

# SNE2302 300mA, Low Power, Low Dropout, RF Linear Regulators

## Features

- Low Dropout Voltage
- Thermal Overload Protection
- Built-In Fold Back Protection Circuit
- 20µA Low Ground Current
- 10nA Logic-Controlled Shut down
- 1.6V to 5.5V Input Voltage Range
- Fixed Outputs 0.8V to 5.0V
- Short Auto-Discharge Function
- 300mA Output Current
- High Output Voltage Accuracy
- Quick Start-Up Time
- -40°C to +125°C Operating Temperature Range
- Available in Green UTDFN-1×1-4L and SOT-23-5 Packages

## Applications

- Cellular Telephones
- PCMCIA Cards
- Modems
- Hand-Held Instruments
- Palmtop Computers
- Portable/Battery-Powered Equipment

## General Description

The SNE2302 series low-power, low-dropout, CMOS linear voltage regulators operate from a 1.6V to 5.5V input voltage and deliver up to 300mA output current. They are the perfect choice for low voltage, low power applications. A low ground current makes this part attractive for battery operated power systems. The SNE2302 series also offer low dropout voltage to prolong battery life in portable electronics. Systems requiring a quiet voltage source, such as RF applications, will benefit from the SNE2302 series' low output noise and high PSRR.


Other features include a 10nA logic-controlled shutdown mode, short current limit and thermal shutdown protection.

The SNE2302 has auto-discharge function to quickly discharge  $V_{OUT}$  in the disable status.

The SNE2302 is available in Green UTDFN-1×1-4L SOT-23-5 and packages. It operates over an ambient temperature range of -40°C to +125°C.

## Ordering Information

Part Number	$V_{OUT}$ (V)	Accuracy	Temperature	Package	Ordering Number	Packing Option
SNE2302	XX	2.5%	-40~+125°C	SOT-23-5	SNE2302-XXHAREA1R	Tape and Reel, 3000
SNE2302	XX	2.5%	-40~+125°C	UTDFN-1×1-4L	SNE2302-XXHARHC1R	Tape and Reel, 10000

 **Note:** XX indicates 0.8V~5.0V. For example, 33 means product outputs 3.3V.

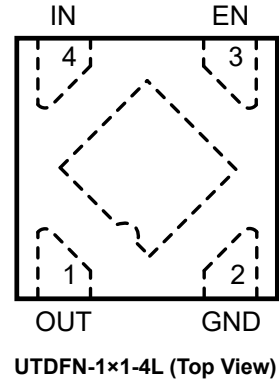
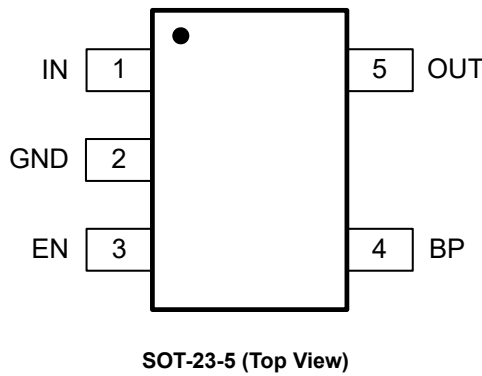
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# 1 Pin Description

## 1.1 Pin Assignment



## 1.2 Pin Definition

Pin		Name	Function
UTDFN-1x1-4L	SOT-23-5		
1	5	OUT	Regulator Output.
2	2	GND	Ground.
3	3	EN	Enable Pin. This pin has an internal pull-down resistor. A logic low reduces the supply current to less than 1 $\mu$ A. Connect to IN for normal operation.
4	1	IN	Regulator Input. Supply voltage can range from 1.6V to 5.5V. Bypass with a 1 $\mu$ F capacitor to GND.
	4	BP	Reference-Noise Bypass Pin . Bypass with a low-leakage 0.01 $\mu$ F ceramic capacitor for reduced noise at the output. The capacitor is recommended to be placed very close to the pin for high PSRR.
Exposed Pad			The exposed pad should be connected to a large ground plane to maximize thermal performance.

## 2 Specifications

### 2.1 Absolute Maximum Ratings

Parameter	Symbol	Value	Unit	
IN to GND	$V_{IN}$	-0.3 ~ 6	V	
EN to GND	$V_{EN}$	-0.3 ~ 6	V	
OUT, BP to GND	$V_{OUT}$	-0.3 ~ ( $V_{IN}+0.3$ )	V	
Power Dissipation @ $T_A = 25^\circ\text{C}$	UTDFN-1×1-4L	$P_{D, UTDFN-1\times 1-4L}$	400	mW
	SOT-23-5	$P_{D, SOT-23-5}$	390	mW
Package Thermal Resistance	UTDFN-1×1-4L	$\theta_{JA, UTDFN-1\times 1-4L}$	280	$^\circ\text{C/W}$
	SOT-23-5	$\theta_{JA, SOT-23-5}$	285	$^\circ\text{C/W}$
Operating Temperature Range	$T_A$	-40 ~ +125	$^\circ\text{C}$	
Junction Temperature	$T_J$	150	$^\circ\text{C}$	
Storage Temperature Range	$T_{STG}$	-65 ~ 150	$^\circ\text{C}$	
Lead Temperature (Soldering, 10s)	$T_{SOLDER}$	260	$^\circ\text{C}$	
ESD Susceptibility	HBM	$V_{ESD, HBM}$	4000	V
	MM	$V_{ESD, MM}$	400	V

**Note:** Stresses beyond those listed under “AbsoluteMaximum 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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**Attention:** This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SENASIC recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

SENASIC reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SENASIC sales office to get the latest datasheet.


### 2.2 Electrical Characteristics

$V_{IN} = V_{OUT(NOMINAL)} + 0.5\text{V}$  or  $2.5\text{V}$ , whichever is greater, Full =  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$ , unless otherwise noted.

