



General Description

The AP2138N-xxTRG1 series is a set of three-terminal low power high voltage regulators implemented in CMOS technology. They allow input voltages as high as 15V. The series features extremely low quiescent current which is typically 2uA. They are available with several fixed output voltages ranging from 1.5V to 5.0V. CMOS technology ensures low voltage drop and low quiescent current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain variable voltages and currents.

Features

- Low Power Consumption
- Low Voltage Drop
- Low temperature coefficient
- Ultra low quiescent current: 2uA(typ.)
- High input voltage (up to 15V)
- Maximum output current: 250mA
- Output Voltage Accuracy: tolerance $\pm 2\%$
- SOT-23 package

Application

- Battery-powered Equipments
- Communication Equipments
- Audio/Video Equipments

Pin Configuration And Descriptions

SOT-23 (Top View)

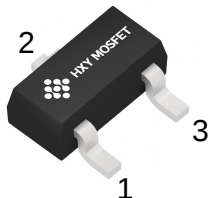


Table1:AP2138N-xxTRG1 series (SOT-23 PKG)

PIN NO.	PIN NAME	FUNCTION
1	GND	GND pin
2	VIN	Input voltage pin
3	VOUT	Output voltage pin

Order Information

Orderable Device	Package	Output Voltage	Packing Option
AP2138N-xxTRG1	SOT-23	1.5V 1.8V 2.5V 2.8V 3.0V 3.3V 3.6V 4.0V 4.4V 5.0V	3000/Reel

xx : From 1.5-5.0



Absolute Maximum Ratings

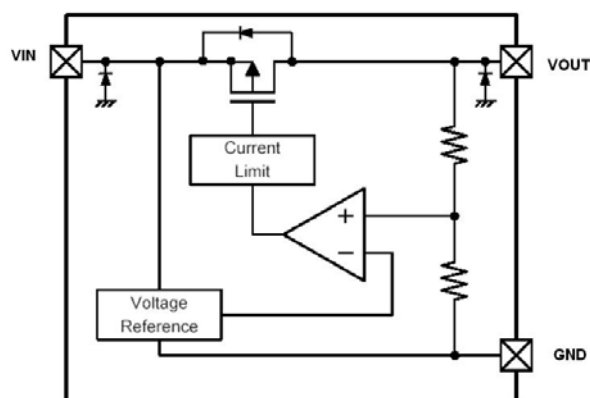
Description	Symbol	Value Range	Unit
Supply Voltage	V_{IN}	-0.3~+18	V
Storage Temperature Range	T_{STG}	-50~+125	°C
Operating Free-air Temperature Range	T_A	-30~+85	°C

Note: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

Heat Dissipation

Description	Symbol	Package	Value Range	Unit
Thermal resistance	θ_{JA}	SOT-23	500	°C/W
Power dissipation	P_W	SOT-23	0.2	W

Block Diagram



*Diodes inside the circuit are an ESD protection diode and a parasitic diode.



DC Characteristics (unless otherwise noted T_A= 25°C)

AP2138N-1.5TRG1 Output Type

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V _{IN}	Conditions				
V _{OUT}	Output Voltage	3.5V	I _{OUT} =40mA	1.47	1.50	1.53	V
I _{OUT}	Output Current	3.5V	-	-	250	-	mA
Δ V _{OUT}	Load Regulation	3.5V	1mA ≤ I _{OUT} ≤ 60mA	-	45	90	mV
V _{DIF}	Voltage Drop(Note)	-	I _{OUT} =40mA, Δ V _{OUT} =2%	-	650	-	mV
I _{SS}	Current Consumption	3.5V	No load	-	2.0	3.0	μ A
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	-	2.5V ≤ V _{IN} ≤ 12V I _{OUT} =40mA	-	0.2	-	%/V
V _{IN}	Input Voltage	-	-	-	-	15	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	3.5V	I _{OUT} =40mA -40°C < T _a < 85°C	-	±0.5	-	mV/°C

Note: Dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at V_{IN} = V_{OUT}+1V with a fixed load.

