Description

The EC8841 series is a positive voltage regulator with high accuracy output voltage and ultra-low quiescent current which is typically 1.0μA. The device is ideal for battery powered handheld equipments which require low quiescent current. The EC8841 contains a bandgap voltage reference, an error amplifier, a P-channel pass transistor, and a resistor-divider for setting output voltage. The output voltage is fixed with high accuracy by advanced trimming technology.

The EC8841 has been designed to be used with low cost ceramic capacitors and requires a minimum output capacitor of 1.0μF. The devices are available in SOT23-3/5, SOT89 and TO92 packages

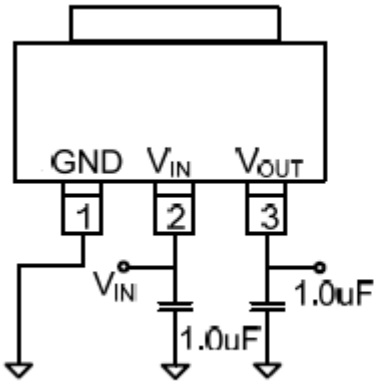
Features

- Operating Voltages Range：+2.5V to +18V
- Output Voltages Range：+1.5V to +5.0V with 100mV Increment
- Low Dropout: 800mV @ 50mA
- High Output Voltage Accuracy±2%：Vout ≧2.7V
- Thermal Overload Shutdown Protection
- Low ESR Capacitor Compatible
- SOT23-3, SOT23-5, SOT89, TO92 Packages
- RoHS Compliant and 100% Lead (Pb)-Free and Green (Halogen Free with Commercial Standard)

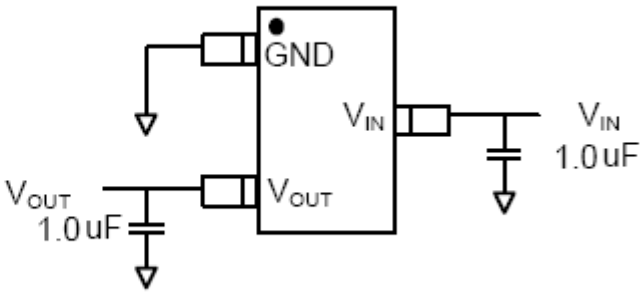
Applications

- Battery powered equipments
- Hand-Held Electronics
- Portable Communication Devices
- Wireless Communication systems
- Precision Voltage Reference

Simplified Application Circuit



SOT89



SOT23 Series

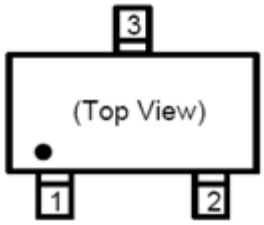
Ordering Information

EC8841 XX XX X R

- Circuit Type
- Output Voltage(exam):
  VOUT= 1.5V= 15
  :
  :
  VOUT= 5.0V= 50
- Package Type：
  B1=SOT23-3
  B2=SOT23-5
  B6= SOT89 3L
  A6=TO92-3L
- Pin Type: SOT89:L/Y
  N：Normal
- R:Tape & Reel

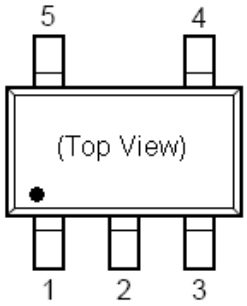
Package	Part Number	Marking	Marking Information
SOT23-3	EC8841XXB1NR	8841V TTTTT	Product part ： 8841 V is the output voltage of production. Example: 8=1.5V;A=1.8V,G=2.5V;J=2.7V; K=2.8V;M=3.0V;Q=3.3V. V=3.6V. Z=5.0V TTTTT：Lot No
SOT23-5	EC8841XXB2NR	8841V TTTTT	
SOT89	EC8841XXB6LR(Pin Type：L)	8841V TTTTL	
	EC8841XXB6YR(Pin Type：Y)	8841V TTTTY	
TO92	EC8841XXA6NR	8841V TTTTT	

Pin Assignment & Pin Description



SOT23-3

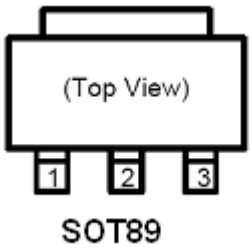
Pin Number (SOT23-3)	Pin Name	Pin Description
1	GND	GND Pin
2	V_{OUT}	Output Pin
3	V_{IN}	Power Input



SOT23-5

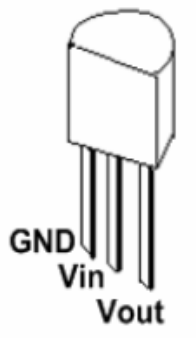
Pin Number (SOT23-5)	Pin Name	Pin Description
1	GND	GND Pin
2	V_{IN}	Power Input
3	V_{OUT}	Output Pin
4	NC	No Connection
5	NC	No Connection

Pin Assignment & Pin Description



SOT89

Pin Number		Pin Name	Pin Description
SOT89 (Pin Type L)	SOT89 (Pin Type Y)		
1	1	GND	GND Pin
2	3	V_{IN}	Power Input
3	2	V_{OUT}	Output Pin



Pin Number (TO92)	Pin Name	Pin Description
1	GND	GND Pin
2	V_{IN}	Power Input
3	V_{OUT}	Output Pin

