

LDO ICs

Micro-Power consumption 40V, 250mA, Low-Dropout Voltage Linear Regulator

**AS9142**

● General Description

The AS9142 is a CMOS low dropout, low noise, low power consumption, low quiescent current positive linear regulator with wide input voltage range. The AS9142 can deliver a guaranteed 250mA load current with a low dropout voltage. Quiescent current of only 1.5uA makes these devices ideal for powering the battery-powered, always-on systems that require very little idle-state power dissipation to a longer service life. There is an option of shutdown function by selecting the parts with the EN pin and pulling it low. The off state of AS9142 that consumes less than 0.1uA during shutdown mode.

The device is suitable for portable application such as cellular handsets or PDA. The AS9142 is designed and optimized to work with low cost ceramic capacitors 1.0uF, which consumes less than 0.1uA 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 AS9142 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, SOT223 and SOT89-3L packages are attractive for hand-held applications. The device is specified over an ambient temperature range of -40°C to 85°C.

● Features

- Output Current Up to 250mA
- Wide Voltage V_{IN} Range: 2.7V to 40V
- Very Low Quiescent Current at 1.5uA
- Low Dropout voltage of 1.0V at 250mA/ $V_{IN} = V_{OUT} + 1V$
- Output Voltage Accuracy at $\pm 2.0\%$
- Support Fixed Output Voltage: 1.8V, 3.0V, 3.3V, 5V.
- PSRR 70dB at 100Hz
- Needs Only 1.0uF Capacitor for Stability
- Current Limit Protection
- Without EMI and Switch Noise
- Stable with Ceramic Capacitor or Tantalum Capacitor
- RoHS and Green Compliant
- SOT23-3L, SOT23-5L, SOT223 and SOT89-3L Packages
- -40°C to +85 °C Temperature Range

● Applications

- Portable, Battery Powered Equipment
- Low Power Microcontrollers
- Laptop, Palmtops & PDAs
- Audio/Video Equipment
- Car Navigation Systems
- Industrial Control
- Weighting Scales
- Meters/Home Automation

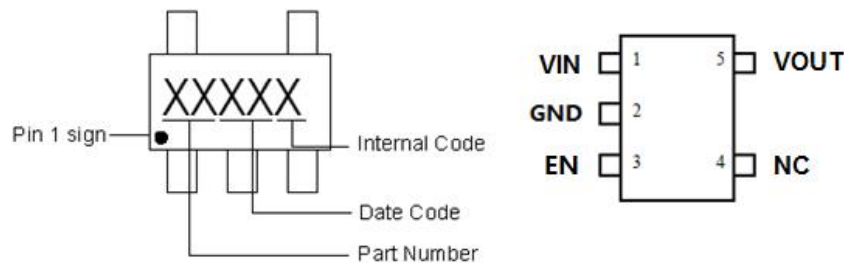
● Ordering Information

AS9142XXXX			
Output Voltage:	Package:	Packing:	Temperature Grade:
18: 1.8V 30:3.0V	W: SOT23-5L	R:Tape&Reel	N: -40°C~85°C
33: 3.3V 50:5.0V	YN: SOT89-3L (N-type Pin)		
	YL: SOT89-3L (L-type Pin)		
	YR: SOT89-3L (R-type Pin)		
	S3MO: SOT23-3L (MO type Pin)		
	S3MC: SOT23-3L (MC type Pin)		
	S3MY: SOT23-3L (MY type Pin)		
	E: SOT223		

Part Number	Driver Capability	Package Type	Package Qty	Temperature	Eco Plan
AS9142-XXWRN	250mA	SOT23-5L	7-in reel 3000pcs/reel	-40~85°C	Green
AS9142-XXYNRN	250mA	SOT89-3L	7-in reel 1000pcs/reel	-40~85°C	Green
AS9142-XXYLRN	250mA	SOT89-3L	7-in reel 1000pcs/reel	-40~85°C	Green
AS9142-XXYRRN	250mA	SOT89-3L	7-in reel 1000pcs/reel	-40~85°C	Green
AS9142-XXS3MORN	250mA	SOT23-3L	7-in reel 3000pcs/reel	-40~85°C	Green
AS9142-XXS3MCRN	250mA	SOT23-3L	7-in reel 3000pcs/reel	-40~85°C	Green
AS9142-XXS3MYRN	250mA	SOT23-3L	7-in reel 3000pcs/reel	-40~85°C	Green
AS9142-XXERN	250mA	SOT223	7-in reel 1000pcs/reel	-40~85°C	Green

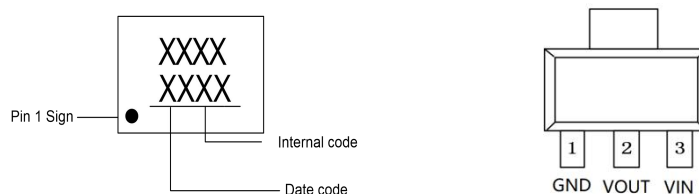
● Marking Information & Pin Assignment

SOT23-5L



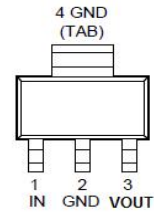
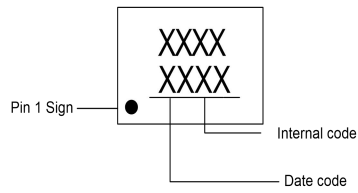
Pin Name	SOT23-5L Pin No.	I/O	Pin Function
VIN	1	P	Input Power Supply
GND	2	P	Ground
EN	3	I	Pull this pin high to enable IC, pull this pin low to shutdown IC.
NC	4	-	Not Connected.
VOUT	5	O	Output Pin

