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 requiringa 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 anambient temperature range of -40°C to +125°C.

Ordering Information

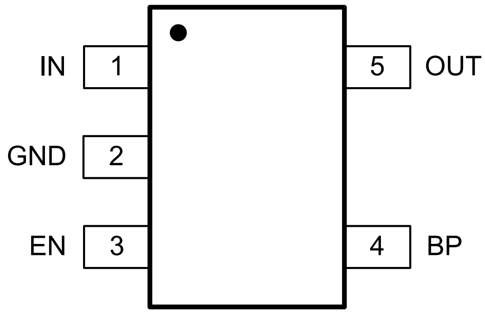
Part Number	V_{OUT} (V)	Accuracy	Temperature	Package	Ordering Number	Packing Option
SNE2302	XX	2.5%	-40~+125°C	SOT-23-5	SNE2302-XXHAREA1R	Tape and Real, 3000
SNE2302	XX	2.5%	-40~+125°C	UTDFN-1×1-4L	SNE2302-XXHARHC1R	Tape and Real, 10000

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

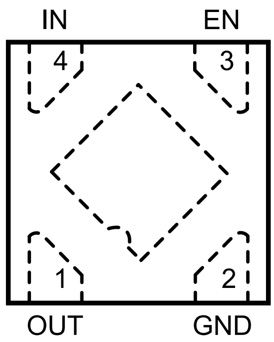
Contents

1 Pin Description

1.1 Pin Assignment



SOT-23-5 (Top View)



UTDFN-1×1-4L (Top View)

1.2 Pin Definition

Pin		Name	Function
UTDFN-1×1-4L	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 1μA. Connect to IN for normal operation.
4	1	IN	Regulator Input. Supply voltage can range from 1.6V to 5.5V. Bypass with a 1μF capacitor to GND.
	4	BP	Reference-Noise Bypass Pin . Bypass with a low-leakage 0.01μF 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°C	UTDFN-1×1-4L	$P_{D,\ UTDFN\text{-}1\times1\text{-}4L}$	400	mW
	SOT-23-5	$P_{D,\ SOT\text{-}23\text{-}5}$	390	mW
Package Thermal Resistance	UTDFN-1×1-4L	$\theta_{JA,\ UTDFN\text{-}1\times1\text{-}4L}$	280	°C/W
	SOT-23-5	$\theta_{JA,\ SOT\text{-}23\text{-}5}$	285	°C/W
Operating Temperature Range		T_A	-40 ~ +125	°C
Junction Temperature		T_J	150	°C
Storage Temperature Range		T_{STG}	-65 ~ 150	°C
Lead Temperature (Soldering, 10s)		T_{SOLDER}	260	°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 arestress ratings only, and functional operation of the device at these or any other conditions beyond those indicated inthe operational sections of the specifications is notimplied. Exposure to absolute maximum rating conditions forextended periodsmay 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 notto meet its published specifications.

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

2.2 Electrical Characteristics

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

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

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

Parameter	Symbol	Conditions	Temp	Min	Typ	Max	Unit
Start-Up Time[3]	t_{STR}	C_{OUT} = 1μF, No Load	+25°C		30		μs
R_{ON} of Discharge MOSFET		V_{IN} = 4.0V, V_{EN} = 0V	+25°C		50		Ω
THERMAL PROTECTION							
Thermal Shutdown Temperature	T_{SHDN}				140		°C
Thermal Shutdown Hysteresis	ΔT_{SHDN}				15		°C

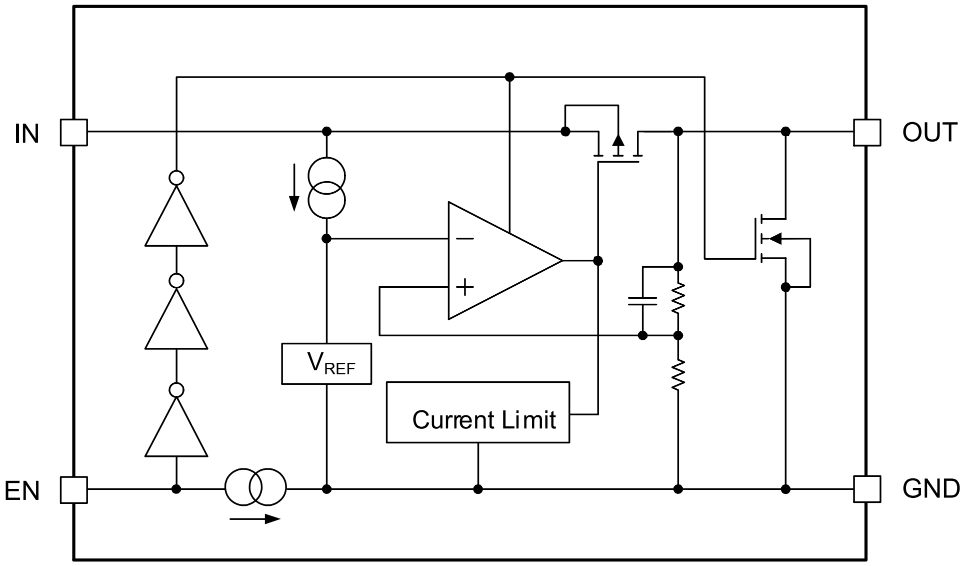
Note:

[1] Maximum output current is affected by the PCB layout, size of metal trace, the thermal conduction path between metal layers, ambient temperature andthe 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.

