High Efficiency, synchronous PFM step-up DC-DC converter

General Description

ME2188 Series is a PFM Step-up DC/DC converter IC with low supply current by CMOS process. High frequency noise that occurs during switching is reduced by using advanced circuit designed, output voltage is programmable in 0.1V steps between 1.9V~5.0V and maximum frequency is 320KHz(TYP.). A low ripple, high efficiency step-up DC/DC converter can be constructed of ME2188 with only two external components. ME2188 is suitable for use with battery-powered instruments with low noise and low supply current.

Features

- High efficiency：93%
- Maximum frequency：320KHz
- Low Quiescent Current：7.5μA
- Input Voltage: 0.9V ~ 5.0V
- Output Voltage Range:1.9V ~ 5.0V
- High Accuracy: ± 2%
- Low ripple and Low noise

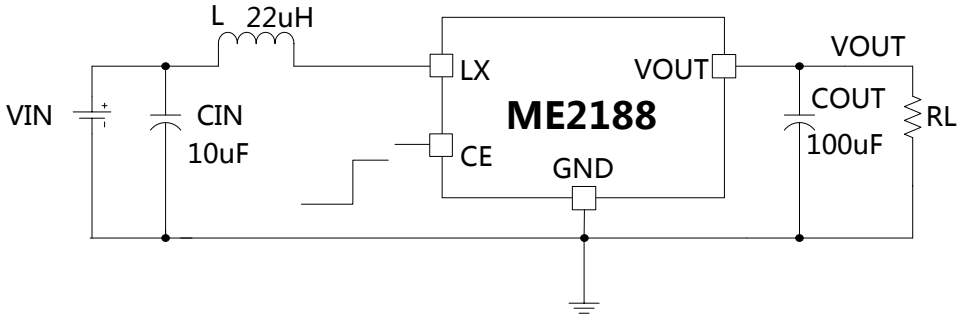
Typical Application

- Power source for battery-powered equipment
- Power source for Wireless mouse, toys, Cameras, VCRs, PDAs, MP3, and Led lighting etc

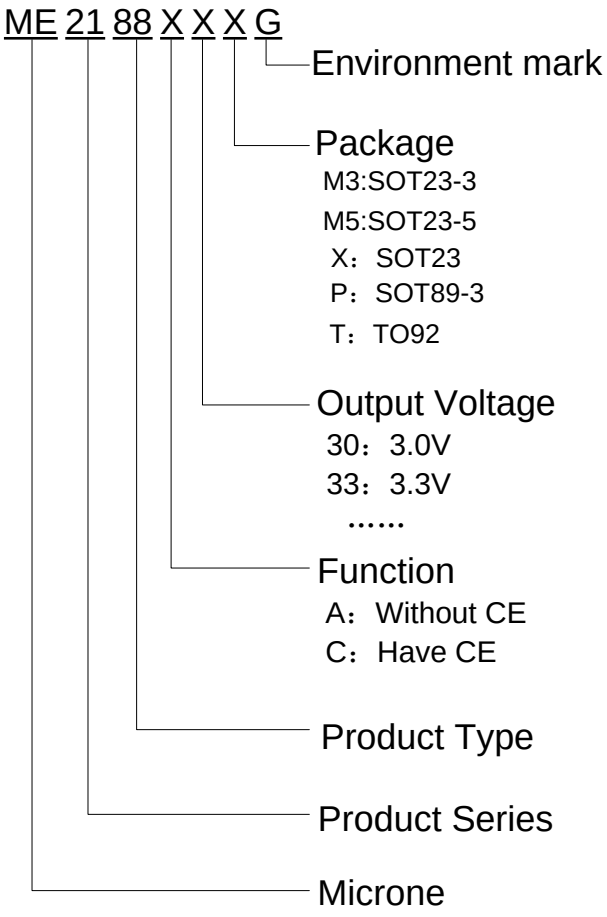
Package

- 5-pin SOT23-5
- 3-pin SOT23、SOT23-3、SOT89-3、TO92

Typical Application Circuit



Selection Guide

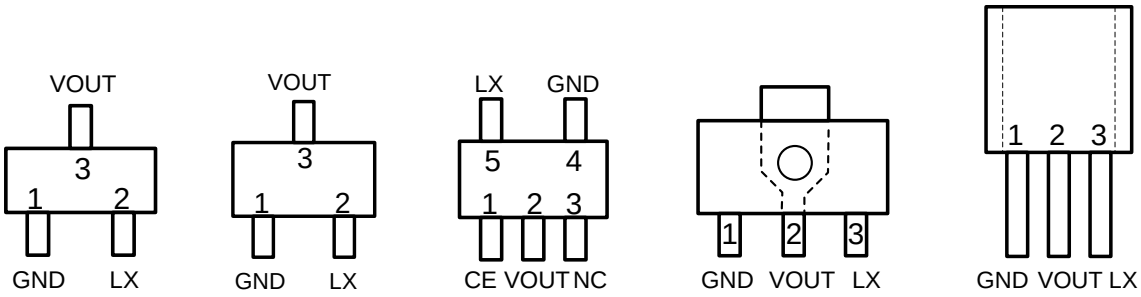


product series	product description
ME2188A22M3G	V_{OUT} =2.2V，Without CE pin，Package：SOT23-3
ME2188A22TG	V_{OUT} =2.2V，Without CE pin， Package ： TO-92
ME2188A22XG	V_{OUT} =2.2V，Without CE pin， Package ： SOT23
ME2188A33M3G	V_{OUT} =3.3V，Without CE pin，Package：SOT23-3
ME2188A33XG	V_{OUT} =3.3V，Without CE pin， Package ： SOT23
ME2188A33PG	V_{OUT} =3.3V，Without CE pin， Package ： SOT89-3
ME2188A33TG	V_{OUT} =3.3V，Without CE pin， Package ： TO-92
ME2188C33M5G	V_{OUT} =3.3V，Have CE pin， Package ： SOT23-5

