

# SK6013 Low Noise, High PSRR, High Speed, CMOS LDO

## GENERAL DESCRIPTION

The SK6013 is a high accuracy, low noise, high speed, low dropout CMOS Linear regulator with high ripple rejection and fast discharge function. The device offers a new level of cost effective 63 devices.

SK6013 can provide product selections of output value in the range of 1.0V~3.6V by every 0.1V step.

The current limiter's fold-back circuit also operates as a short circuit protection and an output current limiter at the output pin.

The SK6013 regulators are available in standard SOT23-5L and DFN1x1-4L packages. Standard products are Pb-free and Halogen-free.

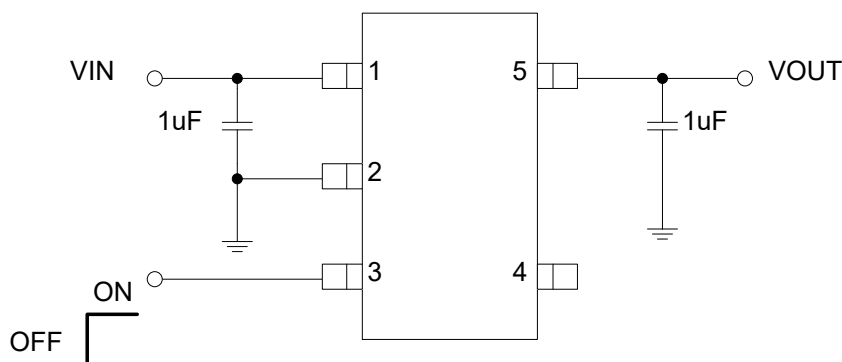
## FEATURES

- Input voltage: 2.5V~6.5V
- Output range: 1.0V~3.6V (customized by every 0.1V step)
- Maximum output current: 400mA@  $V_{IN}-V_{OUT}=0.5V$
- PSRR: 75dB @1KHz
- Dropout voltage: 220mV @  $I_{OUT}=200mA$
- Quiescent current : 35 $\mu$ A Typ.
- Shut-down current: <1 $\mu$ A
- Recommend capacitor: 1 $\mu$ F
- Ultra-low output noise: 20 $\mu$ V<sub>RMS</sub>

## APPLICATIONS

- Digital cameras
- Cellphones
- Bluetooth and wireless handsets
- Other portable electronic devices

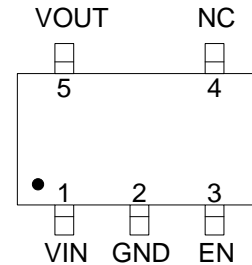
## TYPICAL APPLICATION CIRCUIT



## PIN ASSIGNMENT



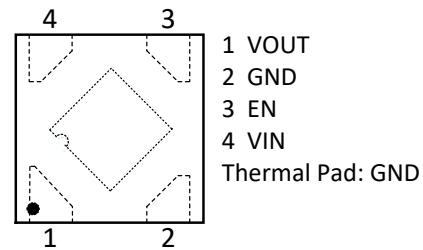
SOT23-5L



SOT23-5L (Top View)



DFN1x1-4L



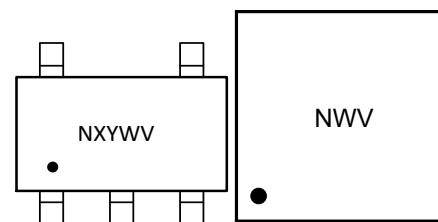
DFN1x1-4L (Top View)

## PART NUMBER RULES

SK6013<sup>1</sup>-<sup>2</sup>-<sup>3</sup>

Code	Description
<sup>1</sup>	V <sub>OUT</sub> discharge " " : w/o fast discharge A/B: with fast discharge
<sup>2</sup>	Package: S5: SOT23-5L D4: DFN1x1-4L
<sup>3</sup>	Voltage version: XX: 1.0V~3.6V by 0.1V step Example: 28: 2.8V

## MARKING DESCRIPTION:



SOT23-5L

DFN1x1-4L

"N": Product code

"X": Package factory

"Y": Wafer foundry vendor.

"W": The week of manufacturing. "A" stands for week 1, "Z" stands for week 26, "a" stands for week 27, "z" stands for week 52.

"V": Output voltage code.