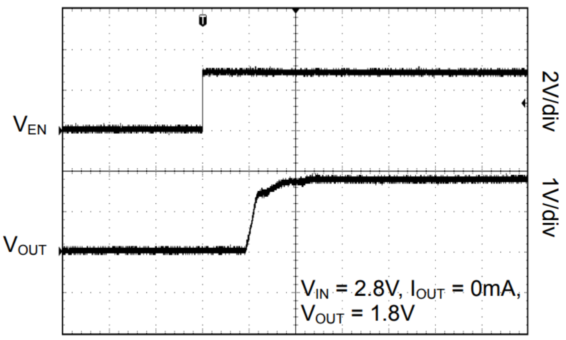
[3] Time needed for V_{OUT} to reach 90% of final value.

3 Simplified Block Diagram



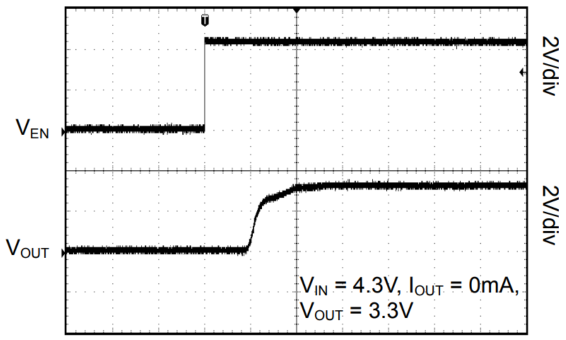
4 Performance Characteristics

Turn On Speed with EN Pin



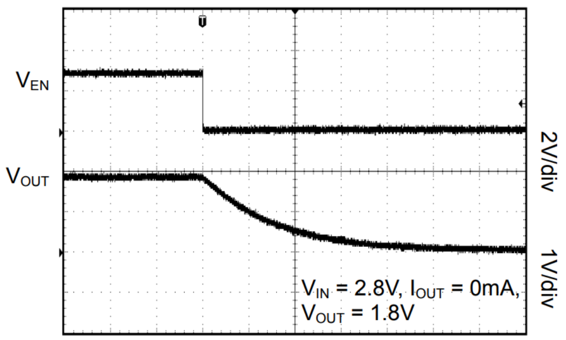
Time (20μs/div)

Turn On Speed with EN Pin



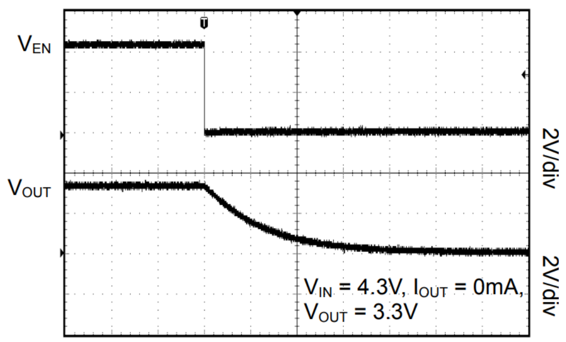
Time (20μs/div)

Turn Off Speed with EN Pin



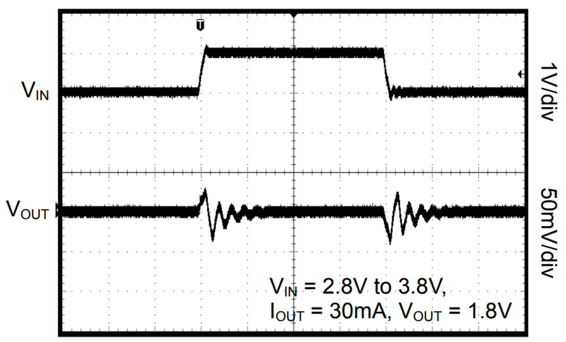
Time (40μs/div)

Turn Off Speed with EN Pin



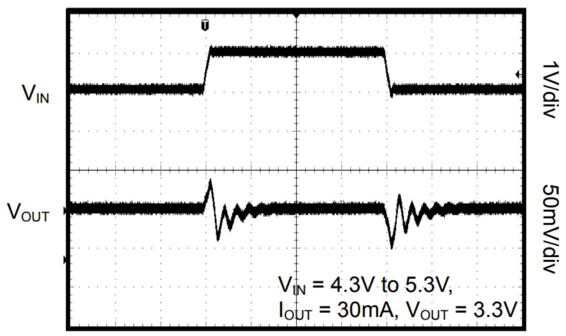
Time (40μs/div)

Line Transient Response



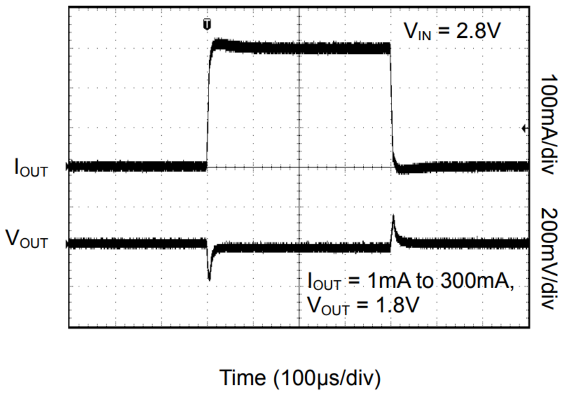
Time (40μs/div)

