

# SUL6018

## 1.3 $\mu$ A, High PSRR, 350mA Low-Dropout Linear Regulator

### FUNCTIONAL DESCRIPTION

The SUL6018 is an ultra-small, ultra-low quiescent current low-dropout linear regulator (LDO) that can source 350mA with excellent transient performance.

The SUL6018, with an ultra-low IQ of 1.3 $\mu$ A, is designed specifically for applications where very-low quiescent current is a critical parameter. This device maintains low IQ consumption even in dropout mode to further increase the battery life.

The feature of 1.3 $\mu$ A low quiescent current and 0.05 $\mu$ A shutdown current are ideal for the battery application with long service life. The other features include current limit function, over temperature protection and output discharge function.

The SUL6018 is available SOT-23-5 and DFN-1x1-4L Packages. Standard products are Pb-free and Halogen-free.

### MAIN FEATURES

- Input Voltage Range: 1.2V to 5.5V
- Ultra Low IQ: 1.3 $\mu$ A
- High PSRR = 85dB @1KHz
- Output Voltage Range:
  - Adjustable Mode: 0.8V to 4.5V
  - Fixed Mode: 0.8V~4.5V, 0.05V step.
- High Output Accuracy:  $\pm$ 1%
- Ultra Low Dropout Voltage: 150mV @ 350mA when VOUT  $\geq$  3V
- Low Noise: 30  $\mu$ Vrms
- Current Limit Protection
- Over Temperature Protection
- Output Active Discharge Function

### APPLICATIONS

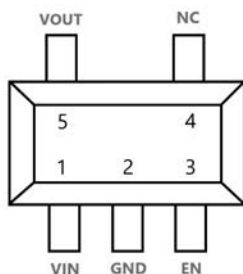
- Portable, Battery Powered Equipment
- Ultra Low Power Microcontrollers
- Notebook Computers

### ORDERING INFORMATION

PART NO	PACAKGE	TEMPERATURE	TAPE & REEL
SUL6018S5-XX <sup>Note</sup>	SOT23-5L	-40 ~ +85 $^{\circ}$ C	3000/REEL
SUL6018D4-XX <sup>Note</sup>	DFN1x1-4L	-40 ~ +85 $^{\circ}$ C	10000/REEL

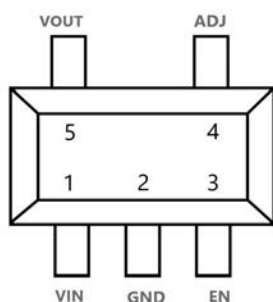
**Note:**XX indicates Vout. For example, 28 means product outputs 2.8V

## PACKAGE INFORMATION & PIN DESCRIPTION



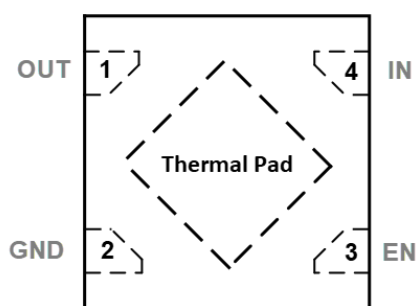
**SOT-23-5 Pin Configuration (Fixed Mode)**

PIN No	Symbol	Pin Description
1	VIN	Input Pin
2	GND	Ground Pin
3	EN	Chip Enable Pin
4	NC	No Connection
5	VOUT	Output Pin



**SOT-23-5 Pin Configuration (ADJ Mode)**

PIN No	Symbol	Pin Description
1	VIN	Input Pin
2	GND	Ground Pin
3	EN	Chip Enable Pin
4	ADJ	No Connection
5	VOUT	Output Pin



**DFN1x1-4L Pin Configuration**

PIN No	Symbol	Pin Description
1	VOUT	Output Pin
2	GND	Ground Pin
3	EN	Chip Enable Pin
4	VIN	Input Pin

## ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating		Unit
V <sub>IN</sub>	Input Voltage	6.0		V
V <sub>CE</sub>	Input Voltage (CE Pin)	-0.3 to 6.0		V
V <sub>OUT</sub>	Output Voltage	-0.3 to 6.0		V
P <sub>D</sub>	Power Dissipation (Standard Land Pattern)	SOT23-5	400	mW
T <sub>OP</sub>	Junction Temperature Range	-40 to 125		°C
T <sub>STG</sub>	Storage Temperature Range	-55 to 125		°C

## RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Rating	Unit
V <sub>IN</sub>	Input Voltage	1.2 to 5.5	V
V <sub>OUT</sub>	Output Voltage	0.8 to 4.5	V
T <sub>a</sub>	Operating Temperature Range	-40 to 85	°C
C <sub>IN</sub> /C <sub>OUT</sub>	Input/Output Capacitance	1/1	uF

## ELECTROSTATIC DISCHARGE

Symbol	Parameter	Value	Unit
ESD	Human Body Mode	± 2	kV
	Machine Mode	± 250	V
	Charge Device Mode	± 1000	V

## THERMAL DATA

Symbol	Parameter	Value	Unit
θ <sub>JA</sub>	Thermal resistance junction-ambient	260 (SOT23-5)	°C/W
θ <sub>JA</sub>	Thermal resistance junction-ambient	250 (DFN1x1-4)	°C/W

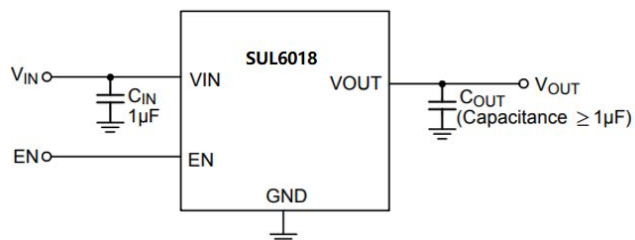
## Electrical Characteristics

( $V_{OUT} + 1 < V_{IN} < 5.5V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified)

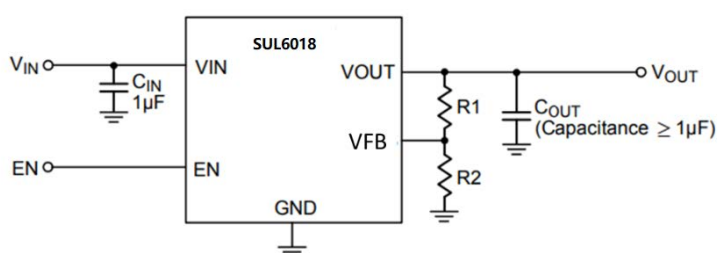
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	
Fixed Output Voltage Range	$V_{OUT}$		0.8	--	4.5	V	
DC Output Accuracy	$V_{OUT\_ACC}$	$I_{LOAD} = 1mA$	$V_{OUT} \geq 1.8V$	-1	--	1	%
			$V_{OUT} < 1.8V$	-1.5	--	1.5	%
Reference Voltage	$V_{REF}$	$I_{LOAD} = 1mA$	0.792	0.8	0.808	V	
Dropout Voltage ( $I_{LOAD} = 350mA$ )	$V_{DROP}$	$0.8V \leq V_{OUT} < 1.05V$	--	0.58	0.75	V	
		$1.05V \leq V_{OUT} < 1.2V$	--	0.4	0.56		
		$1.2V \leq V_{OUT} < 1.5V$	--	0.33	0.45		
		$1.5V \leq V_{OUT} < 1.8V$	--	0.24	0.35		
		$1.8V \leq V_{OUT} < 2.1V$	--	0.2	0.3		
		$2.1V \leq V_{OUT} < 2.5V$	--	0.17	0.25		
		$2.5V \leq V_{OUT} < 3V$	--	0.16	0.23		
		$3V \leq V_{OUT}$	--	0.15	0.2		
Current Limit	$I_{LIM}$	$V_{OUT} = 90\%$ of $V_{OUT(NOM)}$	450			mA	
Short Circuit Current	$I_{SC}$	$V_{OUT} = 0V$		45		mA	
Quiescent Current	$I_Q$	$I_{LOAD} = 0mA$ , $V_{OUT} \leq 4.5V$ $V_{IN} \geq V_{OUT} + V_{DROP}$	--	1.3	2.5	$\mu A$	
Shutdown Current	$I_{SHDN}$	$V_{EN} = 0V$ , $V_{IN} = 5V$	--	0.08	0.5	$\mu A$	
EN Threshold Voltage	H-Level	$V_{ENH}$	$V_{IN} = 5V$	0.9		V	
	L-Level	$V_{ENL}$	$V_{IN} = 5V$			0.4 V	
EN Input Current	$I_{EN}$	$V_{EN} = 5.5V$	--	0.1	0.5	$\mu A$	
Line Regulation	$\Delta LINE$	$I_{LOAD} = 1mA$	--	0.02	0.5	%	
Load Regulation	$\Delta LOAD$	$I_{LOAD} = 1mA$ to 350mA	--	20	50	mV	
Power Supply Ripple Rejection	PSRR	$V_{IN}=3V$ , $I_{LOAD} = 60mA$ , $V_{OUT} = 1.8V$ $C_{OUT} = 1\mu F$ , $f=1kHz$	--	85	--	dB	
Output Voltage Noise	eN	$V_{IN}=2.8V$ , $I_{LOAD} = 30mA$ , $V_{OUT} = 1.8V$ BW= 10Hz to 100 kHz		30		$\mu V_{rms}$	
Thermal Shutdown Temperature	$T_{SD}$	$I_{LOAD} = 5mA$ , $V_{IN} \geq 1.5V$	--	160	--	$^{\circ}C$	
Thermal Shutdown Hysteresis	$\Delta T_{SD}$		--	30	--	$^{\circ}C$	
Discharge Resistance	$R_{Dis}$	$EN = 0V$ , $V_{OUT} = 0.1V$	--	10	--	$\Omega$	