AP2138N-1.8TRG1 Output Type

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V _{IN}	Conditions				
V _{OUT}	Output Voltage	3.8V	I _{OUT} =10mA	1.764	1.800	1.836	V
I _{OUT}	Output Current	3.8V	-	-	250	-	mA
Δ V _{OUT}	Load Regulation	3.8V	1mA ≤ I _{OUT} ≤ 60mA	-	45	90	mV
V _{DIF}	Voltage Drop(Note)	-	I _{OUT} =40mA, Δ V _{OUT} =2%	-	620	-	mV
I _{SS}	Current Consumption	3.8V	No load	-	2.0	3.0	μ A
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	-	2.8V ≤ V _{IN} ≤ 12V I _{OUT} =40mA	-	0.2	-	%/V
V _{IN}	Input Voltage	-	-	-	-	15	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	3.8V	I _{OUT} =10mA -40°C < T _a < 85°C	-	±0.5	-	mV/°C

Note: Dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at V_{IN} = V_{OUT}+1V with a fixed load.



AP2138N-2.5TRG1 Output Type

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V _{IN}	Conditions				
V _{OUT}	Output Voltage	4.5V	I _{OUT} =40mA	2.45	2.500	2.55	V
I _{OUT}	Output Current	4.5V	-	-	250	-	mA
Δ V _{OUT}	Load Regulation	4.5V	1mA ≤ I _{OUT} ≤ 60mA	-	45	90	mV
V _{DIF}	Voltage Drop(Note)	-	I _{OUT} =40mA, Δ V _{OUT} =2%	-	550	-	mV
I _{SS}	Current Consumption	4.5V	No load	-	2.0	3.0	μ A
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	-	3.5V ≤ V _{IN} ≤ 12V I _{OUT} =40mA	-	0.2	-	%/V
V _{IN}	Input Voltage	-	-	-	-	15	V
$\frac{\Delta V_{OUT}}{\Delta Ta}$	Temperature Coefficient	4.5V	I _{OUT} =40mA -40℃ < Ta < 85℃	-	±0.5	-	mV/℃

Note: Dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at V_{IN} = V_{OUT}+1V with a fixed load.

AP2138N-2.8TRG1 Output Type

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V _{IN}	Conditions				
V _{OUT}	Output Voltage	4.8V	I _{OUT} =10mA	2.744	2.800	2.856	V
I _{OUT}	Output Current	4.8V	-	-	250	-	mA
Δ V _{OUT}	Load Regulation	4.8V	1mA ≤ I _{OUT} ≤ 60mA	-	45	90	mV
V _{DIF}	Voltage Drop(Note)	-	I _{OUT} =40mA, Δ V _{OUT} =2%	-	520	-	mV
I _{SS}	Current Consumption	4.8V	No load	-	2.0	3.0	μ A
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	-	3.8V ≤ V _{IN} ≤ 12V I _{OUT} =40mA	-	0.2	-	%/V
V _{IN}	Input Voltage	-	-	-	-	15	V
$\frac{\Delta V_{OUT}}{\Delta Ta}$	Temperature Coefficient	4.8V	I _{OUT} =10mA -40℃ < Ta < 85℃	-	±0.5	-	mV/℃

Note: Dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at V_{IN} = V_{OUT}+1V with a fixed load



AP2138N-3.0TRG1 Output Type

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V _{IN}	Conditions				
V _{OUT}	Output Voltage	5V	I _{OUT} =40mA	2.94	3.00	3.06	V
I _{OUT}	Output Current	5V	-	-	250	-	mA
Δ V _{OUT}	Load Regulation	5V	1mA ≤ I _{OUT} ≤ 60mA	-	45	90	mV
V _{DIF}	Voltage Drop(Note)	-	I _{OUT} =40mA, Δ V _{OUT} =2%	-	480	-	mV
I _{SS}	Current Consumption	5V	No load	-	2.0	3.0	μ A
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	-	4V ≤ V _{IN} ≤ 12V I _{OUT} =40mA	-	0.2	-	%/V
V _{IN}	Input Voltage	-	-	-	-	15	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	5V	I _{OUT} =40mA -40℃ < T _a < 85℃	-	±0.5	-	mV/℃

Note: Dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at V_{IN} = V_{OUT}+1V with a fixed load.