Parameter	Symbol	Conditions	Temp	Min	Typ	Max	Unit
Input Voltage	$V_{IN}$		$+25^\circ\text{C}$	1.6		5.5	V
Output Voltage Accuracy		$I_{OUT} = 0.1\text{mA}$	$+25^\circ\text{C}$	-2.5		+2.5	%

Parameter	Symbol	Conditions	Temp	Min	Typ	Max	Unit	
Maximum Output Current <sup>[1]</sup>			+25°C	300			mA	
Current Limit	I <sub>LIM</sub>		+25°C	360	560		mA	
Supply Pin Current	I <sub>Q</sub>	No Load, V <sub>EN</sub> = V <sub>IN</sub>	+25°C		20	26	μA	
Dropout Voltage <sup>[2]</sup>	V <sub>DROP</sub>	I <sub>OUT</sub> =300mA	V <sub>OUT</sub> =0.8V	+25°C		940	1200	mV
			V <sub>OUT</sub> =0.9V	+25°C		840	1100	
			1.0V≤V <sub>OUT</sub> <1.1V	+25°C		780	1000	
			1.1V≤V <sub>OUT</sub> <1.2V	+25°C		680	900	
			1.2V≤V <sub>OUT</sub> <1.5V	+25°C		590	800	
			1.5V≤V <sub>OUT</sub> <1.8V	+25°C		420	550	
			1.8V≤V <sub>OUT</sub> <2.1V	+25°C		320	420	
			2.1V≤V <sub>OUT</sub> <2.5V	+25°C		260	340	
			2.5V≤V <sub>OUT</sub> <3.0V	+25°C		215	280	
			3.0V≤V <sub>OUT</sub> <3.6V	+25°C		190	250	
3.6V≤V <sub>OUT</sub> ≤5.0V	+25°C		165	210				
Line Regulation		V <sub>IN</sub> =1.6V or (V <sub>OUT</sub> +0.5V) to 5.5V, I <sub>OUT</sub> =1mA	1.8V≤V <sub>OUT</sub> ≤3.3V	+25°C		0.01	0.06	%V
			V <sub>OUT</sub> <1.8V, V <sub>OUT</sub> >3.3V	+25°C		0.01	0.1	
Load Regulation	ΔV <sub>OUT</sub>	I <sub>OUT</sub> = 0.1mA to 300mA	+25°C		12	40	mV	
Short Current Limit	I <sub>SHORT</sub>	V <sub>OUT</sub> = 0V	+25°C		200		mA	
Power Supply Rejection Ratio	PSRR	C <sub>BP</sub> =0μF, I <sub>OUT</sub> =30mA, C <sub>OUT</sub> =1μF, V <sub>IN</sub> =V <sub>OUT</sub> +1V, ΔV <sub>RIPPLE</sub> = 0.2V <sub>P-P</sub>	f = 217Hz	+25°C		80		dB
			f = 1kHz	+25°C		75		
			f = 217Hz	+25°C		82		
			f = 1kHz	+25°C		70		
Output Voltage Noise	e <sub>n</sub>	C <sub>BP</sub> =0μF, f= 10Hz to 100kHz, C <sub>OUT</sub> = 1μF, V <sub>OUT</sub> =1.8V	I <sub>OUT</sub> =0mA	+25°C		100		μV <sub>RMS</sub>
			I <sub>OUT</sub> =30mA	+25°C		200		
		C <sub>BP</sub> =0.01μF, f=10Hz to 100kHz, C <sub>OUT</sub> =1μF, V <sub>OUT</sub> =1.8V	I <sub>OUT</sub> =0mA	+25°C		30		
			I <sub>OUT</sub> =30mA	+25°C		75		
<b>SHUTDOWN</b>								
EN Input Threshold	V <sub>IH</sub>	V <sub>IN</sub> = 1.6V to 5.5V	Full	1.5			V	
	V <sub>IL</sub>		Full			0.4		
EN Input Bias Current	I <sub>BH</sub>	V <sub>EN</sub> = 5.5V	Full		0.8	2	μA	
	I <sub>BL</sub>	V <sub>EN</sub> = 0V	Full		0.01	1		
Shut down Supply Current	I <sub>Q</sub> (SHDN)	V <sub>EN</sub> = 0V	Full		0.01	1	μA	

Parameter	Symbol	Conditions	Temp	Min	Typ	Max	Unit
Start-Up Time <sup>[3]</sup>	t <sub>STR</sub>	C <sub>OUT</sub> = 1μF, No Load	+25°C		30		μs
R <sub>ON</sub> of Discharge MOSFET		V <sub>IN</sub> = 4.0V, V <sub>EN</sub> = 0V	+25°C		50		Ω
<b>THERMAL PROTECTION</b>							
Thermal Shutdown Temperature	T <sub>SHDN</sub>				140		°C
Thermal Shutdown Hysteresis	ΔT <sub>SHDN</sub>				15		°C