## ORDERING INFORMATION

PART NO	PACAKGE	V <sub>OUT</sub> DISCHARGE	TEMPERATURE	TAPE & REEL
SK6013S5-XX <sup>Note</sup>	SOT23-5L	No	-40 ~ +85°C	3000/REEL
SK6013BS5-XX <sup>Note</sup>	SOT23-5L	Yes	-40 ~ +85°C	3000/REEL
SK6013AD4-XX <sup>Note</sup>	DFN1x1-4L	Yes	-40 ~ +85°C	10000/REEL

**Note:**XX indicates 1.0V~3.6V by 0.1V step. For example, 28 means product outputs 2.8V

## PACKAGE INFORMATION

PART NO	PACAKGE	V <sub>OUT</sub> DISCHARGE	TEMPERATURE	TAPE & REEL
SK6013S5-18	SOT23-5L	No	-40 ~ +85°C	3000/REEL
SK6013S5-28	SOT23-5L	No	-40 ~ +85°C	3000/REEL
SK6013S5-30	SOT23-5L	No	-40 ~ +85°C	3000/REEL
SK6013S5-33	SOT23-5L	No	-40 ~ +85°C	3000/REEL
SK6013BS5-12	SOT23-5L	Yes	-40 ~ +85°C	3000/REEL
SK6013BS5-15	SOT23-5L	Yes	-40 ~ +85°C	3000/REEL
SK6013BS5-18	SOT23-5L	Yes	-40 ~ +85°C	3000/REEL
SK6013BS5-25	SOT23-5L	Yes	-40 ~ +85°C	3000/REEL
SK6013BS5-28	SOT23-5L	Yes	-40 ~ +85°C	3000/REEL
SK6013BS5-30	SOT23-5L	Yes	-40 ~ +85°C	3000/REEL
SK6013BS5-33	SOT23-5L	Yes	-40 ~ +85°C	3000/REEL
SK6013AD4-12	DFN1x1-4L	Yes	-40 ~ +85°C	10000/REEL
SK6013AD4-18	DFN1x1-4L	Yes	-40 ~ +85°C	10000/REEL
SK6013AD4-25	DFN1x1-4L	Yes	-40 ~ +85°C	10000/REEL
SK6013AD4-28	DFN1x1-4L	Yes	-40 ~ +85°C	10000/REEL
SK6013AD4-30	DFN1x1-4L	Yes	-40 ~ +85°C	10000/REEL
SK6013AD4-33	DFN1x1-4L	Yes	-40 ~ +85°C	10000/REEL

## PIN DESCRIPTION

PIN NO	SYMBOL	I/O	DESCRIPTION
SOT23-5L			
1	VIN	Power	Input
2	GND	Ground	Ground
3	EN	I	Enable (active high, do not float)
4	NC	/	Not connected
5	VOUT	O	Output

PIN NO	SYMBOL	I/O	DESCRIPTION
DFN1x1-4L			
1	VOUT	O	Output
2	GND	Ground	Ground
3	EN	I	Enable (active high, do not float)
4	VIN	Power	Input

## ABSOLUTE MAXIMUM RATINGS<sup>(Note)</sup>

SYMBOL	ITEMS	VALUE	UNIT
$V_{IN}$	Input Voltage	-0.3~8	V
$I_{OUT}$	Output Current	550	mA
$P_{DMAX}$	Power Dissipation	SOT23-5L	0.3
		DFN1x1-4L	0.6
$T_J$	Junction Temperature	-40~125	°C
$T_A$	Ambient Temperature	-40~85	°C
$T_{STG}$	Storage Temperature	-55 to 150	°C
$T_{SOLDER}$	Package Lead Soldering Temperature	260°C, 10s	