## Typical Application Circuit

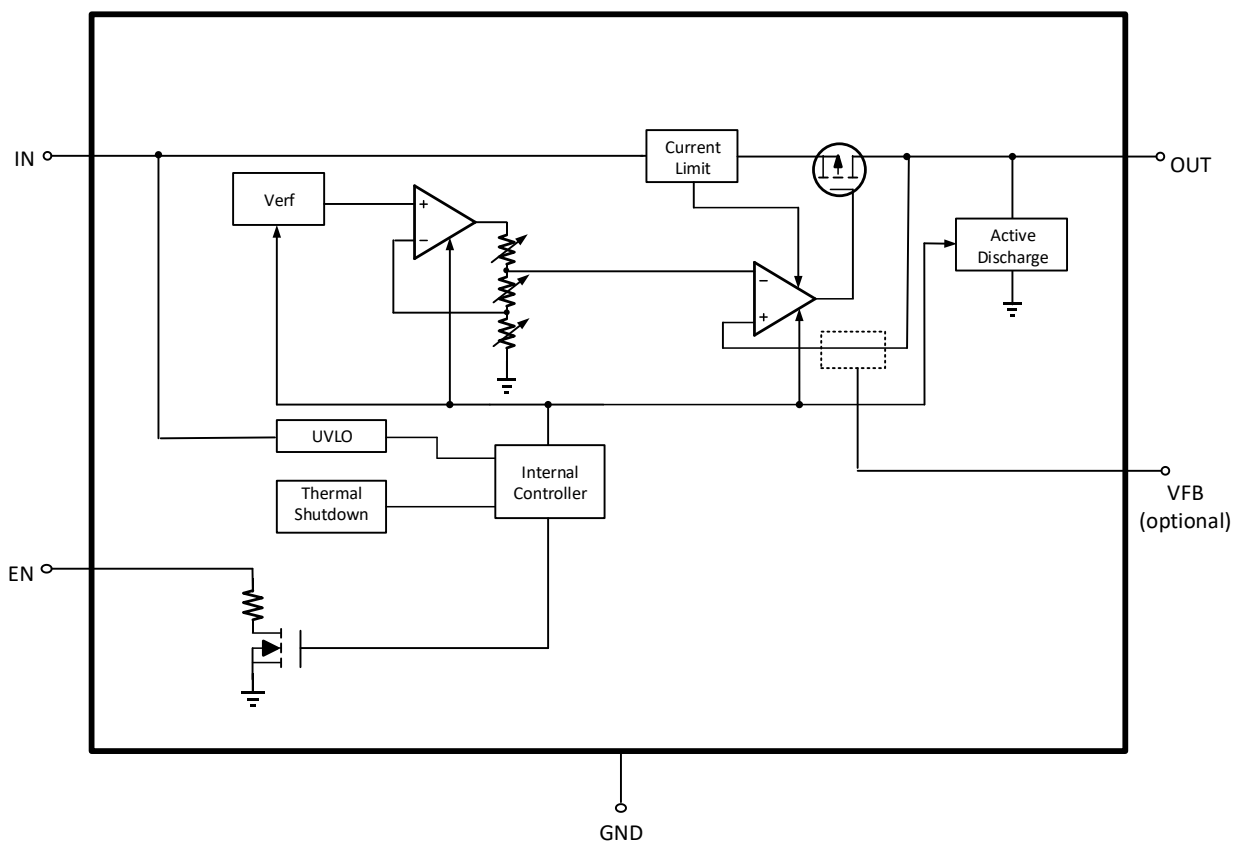
### Fixed Mode



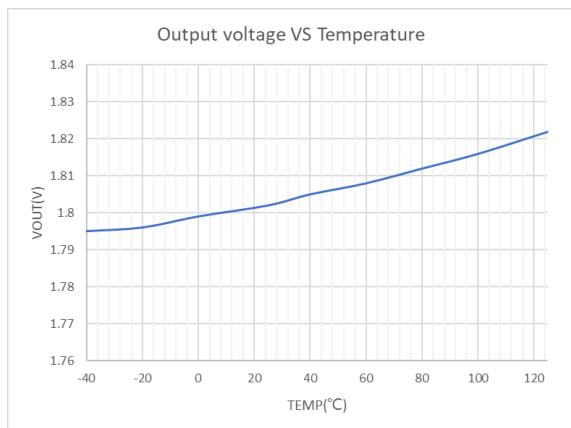
### ADJ Mode



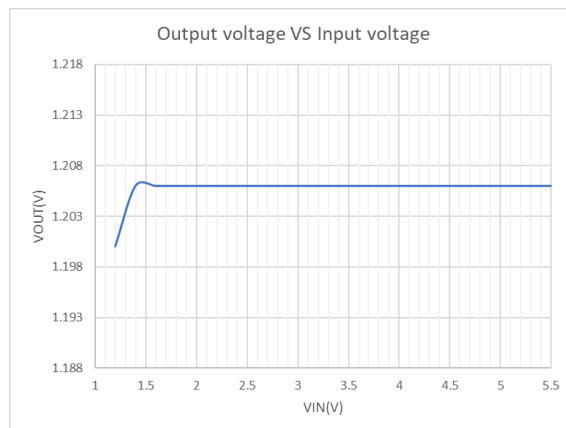
## Functional Block Diagram



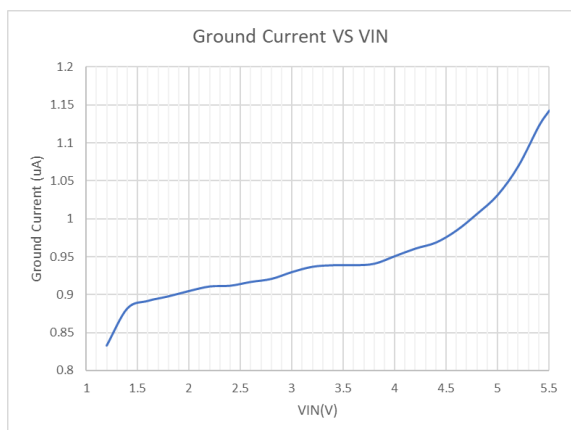
# TYPICAL CHARACTERISTICS



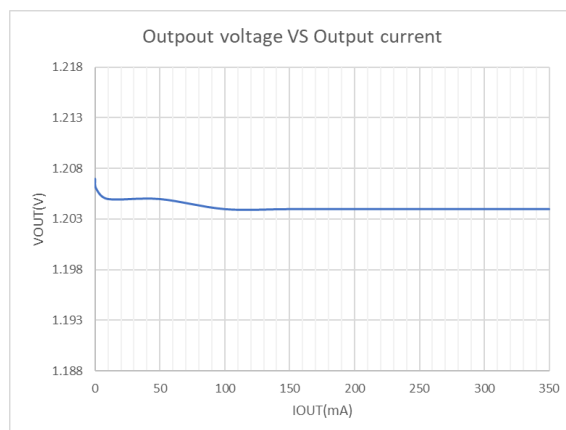