AP2138N-3.3TRG1 Output Type

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V _{IN}	Conditions				
V _{OUT}	Output Voltage	5.3V	I _{OUT} =40mA	3.234	3.300	3.366	V
I _{OUT}	Output Current	5.3V	-	-	250	-	mA
Δ V _{OUT}	Load Regulation	5.3V	1mA ≤ I _{OUT} ≤ 60mA	-	45	90	mV
V _{DIF}	Voltage Drop(Note)	-	I _{OUT} =40mA, Δ V _{OUT} =2%	-	440	-	mV
I _{SS}	Current Consumption	5.3V	No load	-	2.0	3.0	μ A
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	-	4.3V ≤ V _{IN} ≤ 12V I _{OUT} =40mA	-	0.2	-	%/V
V _{IN}	Input Voltage	-	-	-	-	15	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	5.3V	I _{OUT} =40mA -40℃ < T _a < 85℃	-	±0.5	-	mV/℃

Note: Dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at V_{IN} = V_{OUT}+1V with a fixed load.



AP2138N-3.6TRG1 Output Type

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V _{IN}	Conditions				
V _{OUT}	Output Voltage	5.6V	I _{OUT} =40mA	3.528	3.600	3.672	V
I _{OUT}	Output Current	5.6V	-	-	250	-	mA
ΔV _{OUT}	Load Regulation	5.6V	1mA≤I _{OUT} ≤60mA	-	45	90	mV
V _{DIF}	Voltage Drop(Note)	-	I _{OUT} =40mA, ΔV _{OUT} =2%	-	400	-	mV
I _{SS}	Current Consumption	5.6V	No load	-	2.0	3.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	-	4.6V≤V _{IN} ≤12V I _{OUT} =40mA	-	0.2	-	%/V
V _{IN}	Input Voltage	-	-	-	-	15	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	5.6V	I _{OUT} =40mA -40℃<T _a <85℃	-	±0.5	-	mV/℃

Note: Dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at V_{IN} = V_{OUT}+1V with a fixed load.

AP2138N-4.4TRG1 Output Type

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V _{IN}	Conditions				
V _{OUT}	Output Voltage	6.4V	I _{OUT} =40mA	4.312	4.400	4.488	V
I _{OUT}	Output Current	6.4V	-	-	250	-	mA
ΔV _{OUT}	Load Regulation	6.4V	1mA≤I _{OUT} ≤60mA	-	45	90	mV
V _{DIF}	Voltage Drop(Note)	-	I _{OUT} =40mA, ΔV _{OUT} =2%	-	280	-	mV
I _{SS}	Current Consumption	6.4V	No load	-	2.0	3.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	-	5.4V≤V _{IN} ≤12V I _{OUT} =40mA	-	0.2	-	%/V
V _{IN}	Input Voltage	-	-	-	-	15	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Temperature Coefficient	6.4V	I _{OUT} =40mA -40℃<T _a <85℃	-	±0.5	-	mV/℃

Note: Dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at V_{IN} = V_{OUT}+1V with a fixed load.