Absolute Maximum Rating

Parameter		Symbol	Value	Units
Input Voltage V_{IN} to GND		V_{IN}	20	V
Output Current Limit, $I_{(LIMIT)}$		I_{OUT}	100	mA
Power Dissipation	SOT23-3	P_D	350	mW
	SOT23-5		350	mW
	SOT89		550	mW
	TO92		550	mW
Operating Ambient Temperature		T_{OPR}	-40 to+125	°C
Storage Temperature Range		T_{STG}	-55 to +150	°C
Lead Temperature (Soldering, 10sec)		—	+260	°C

Note:

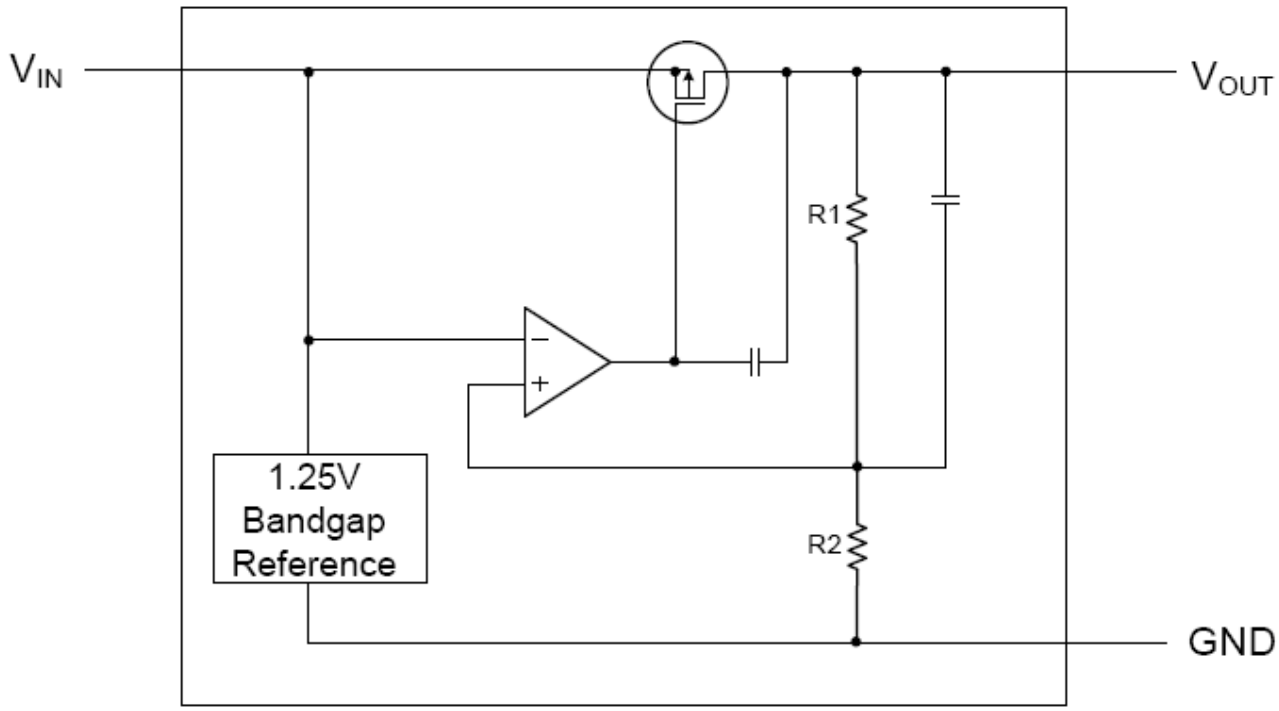
*Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device.These are stress ratings only, and function operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Electrical Characteristics

(T_A=25°C, unless otherwise noted.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage		2.5		18	V
V_{OUT}	Output Voltage	$V_{IN}=V_{OUT}+1.0V$, I_{OUT}=1mA, $V_{OUT}\leqq 2.6V$	V_{OUT}* 0.976	VOUT	V_{OUT}* 1.024	V
		$V_{IN}=V_{OUT}+1.0V$, I_{OUT}=1mA, $V_{OUT}\geqq 2.7V$	V_{OUT}* 0.98		V_{OUT}* 1.02	
I_{MAX}	Maximum Load Current		50			mA
I_Q	Ground Pin Current	I_{LOAD}=0mA , $V_{IN}=V_{OUT}+1.0V$		1.0	2.5	μA
V_{DROP}	Dropout Voltage	I_{OUT}=1mA, V_{OUT}=5V		16	20	mV
		I_{OUT}=10mA, V_{OUT}=5V		160	200	
		I_{OUT}=50mA, V_{OUT}=5V		800	1000	
ΔV_{LINE}	Line Regulation	$V_{OUT}+1.0V<V_{IN}<12V$, I_{OUT}=1mA		0.2	0.3	%/V
ΔV_{LOAD}	Load Regulation	I_{OUT}=0mA to 50mA,		0.01	0.02	%/mA
$\triangle V_{OUT}/\triangle T_A$	Temperature Characteristic of $\triangle V_{OUT}$	V_{IN}=5.0V, I_{OUT}=10mA,T_A=-40℃~125℃		0.6		mV/℃