NOTE: At present ,there are twelve kinds of voltage value: 2.2V、2.3V、2.5V、2.7V、2.8V、3.0V、3.3V、3.6V、3.7V、4.0、4.5V、5.0V。

If you need other voltage and package, please contact our sales staff。

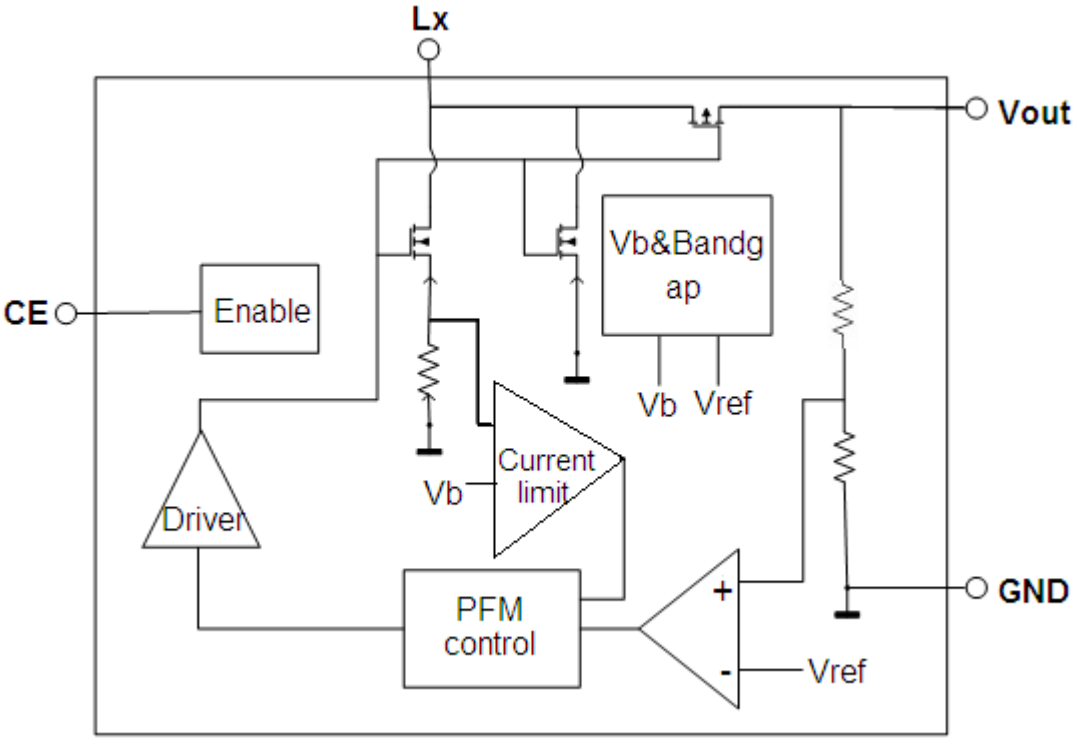
Pin Configuration& Pin Assignment



Pin Assignment

PIN Number				Pin Name	Description
SOT23/ SOT23-3	SOT23-5	SOT89-3	TO92		
2	5	3	3	LX	Switch pin
3	2	2	2	VOUT	Voltage output
-	1	-	-	CE	Chip enable
1	4	1	1	GND	Ground
-	3	-	-	NC	NC

Block Diagram



Absolute Maximum Ratings

Parameter		Symbol	Ratings	Units
CE pin input voltage		VCE	-0.3~6	V
LX pin voltage		LX	-0.3~6	V
LX pin current		ILXmax	1000	mA
VOUT pin voltage		VOUT	-0.3~6	V
Continuous Total Power Dissipation	SOT23-3	P_D	0.54	W
	SOT23-5		0.6	
	SOT89-3		1.25	
	TO92		0.83	
	SOT23		0.38	
Thermal resistance(Junction to air)	SOT23-3	θ_{JA}	230	℃/W
	SOT23-5		210	
	SOT89-3		100	
	TO92		150	
	SOT23		330	
Operating Temperature Range		T_{OPR}	-40~85	℃
Storage Temperature Range		T_{STG}	-55~150	℃
Maximum junction temperature		T_J	-40~150	℃
Welding temperature		TL	260	℃