**Note:** Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect device reliability.

## RECOMMENDED OPERATING RANGE

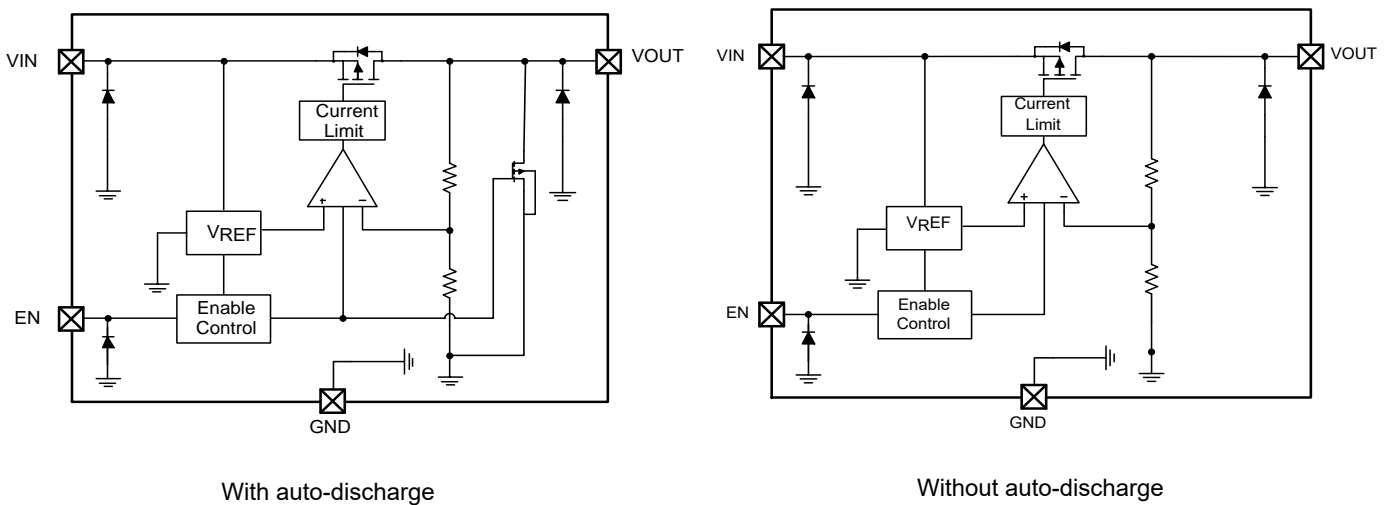
SYMBOL	ITEMS	VALUE	UNIT
$V_{IN}$	Supply Voltage	2.5to 6.5	V
$I_{OUT}$	Output Current	<300	mA
$T_{OPT}$	Operating Temperature	-40 to +85	°C

## ELECTRICAL CHARACTERISTICS

The following specifications apply for  $V_{OUT}=2.8V$ ,  $T_A=25^{\circ}C$ , unless specified otherwise.