Line Transient Response

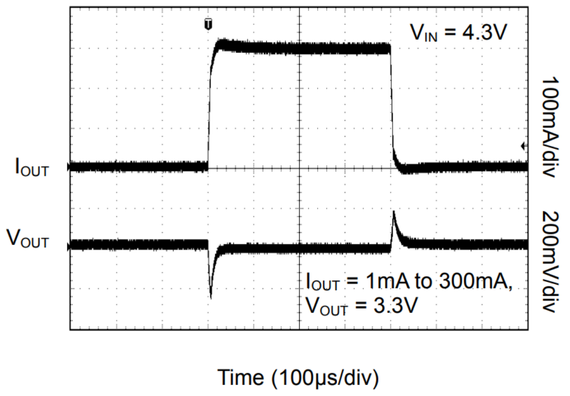


Time (40μs/div)

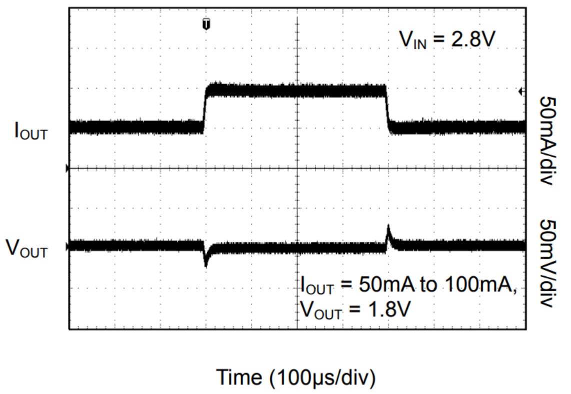
Load Transient Response



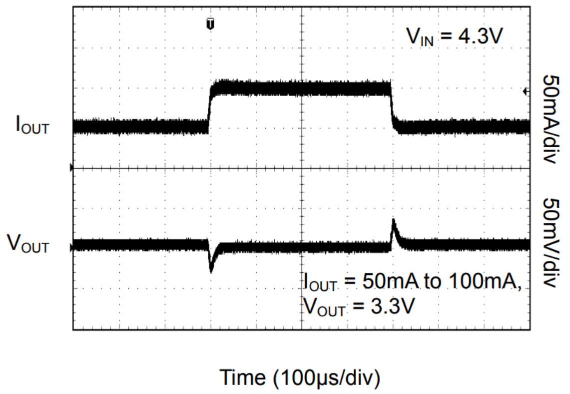
Load Transient Response



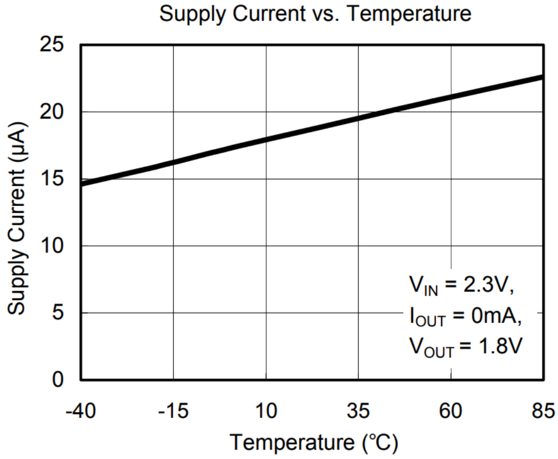
Load Transient Response



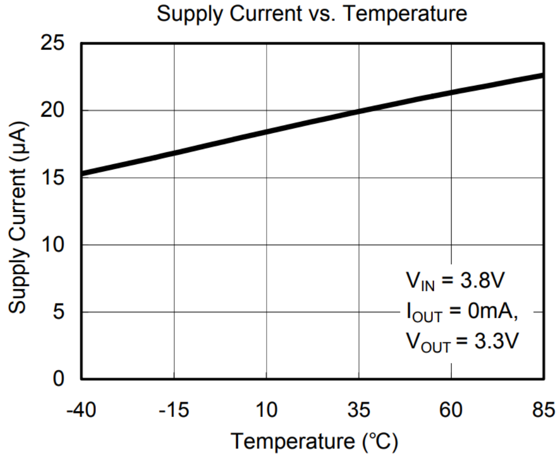
Load Transient Response

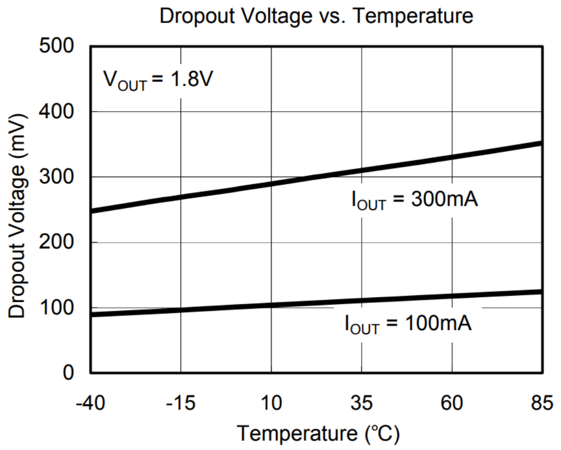


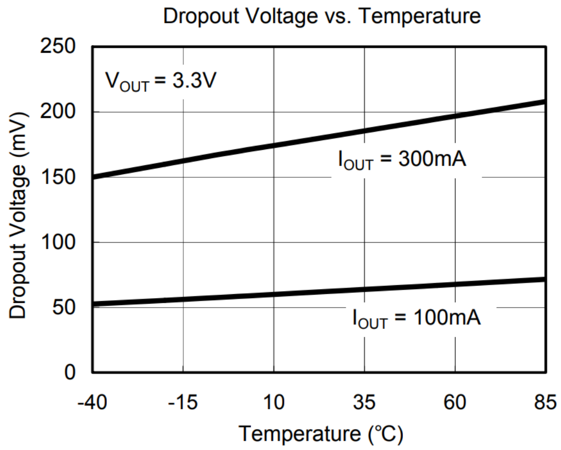
Supply Current vs. Temperature

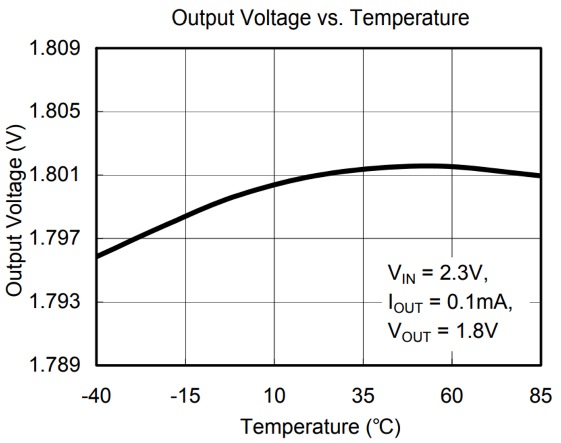