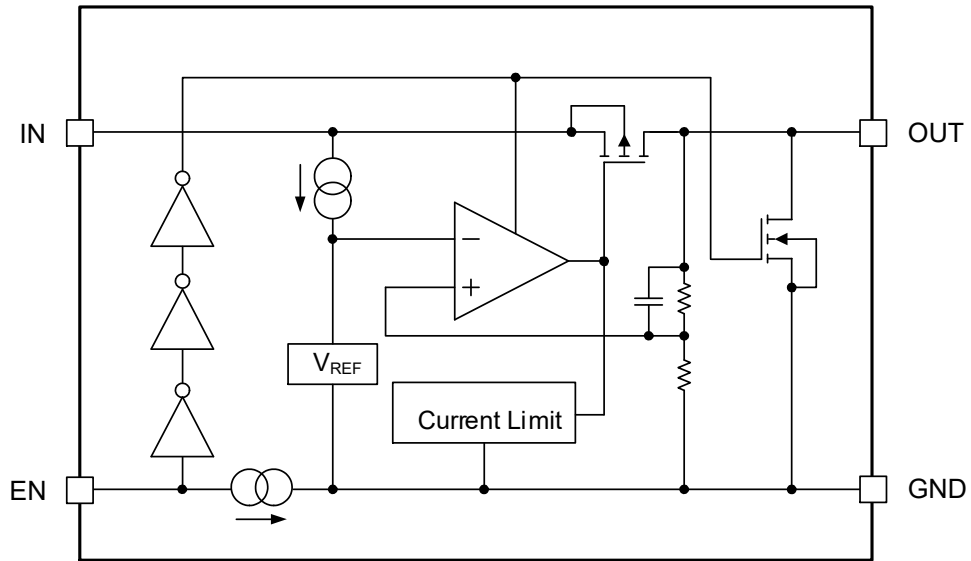
 **Note:**

[1] Maximum output current is affected by the PCB layout, size of metal trace, the thermal conduction path between metal layers, ambient temperature and the other environment factors of system. Attention should be paid to the dropout voltage when  $V_{IN} < V_{OUT} + V_{DROP}$ .

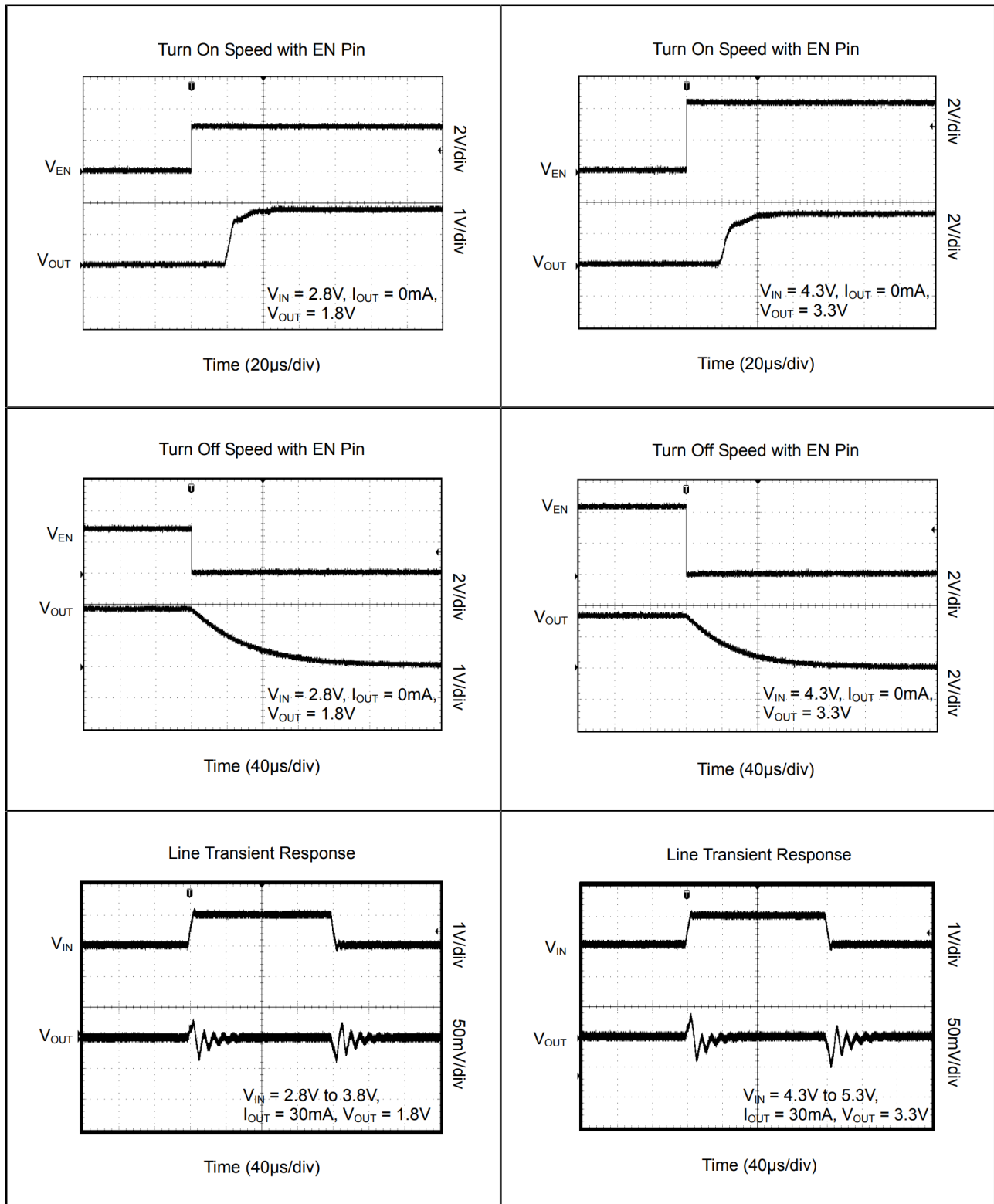
[2] The dropout voltage is defined as  $V_{IN} - V_{OUT}$ , when  $V_{OUT}$  is 100mV below the value of  $V_{OUT}$  for  $V_{IN} = V_{OUT} + 0.5V$  or 2.5V.

[3] Time needed for  $V_{OUT}$  to reach 90% of final value.