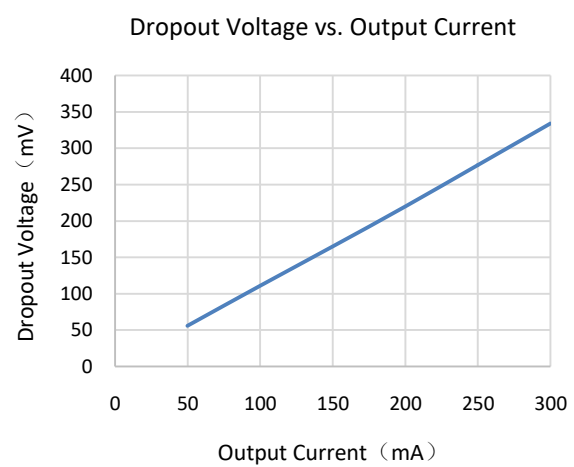
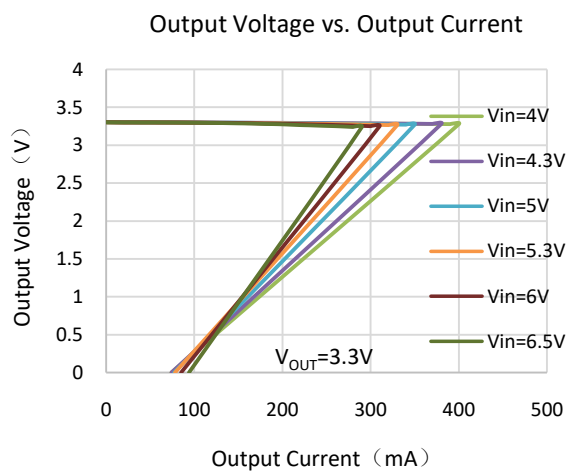
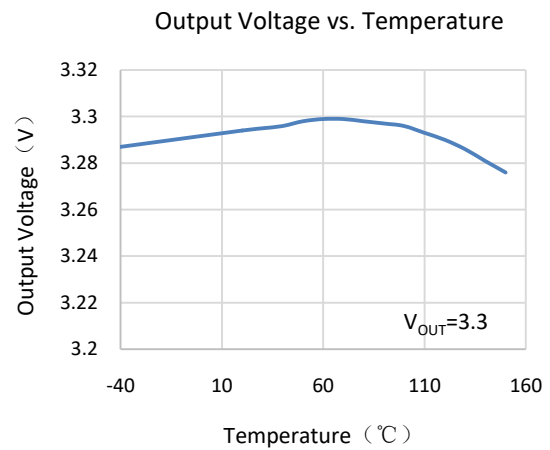
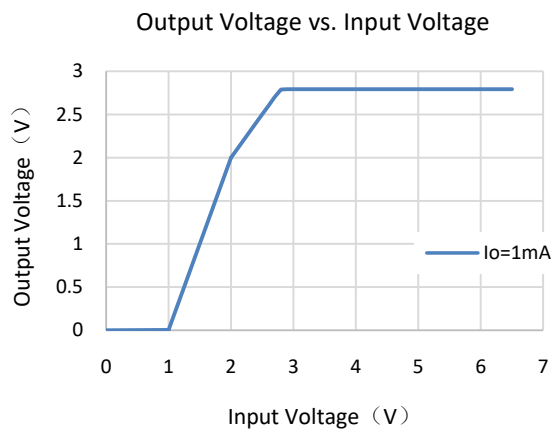
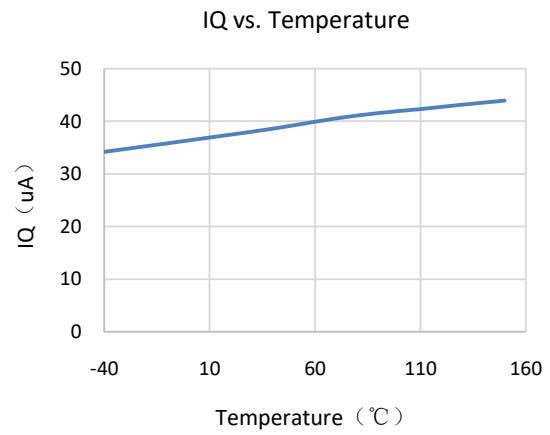
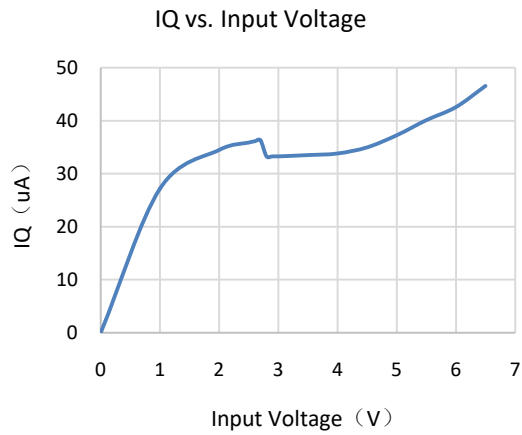
SYMBOL	ITEMS	CONDITIONS	MIN	TYP	MAX	UNIT
$V_{IN}$	Input Voltage				6.5	V
$V_{OUT}$	Output Range	$V_{OUT}<2V$ , $V_{IN}=2.7V$ , $I_{OUT}=1mA$	-3	$V_{OUT}$	3	%
		$V_{OUT}\geq 2V$ , $I_{OUT}=1mA$	-2	$V_{OUT}$	2	
$I_Q$	Quiescent Current	$V_{OUT}=2.8V$ , $I_{OUT}=0$		35		$\mu A$
$I_{LIMIT}$	Current Limit	$V_{IN}=V_{EN}=4.5V$		500		mA
$V_{DROP}$	Dropout Voltage	$V_{OUT}=2.8V$ , $I_{OUT}=200mA$		220	250	mV
		$V_{OUT}=2.8V$ , $I_{OUT}=300mA$		320	350	
$\Delta V_{LINE}$	Line Regulation	$V_{IN}=2.7\sim 5.5V$ , $I_{OUT}=1mA$		0.01	0.15	%/V
$\Delta V_{LOAD}$	Load Regulation	$V_{OUT}=2.8V$ , $I_{OUT}=1\sim 300mA$		40	70	mV
$I_{SHORT}$	Short Current	$V_{EN}=V_{IN}$ , $V_{OUT}$ Short to GND with $1\Omega$		80		mA
$I_{SHDN}$	Shut-down Current	$V_{EN}=0V$			1	$\mu A$
PSRR	Power Supply Rejection Rate	$V_{IN}=5V_{DC}+0.5V_{P-P}$ $F=1KHz$ , $I_{OUT}=10mA$		75		dB
		$V_{IN}=5V_{DC}+0.5V_{P-P}$ $F=1MHz$ , $I_{OUT}=10mA$		55		
$V_{ENH}$	EN logic high voltage	$V_{IN}=5.5V$ , $I_{OUT}=1mA$	1.2		$V_{IN}$	V
$V_{ENL}$	EN logic low voltage	$V_{IN}=5.5V$ , $V_{OUT}=0V$			0.4	V
$I_{EN}$	EN Input Current	$V_{EN}=0$ to $5.5V$			1.0	$\mu A$
$e_{NO}$	Output Noise Voltage	10Hz to 100KHz, $C_{OUT}=1\mu F$		20		$\mu V_{RMS}$