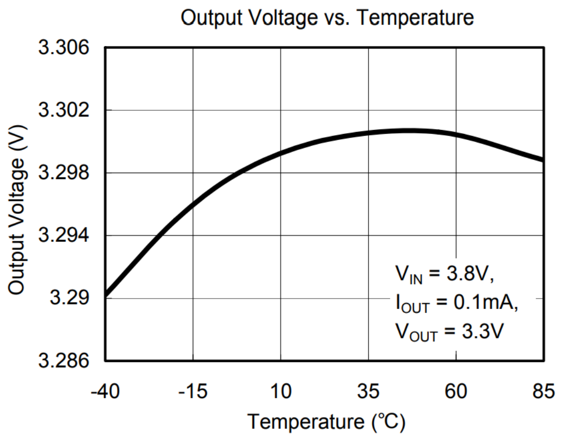
Supply Current vs. Temperature

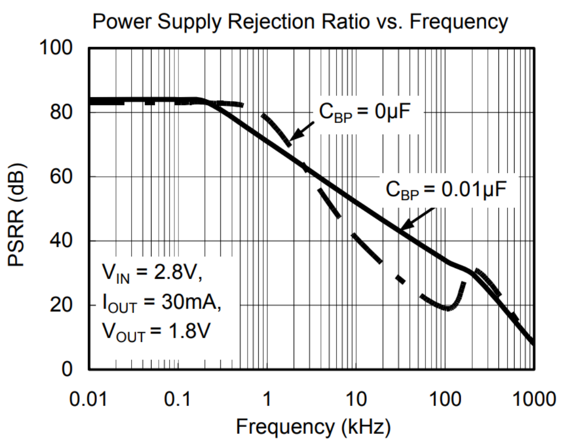


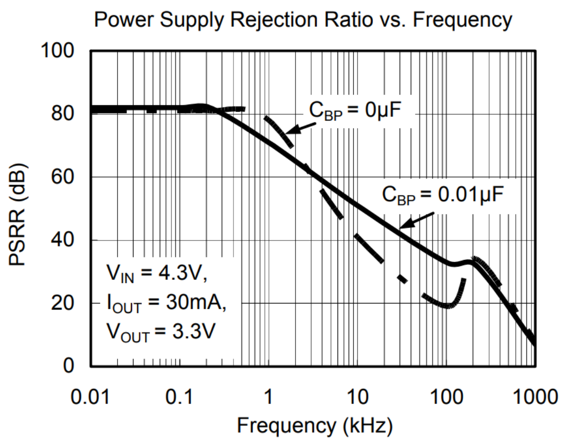

Dropout Voltage vs. Temperature
VOUT = 1.8V
IOUT = 300mA
IOUT = 100mA
Dropout Voltage (mV)
Temperature (℃)
500
400
300
200
100
0
-40
-15
10
35
60
85

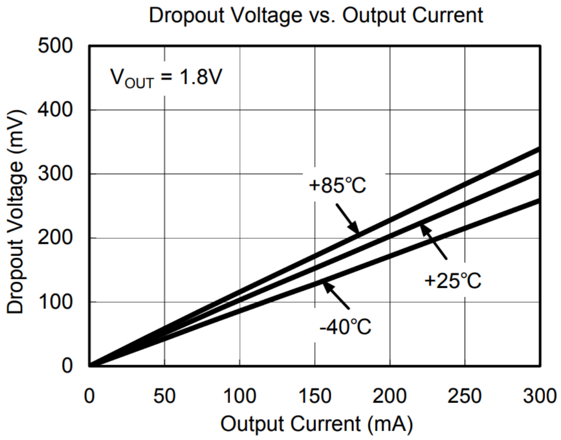

Dropout Voltage vs. Temperature
VOUT = 3.3V
IOUT = 300mA
IOUT = 100mA
Dropout Voltage (mV)
Temperature (℃)
250
200
150
100
50
0
-40
-15
10
35
60
85