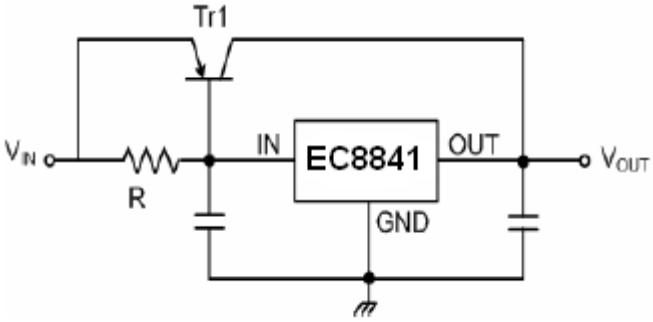
Function Block Diagram



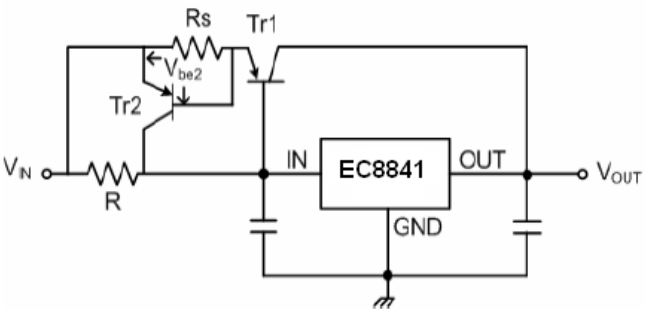
APPLICATION CIRCUITS

Current Boost Circuit

The figure below shows a boost circuit for increasing the output current. Output current 60mA or more can be obtained by this circuit.



Short-Circuit protection of Tr1 can be implemented by adding the sense resistor RS and the PNP transistor Tr2 as shown below.

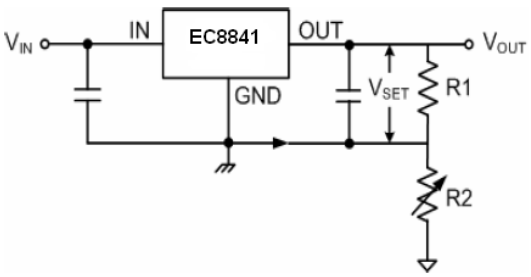


The current limit of the protection circuit is:

$$I_{LIMIT} = \frac{V_{be2}}{Rs}$$

Voltage Boost Circuit

If the output voltage you need is greater than 5.0V, the circuit in the figure below will increase output voltages easily



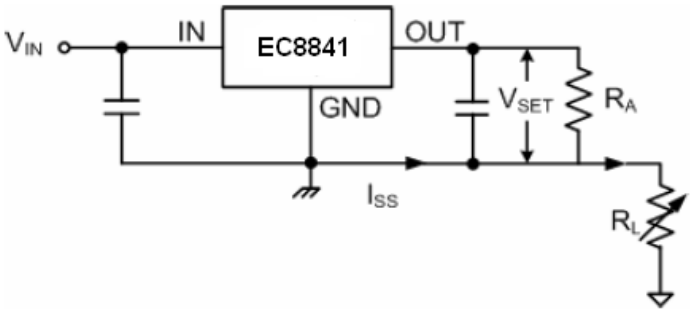
The output voltage is obtained by:

$$V_{OUT} = V_{SET} \times \left(1 + \frac{R2}{R1}\right) + I_{SS} \times R2$$

Where V_{SET} is the preset output voltage of EC8841 and I_{SS} is the quiescent current. Because of the low quiescent current, the resistor values, R1 and R2, can be set as large as several hundreds kΩ to lower the power consumption of the whole system.

Constant Current Source

The EC8841 Series can be used as a constant current source within allowable current limit.

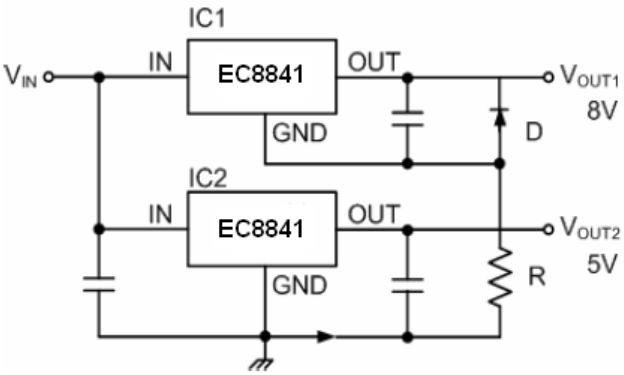


The output current is obtained by:

$$I_{OUT} = \frac{V_{SET}}{R_A} + I_{SS}$$

Dual Supply

A dual supply can be constructed with two EC8841 series as show in the figure below. This circuit provides two outputs (5V and 8V) with the EC884130 and the EC884150. As the resistance R lets the quiescent current of IC1 pass. R is unnece-ssary if the minimum output current of IC2 is more than the IC1 quiescent current. D is a protection diode in case V_{OUT2} becomes larger than V_{OUT1}.



Detail Description

The EC8841 is a low quiescent current LDO linear regulator. It supplies a preset 3.3V, 3.6V and 5.0V output voltages for output current up to 50mA. Other mask options for special output voltages from 1.5V to 5.0V with 100mV increment are also available. As illustrated in function block diagram, it consists of a 1.23V band gap reference, error amplifier, P-channel pass transistor and an internal feedback voltage divider.