Electrical Characteristics

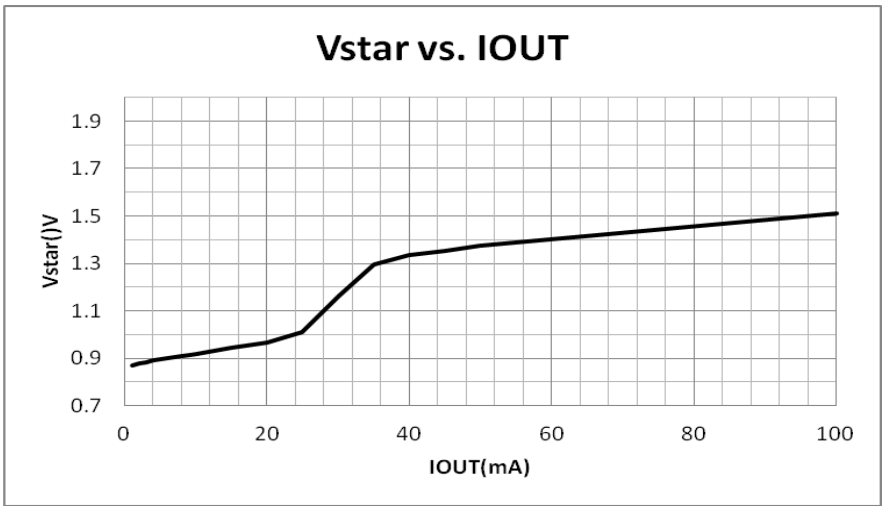
TA = 25 ºC, VIN =VEN=2V, VOUT=3.3V,L=22uH,CIN=10uF，COUT=100uF, unless otherwise noted.

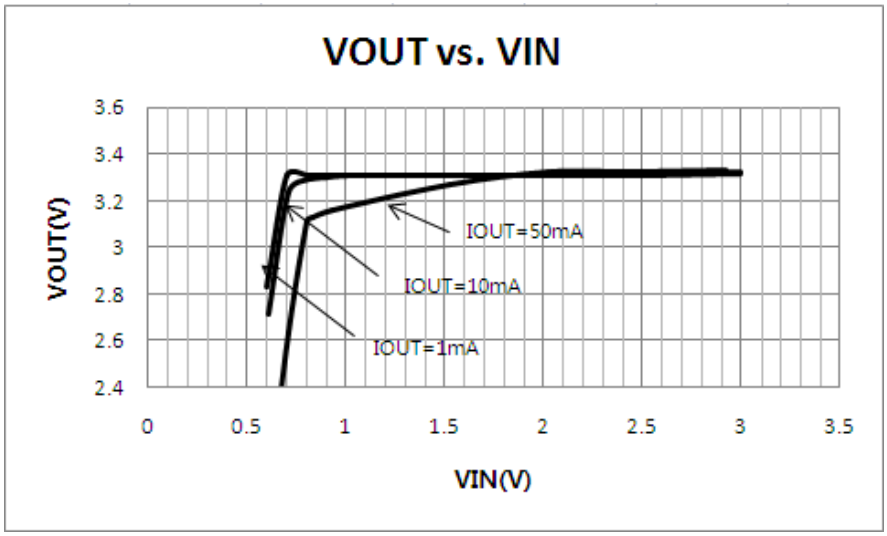
Symbol	Parameter	Test Conditions	MIN	TYP	MAX	UNIT
Start voltage	Vstart	ILOAD=1mA, VIN:0→2V	0.7	0.9	1.1	V
Hold voltage	Vhold	ILOAD=1mA, VIN:2→0V	0.5			V
Maximum input voltage	Vinmax		0.9		5	V
Output voltage accuracy	Vout		-2		+2	%
Power adjustment	ΔVout1	VIN=Vout×0.4~×0.6,IOUT=10mA		5	20	mV
Load adjustment	ΔVout2	IOUT=0~100mA,VIN=2V		20	30	mV
Quiescent Current	ISS	VOUT=VOUT+0.5		7.5	15	uA
Shutdown current	ISS0	VCE=0V		0	0.5	uA
Current limit	Ilimit		800	1000	1200	mA
No load input current	Iin0	VIN=1.5V ,VOUT=2.2V		10	15	uA
Efficiency				93	96	%
oscillation frequency				320		KHz
Oscillation signal duty cycle	DCosc			74		%
EN input high level				0.7		V
EN input low level					0.2	V

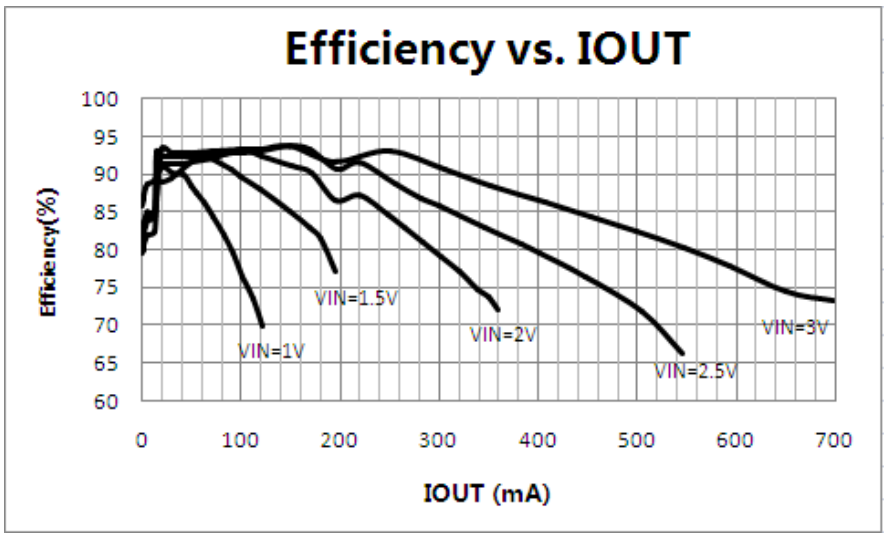
Type Characteristics

L=22uH,CIN=10uF，COUT=100uF， TA = 25 ºC, unless otherwise noted.