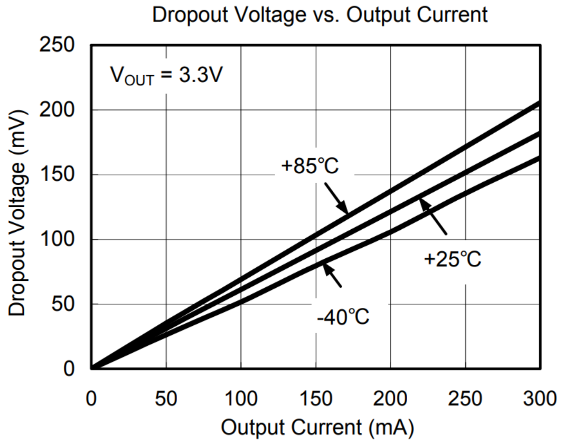

Output Voltage vs. Temperature
VIN = 2.3V,
IOUT = 0.1mA,
VOUT = 1.8V
Output Voltage (V)
Temperature (℃)
1.809
1.805
1.801
1.797
1.793
1.789
-40
-15
10
35
60
85

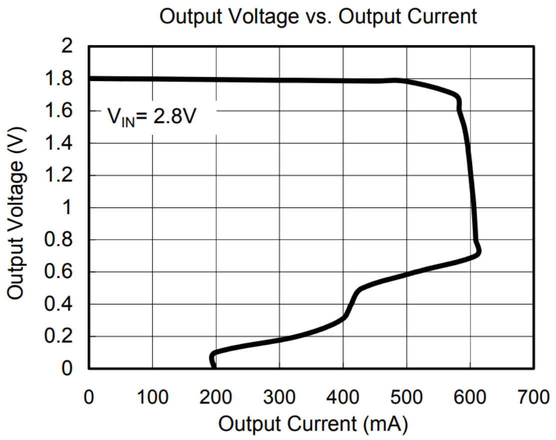

Output Voltage vs. Temperature
VIN = 3.8V,
IOUT = 0.1mA,
VOUT = 3.3V
Output Voltage (V)
Temperature (℃)
3.306
3.302
3.298
3.294
3.29
3.286
-40
-15
10
35
60
85

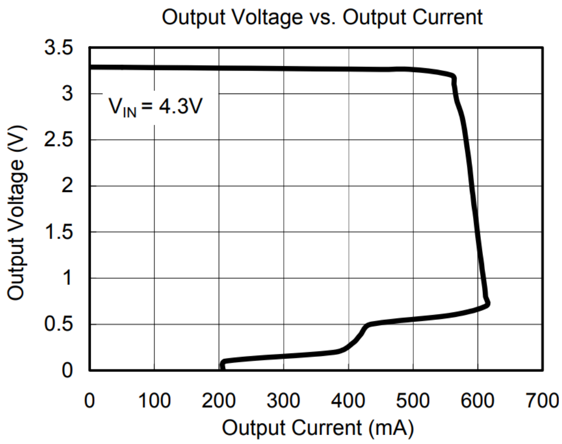

Power Supply Rejection Ratio vs. Frequency
CBP = 0μF
CBP = 0.01μF
VIN = 2.8V,
IOUT = 30mA,
VOUT = 1.8V
PSRR (dB)
Frequency (kHz)
100
80
60
40
20
0
0.01
0.1
1
10
100
1000

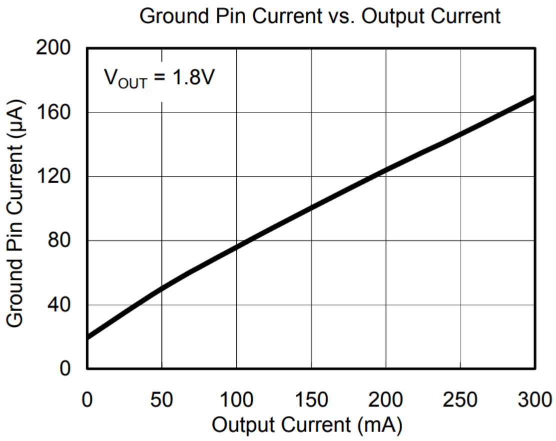

Power Supply Rejection Ratio vs. Frequency
CBP = 0μF
CBP = 0.01μF
VIN = 4.3V,
IOUT = 30mA,
VOUT = 3.3V
PSRR (dB)
Frequency (kHz)
100
80
60
40
20
0
0.01
0.1
1
10
100
1000