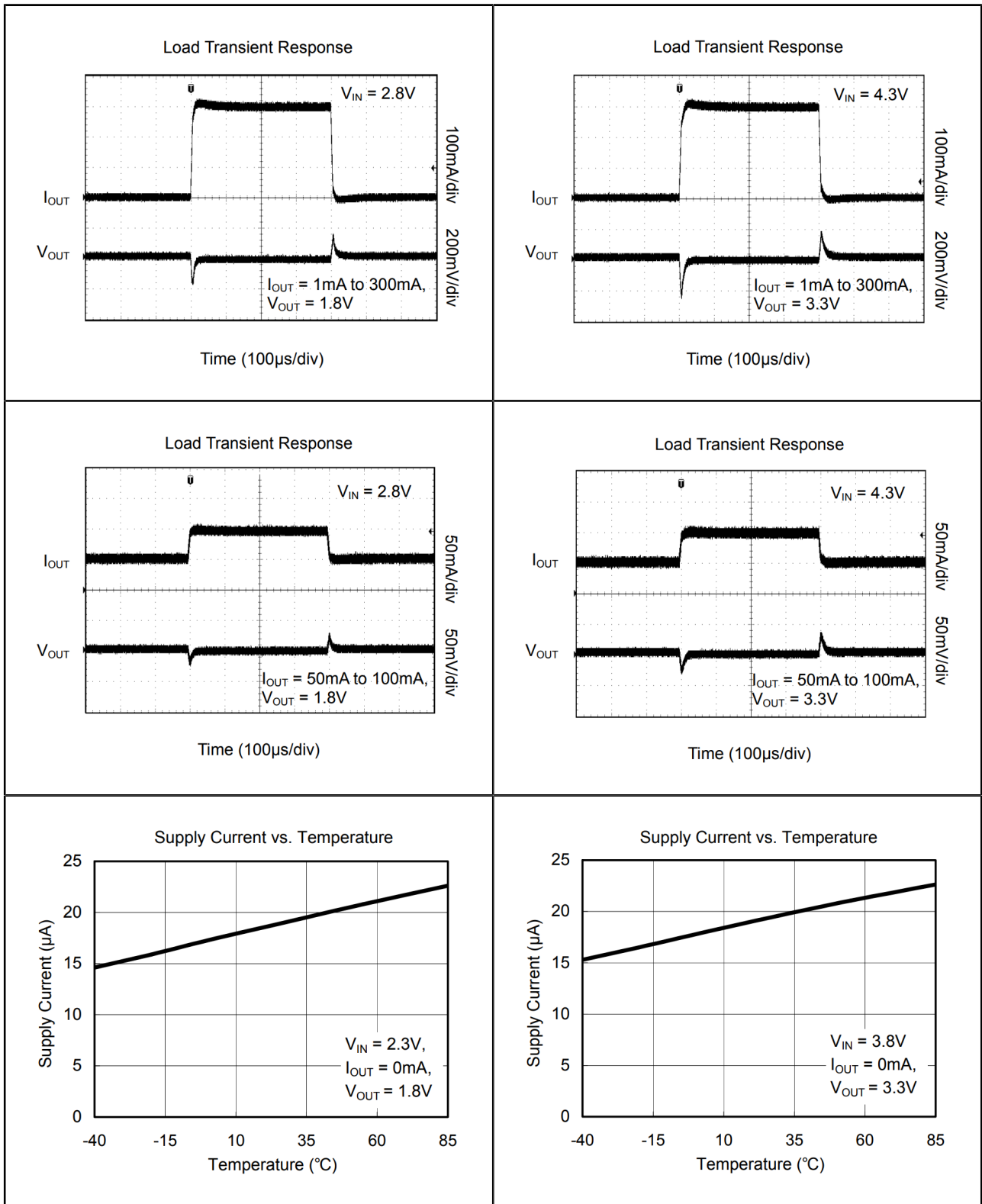
### 3 Simplified Block Diagram

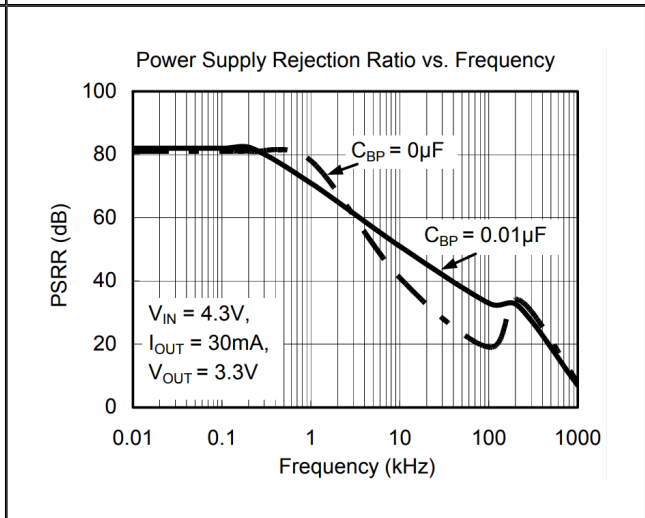
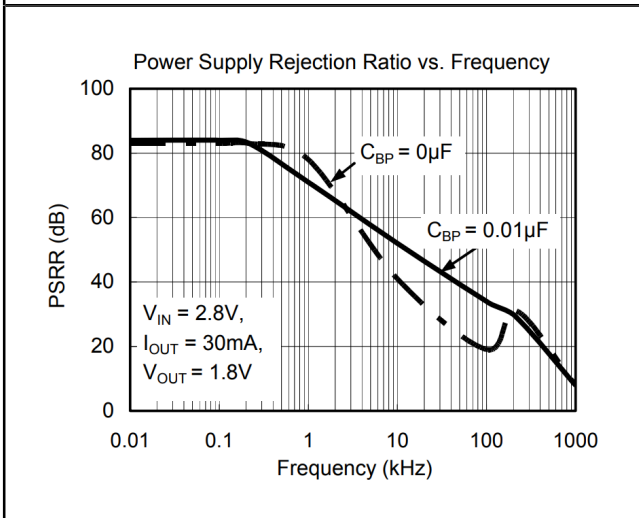
