

# SK6054 500mA Ultra Low Output Voltage LDO

## DESCRIPTION

The SK6054 Series are low voltage 500 mA voltage regulator. The input voltage is as low as Min. 1.2 V and the output voltage can be set from 0.5 V. The output voltage accuracy has been improved to  $\pm 1\%$  and due to a built-in transistor with low on-resistance. Each of these ICs consists of a voltage reference unit, an error amplifier, a resistor-net for voltage setting, and a current limit circuits for over-current for the destruction prevention by the over-current. The SK6054 series use a type of outstanding CMOS process to minimize the supply current. A low on-resistance PMOS pass device is equipped for lower dropout voltage. SK6054 also possess the CE function to save more energy and extend the battery life. The CE pin can switch the regulator to standby mode.

The SK6054 series are available in the DFN1×1-4, SOT23-5 packages.

## FEATURES

- Wide Input Voltage Range: 1.2 V to 5.5 V
- Very Low IQ: 48  $\mu$ A
- Up to 500 mA Load Current
- Output Voltage Range: 0.5 V to 3.8 V
- Output Voltage Accuracy:  $\pm 1\%$  ( $V_{OUT} \geq 1.0$  V,  $T_A = 25^\circ\text{C}$ )
- Dropout Voltage: Typ. 0.22 V ( $V_{OUT} = 1.5$  V)
- Excellent Load/Line Transient Response, Line Regulation: 0.1%/V (typical)
- Built-in Fold Back Protection Circuit
- Built-in Constant Slope Circuit
- Built-in Auto-Discharging Circuit
- Package: DFN1×1-4, SOT23-5

## APPLICATION

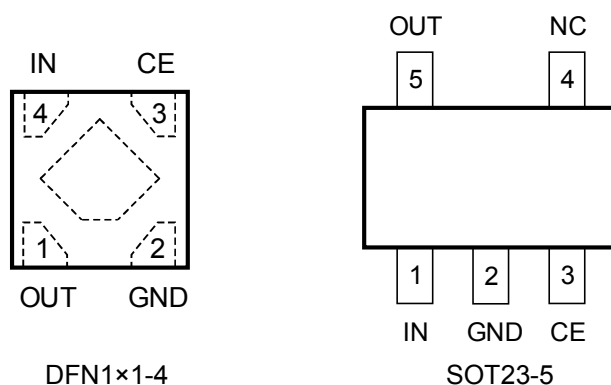
- Constant-voltage power supply for battery-powered device
- Constant-voltage power supply for TV, notebook PC and home electric appliance
- Constant-voltage power supply for portable equipment

## ORDERING INFORMATION

Ordering Number	Package	Temperature	Tape and Reel
SK6054S5-XX	SOT23-5	-40°C to +85°C	3000
SK6054D4-XX	DFN1×1-4	-40°C to +85°C	000

NOTE:XX: When expressed as 18, the output voltage is 1.8 V; when expressed as 075 the output voltage is 0.75 V.

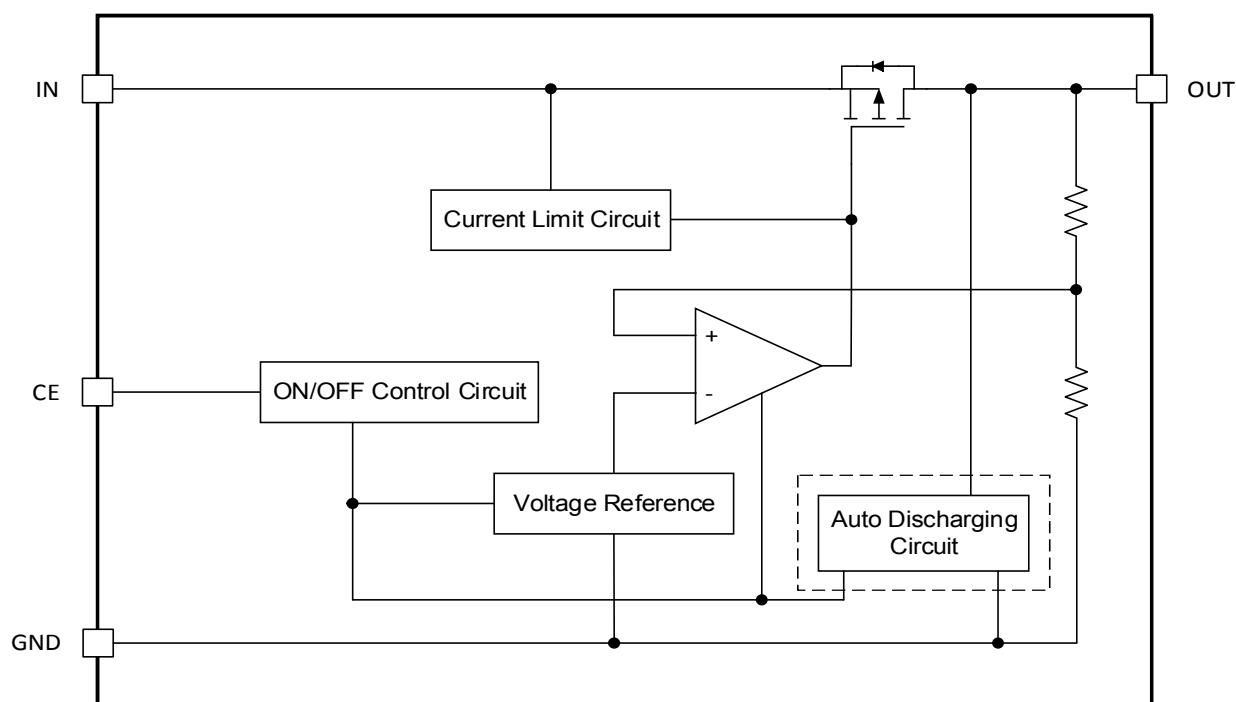
## PIN CONFIGURATION (Top View)