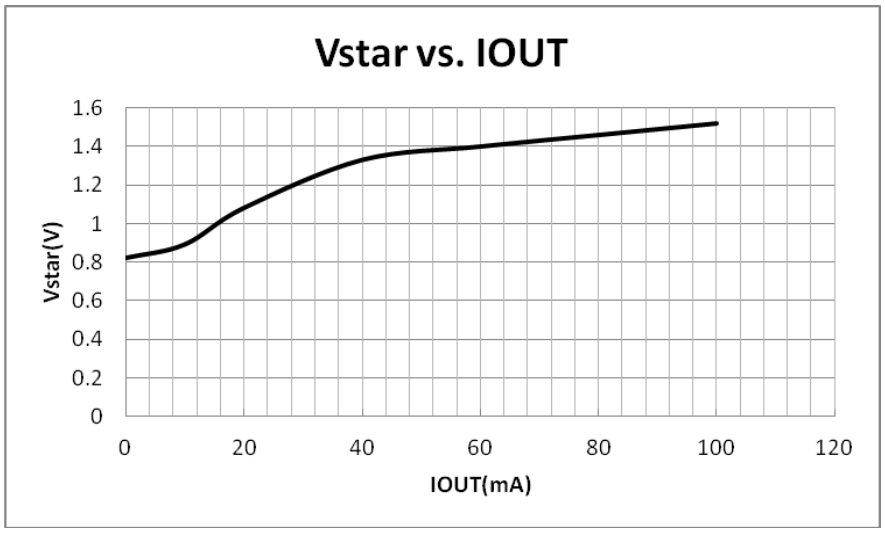
- **ME2188A33**

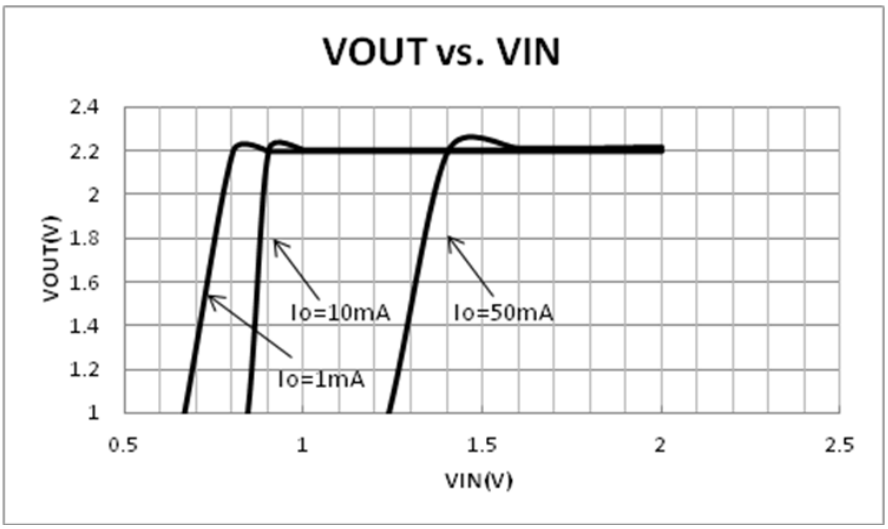


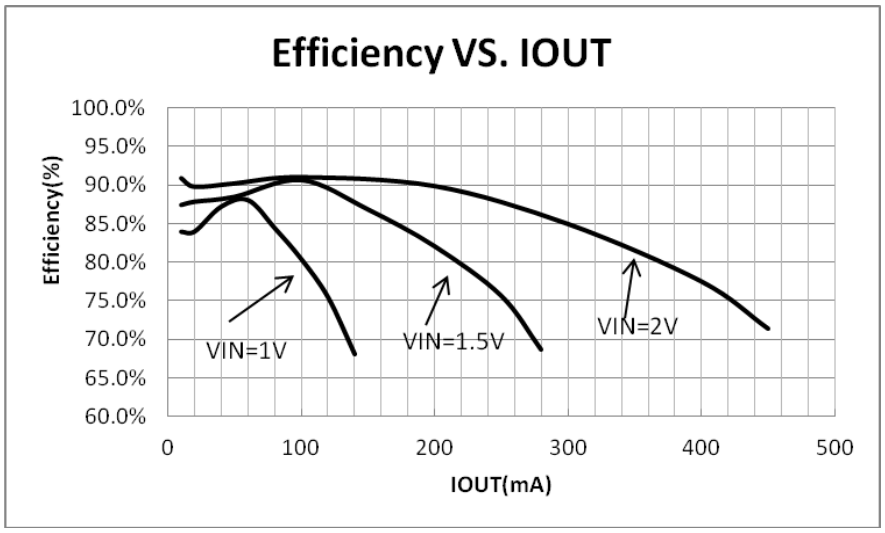




- **ME2188A22**

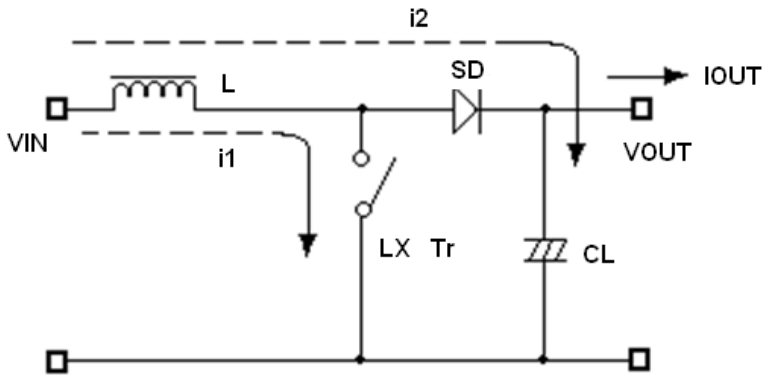

Vstar vs. IOUT
Vstar(V)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
IOUT(mA)