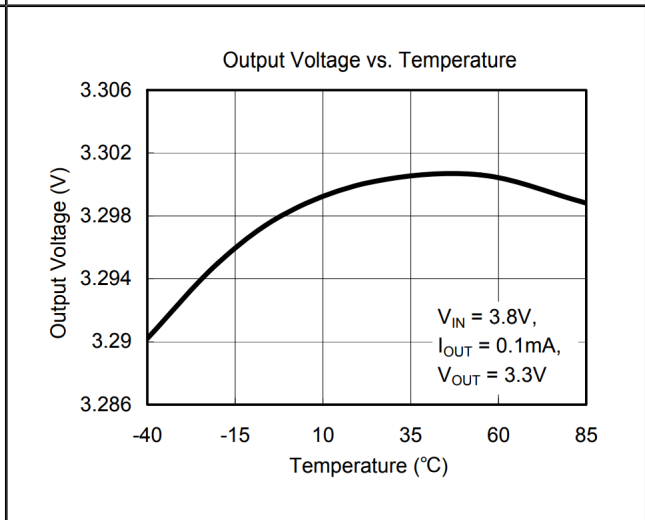
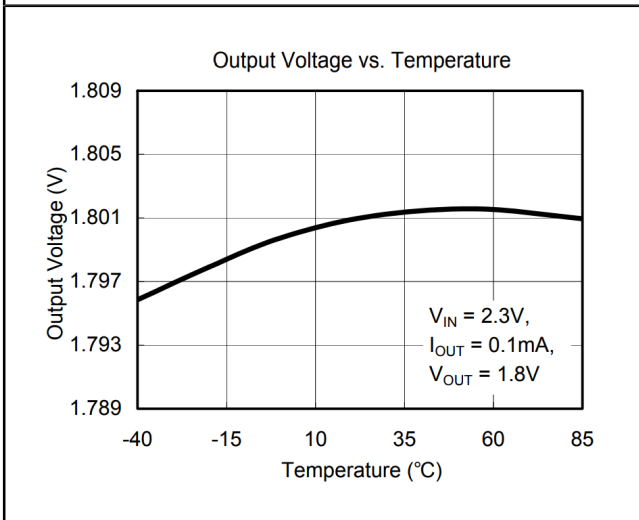
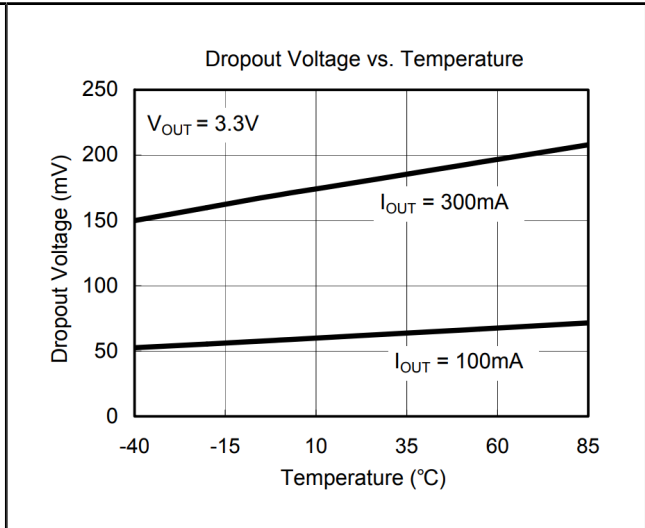
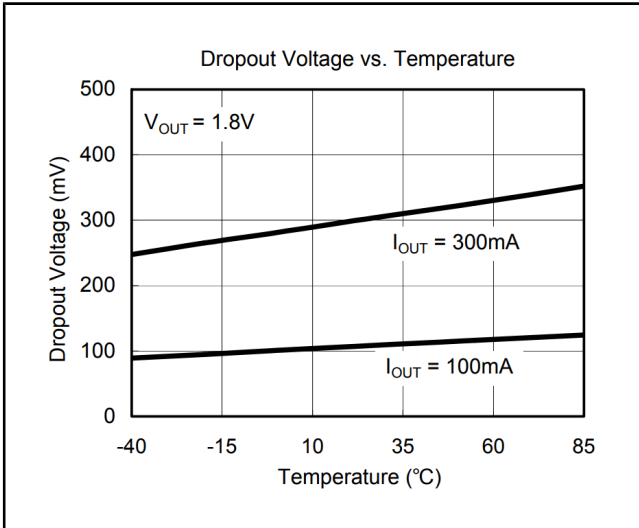