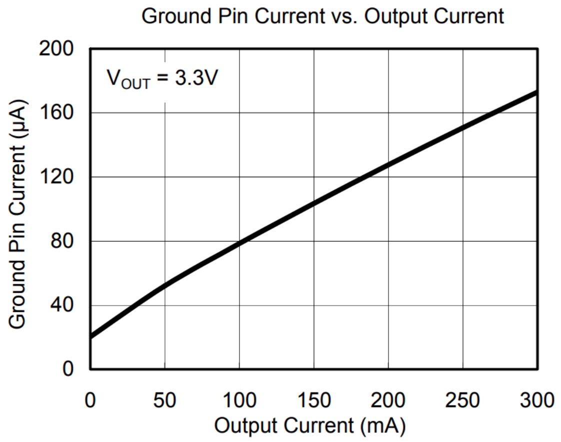

Dropout Voltage vs. Output Current
VOUT = 1.8V
Dropout Voltage (mV)
Output Current (mA)
+85°C
+25°C
-40°C
0
100
200
300
400
500
0
50
100
150
200
250
300

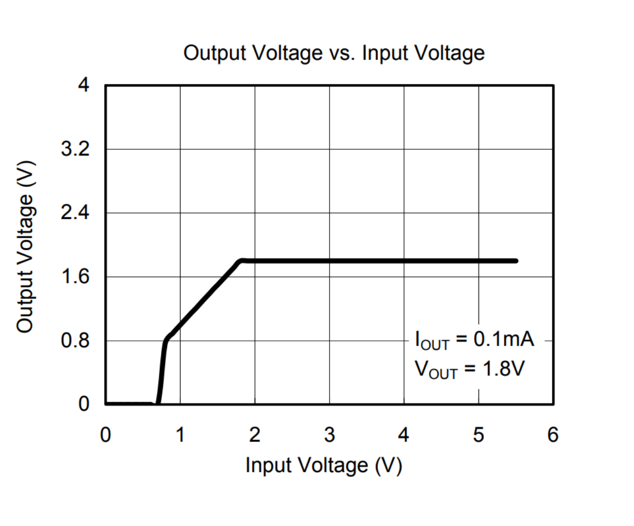

Dropout Voltage vs. Output Current
VOUT = 3.3V
Dropout Voltage (mV)
Output Current (mA)
+85°C
+25°C
-40°C
0
50
100
150
200
250
0
50
100
150
200
250
300

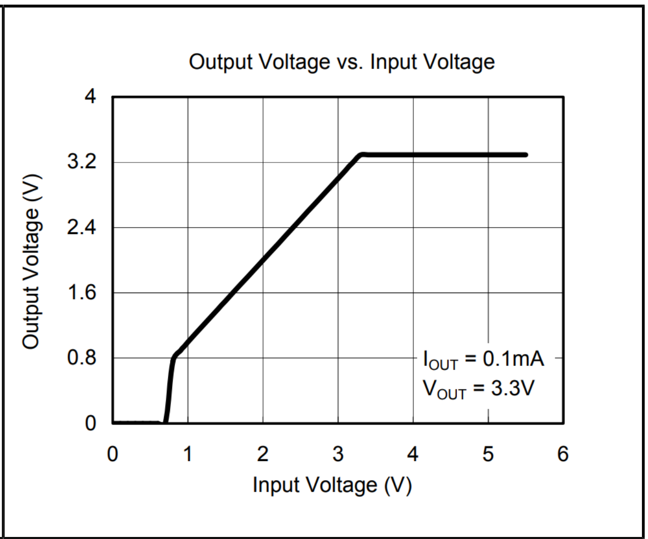

Output Voltage vs. Output Current
VIN= 2.8V
Output Voltage (V)
Output Current (mA)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0
100
200
300
400
500
600
700

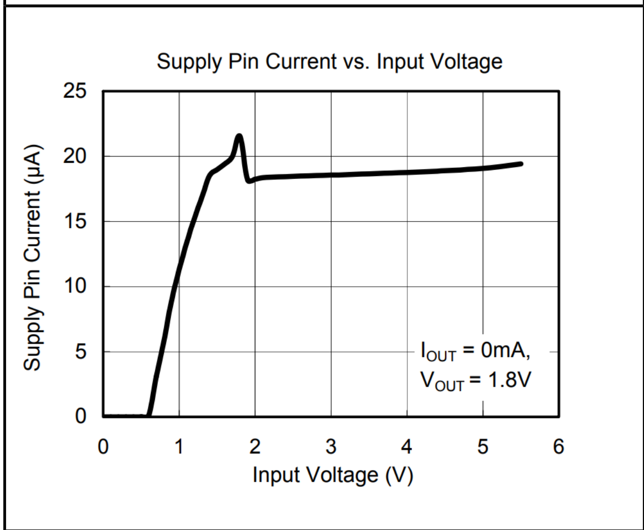

Output Voltage vs. Output Current
VIN = 4.3V
Output Voltage (V)
Output Current (mA)
0
0.5
1
1.5
2
2.5
3
3.5
0
100
200
300
400
500
600
700

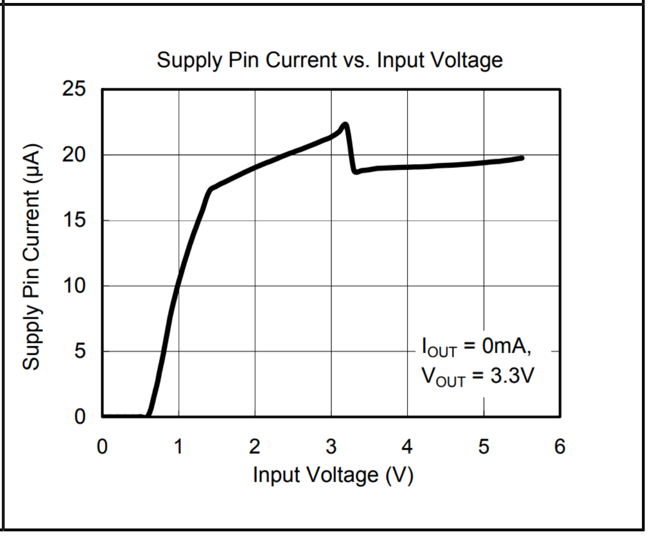

Ground Pin Current vs. Output Current
VOUT = 1.8V
Ground Pin Current (μA)
Output Current (mA)
0
40
80
120
160
200
0
50
100
150
200
250
300