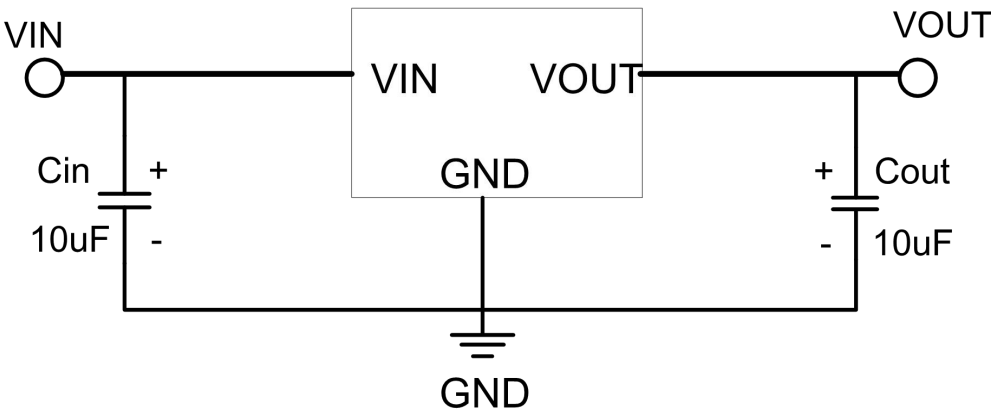
TXAP2138N-5.0TRG1 Output Type

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V _{IN}	Conditions				
V _{OUT}	Output Voltage	7V	I _{OUT} =40mA	4.9	5.00	5.1	V
I _{OUT}	Output Current	7V	-	-	250	-	mA
Δ V _{OUT}	Load Regulation	7V	1mA≤I _{OUT} ≤60mA	-	45	90	mV
V _{DIF}	Voltage Drop(Note)	-	I _{OUT} =40mA, Δ V _{OUT} =2%	-	200	-	mV
I _{SS}	Current Consumption	7V	No load	-	2.0	3.0	μ A
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	-	6V≤V _{IN} ≤12V I _{OUT} =40mA	-	0.2	-	%/V
V _{IN}	Input Voltage	-	-	-	-	15	V
$\frac{\Delta V_{OUT}}{\Delta Ta}$	Temperature Coefficient	7V	I _{OUT} =40mA -40℃<Ta<85℃	-	±0.5	-	mV/℃

Note: Dropout voltage is defined as the input voltage minus the output voltage that produces a 2% change in the output voltage from the value at V_{IN} = V_{OUT}+1V with a fixed load.

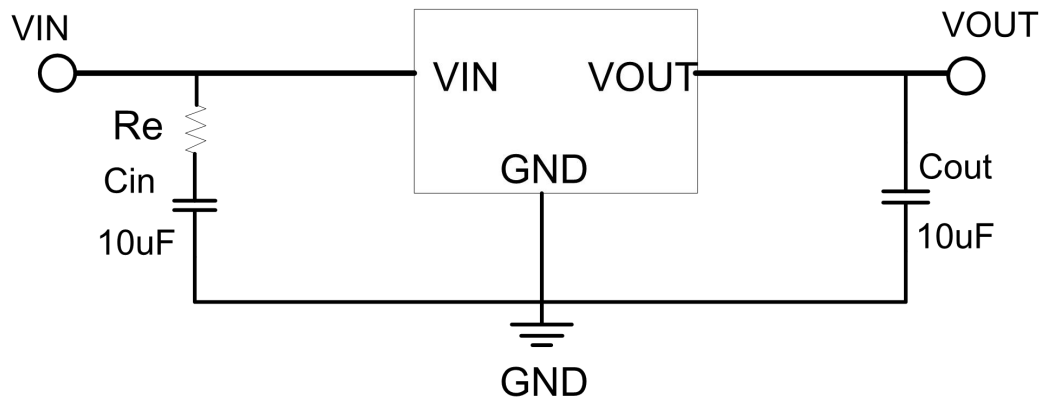
Application Circuit

Basic Circuits



Note1: Cin=Cout=10uF. (10uF Electrolytic capacitor is recommended).

Note2: If the input and output capacitors are ceramic, add a resistor at the input, as follows.

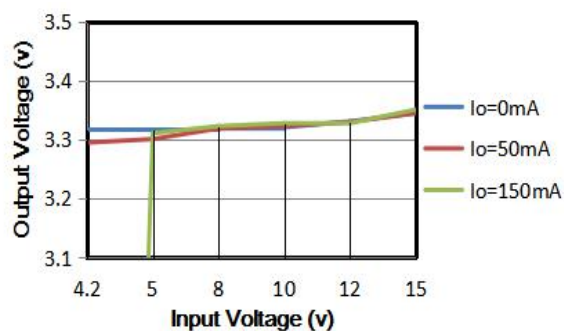
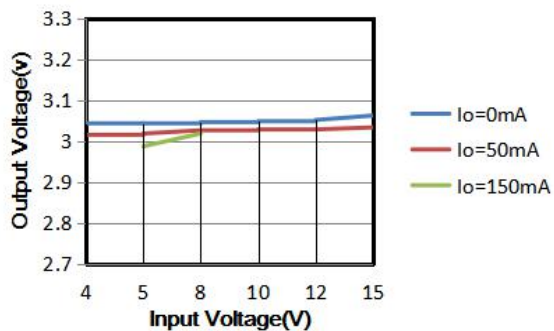


Note: $R_e = (1.2 \sim 1.8) \Omega$.