SOT223:

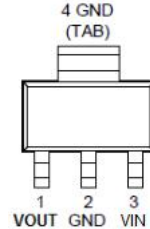
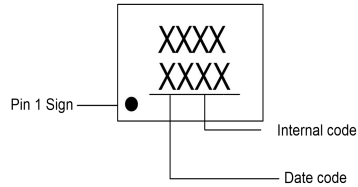


Pin Name	Pin No. SOT223	I/O	Pin Function
VOUT	2	O	Output Pin
GND	1	P	Ground
VIN	3	P	Input Power Supply
TAB	4	P	Please Connected to VOUT.

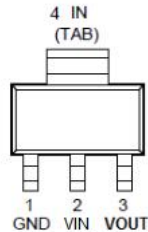
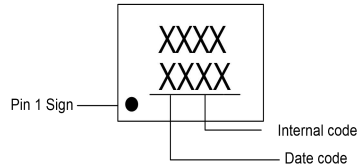
SOT89-3L (N-type Pin):



SOT89-3L (L-type Pin):

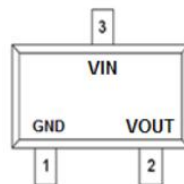
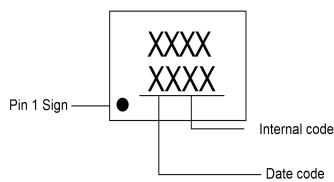


SOT89-3L (R-type Pin):

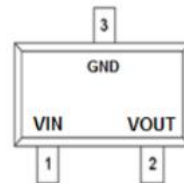
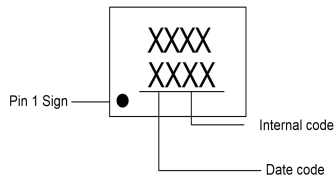


Pin Name	Pin No.			I/O	Pin Function
	SOT89-3L (N-type Pin)	SOT89-3L (L-type Pin)	SOT89-3L (R-type Pin)		
VOUT	3	1	3	O	Output Pin
GND	2	2	1	P	Ground
VIN	1	3	2	P	Input Power Supply
TAB	4	4	-	P	Please Connected to GND.
TAB	-	-	4	P	Please Connected to VIN.

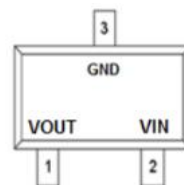
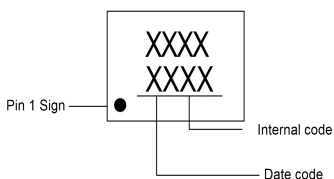
SOT23-3L (MO-type Pin):



SOT23-3L (MC-type Pin):



SOT23-3L (MY-type Pin):



Pin Name	Pin No.			I/O	Pin Function
	SOT23-3L (MO-type Pin)	SOT23-3L (MC-type Pin)	SOT23-3L (MY-type Pin)		
VOUT	2	2	1	O	Output Pin
GND	1	3	3	P	Ground
VIN	3	1	2	P	Input Power Supply