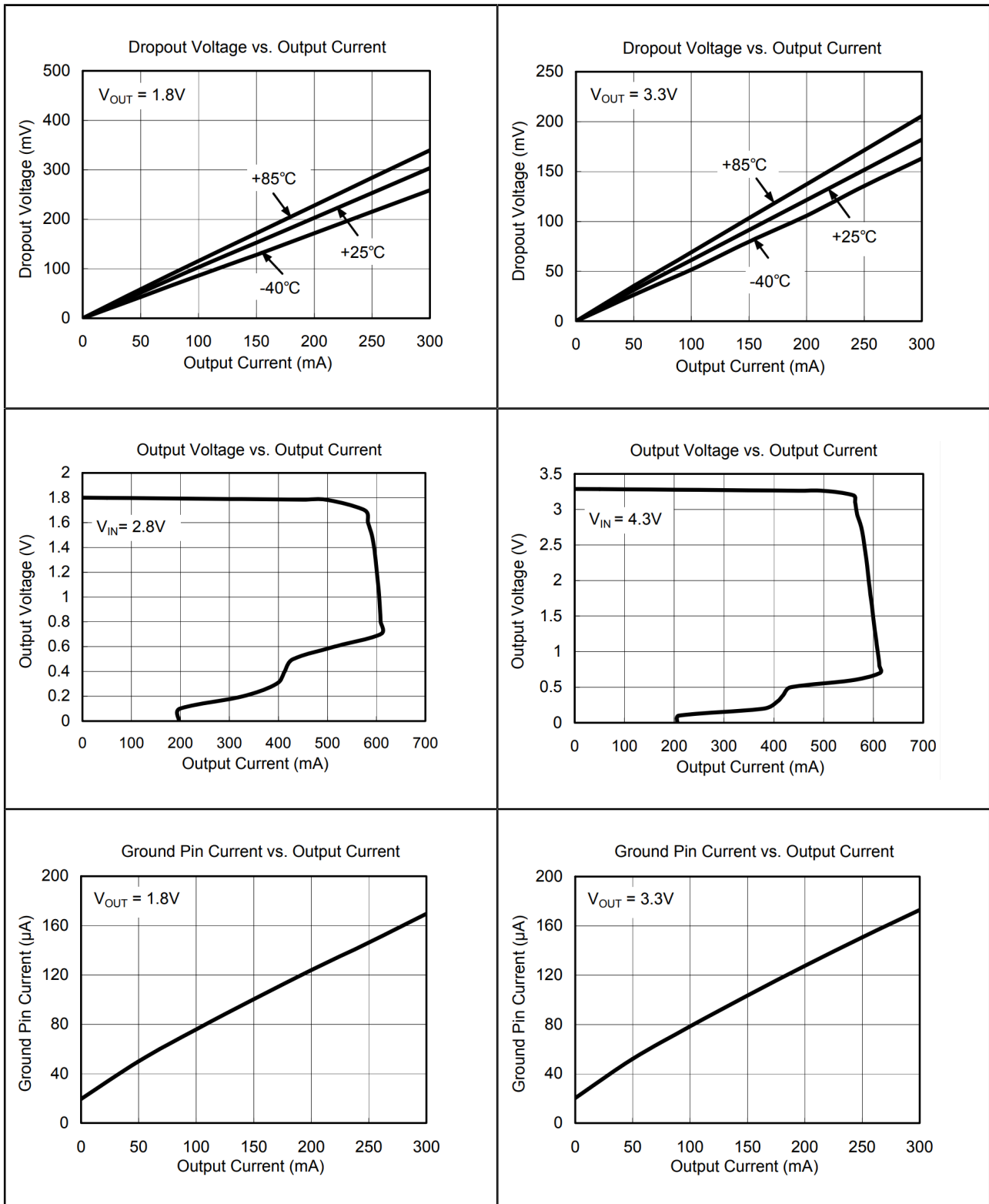
## 4 Performance Characteristics

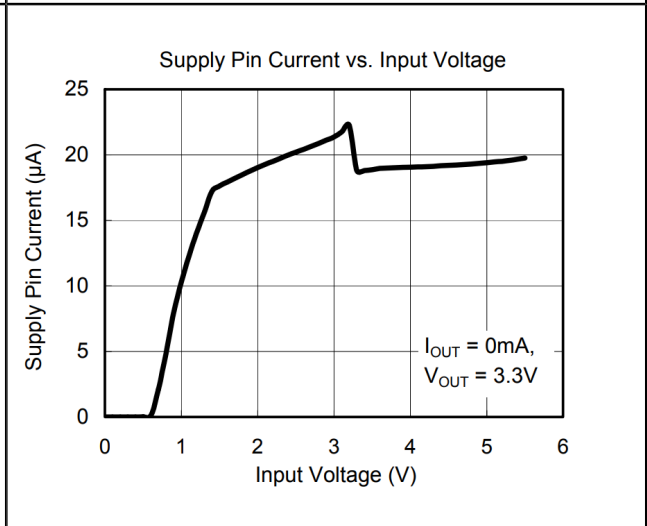
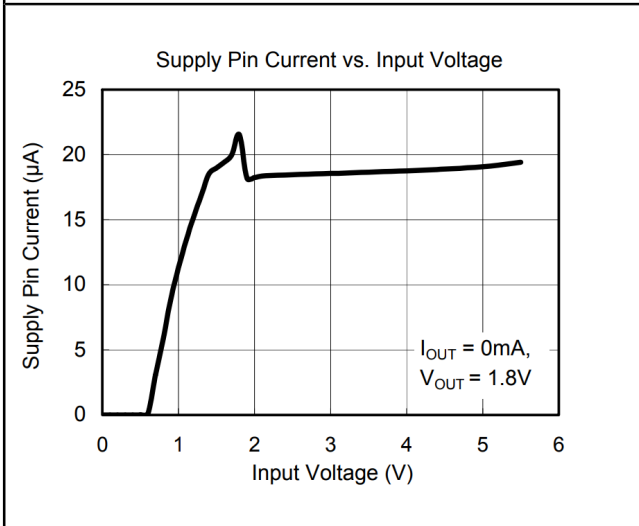
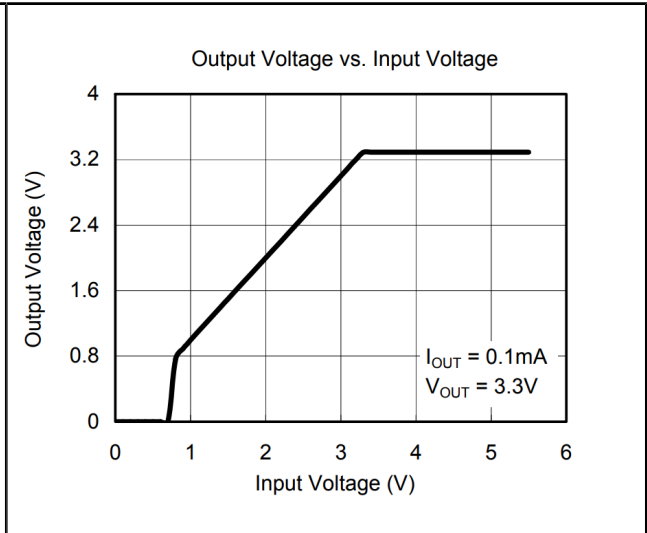
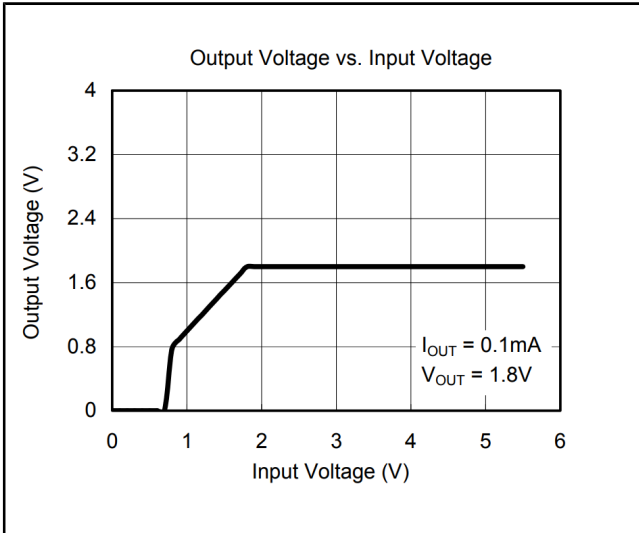