## PIN DESCRIPTIONS

Pin		Symbol	Description
DFN1x1-4	SOT23-5		
1	5	OUT	Output Pin.
2	2	GND	Ground Pin.
3	3	CE	Chip Enable Pin, "H" Enable.
4	1	IN	Input Pin.
	4	NC	No Connection.

## BLOCK DIAGRAM



\*Auto Discharging is an optional function

## FUNCTIONAL DESCRIPTION

### Input Capacitor

A 1  $\mu$ F ceramic capacitor is recommended to connect between IN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both IN and GND.

### Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is 1  $\mu$ F, ceramic capacitor is recommended, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to OUT and GND pins.

### CE Pin Operation

The SK6054 is turned on by setting the CE pin to “H”. Since the CE pin is neither pulled down nor pulled up internally, do not set it in floating status. When the CE pin is not used, connect the CE pin with IN pin to keep the LDO in operating mode.

### Current Limit Protection

When output current of OUT pin is higher than current limit threshold or the OUT pin is direct short to GND, the current limit protection will be triggered and clamp the output current at a predesigned level to prevent over-current and thermal damage.

### Auto Discharging

When the CE pin set to “L”, the output circuit will be disable immediately, and the Auto-Discharging circuit will be turned on to discharge the electric charge on output capacitor, and decrease the voltage of OUT in very short time. The Auto-Discharging function is optional.

## ABSOLUTE MAXIMUM RATINGS

Symbol	Item		Rating	Unit
$V_{IN}$	Input Voltage		5.5	V
$V_{CE}$	Input Voltage (CE Pin)		-0.3 to 5.5	V
$V_{OUT}$	Output Voltage		-0.3 to $V_{IN} + 0.3$	V
$\theta_{JA}$	Package Thermal Resistance	DFN1×1-4	180	°C/W
		SOT23-5	260	
$T_A$	Operating Temperature Range		-40 to +85	°C
$T_J$	Maximum Junction Temperature		150	°C
$T_{STG}$	Storage Temperature Range		-55 to +150	°C

### NOTE:

Stresses beyond those listed under “ABSOLUTE MAXIMUM 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.

### CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SUNTEK 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.

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

## ELECTRICAL CHARACTERISTICS

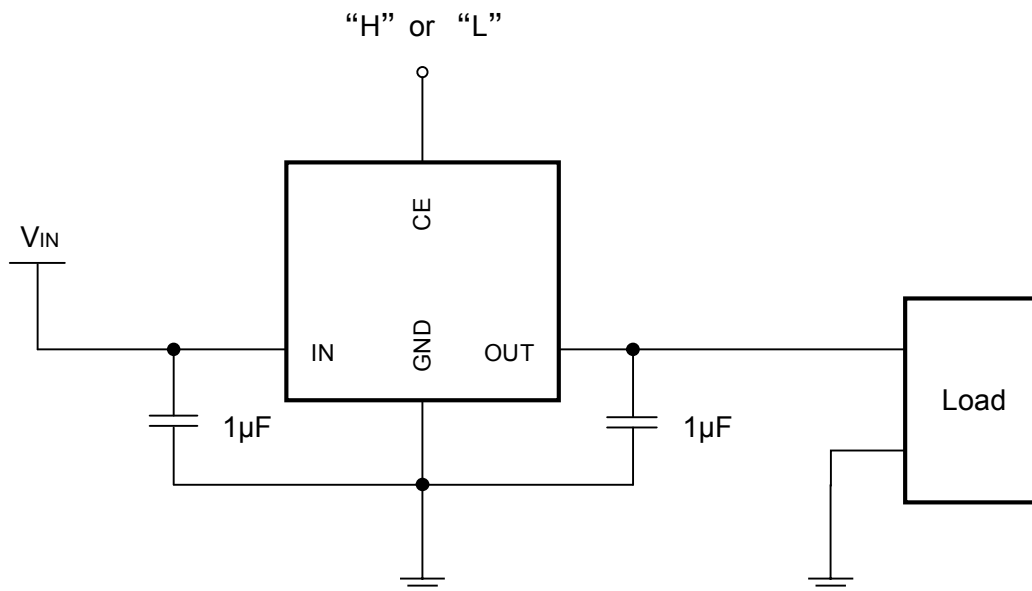
$V_{IN} = V_{OUT} + 1.0\text{ V}$ ,  $I_{OUT} = 1\text{ mA}$ ,  $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ , unless otherwise noted.