VOUT vs. VIN
VOUT(V)
2.4
2.2
2
1.8
1.6
1.4
1.2
1
Io=10mA
Io=50mA
Io=1mA
0.5
1
1.5
2
2.5
VIN(V)


Efficiency VS. IOUT
Efficiency(%)
100.0%
95.0%
90.0%
85.0%
80.0%
75.0%
70.0%
65.0%
60.0%
VIN=1V
VIN=1.5V
VIN=2V
0
100
200
300
400
500
IOUT(mA)

Operation Description

ME2188 step-up DC/DC converter charges energy in the inductor when Lx Transistor is on, and discharges the energy with the addition of the energy from input power source thereto, so that a higher output voltage than the input voltage is obtained. Following is the operation diagram.



Switching DC/DC Step up Converter operating process

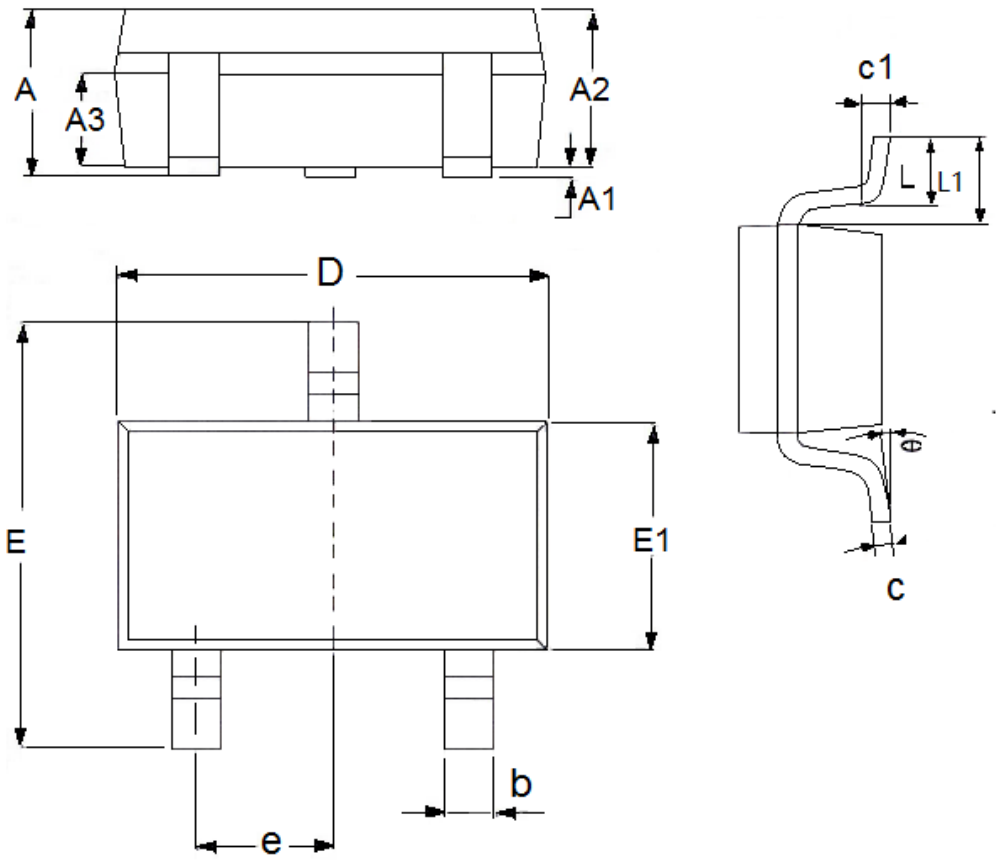
PCB Layout：

Set external components as close as possible to the IC and minimize the connection between the components and the IC. In particular, when an external component is connected to VOUT Pin, make minimum connection with the capacitor.

Make Vss pin sufficient grounding, otherwise, the zero level within IC will varied with the switching current. This may result in unstable operation of IC.