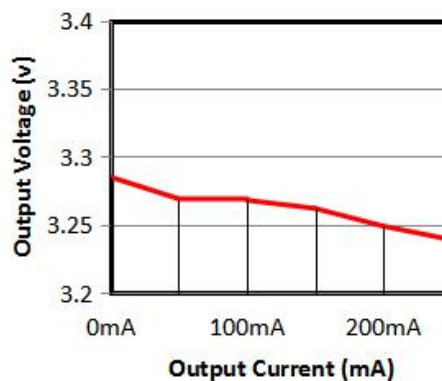
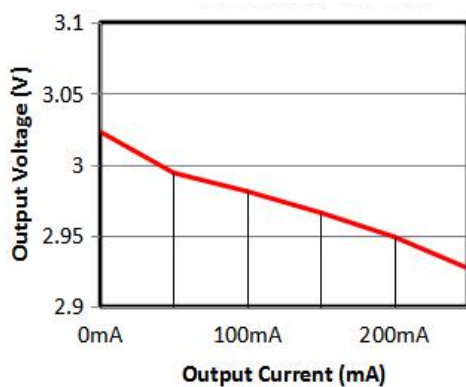


Typical Characteristics

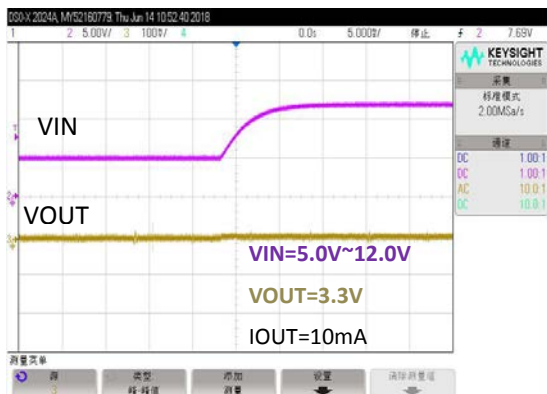
(1) Output Voltage vs Input voltage



(2) Output Voltage vs. Output Current

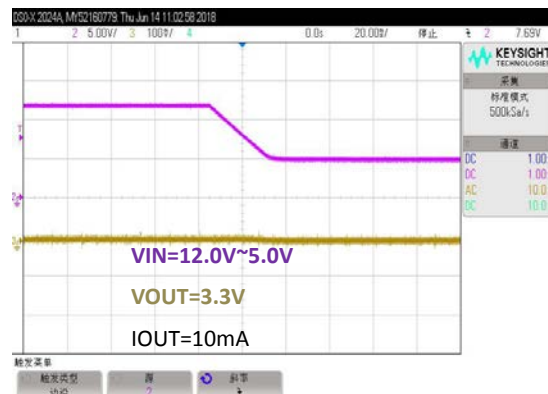


(3) Input Transient Response



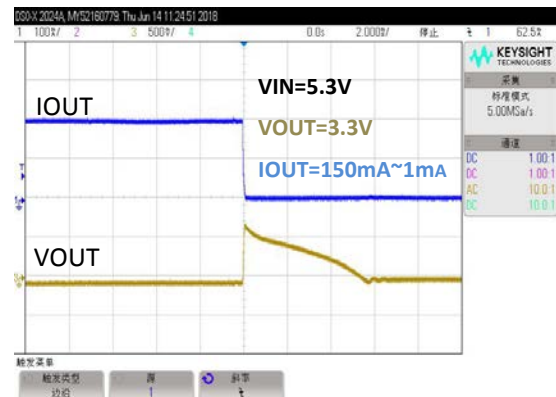
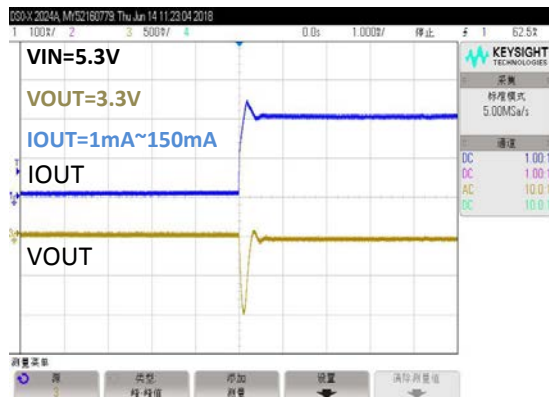
VIN