The 1.23V band gap reference is connected to the error amplifier, which compares this reference with the feedback voltage and amplifies the voltage difference. If the feedback voltage is lower than the reference voltage, the pass-transistor gate is pulled lower, which allows more current to pass to the output pin and increases the output voltage. If the feedback voltage is too high, the pass-transistor gate is pulled up to decrease the output voltage.

The output voltage is feedback through an internal resistor-divider connected to OUT. Additional blocks include an output current limiter, thermal sensor, and shutdown logic.

Internal P-channel Pass Transistor

The EC8841 features a P-channel MOSFET pass transistor. Unlike similar designs using PNP pass transistors, P-channel MOSFETs require no base drive,which reduces ground pin current.PNP-based regulators also waste considerable current in dropout conditions when the pass transistor saturates,and use high base-drive currents under large loads.The EC8841 does not suffer from these problems and consumes only 1.0μA (Typ.) of ground pin current under heavy loads as well as in dropout conditions.

Output Voltage Selection

The first two digits of part number suffix identify the output voltage(see Ordering Information).For example, the EC884150 has a preset 5.0V output voltage.

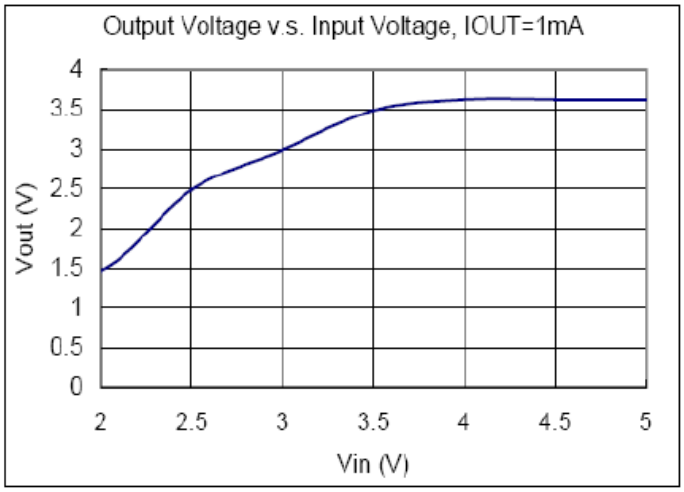
Input-Output Voltage

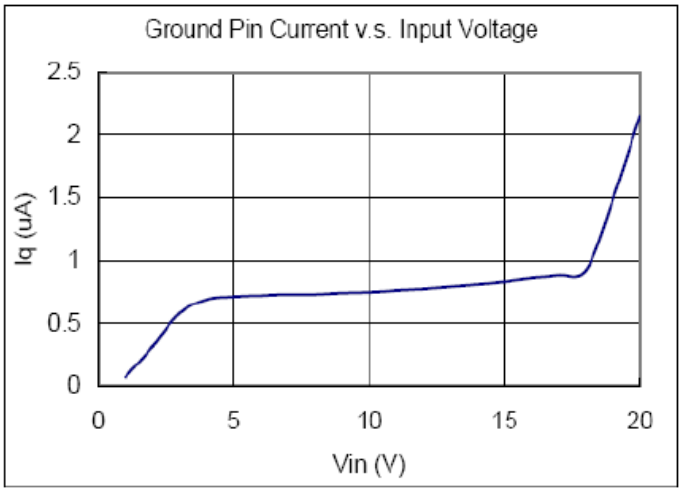
A regulator's minimum input-output voltage differential, or dropout voltage,determines the lowest usable supply voltage.In battery-powered systems,this will determine the useful end-of-life battery voltage. The EC8841 uses a P-channel MOSFET pass transistor,its dropout voltage is a function of drain-to-source on-resistance (RDS(ON))multiplied by the load current.

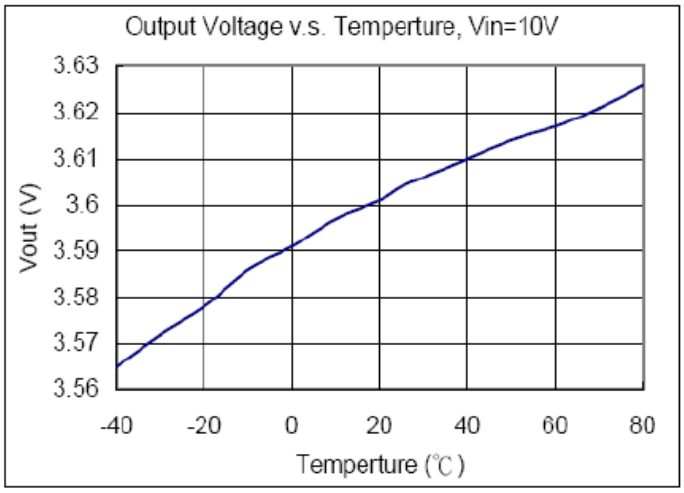
$$V_{DROPOUT} = V_{IN} - V_{OUT} = R_{DS(ON)} \times I_{OUT}$$