## 5 Typical Application Circuit

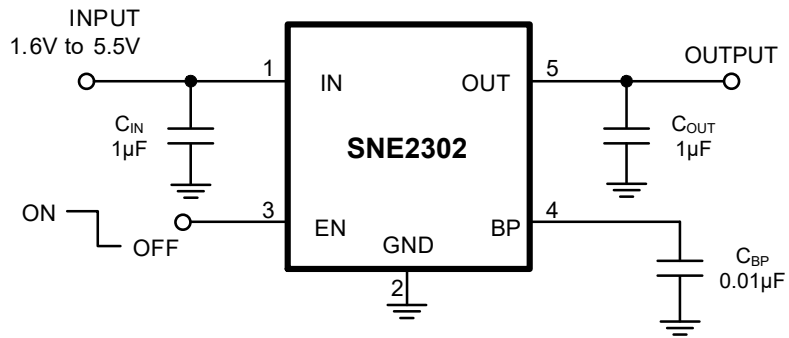


Figure 5-1 Typical Application Circuit (SOT-23-5)

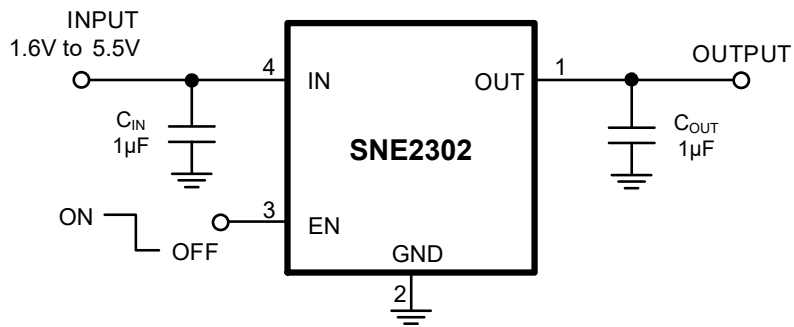


Figure 5-2 Typical Application Circuit (UTDFN-1x1-4L)

## 6 Application Note

When LDO is used in handheld products, attention must be paid to voltage spikes which could damage SNE2302. In such applications, voltage spikes will be generated at charger interface and  $V_{BUS}$  pin of USB interface when charger adapters and USB equipments are hot-plugged. Besides this, handheld products will be tested on the production line without battery. Test engineer will apply power from the connector pin which connects with positive pole of the battery. When external power supply is turned on suddenly, the voltage spikes will be generated at the battery connector. The voltage spikes will be very high, and it always exceeds the absolute maximum input voltage (6.0V) of LDO. In order to get robust design, design engineer needs to clear up this voltage spike. Zener diode is a cheap and effective solution to eliminate such voltage spike. For example, BZM55B5V6 is a 5.6V small package Zener diode which can be used to remove voltage spikes in cell phone designs. The schematic is shown below.

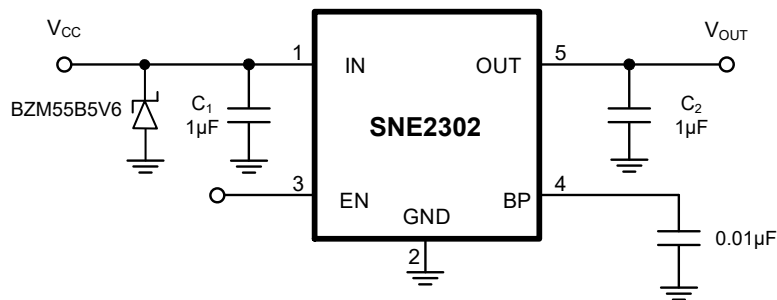


Figure 6-1 Handheld product application circuit (SOT-23-5)