## SIMPLIFIED BLOCK DIAGRAM

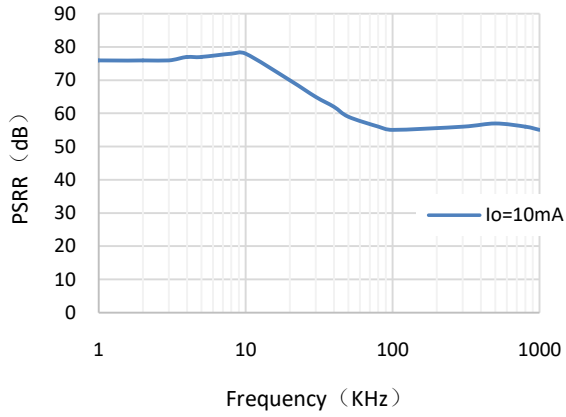


## TYPICAL PERFORMANCE CHARACTERISTICS

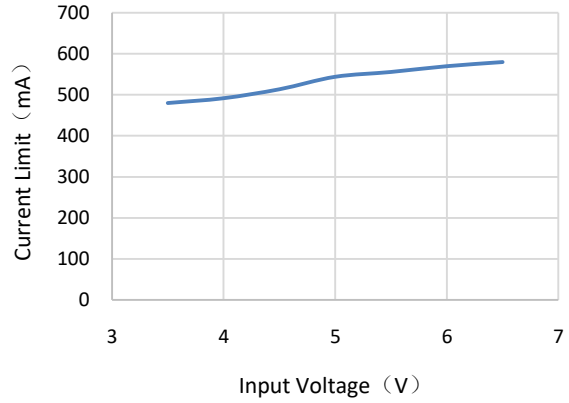
$C_{IN}=1\mu F$ ,  $C_{OUT}=1\mu F$ ,  $V_{IN}=4.5V$ ,  $V_{OUT}=2.8V$ ,  $T_A=25^\circ C$ , unless specified otherwise.