Ground Pin Current vs. Output Current
VOUT = 3.3V
Ground Pin Current (μA)
Output Current (mA)
0
40
80
120
160
200
0
50
100
150
200
250
300


Output Voltage vs. Input Voltage
Output Voltage (V)
0
0.8
1.6
2.4
3.2
4
Input Voltage (V)
0
1
2
3
4
5
6
IOUT = 0.1mA
VOUT = 1.8V


Output Voltage vs. Input Voltage
Output Voltage (V)
0
0.8
1.6
2.4
3.2
4
Input Voltage (V)
0
1
2
3
4
5
6
IOUT = 0.1mA
VOUT = 3.3V


Supply Pin Current vs. Input Voltage
Supply Pin Current (µA)
0
5
10
15
20
25
Input Voltage (V)
0
1
2
3
4
5
6
IOUT = 0mA,
VOUT = 1.8V


Supply Pin Current vs. Input Voltage
Supply Pin Current (µA)
0
5
10
15
20
25
Input Voltage (V)
0
1
2
3
4
5
6
IOUT = 0mA,
VOUT = 3.3V

5 Typical Application Circuit

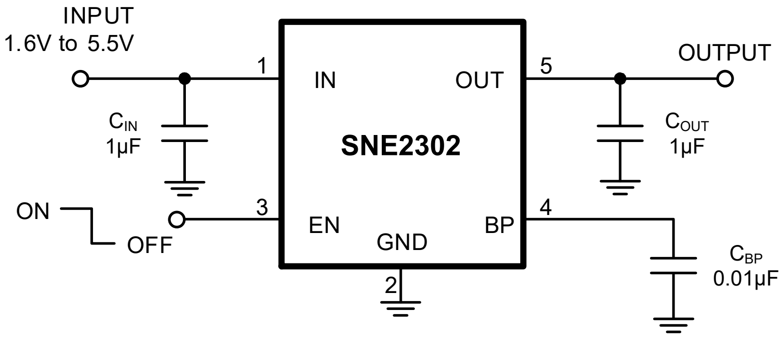


Figure 5-1 Typical Application Circuit (SOT-23-5)

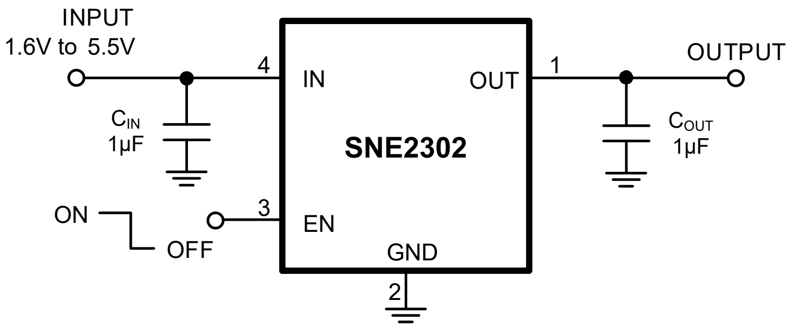


Figure 5-2 Typical Application Circuit (UTDFN-1×1-4L)

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.

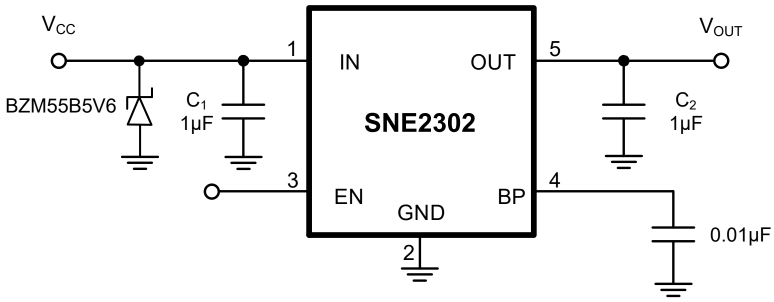


Figure 6-1 Handheld product application circuit (SOT-23-5)