Symbol	Item	Conditions	Min	Typ	Max	Unit
$V_{OUT}$	Output Voltage	$V_{OUT} \geq 1.0$ , $T_A = 25^\circ\text{C}$	$\times 0.99$		$\times 1.01$	V
		$V_{OUT} < 1.0$ , $T_A = 25^\circ\text{C}$	- 10		+ 10	mV
		$V_{OUT} \geq 1.0$ , $-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$	$\times 0.98$		$\times 1.02$	V
		$V_{OUT} < 1.0$ , $-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$	- 20		+ 20	mV
$I_{LOAD}$	Load Current			500		mA
$I_{LIM}$	Current Limit	$T_A = 25^\circ\text{C}$		700		mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	$V_{IN} = V_{OUT} + 1\text{ V}$ , $1\text{ mA} \leq I_{OUT} \leq 400\text{ mA}$		25	45	mV
$V_{DROP}$	Dropout Voltage	$V_{OUT} = 1.5\text{ V}$ , $I_{OUT} = 400\text{ mA}$ , $V_{OUT}$ dropping to $0.98 \times V_{OUT}$		220		mV
		Other refer to the following table				
$I_Q$	DC Supply Quiescent Current	$I_{OUT} = 0\text{ mA}$		48		$\mu\text{A}$
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	$V_{OUT} + 0.5\text{ V} \leq V_{IN} \leq 3.6\text{ V}$ ( $V_{IN} \geq 1.4\text{ V}$ )		0.10	0.25	%/V
PSRR	Power Supply Rejection Ratio	$f = 1\text{ kHz}$ , Ripple $0.2\text{Vp-p}$ , $V_{IN} =$ $V_{OUT} + 1\text{ V}$ , $I_{OUT} = 30\text{ mA}$		80		dB
$V_{IN}$	Input Voltage		1.2		5.5	V
$\Delta V_{OUT}/\Delta T_A$	Output Voltage Temperature Coefficient	$-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$		$\pm 90$		ppm/ $^\circ\text{C}$
$I_{SHORT}$	Short Current Limit	$V_{OUT} = 0\text{ V}$		110		mA
$I_{SD}$	Shutdown Supply Current				1	$\mu\text{A}$
$V_{CEH}$	CE Input Voltage High		0.9			V
$V_{CEL}$	CE Input Voltage Low				0.4	V
$e_N$	Output Noise	$BW = 10\text{ Hz to }100\text{ kHz}$ $I_{OUT} =$ $30\text{ mA}$ , $V_{OUT} = 0.5\text{ V}$		40		$\mu\text{V}_{RMS}$
$R_{DIS}$	Auto-discharge Nch Tr. ON Resistance	$V_{IN} = 2.0\text{ V}$ , $V_{CE} = 0\text{ V}$		40		$\Omega$