PSRR vs. Frequency

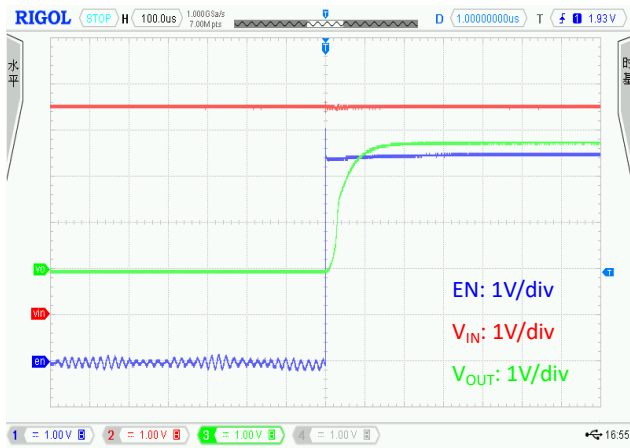


Current Limit vs. Input Voltage



EN ON / OFF

$V_{EN}=0V$  to  $4.5V$        $I_{OUT}=10mA$

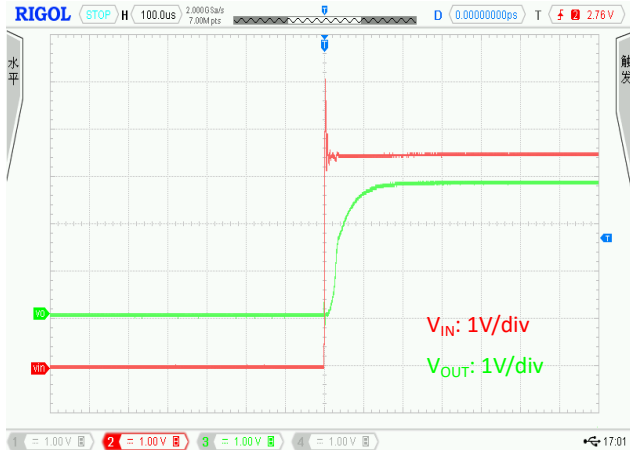


$V_{EN}=4.5V$  to  $0V$        $I_{OUT}=10mA$



Power ON / OFF

$V_{IN}=0V$  to  $4.5V$        $I_{OUT}=10mA$



$V_{IN}=4.5V$  to  $0V$        $I_{OUT}=10mA$



### Line Transient

$V_{IN}=4V$  to  $5V$        $I_{OUT}=10mA$

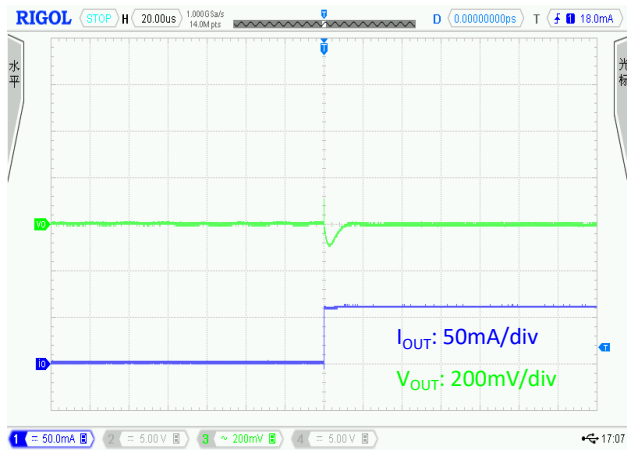


$V_{IN}=5V$  to  $4V$        $I_{OUT}=10mA$

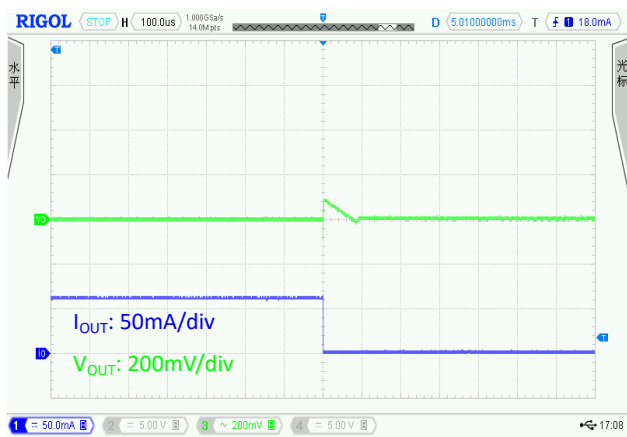


### Load Transient

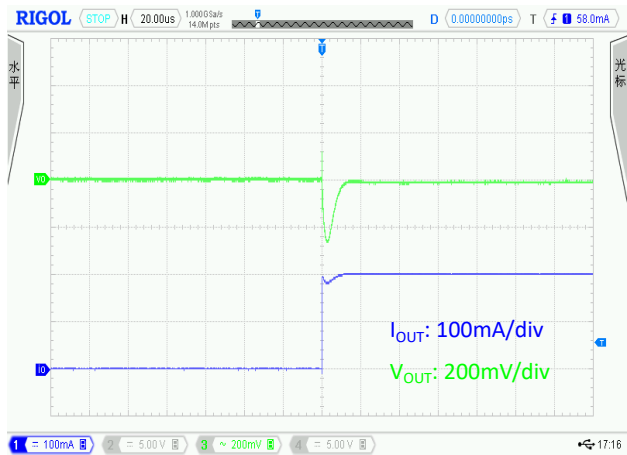
$V_{IN}=4.5V$        $I_{OUT}=1mA$  to  $60mA$