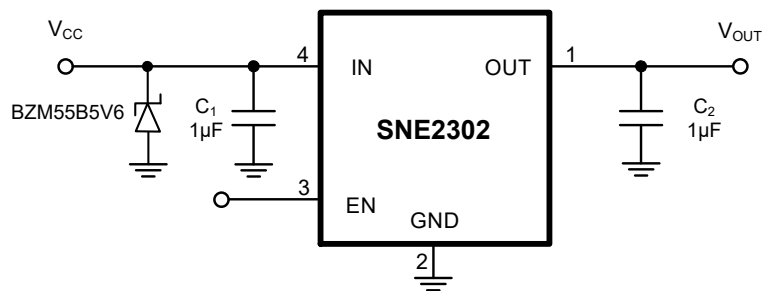
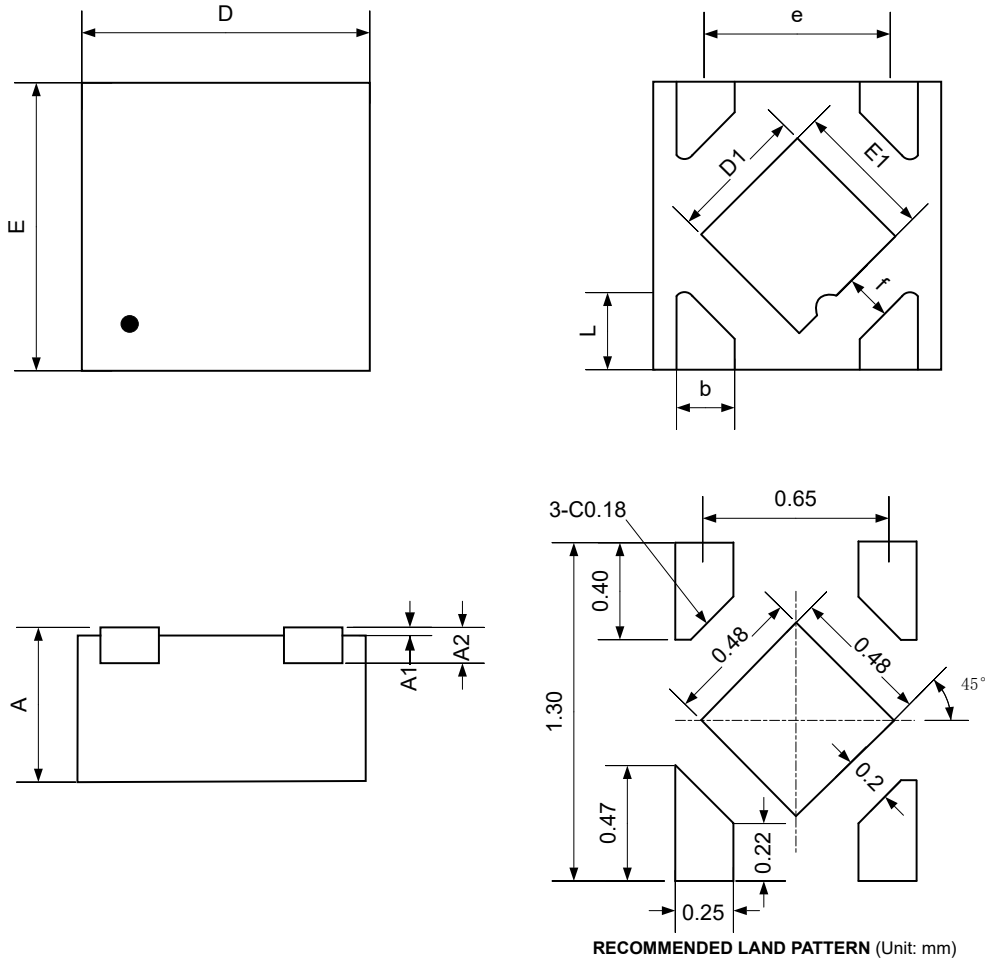


Figure 6-2 Handheld product application circuit (UTDFN-1x1-4L)

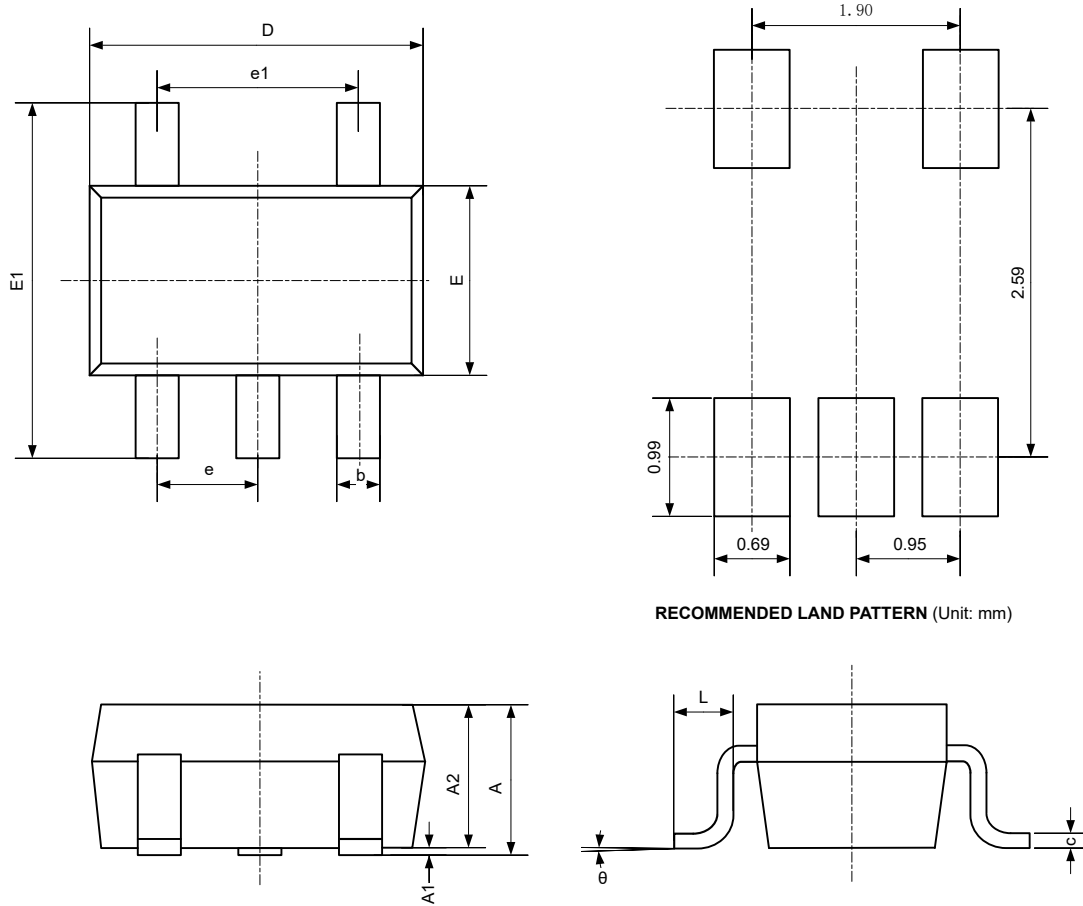
## 7 Package Outline

### 7.1 UTDFN-1x1-4L



Symbol	Dimensions in Millimeters		
	Min	Nominal	Max
A	0.500	0.550	0.600
A1	0.000		0.050
A2	0.152 REF		
D	0.950	1.000	1.050
D1	0.450	0.500	0.550
E	0.950	1.000	1.050
E1	0.450	0.500	0.550
b	0.175	0.225	0.275
e	0.625 BSC		
f	0.195 REF		
L	0.200	0.250	0.300

### 7.2 SOT-23-5



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°



## 8 Revision History

Version	Date	Description
0.1	2022/07/12	Initial release

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