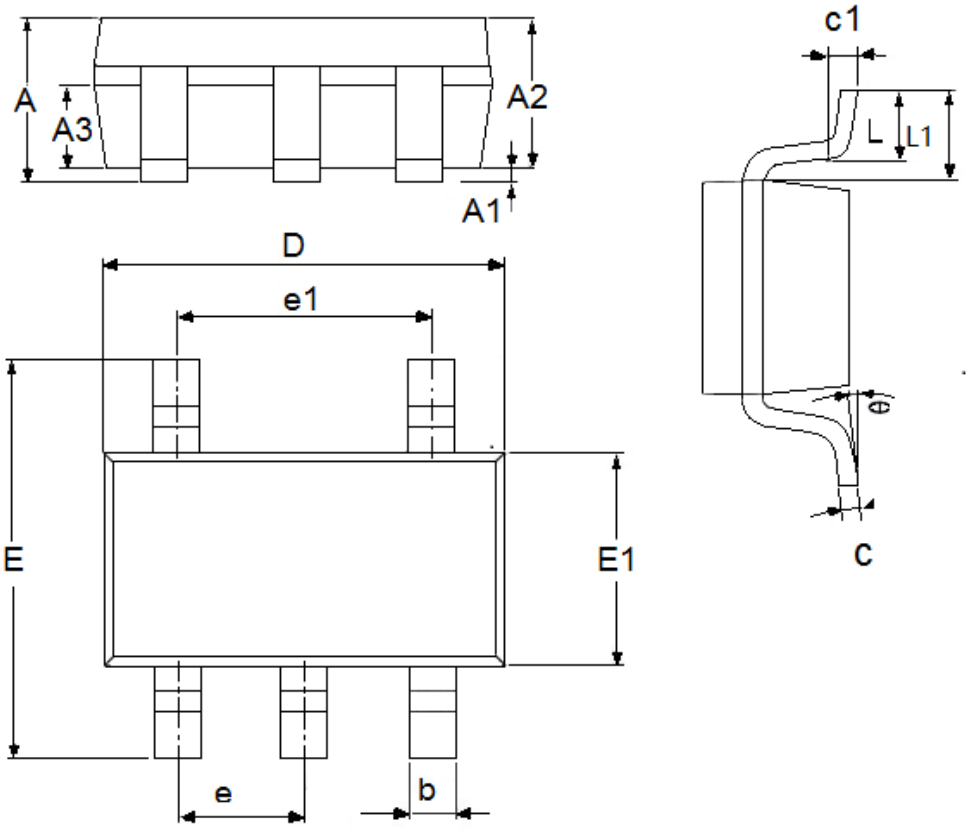
Packaging Information

- **Package Type:SOT23-3**



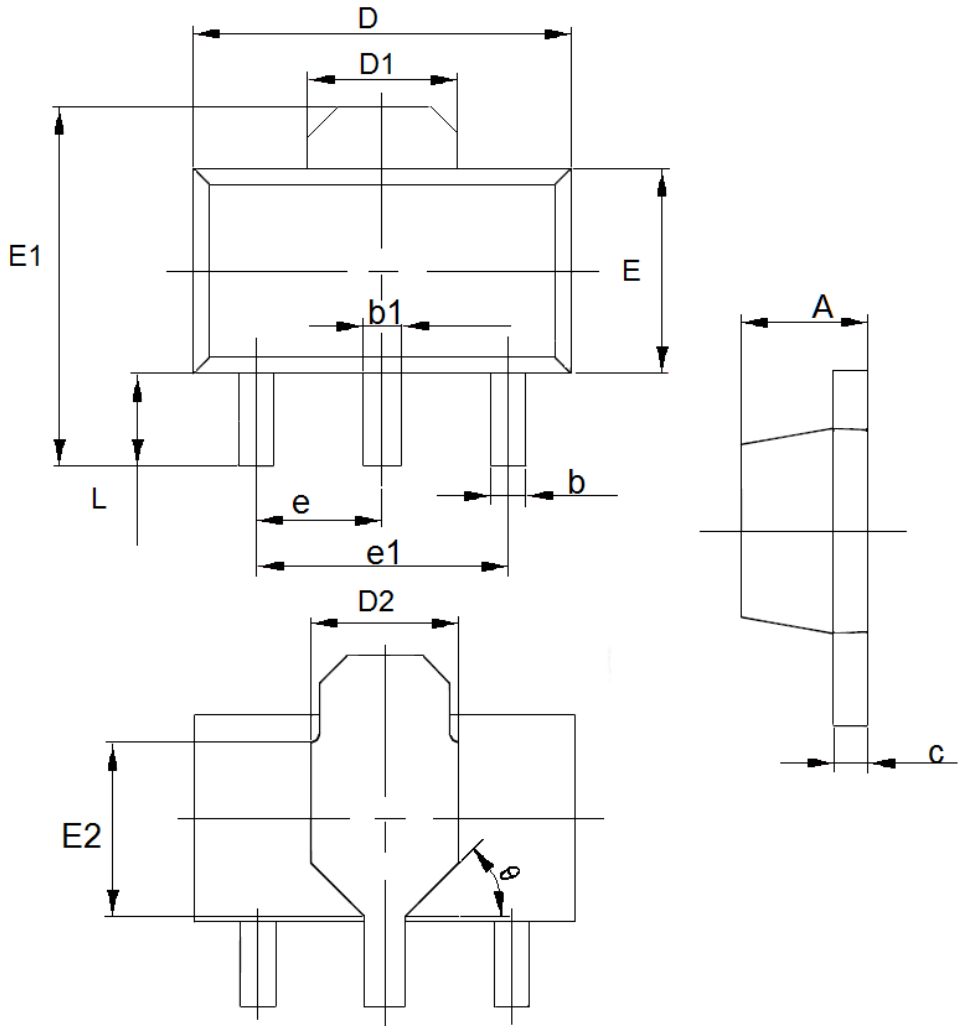
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.05	1.45	0.0413	0.0571
A1	0	0.15	0.0000	0.0059
A2	0.9	1.3	0.0354	0.0512
A3	0.6	0.7	0.0236	0.0276
b	0.25	0.5	0.0098	0.0197
c	0.1	0.25	0.0039	0.0098
D	2.8	3.1	0.1102	0.1220
E	2.6	3.1	0.1023	0.1220
E1	1.5	1.8	0.0591	0.0709
e	0.95(TYP)		0.0374(TYP)	
L	0.25	0.6	0.0098	0.0236
L1	0.59(TYP)		0.0232(TYP)	
θ	0	8°	0.0000	8°
c1	0.2(TYP)		0.0079(TYP)	