$V_{IN}=4.5V$   $I_{OUT}=60mA$  to  $1mA$



$V_{IN}=4.5V$   $I_{OUT}=1mA$  to  $200mA$

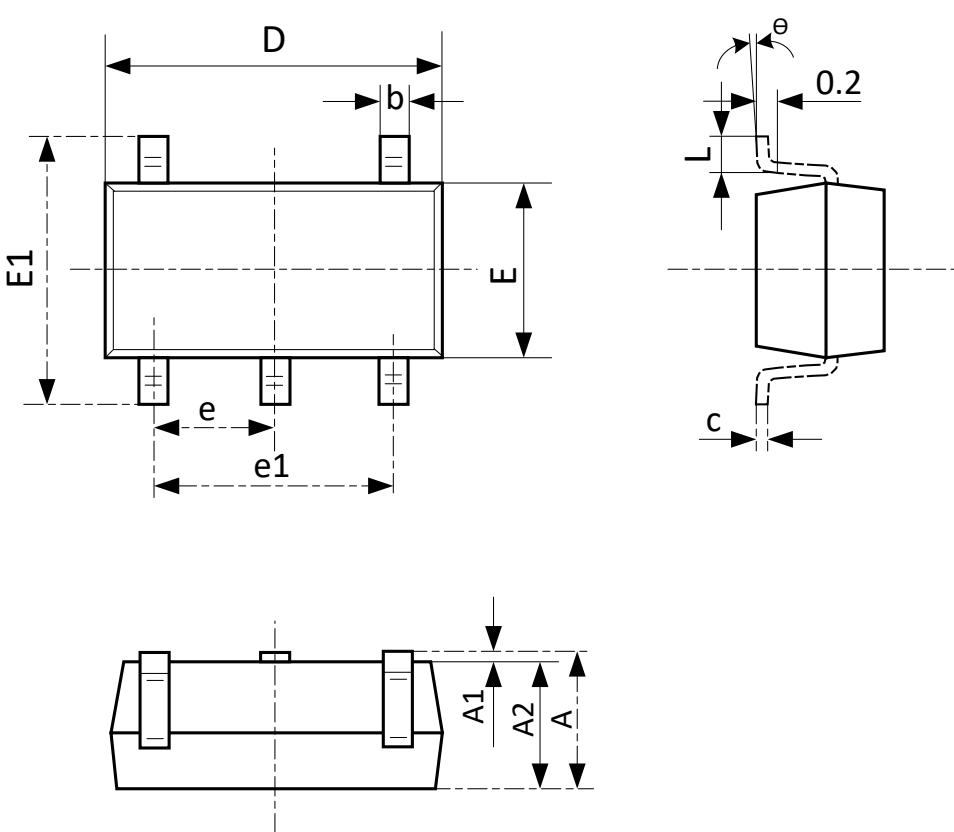


$V_{IN}=4.5V$   $I_{OUT}=200mA$  to  $1mA$

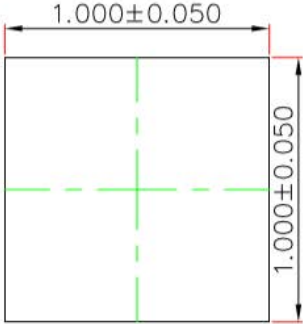
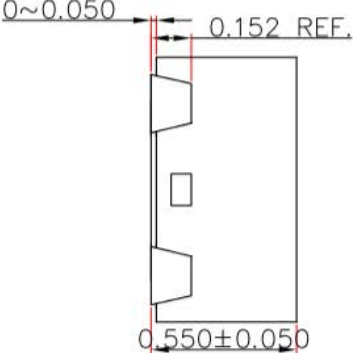
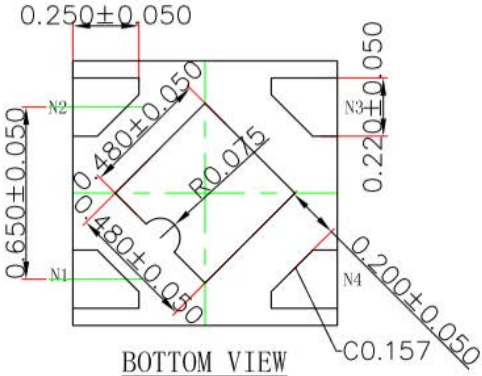




