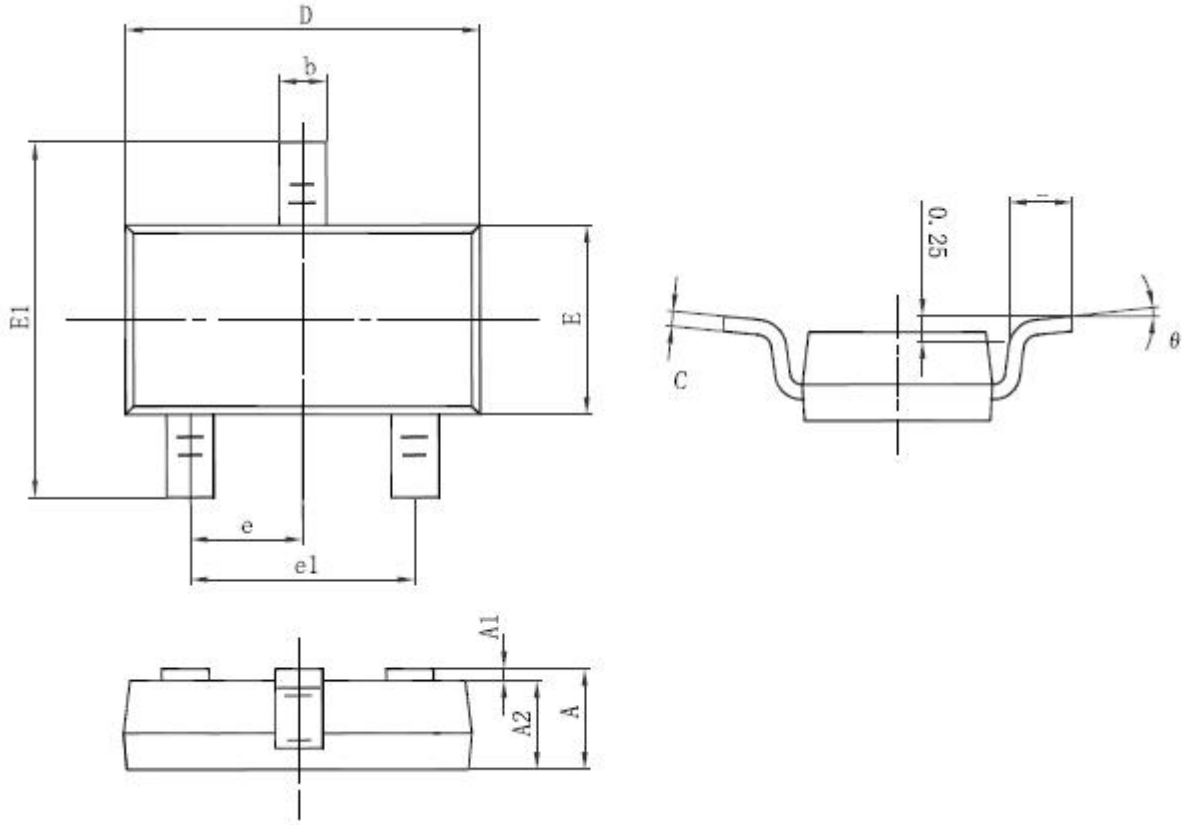
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.340	0.400	0.014	0.016
A1	0.000	0.050	0.000	0.002
A3	0.152 BSC		0.006 BSC	
D	0.950	1.050	0.038	0.042
E	0.950	1.050	0.038	0.042
D1	0.450	0.550	0.018	0.022
E1	0.450	0.550	0.018	0.022
k	0.211 BSC		0.008 BSC	
b	0.180	0.280	0.0072	0.0112
e	0.625 BSC		0.025 BSC	
L	0.200	0.300	0.008	0.012

SOT23-5L:



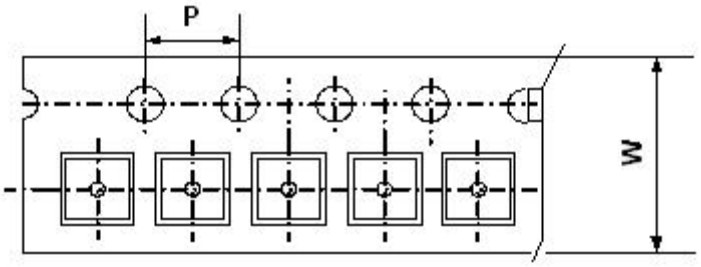
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.450	0.036	0.058
A1	0.000	0.150	0.000	0.006
A2	0.900	1.300	0.036	0.052
b	0.300	0.500	0.012	0.020
C	0.080	0.200	0.003	0,008
D	2.800	3.000	0.112	0.120
E	1.500	1.700	0.060	0.068
E1	2.600	3.000	0.104	0.120
e	0.95(BSC)		0.037(BSC)	
e1	1.90(BSC)		0.075(BSC)	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

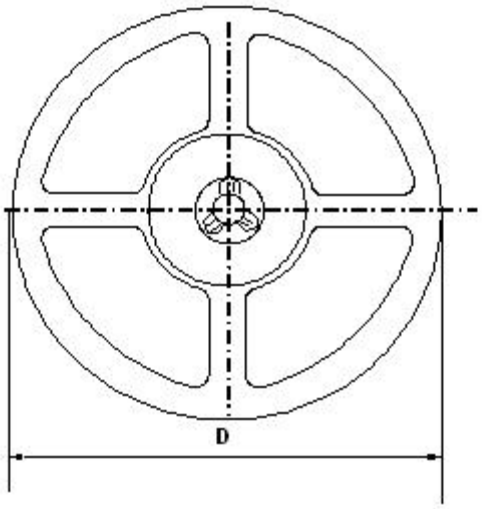
SOT23-3L:



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.900(BSC)		0.075(BSC)	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

■ Packing Information





Package Type	Carrier Width(W)	Pitch(P)	Reel Size(D)	Packing Minimum
DFN1010-4L	8.0±0.1 mm	2.0±0.1 mm	180±1 mm	10000pcs
SOT23-5L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs
SOT23-3L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs

Note: Carrier Tape Dimension, Reel Size and Packing Minimum