**VOUT=1.8V, IOU=1mA**



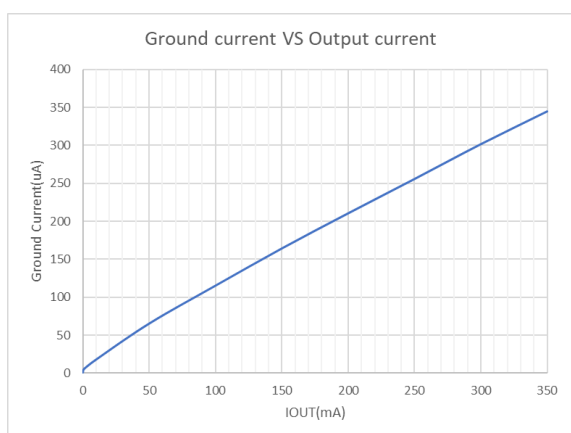
**VOUT=1.2V, IOU=1mA**



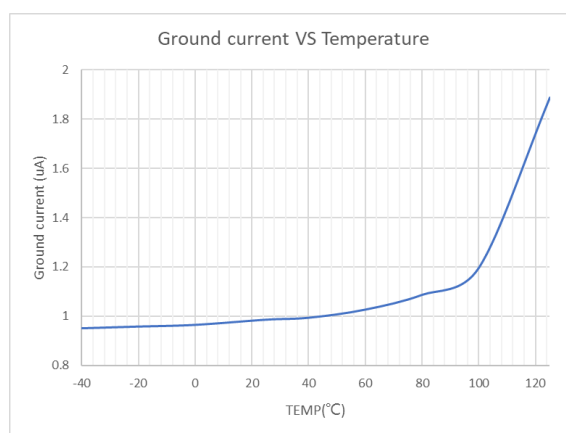
**VOUT=0.8V**



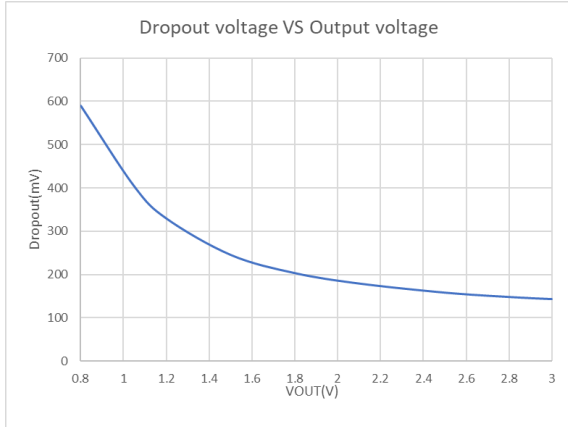
**VOUT=1.2V**



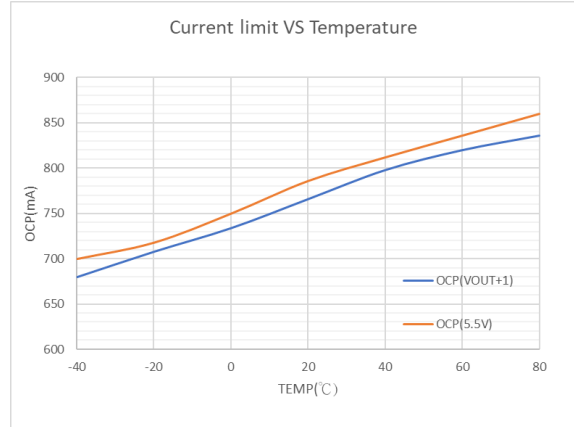
**VOUT=1.2V**



**VOUT=1.2V**



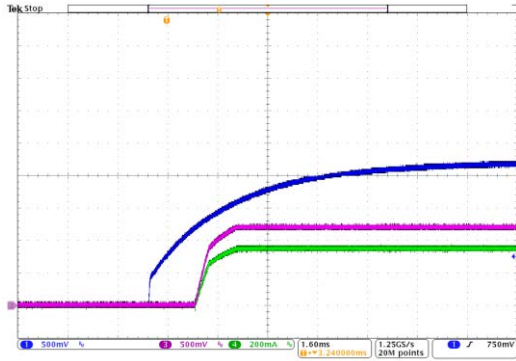
IOUT=300mA



VOUT=1.2V

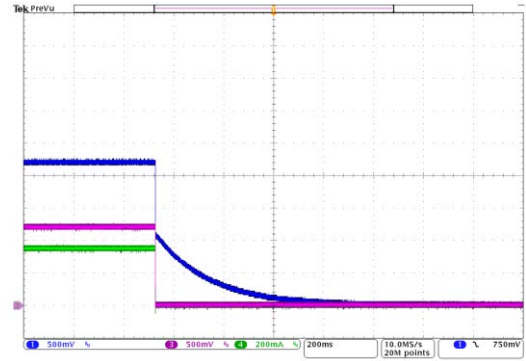