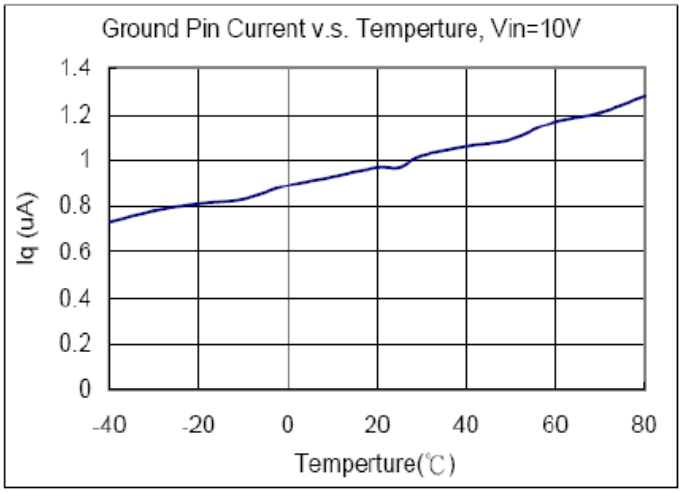
Typical Operating Characteristics

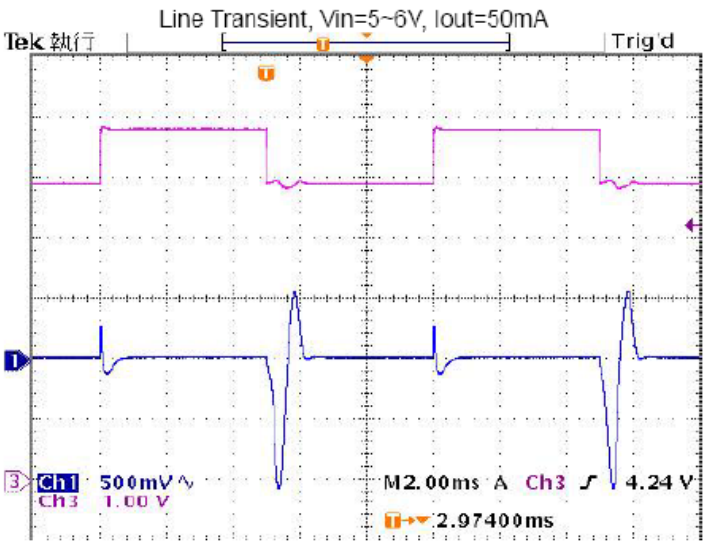
(EC884136A6NR tested, C_{IN}=1.0μF, C_{OUT}=1.0μF, T_A=+25℃, unless otherwise noted.)