- **Package Type:SOT23-5**



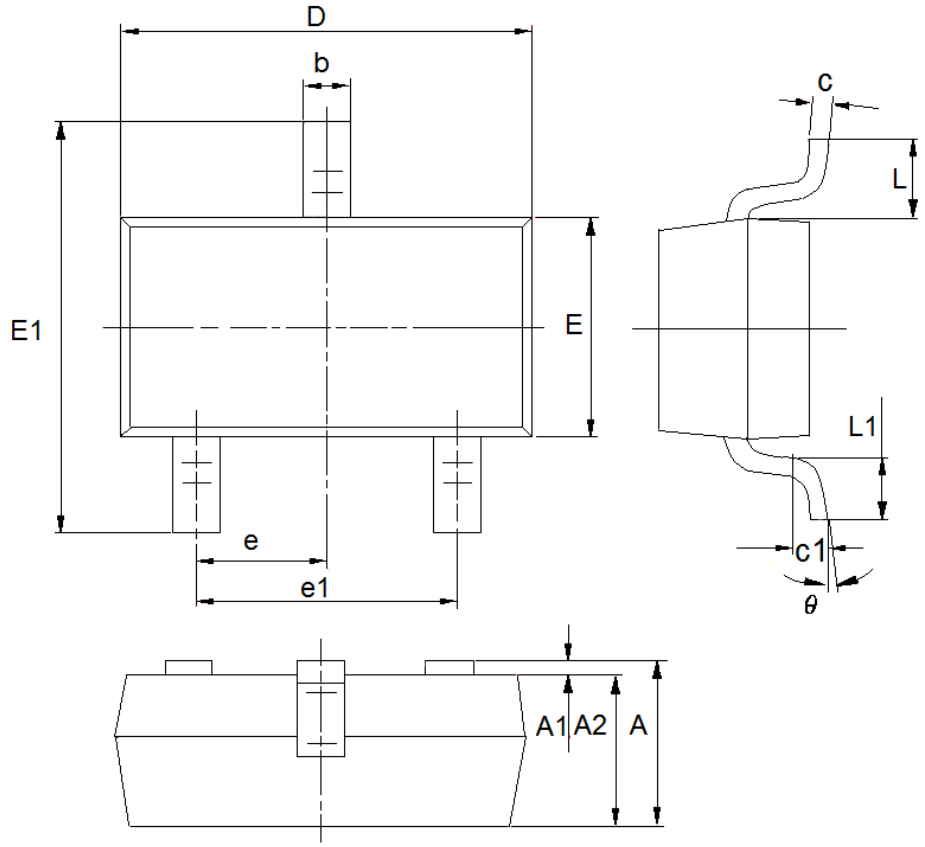
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.05	1.45	0.0413	0.0571
A1	0	0.15	0.0000	0.0059
A2	0.9	1.3	0.0354	0.0512
A3	0.6	0.7	0.0236	0.0276
b	0.25	0.5	0.0098	0.0197
c	0.1	0.23	0.0039	0.0091
D	2.82	3.05	0.1110	0.1201
e1	1.9(TYP)		0.0748(TYP)	
E	2.6	3.05	0.1024	0.1201
E1	1.5	1.75	0.0512	0.0689
e	0.95(TYP)		0.0374(TYP)	
L	0.25	0.6	0.0098	0.0236
L1	0.59(TYP)		0.0232(TYP)	
θ	0	8°	0.0000	8°
c1	0.2(TYP)		0.0079(TYP)	