VOUT





(4) Load Transient Response



(5) MAX Output Current Vs. Input Voltage

TX7330MPR

Input Voltage	Max Output Current
6V	250mA
9V	200mA
12V	150mA
15V	100mA

TX7333MPR

Input Voltage	Max Output Current
6.3V	250mA
9V	200mA
12V	150mA
15V	100mA

TX7350MPR

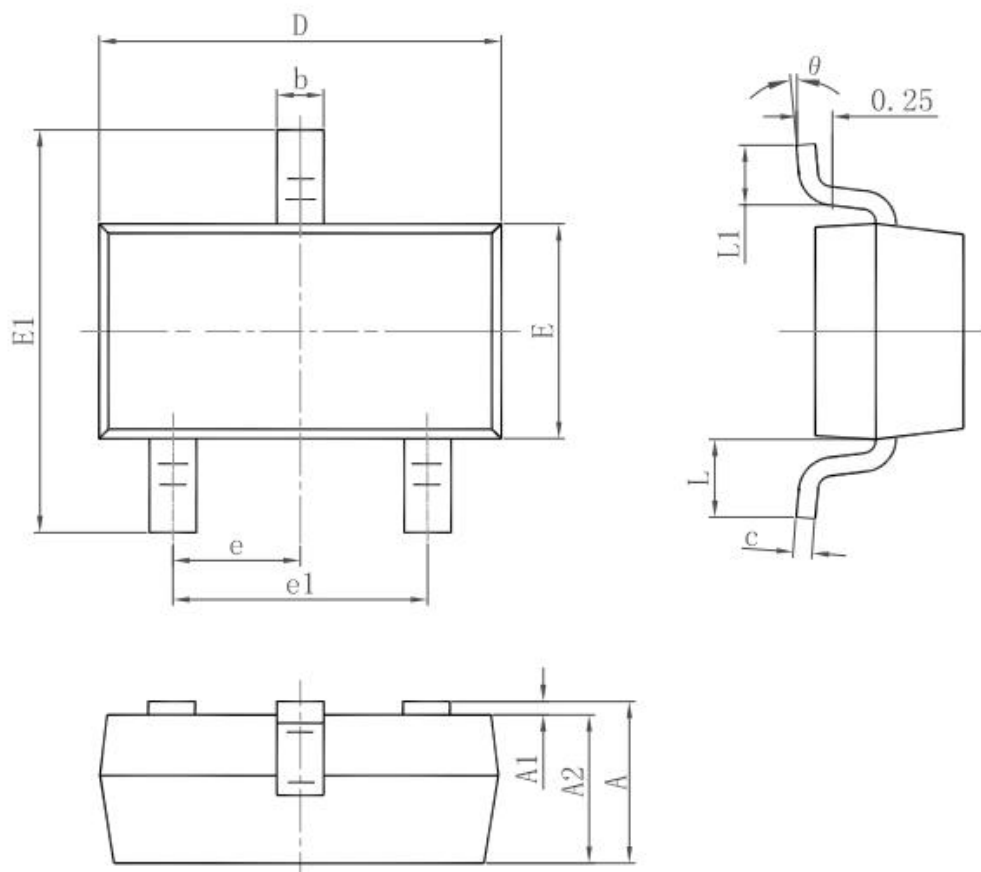
Input Voltage	Max Output Current
8V	250mA
9V	200mA
12V	150mA
15V	100mA

Note: 1. The Max Output Current is the typical value;

2. In order to ensure that the best parameters can be achieved, the PCB is preferably provided with a large copper foil area to increase heat dissipation.



Package Outline Dimensions SOT-23



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP.		0.037 TYP.	
e1	1.800	2.000	0.071	0.079
L	0.550 REF.		0.022 REF.	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°



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