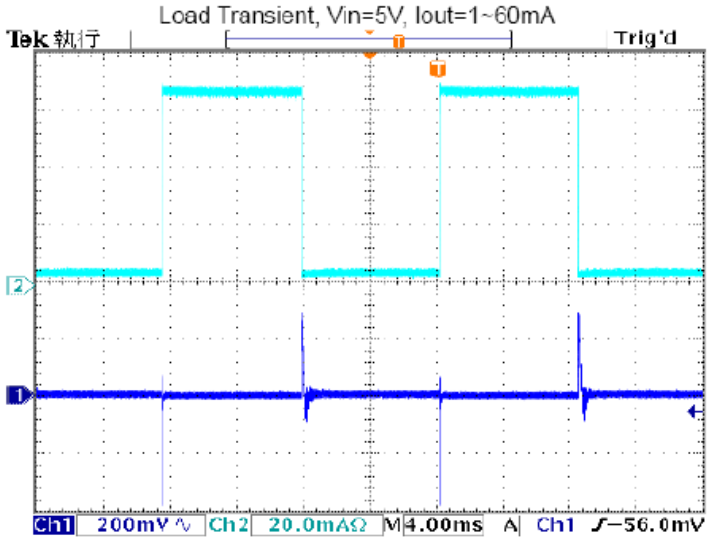






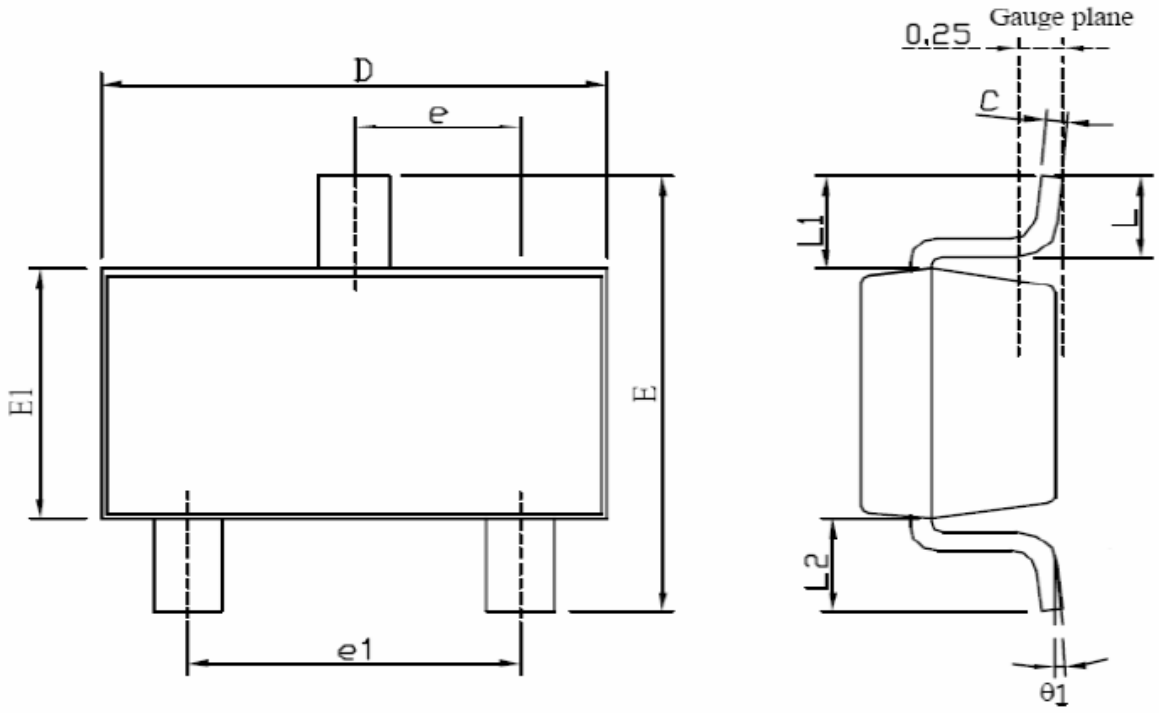


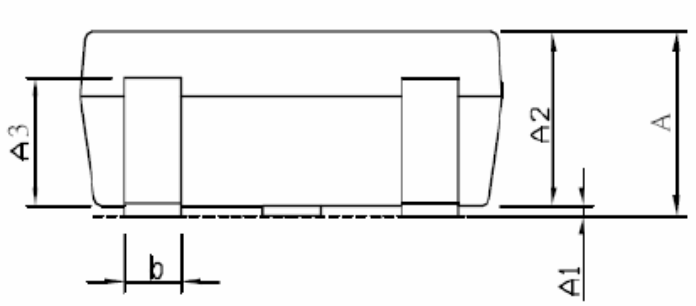




Mechanical Dimensions

OUTLINE DRAWING SOT23-3

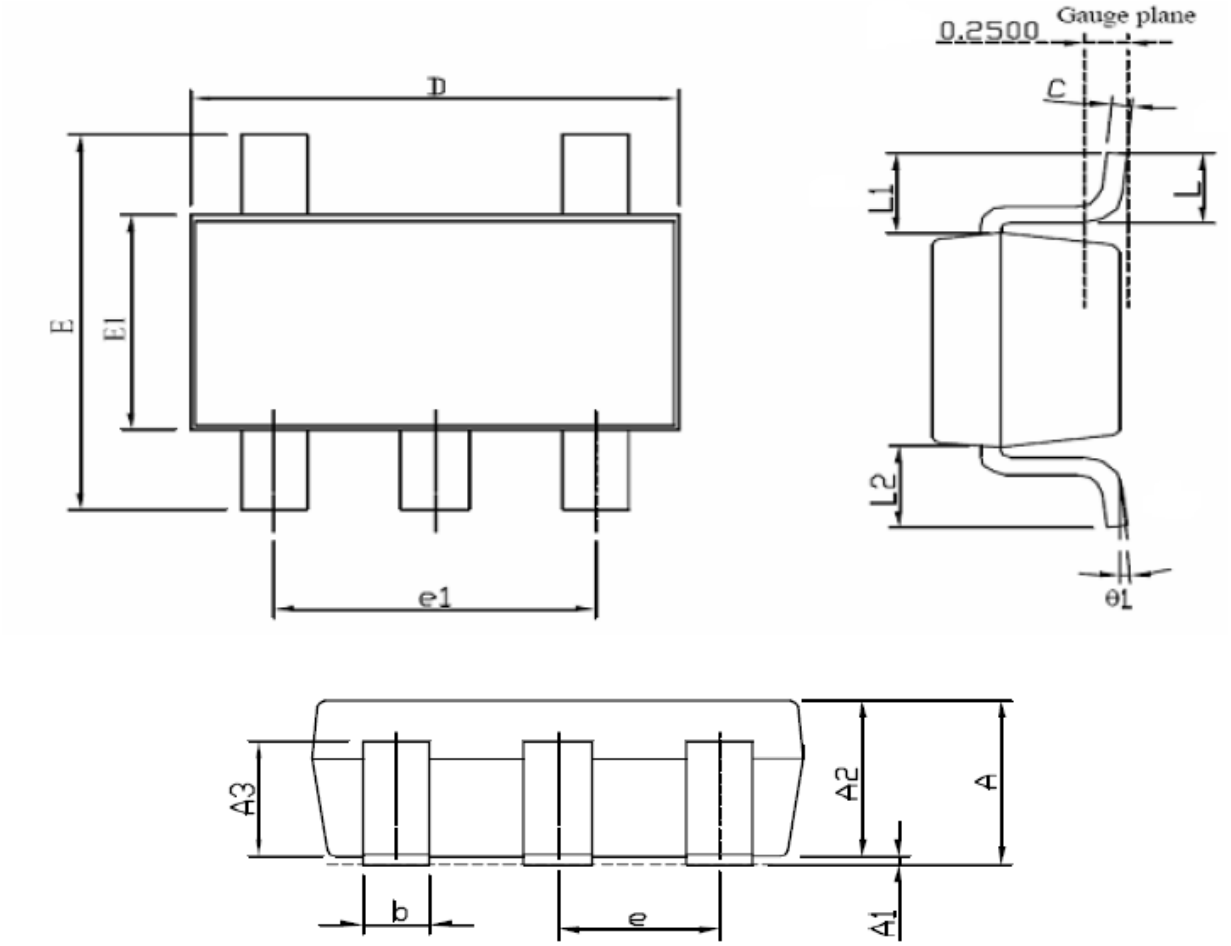




Symbols	Dimensions in Millmeters		
	Min	Nom	Max
A	1.00	1.10	1.40
A1	0.00	0.05	0.10
A2	1.00	1.10	1.30
A3	0.70	0.80	0.90
b	0.35	0.40	0.50
C	0.12	0.125	0.225
D	2.70	2.90	3.10
E	2.60	2.80	3.00
E1	1.40	1.60	1.80
e	---	0.95(Typ)	---
e1	---	1.90(Typ)	---
θ1	1°	5°	9°
L	0.37	---	---
L1	---	0.6REF	---
L1-L2	---	---	0.12