● Typical Application Circuit

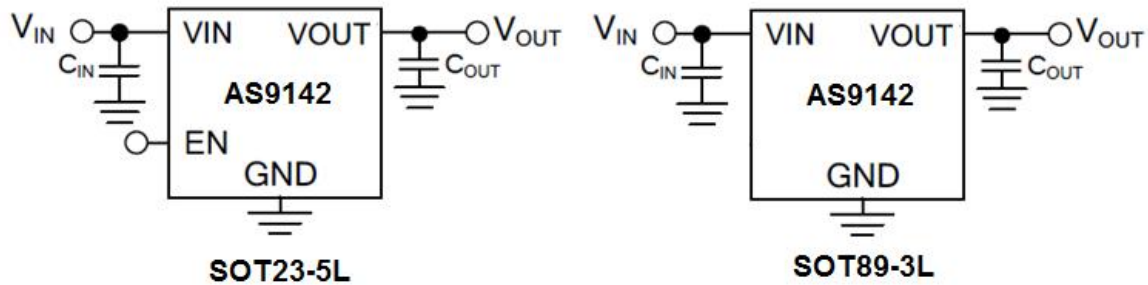


Figure 1, Typical Application Circuit of AS9142 Fixed Output Voltage

● Block Diagram

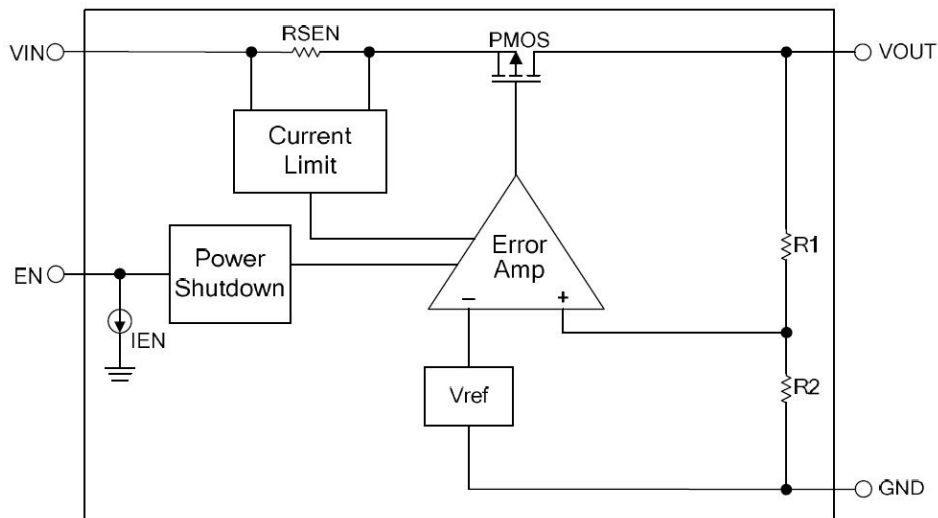


Figure 2, Block Diagram of AS9142

● Absolute Maximum Ratings¹ ($T_A=25^{\circ}\text{C}$, unless otherwise noted)

Parameter	Symbol	Rating	Unit
V_{IN} , EN Pin to GND	V^*	-0.3 to +45	V
Output Pin to GND $V_{OUT}=1.8\text{V}/3.3\text{V}/5.0\text{V}$	V_{OUT}	-0.3 to +6.0	V
Storage Temperature Range	T_S	-55 to +150	$^{\circ}\text{C}$
Operating Junction Temperature Range	T_J	-40 to +150	$^{\circ}\text{C}$
Maximum Soldering Temperature (at leads, 10 sec)	T_{LEAD}	260	$^{\circ}\text{C}$

● Recommended Operating Conditions²

Parameter		Symbol	Rating	Unit
V_{IN} Pin Voltage to GND		V_{IN}	+2.0 to +40	V
Output Current		I_{OUT}	Up to 250	mA
Operating Temperature Range		T_{OP}	-40 to +85	°C
Maximum Thermal Resistance	SOT23-3/5L	Θ_{JA}	200	°C/W
	SOT89-3L	Θ_{JA}	65	°C/W
Maximum Power Dissipation, $T_A < 25^\circ\text{C}$	SOT23-3/5L	P_D	0.50	W
	SOT89-3L	P_D	1.50	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 $+85^\circ\text{C}$ unless otherwise noted. $T_A = +25^\circ\text{C}$, $V_{IN} = V_{OUT} + 1\text{V}$, $I_{OUT} = 1\text{mA}$, $C_{IN} = 2.2\mu\text{F} = C_{OUT}$)

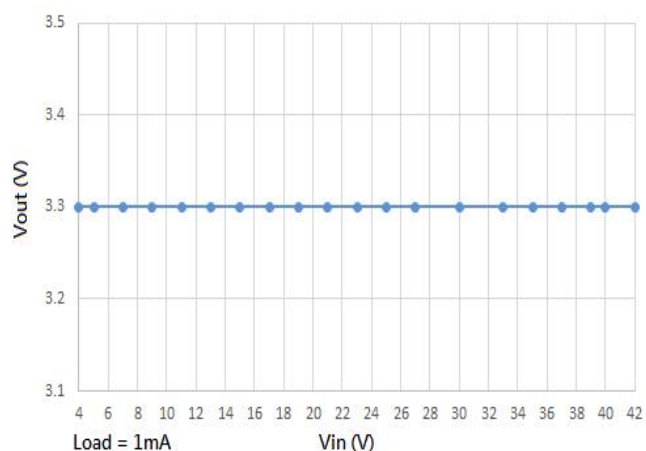
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Supply						
V_{IN}	Input Voltage		2.7	-	40	V
I_Q	Ground Current	$I_{OUT} = 0\text{mA}$, $V_{OUT} \leq 5.0\text{V}$,	-	1.5	-	uA
		$I_{OUT} = 0\text{mA}$, $5.0\text{V} \leq V_{OUT} \leq 12\text{V}$,	-	1.5	-	
I_{SHDN}	Supply Current Shutdown	$V_{EN} = 0\text{V}$	-	0.1	0.5	μA
Output Current						
ΔV_{OUT}	Output Voltage Accuracy	$I_O = 0.1\text{m}$	-2.0	-	2.0	%
I_{OUT}	Output Current		-	250	-	mA
I_{LIMIT}	Output Current Limit		270	320	-	mA
I_{SHDNLK}	Shutdown Leakage Current	$V_{EN} = 0\text{V}$	-	0.01	0.5	μA
V_{DROP}	Dropout Voltage	$I_O = 100\text{mA}$	-	400	-	mV
		$I_O = 250\text{mA}$	-	1000	-	mV
ΔV_{LOAD}	Load Regulation	$I_O = 1\text{mA}$ to 100mA	-	10	-	mV
		$I_O = 1\text{mA}$ to 250mA	-	30	-	mV
ΔV_{LINE}	Line Regulation	$I_O = 1\text{mA}$, $V_{IN} = 5.0\text{V}$ to 40V	-	2.0	12	mV
PSRR	Ripple Rejection ($I_O = 1\text{mA}$)	$V_{IN} = 12\text{V}$, $V_O = 5\text{V}$, $f_R = 100\text{Hz}$	-	70	-	dB
Enable (/SHDN)						
V_{ENL}	EN OFF Threshold	V_{EN} Falling	0	-	0.4	V
V_{ENH}	EN ON Threshold	V_{EN} Rising	0.9	-	V_{IN}	V
I_{EN}	EN Pin Bias Current		-	0.3	1.0	μA
Thermal Shut-Down						
TSD	Shut-Down Temperature	Rising	-	150	-	°C
ΔTSD	Temperature Hysteresis	Falling	-	20	-	°C

Note 3: Guarantee by designed.