Power On From VIN

Ch1:VIN Ch3:VOUT Ch4:IOUT



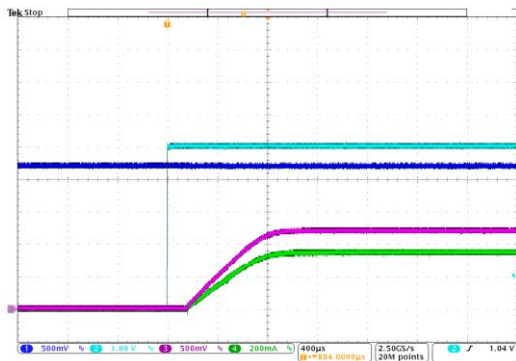
Power Off From VIN

Ch1:VIN Ch3:VOUT Ch4:IOUT



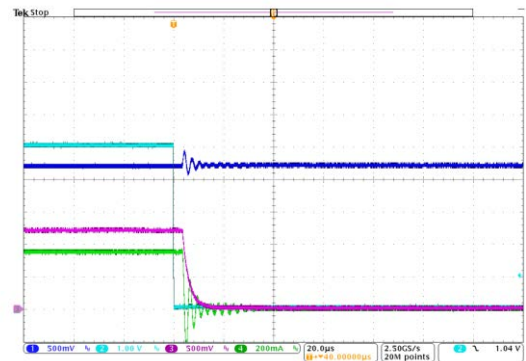
Power On From EN

Ch1:VIN Ch2:EN Ch3:VOUT Ch4:IOUT



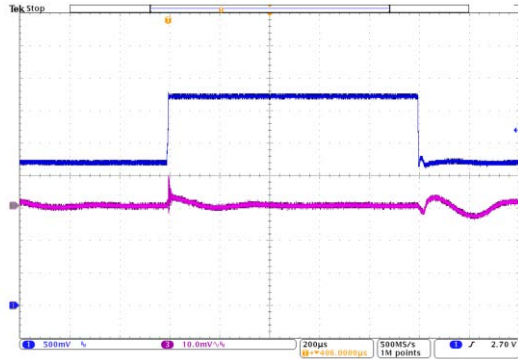
Power Off From EN

Ch1:VIN Ch2:EN Ch3:VOUT Ch4:IOUT



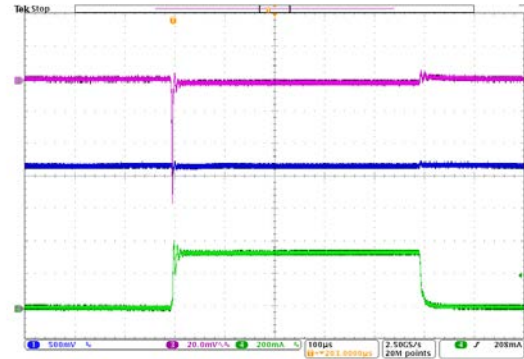