Mechanical Dimensions

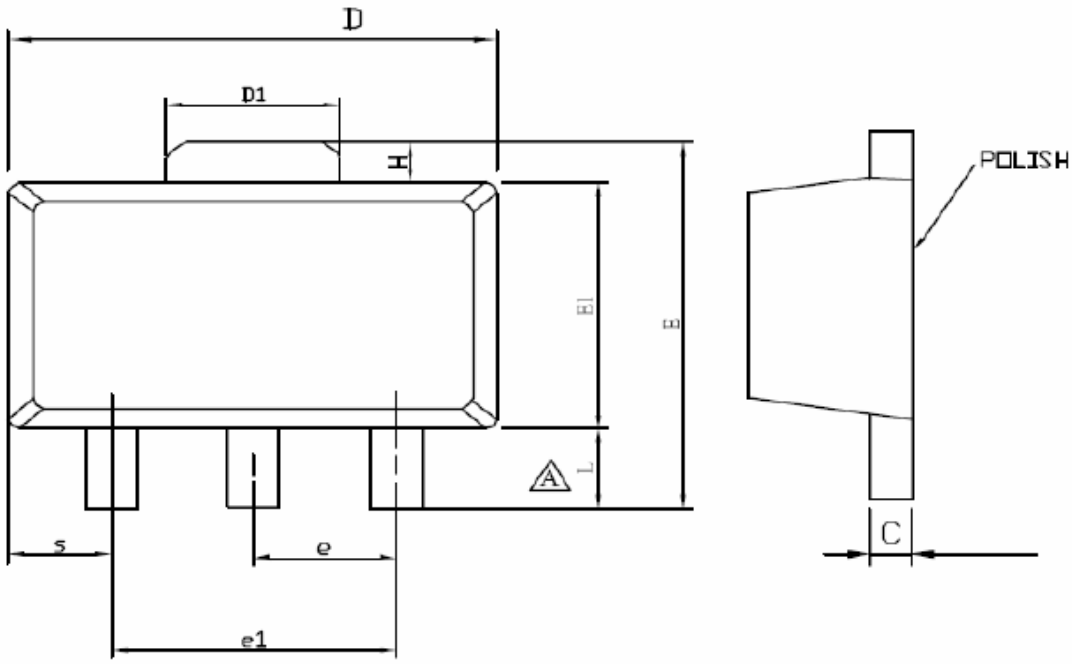
OUTLINE DRAWING SOT23-5

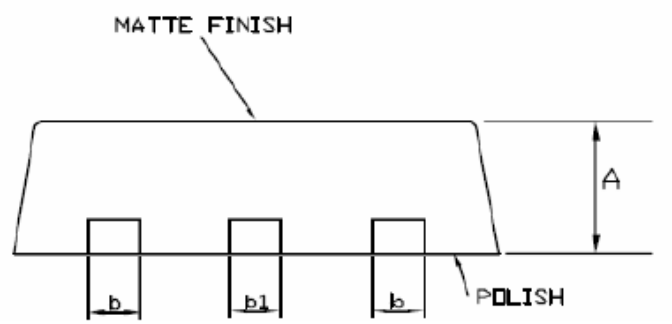


Symbols	Dimensions in Millimeters		
	Min	Nom	Max
A	1.00	1.10	1.40
A1	0.00	---	0.10
A2	1.00	1.10	1.30
A3	0.70	0.80	0.90
b	0.35	0.40	0.50
C	0.12	0.125	0.225
D	2.70	2.90	3.10
E1	1.40	1.60	1.80
e1	---	1.90(TYP)	---
E	2.60	2.80	3.00
L	0.37	---	---
θ1	1°	5°	9°
e	---	0.95(TYP)	---
L1	---	0.6(REF)	---
LI-L2	---	---	0.12

Mechanical Dimensions

OUTLINE DRAWING SOT-89

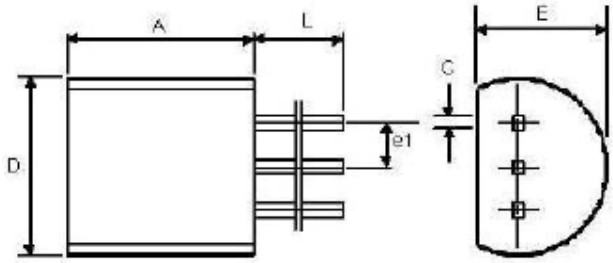




Symbol	Dimensions in millimeters			Dimensions in inches		
	Min	Nom	Max	Min	Nom	Max
A	1.40	1.50	1.60	0.055	0.059	0.063
L	0.89	1.04	1.20	0.0350	0.041	0.047
b	0.36	0.42	0.48	0.014	0.016	0.018
b1	0.41	0.47	0.53	0.016	0.018	0.020
C	0.38	0.40	0.43	0.014	0.015	0.017
D	4.40	4.50	4.60	0.173	0.177	0.181
D1	1.40	1.60	1.75	0.055	0.062	0.069
E	3.64	---	4.25	0.143	---	0.167
E1	2.40	2.50	2.60	0.094	0.098	0.102
e1	2.90	3.00	3.10	0.114	0.118	0.122
H	0.35	0.40	0.45	0.014	0.0169	0.018
S	0.65	0.75	0.85	0.026	0.030	0.034
e	1.40	1.50	1.60	0.054	0.059	0.063