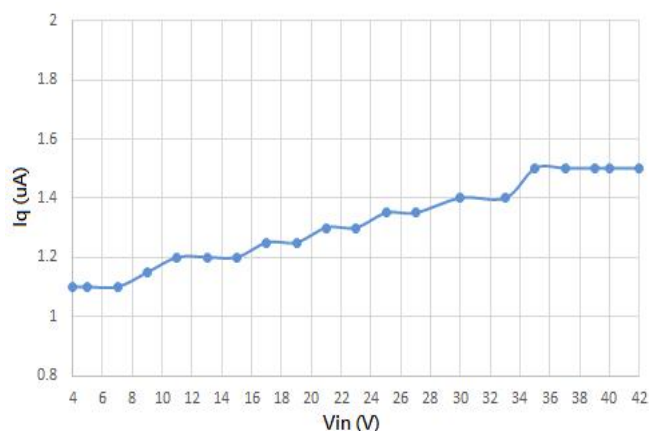
• Typical Characteristics—AS9142

(Unless otherwise noted, $V_{IN} = V_{OUT} + 1V$, $I_{OUT} = 1mA$, $C_{IN} = 1.0\mu F = C_{OUT}$)

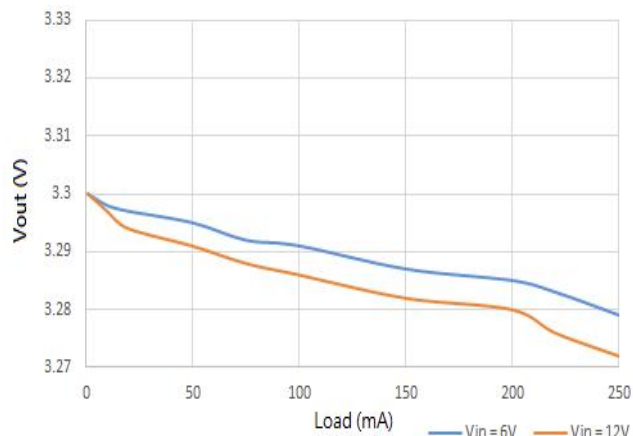
Output Voltage vs. input Voltage
($I_{OUT} = 1mA$)



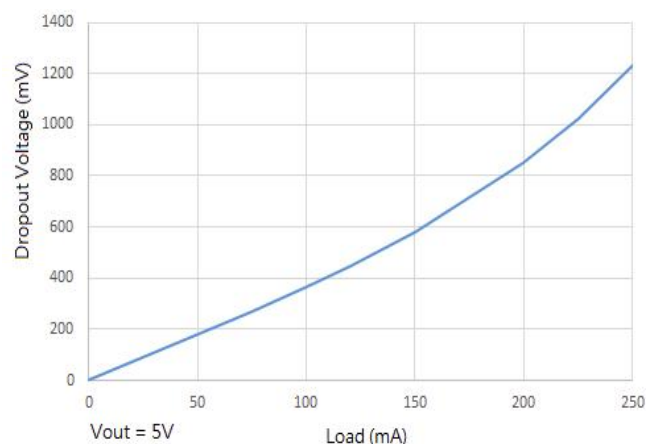
Ground Current vs. Input Voltage



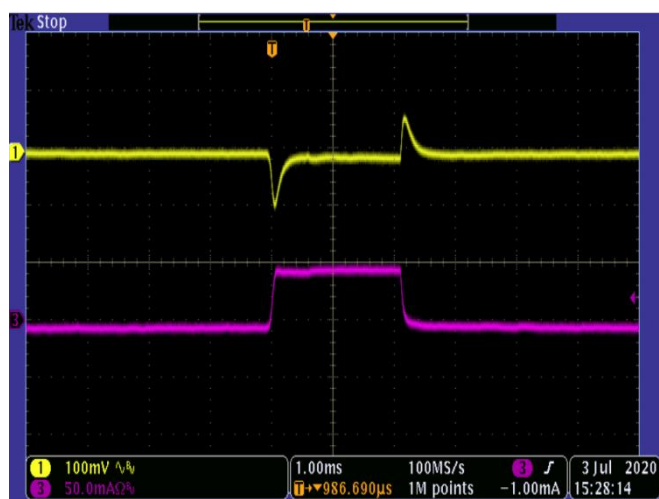
Output Voltage vs. Output Current
($V_{IN} = 6/12V$, $V_{OUT} = 3.3V$)