**Line Transient Response**  
VIN=2.2V to 3.2V, IOUT=1mA

Ch1:VIN Ch3:VOUT

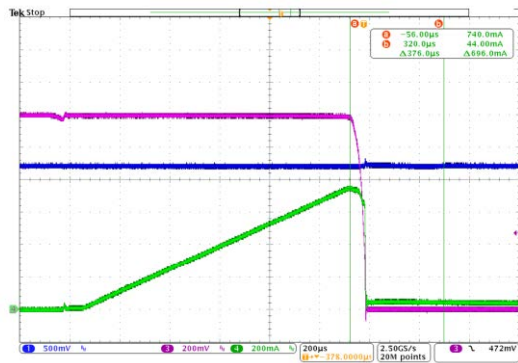


**Load Transient Response**  
IOUT=1mA to 350mA

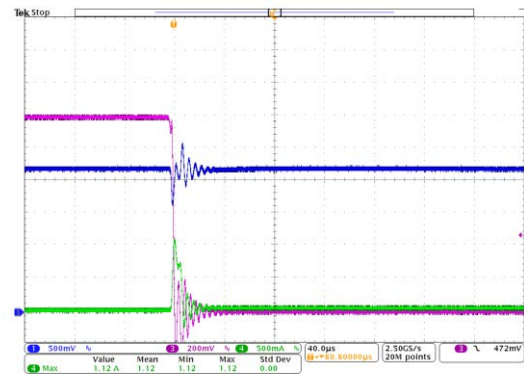
Ch1:VIN Ch3:VOUT Ch4:IOUT



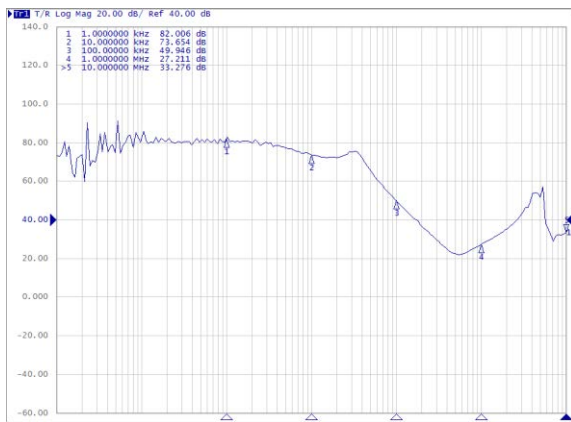
**Over Current Protection**  
Ch1:VIN Ch3:VOUT Ch4:IOUT