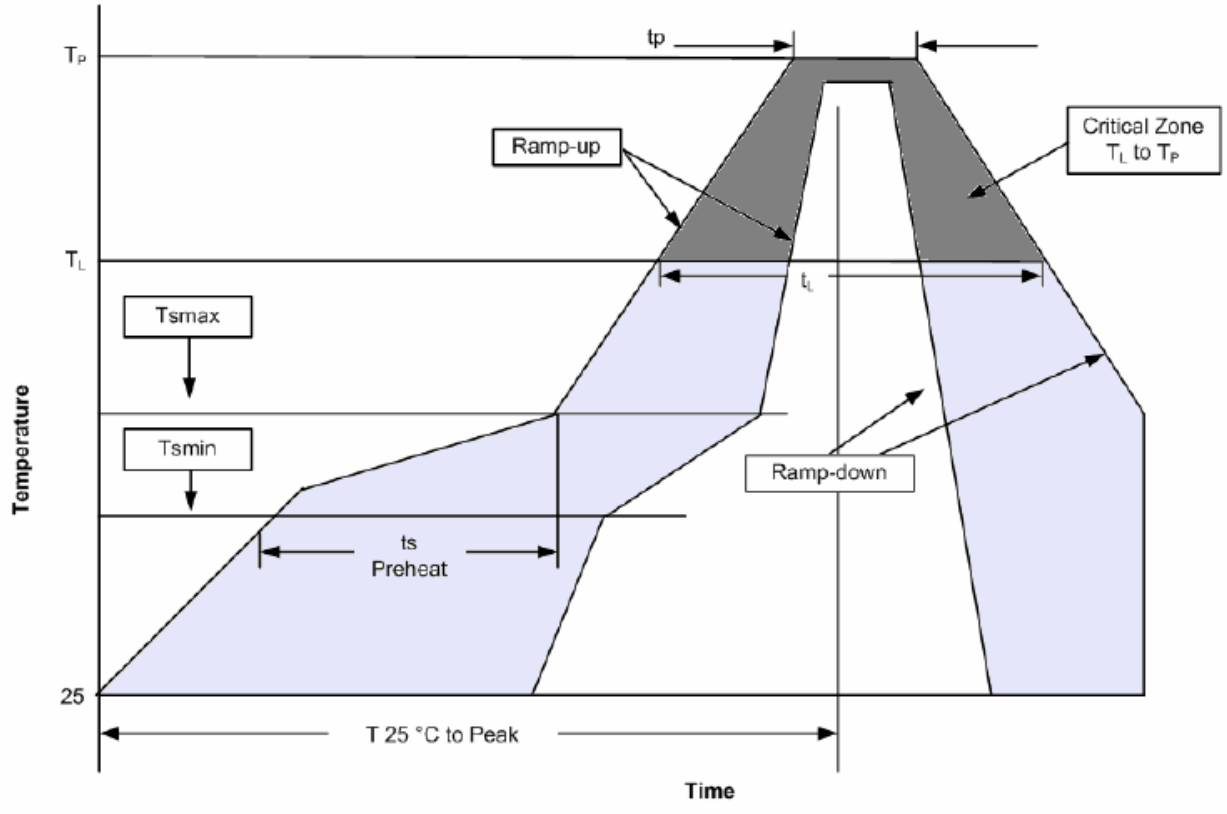
Mechanical Dimensions

OUTLINE DRAWING TO-92



SYMBOL	MIN	MAX
A	4.32	5.33
C	0.38 (TYP.)	
D	4.40	5.20
E	3.17	4.20
e1	1.27 (TYP.)	
L	12.7	-

Reflow Condition (IR/Convection or VPR Reflow)



Classification Reflow Profiles

Profile Feature	Pb-Free / Green Assembly
Average ramp-up rate (T_L to T_P)	3°C/second max
Preheat - Temperature Min (Tsmin) - Temperature Max (Tsmax) - Time (min to max) (ts)	150°C 200°C 60-180 seconds
Time maintained above: - Temperature (T_L) - Time (t_L)	217°C 60-150 seconds
Peak/Classification Temperature (Tp)	See table 1
Time within 5°C of actual Peak Temperature (tp)	20-40 seconds
Ramp-down Rate	6°C/second max
Time 25°C to Peak Temperature	8 minutes max

Notes：
1) All temperatures refer to topside of the package.
2) Measured on the body surface.

Table 2. Pb-free / Green Process – Package Classification Reflow Temperatures

Package Thickness	Volume mm³ <350	Volume mm³ 350~2000	Volume mm³ ≧2000
<2.5 mm	260 +0°C*	260 +0°C*	260 +0°C*
1.6-2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≧2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*

Notes：
* Tolerance: The device manufacturer/supplier shall assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0°C. For example 260°C+0°C) at the rated MSL level.