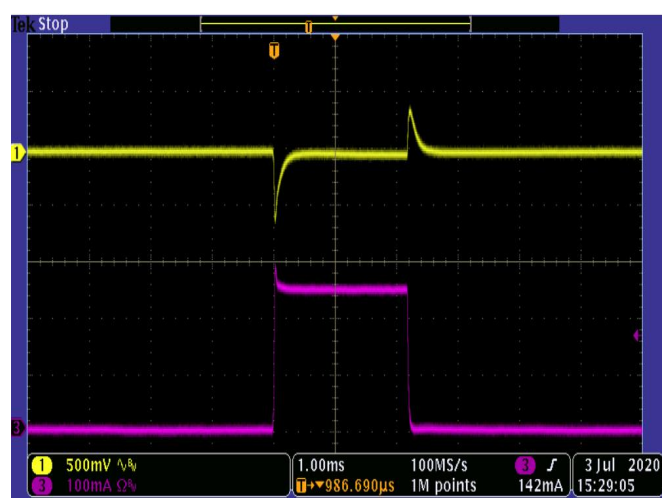
Drop Out Voltage vs. Output Current
($V_{OUT} = 5V$)



Load Transient Response
($I_{OUT} = 0mA$ to $50mA$)

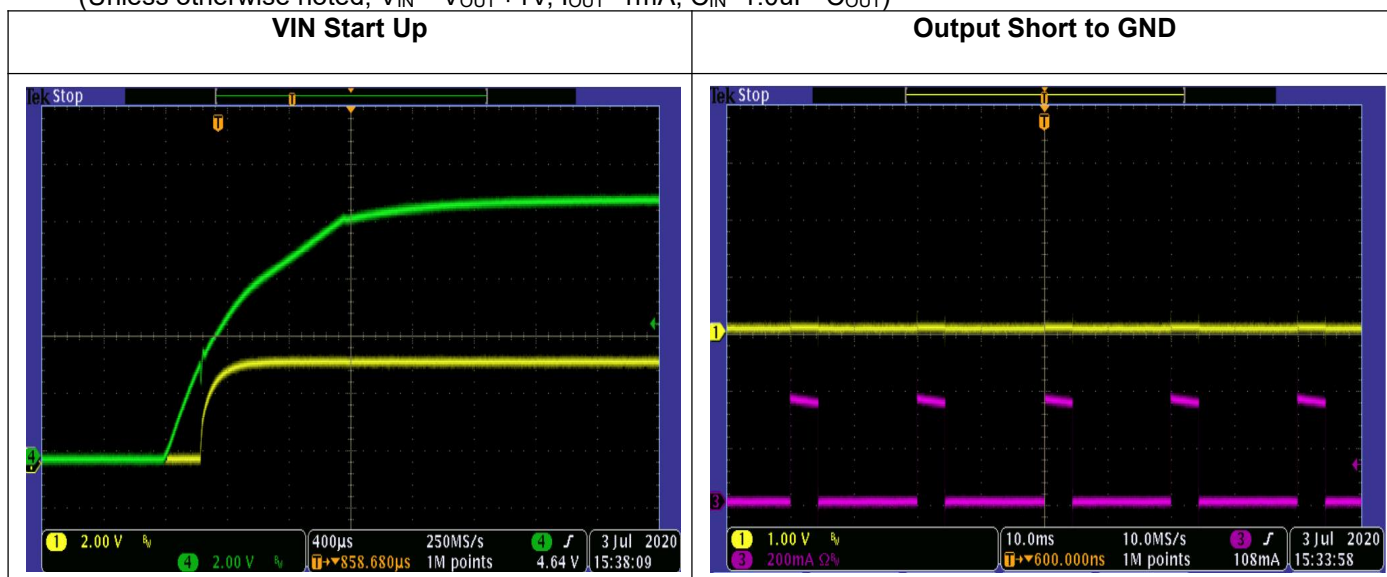


Load Transient Response
($I_{OUT} = 1mA$ to $250mA$)



● **Typical Characteristics—AS9142**

(Unless otherwise noted, $V_{IN} = V_{OUT} + 1V$, $I_{OUT} = 1mA$, $C_{IN} = 1.0\mu F = C_{OUT}$)



● Application Information

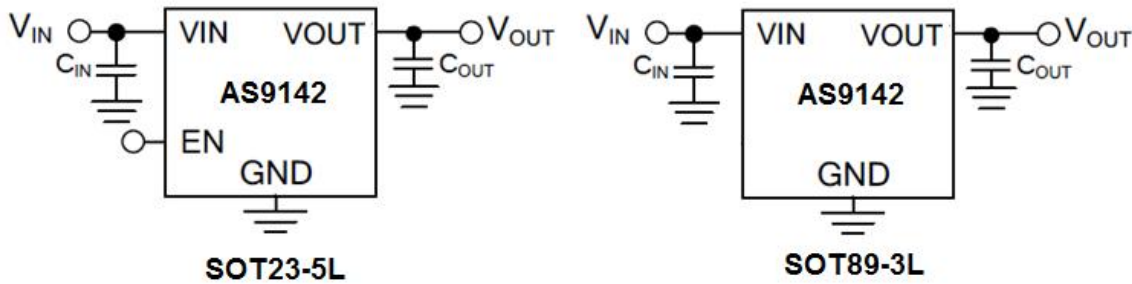


Figure 3, Typical Application Circuit of AS9142

The AS9142 series are low dropout linear regulators that could provide 250mA 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 AS9142 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 external input and output capacitors of AS9142 series must be properly selected for stability and performance. Use a 2.2 μ F or larger input capacitor and place it close to the IC's VIN and GND pins. Any output capacitor meeting the minimum 1m Ω ESR (Equivalent Series Resistance) and effective capacitance between 1 μ F and 22 μ F requirement may be used. Place the output capacitor close to the IC's VOUT and GND pins. Increasing capacitance and decreasing ESR can improve the circuit's PSRR and line transient response.