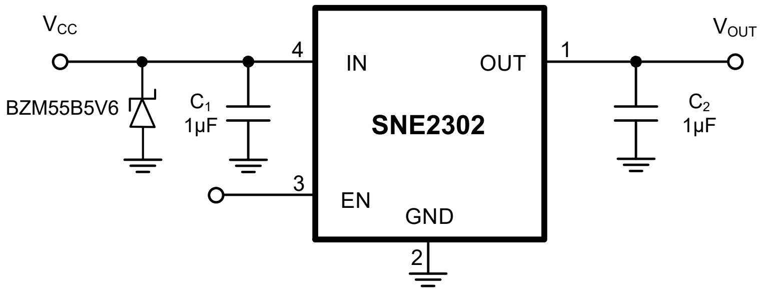
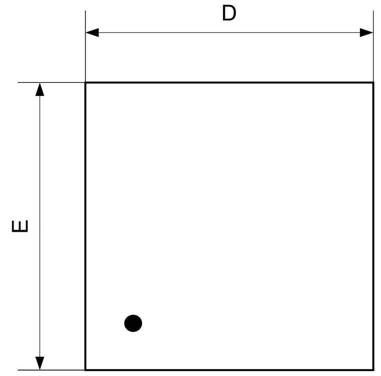
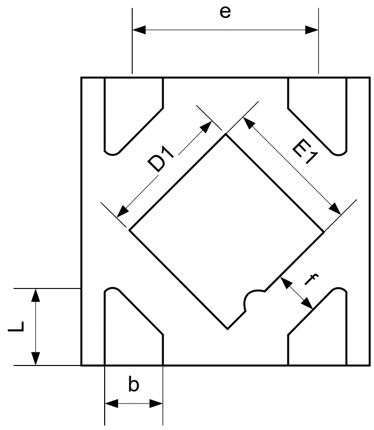


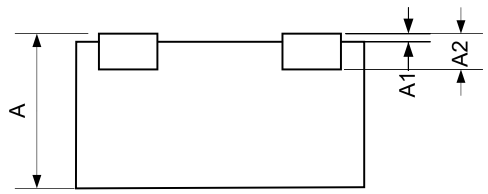
Figure 6-2 Handheld product application circuit (UTDFN-1×1-4L)

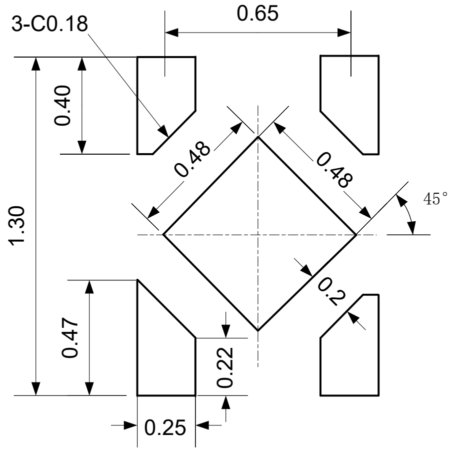
7 Package Outline

7.1 UTDFN-1x1-4L





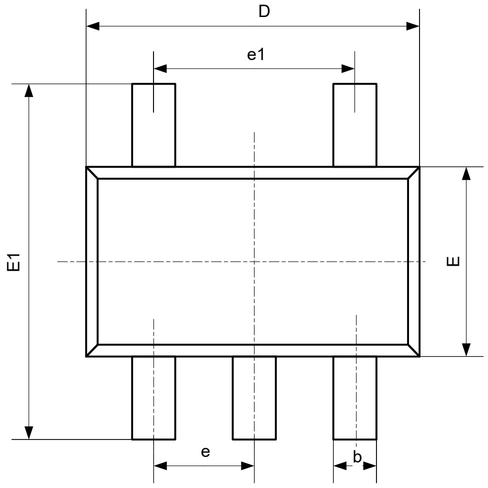


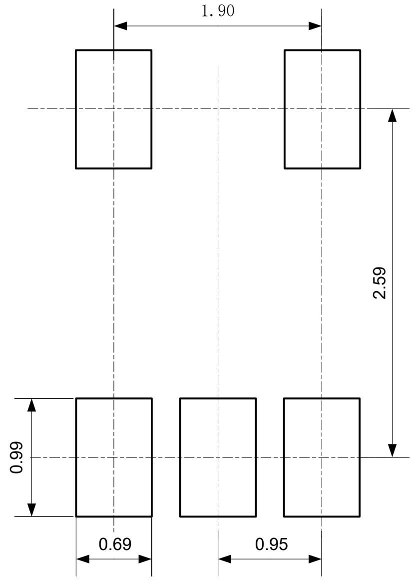


RECOMMENDED LAND PATTERN (Unit: mm)

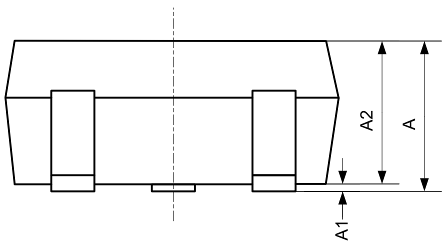
Symbol	Dimensions in Millimeters		
	Min	**Nominal**	**Max**
A	0.500	0.550	0.600
A1	0.000		0.050
A2	0.152 REF		
D	0.950	1.000	1.050
D1	0.450	0.500	0.550
E	0.950	1.000	1.050
E1	0.450	0.500	0.550
b	0.175	0.225	0.275
e	0.625 BSC		
f	0.195 REF		
L	0.200	0.250	0.300

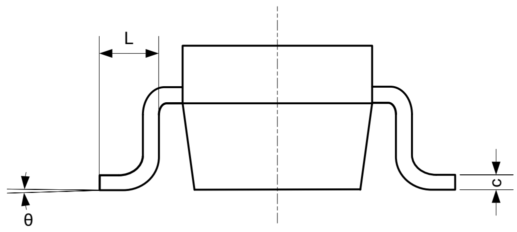
7.2 SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)





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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