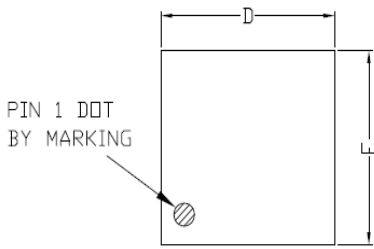
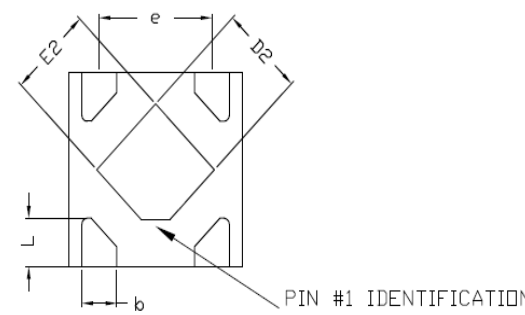
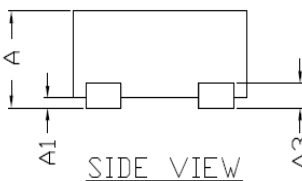
## PACKAGE OUTLINE

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	
$\theta$	0°C	8°C	0°C	8°C	

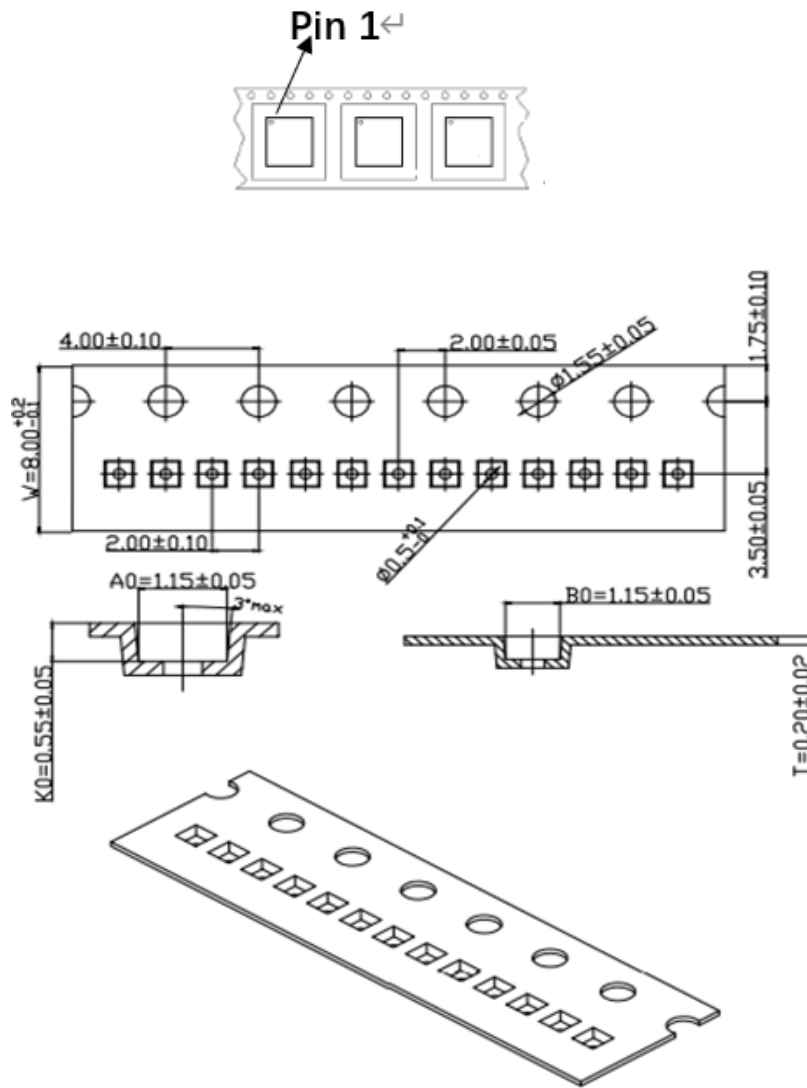
## PACKAGE OUTLINE

Package	DFN1x1-4L	Devices per reel	10000Pcs	Unit	mm
Package Dimension #1:					
 <p><u>TOP VIEW</u> [顶视图]</p>		 <p><u>SIDE VIEW</u> 侧视图</p>			
 <p><u>BOTTOM VIEW</u> 背视图</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">X1EXTREME 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.	X1EXTREME 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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Tape



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