Current Limit

The AS9142 series contain the current limiter of output power transistor, which monitors and controls the transistor, limiting the output current to 600mA (typical). The output can be shorted to ground indefinitely without damaging the part.

Active / Shutdown Input Operation

The AS9142 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 VIN to keep the regulator output available all the time.

Drop Out Voltage

The AS9142 series use a PMOS pass transistor to achieve low dropout. When $(V_{IN} - V_{OUT})$ is less than the dropout voltage (V_{DROP}), the PMOS pass device is in the linear region of operation and the input-to-output resistance is the $R_{DS(ON)}$ of the PMOS pass element. V_{DROP} scales approximately with the output current because the PMOS device behaves as a resistor in dropout condition.

As any linear regulator, PSRR and transient response are degraded as $(V_{IN} - V_{OUT})$ approaches dropout condition.

Thermal Consideration

In order to prevent overloading or thermal condition from damaging the device, AS9142 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.

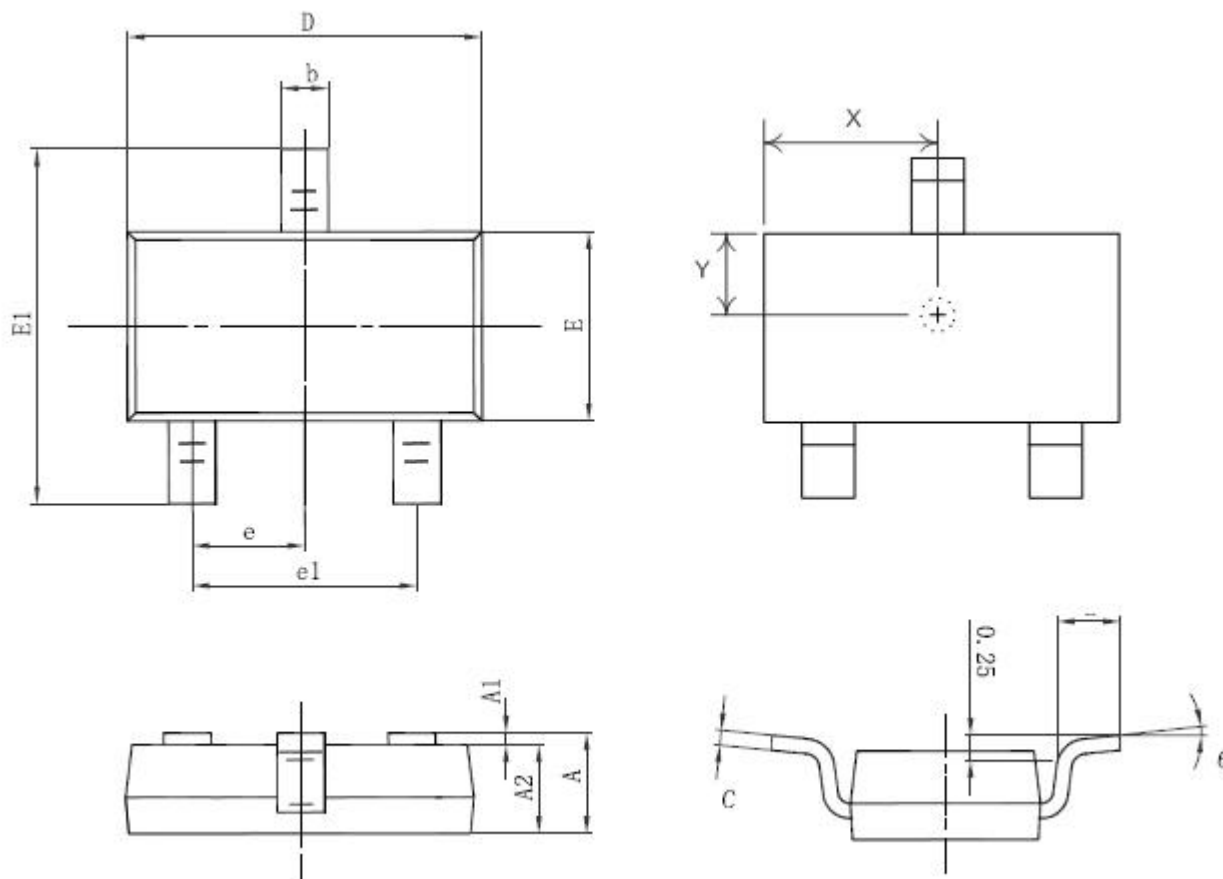
The power handling capability of the device will be limited by allowable operation junction temperature (125 $^{\circ}$ C). The power dissipated by the device will be estimated by $P_D = I_{OUT} (V_{IN} - V_{OUT})$. The power dissipation should be lower than the maximum power dissipation listed in "Absolute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

Layout Consideration

By placing input and output capacitors on the same side of the PCB as the LDO, and placing them as close as is practical to the package can achieve the best performance. The ground connections for input and output capacitors must be back to the AS9142 ground pin using as wide and as short of a copper trace as is practical. Connections using long trace lengths, narrow trace widths, and/or connections through via must be avoided. These add parasitic inductances and resistance that results in worse performance especially during transient conditions.