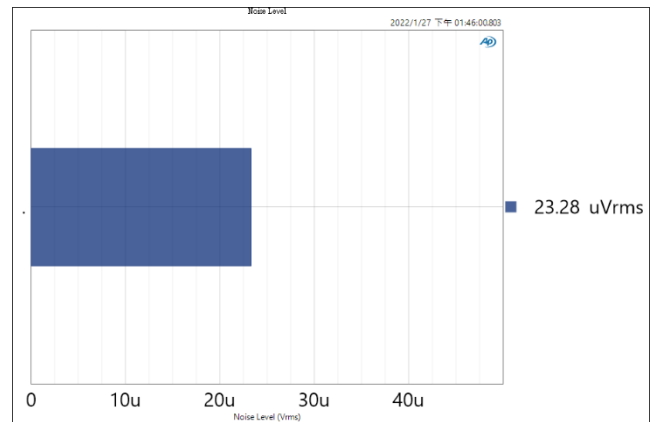
**Output Short Protect**  
Ch1:VIN Ch3:VOUT Ch4:IOUT



**PSRR vs. Frequency**

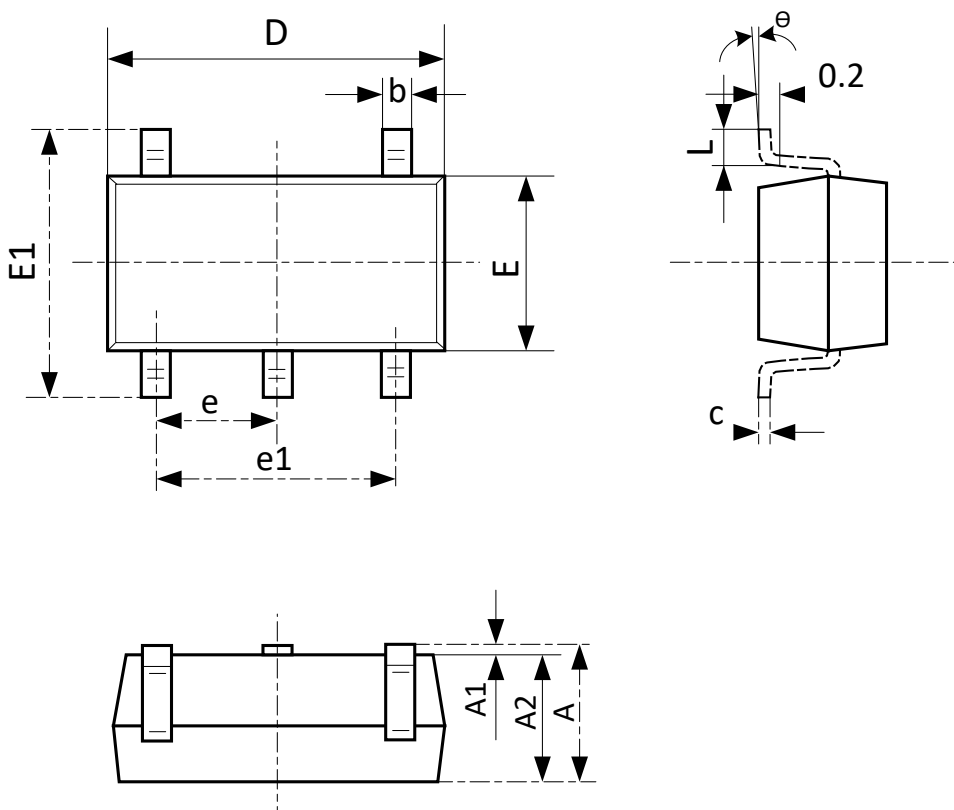


**Output Noise vs. Frequency**

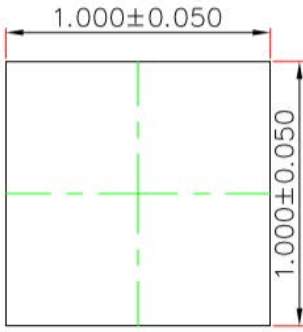
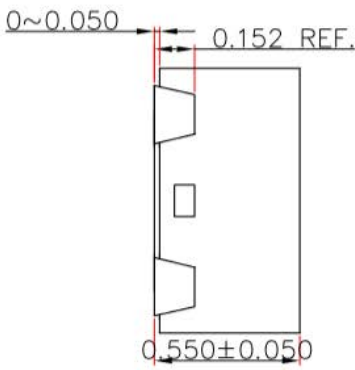
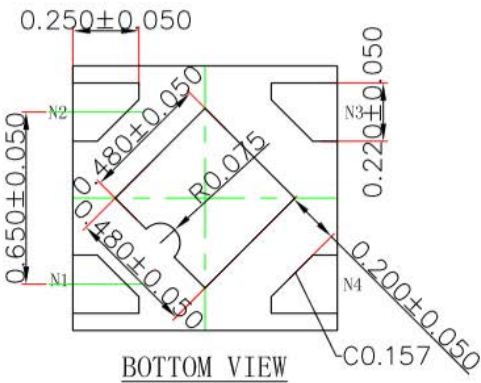