- **Package Type:SOT89-3**



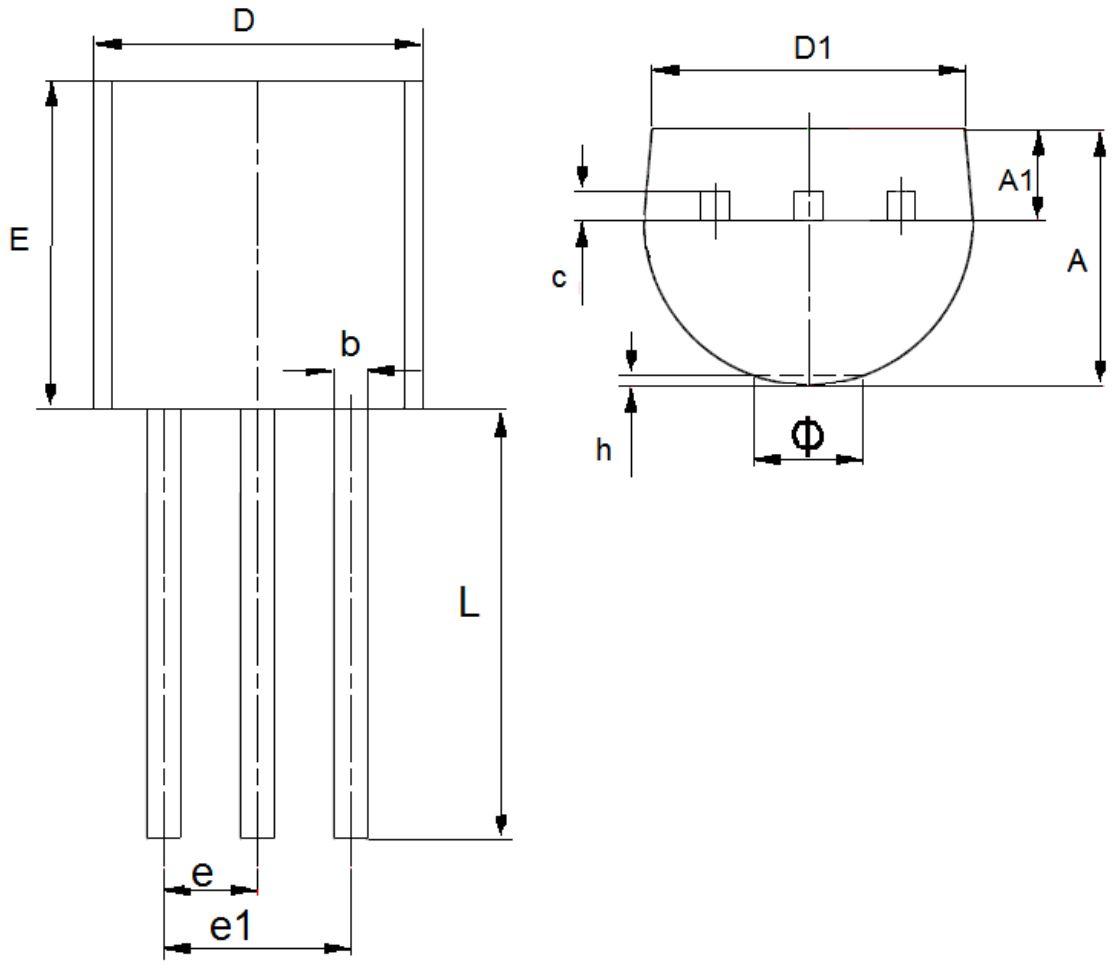
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.4	1.6	0.0551	0.0630
b	0.32	0.52	0.0126	0.0205
b1	0.4	0.58	0.0157	0.0228
c	0.35	0.45	0.0138	0.0177
D	4.4	4.6	0.1732	0.1811
D1	1.55(TYP)		0.061(TYP)	
D2	1.75(TYP)		0.0689(TYP)	
e1	3.0(TYP)		0.1181(TYP)	
E	2.3	2.6	0.0906	0.1023
E1	3.94	4.4	0.1551	0.1732
E2	1.9(TYP)		0.0748(TYP)	
e	1.5(TYP)		0.0591(TYP)	
L	0.8	1.2	0.0315	0.0472
θ	45°		45°	

- **Package Type:SOT23**



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	0.9	1.15	0.0354	0.0453
A1	0	0.14	0.0000	0.0055
A2	0.9	1.05	0.0354	0.0413
b	0.28	0.52	0.0110	0.0205
c	0.07	0.23	0.0028	0.0091
D	2.8	3.0	0.1102	0.1181
e1	1.8	2.0	0.0709	0.0787
E	1.2	1.4	0.0472	0.0551
E1	2.2	2.6	0.0866	0.1024
e	0.95(TYP)		0.0374(TYP)	
L	0.55(TYP)		0.0217(TYP)	
L1	0.25	0.55	0.0098	0.0217
θ	0	8°	0.0000	8°
c1	0.25(TYP)		0.0098(TYP)	

- **Package Type:TO-92**



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	3.3	3.7	0.1299	0.1457
A1	1.1	1.4	0.0433	0.0551
b	0.38	0.55	0.015	0.0217
c	0.36	0.51	0.0142	0.0201
D	4.3	4.7	0.1693	0.185
D1	3.43	—	0.135	—
E	4.3	4.7	0.1693	0.185
e	1.27TYP		0.05TYP	
e1	2.44	2.64	0.0961	0.1039
L	14.1	14.5	0.5551	0.5709
h	0	0.38	0	0.015
Φ	—	1.6	—	0.063

- The information described herein is subject to change without notice.
- Nanjing Micro One Electronics Inc is not responsible for any problems caused by circuits or diagrams described herein whose related industrial properties, patents, or other rights belong to third parties. The application circuit examples explain typical applications of the products, and do not guarantee the success of any specific mass-production design.
- Use of the information described herein for other purposes and/or reproduction or copying without the express permission of Nanjing Micro One Electronics Inc is strictly prohibited.
- The products described herein cannot be used as part of any device or equipment affecting the human body, such as exercise equipment, medical equipment, security systems, gas equipment, or any apparatus installed in airplanes and other vehicles, without prior written permission of Nanjing Micro One Electronics Inc.
- Although Nanjing Micro One Electronics Inc exerts the greatest possible effort to ensure high quality and reliability, the failure or malfunction of semiconductor products may occur. The user of these products should therefore give thorough consideration to safety design, including redundancy, fire-prevention measures, and malfunction prevention, to prevent any accidents, fires, or community damage that may ensue.