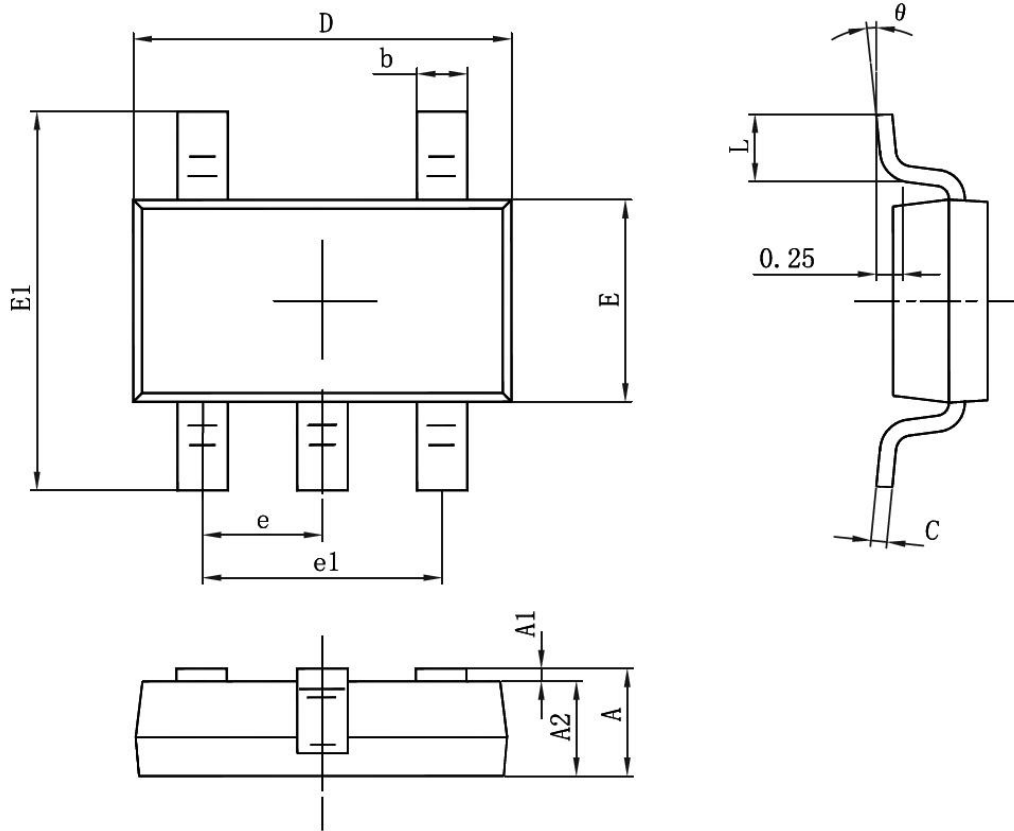
● Package Information

SOT23-3L:

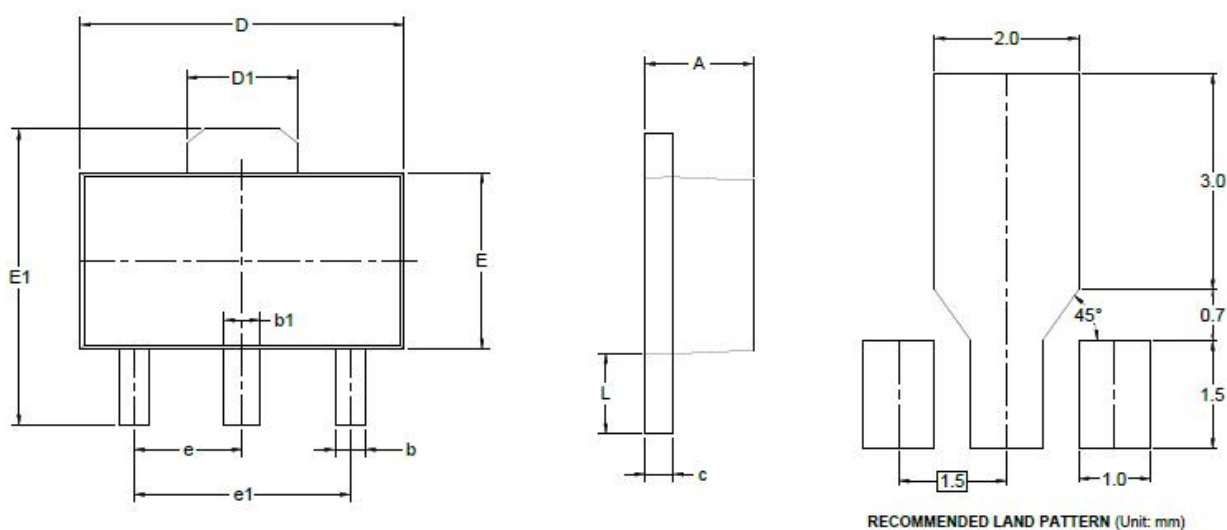


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)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

SOT23-5L:

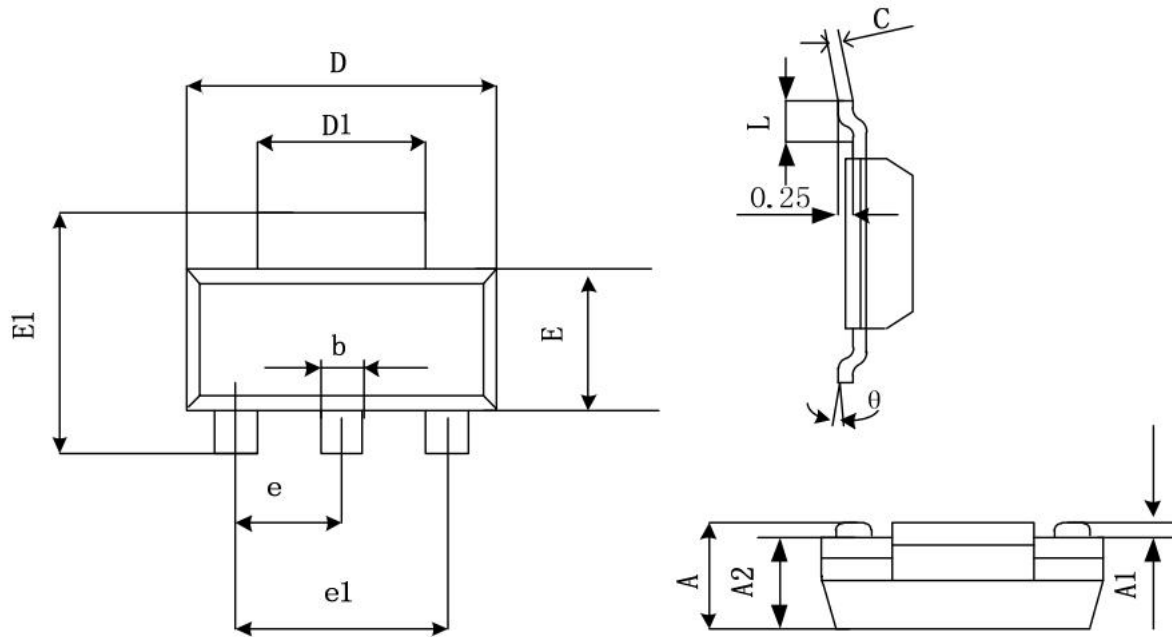


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.450	0.036	0.058
A1	0.000	0.150	0.000	0.006
A2	0.900	1.300	0.036	0.052
b	0.300	0.500	0.012	0.020
C	0.080	0.200	0.003	0.008
D	2.800	3.000	0.112	0.120
E	1.500	1.700	0.060	0.068
E1	2.600	3.000	0.104	0.120
e	0.95(BSC)		0.037(BSC)	
e1	1.90(BSC)		0.075(BSC)	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOT89-3L:


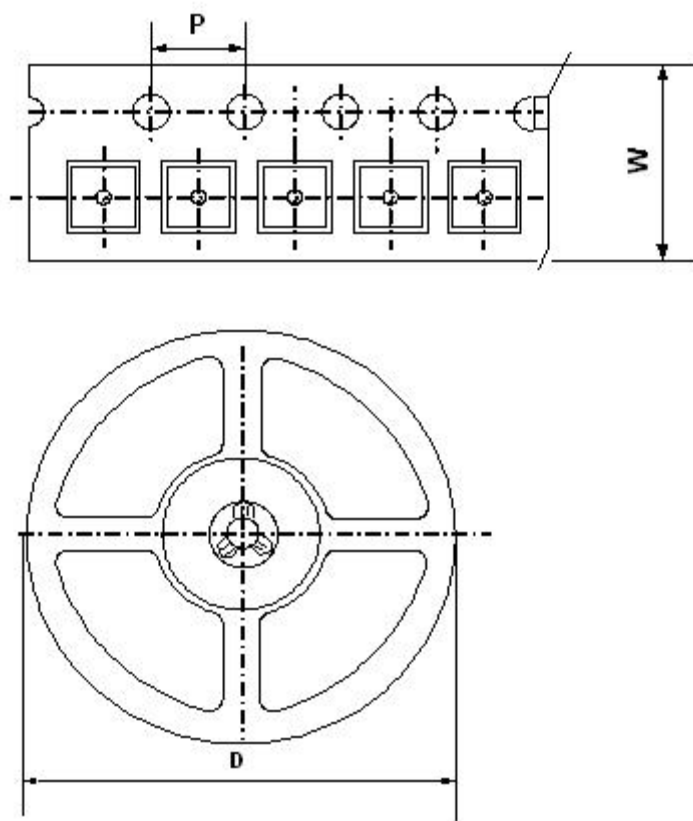
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF		0.061 REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060 TYP	
e1	3.000 TYP		0.118 TYP	
L	0.900	1.200	0.035	0.047

SOT223:



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.520	1.800	0.060	0.071
A1	0.020	0.130	0.001	0.005
A2	1.500	1.700	0.059	0.067
b	0.660	0.840	0.026	0.033
c	0.230	0.350	0.009	0.014
D	6.450	6.850	0.254	0.270
D1	2.900	3.000	0.114	0.122
E	3.450	3.850	0.136	0.152
E1	6.830	7.070	0.269	0.278
e	2.300 (BSC)		0.091 (BSC)	
e1	1.900(BSC)		0.075(BSC)	
e1	4.500	4.700	0.177	0.185
L	0.900	1.150	0.035	0.045
θ	0°	10°	0°	10°

Packing Information



Package Type	Carrier Width(W)	Pitch(P)	Reel Size(D)	Packing Minimum
SOT23-3L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs
SOT23-5L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	3000pcs
SOT89-3L	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	1000pcs
SOT223	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	1000pcs

Note: Carrier Tape Dimension, Reel Size and Packing Minimum