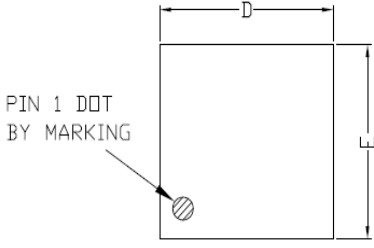
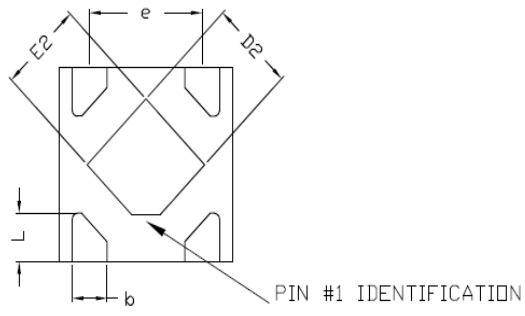
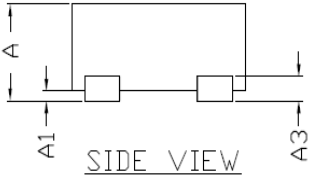
## PACKAGE OUTLINE

Package	SOT23-5L	Devices per reel	3000Pcs	Unit	mm
Package Dimension:					
					
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	1.800	2.000	0.071	0.079	
L	0.300	0.600	0.012	0.024	
θ	0°	8°	0°	8°	

## PACKAGE OUTLINE

Package	DFN1x1-4L	Devices per reel	10000Pcs	Unit	mm
Package Dimension #1:					
 <p style="text-align: center;"><u>TOP VIEW</u></p>		 <p style="text-align: center;"><u>SIDE VIEW</u></p>			
 <p style="text-align: center;"><u>BOTTOM VIEW</u></p>					

## PACKAGE OUTLINE

Package	DFN1x1-4L	Devices per reel	10000Pcs	Unit	mm																																																				
Package Dimension #2:																																																									
 <p>PIN 1 DOT BY MARKING</p> <p><b>TOP VIEW</b></p>		 <p>PIN #1 IDENTIFICATION CHAFMER 0.12MM</p> <p><b>BOTTOM VIEW</b></p>																																																							
 <p><b>SIDE VIEW</b></p>		<table border="1"> <thead> <tr> <th colspan="4">COMMON DIMENSIONS(MM)</th> </tr> <tr> <th>PKG.</th> <th colspan="3">X1:EXTREME THIN</th> </tr> <tr> <th>REF.</th> <th>MIN.</th> <th>NOM.</th> <th>MAX</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>0.40</td> <td>-</td> <td>0.50</td> </tr> <tr> <td>A1</td> <td>0.00</td> <td>-</td> <td>0.05</td> </tr> <tr> <td>A3</td> <td colspan="3">0.125REF.</td> </tr> <tr> <td>D</td> <td>0.95</td> <td>1.00</td> <td>1.05</td> </tr> <tr> <td>E</td> <td>0.95</td> <td>1.00</td> <td>1.05</td> </tr> <tr> <td>b</td> <td>0.15</td> <td>0.20</td> <td>0.25</td> </tr> <tr> <td>L</td> <td>0.15</td> <td>0.25</td> <td>0.35</td> </tr> <tr> <td>D2</td> <td>0.38</td> <td>0.48</td> <td>0.58</td> </tr> <tr> <td>E2</td> <td>0.38</td> <td>0.48</td> <td>0.58</td> </tr> <tr> <td>e</td> <td colspan="3">0.65 BSC</td> </tr> </tbody> </table>				COMMON DIMENSIONS(MM)				PKG.	X1:EXTREME THIN			REF.	MIN.	NOM.	MAX	A	0.40	-	0.50	A1	0.00	-	0.05	A3	0.125REF.			D	0.95	1.00	1.05	E	0.95	1.00	1.05	b	0.15	0.20	0.25	L	0.15	0.25	0.35	D2	0.38	0.48	0.58	E2	0.38	0.48	0.58	e	0.65 BSC		
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