## Dropout Voltage by Output Voltage

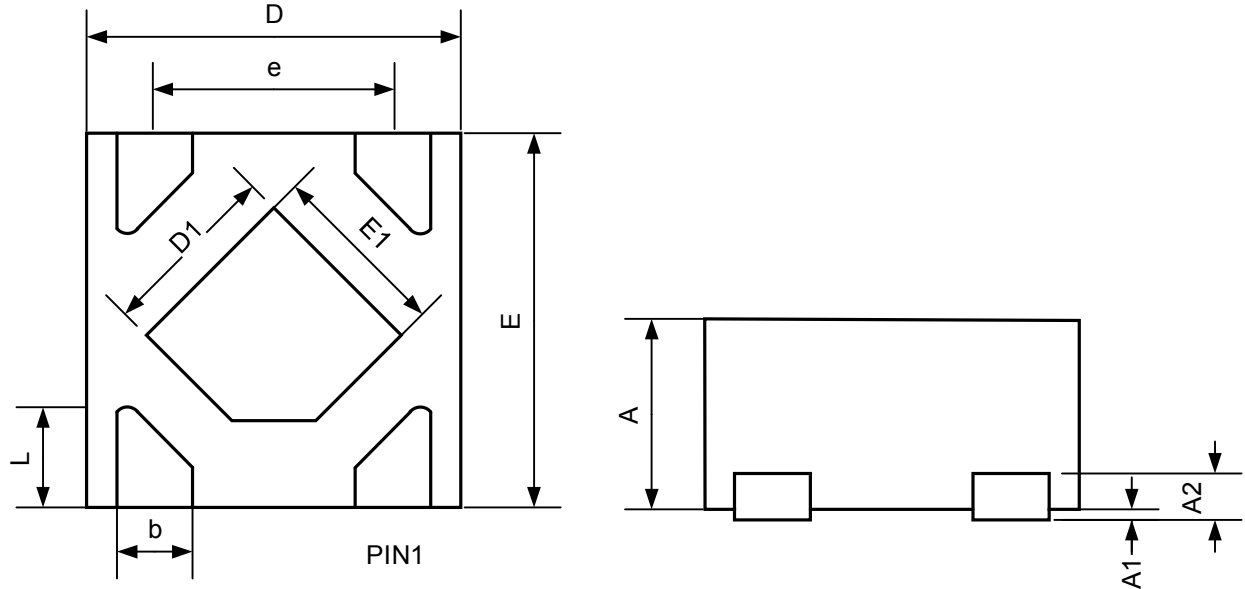
Output Voltage $V_{OUT}$ (V)	Dropout Voltage $V_{DIF}$ (V)		
	Condition	Typ	Max
$0.5 \leq V_{OUT} < 0.8$	$I_{OUT} = 400 \text{ mA}$	0.50	0.65
$0.8 \leq V_{OUT} < 0.9$		0.42	0.57
$0.9 \leq V_{OUT} < 1.0$		0.38	0.50
$1.0 \leq V_{OUT} < 1.2$		0.34	0.46
$1.2 \leq V_{OUT} < 1.5$		0.30	0.41
$1.5 \leq V_{OUT}$		0.24	0.34

## APPLICATION CIRCUITS



## PACKAGE OUTLINE

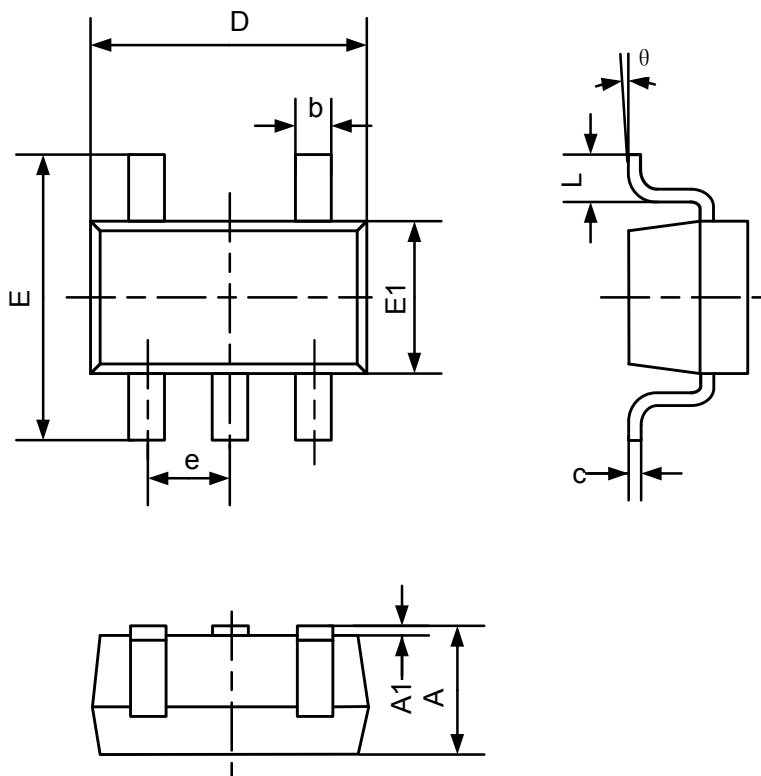
### DFN1×1-4



Symbol	Dimensions In Millimeters	
	Min	Max
A	0.400	0.500
A1	0.000	0.050
A2	0.125REF	
b	0.150	0.250
D	0.950	1.050
D1	0.380	0.580
E	0.950	1.050
E1	0.380	0.580
e	0.650BSC	
L	0.150	0.350

## PACKAGE OUTLINE

SOT23-5



Symbol	Dimensions In Millimeters	
	Min	Max
A	0.700	1.250
A1	0.000	0.100
b	0.300	0.500
c	0.100	0.200
D	2.820	3.020
E	2.650	2.950
E1	1.500	1.700
e	0.950BSC	
L	0.300	0.600
$\theta$	0°	8°