SK6512 30V 200mA 1.6μA Low Power LDO

GENERAL DESCRIPTION

The SK6512 is a high voltage, low power consumption and high performance LDO. The family uses an advanced CMOS process and a PMOSFET pass device to achieve fast start-up, with high output voltage accuracy. The SK6512 is stable with a 10μF ceramic output capacitor.

The SK6512 series has thermal shutdown, current limit, and short circuit protections for safety.

The SK6512 is available in SOT23-3, SOT23-5 and SOT89-3 Packages

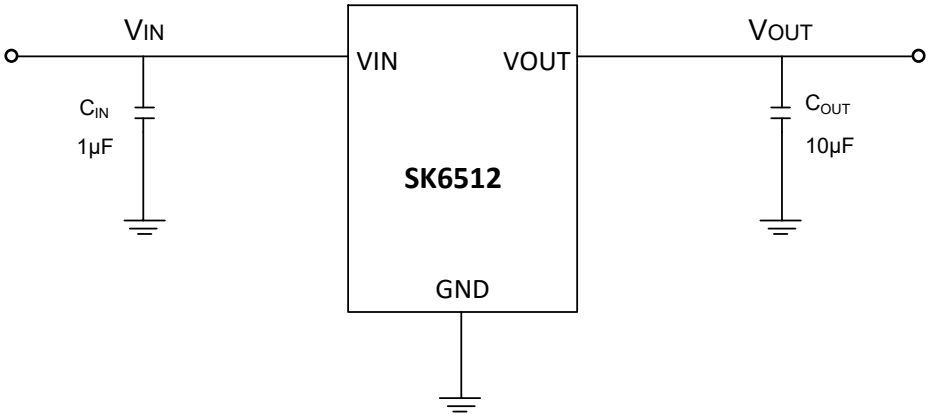
FEATURES

- Wide Input Voltage Range: 3.0V to 30V
- Output Current: 200 mA
- Standard Fixed Output Voltage Options: 3.0V, 3.3V, 3.6V, 4.0V and 5.0V
- Other Output Voltage Options Available on Request
- Low IQ: 1.6μA
- Low Dropout Voltage: 500mV@100mA
- Short current protection: 120mA
- Excellent Load / Line Transient Response
- Line Regulation: 0.01 %/V typical
- Operating Temperature Range: -40~85℃

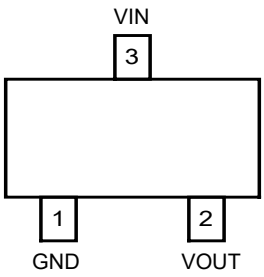
APPLICATIONS

- Battery-powered Equipment
- Smoke Detector and Sensor
- Micro Controller Applications

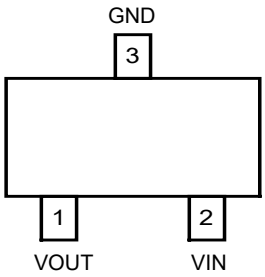
TYPICAL APPLICATION CIRCUIT



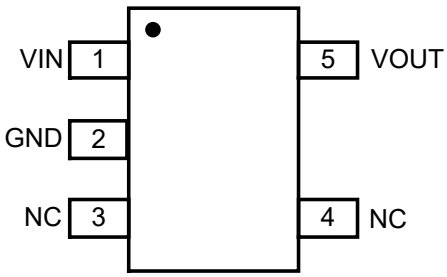
PIN CONFIGURATION (TOP VIEW)



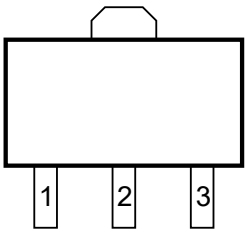
SK6512S3-XX
SOT23-3



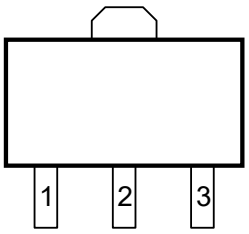
SK6512S3C-XX
SOT23-3



SOT23-5



SK6512T3A-XX
SOT89-3



SK6512T3B-XX
SOT89-3

PIN DESCRIPTIONS

Pin Number					Symbol	Description
SOT23-3	SOT23-3 (C-Type)	SOT23-5	SOT89-3 (A-Type)	SOT89-3 (B-Type)		
3	2	1	1	2	VIN	Supply input pin. Must be closely decoupled to GND with a 1μF or greater ceramic capacitor.
1	3	2	2	1	GND	Ground.
		3, 4			NC	No connection.
2	1	5	3	3	VOUT	Output pin. Bypass a 10μF or greater ceramic capacitor from this pin to ground.

ODERING INFORMATION

Model	Package	Ordering Number	Package / Tape and Reel
SK6512	SOT23-3	SK6512S3-XX	3000 pcs
	SOT23-3 (C-Type)	SK6512S3C-XX	3000 pcs
	SOT23-5	SK6512S5A-XX	3000 pcs
	SOT89-3 (A-Type)	SK6512T3A-XX	1000 pcs
	SOT89-3 (B-Type)	SK6512T3B-XX	1000 pcs

*XX: When expressed as 18, the output voltage is 1.8V; when expressed as 30 the output voltage is 3.0V.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Parameter	Description	Min	Max	Unit
Input Voltage	VIN to GND	-0.3	36	V
	VOUT to GND	-0.3	7	V
	VIN to VOUT	-0.3	31	V
Current	Peak output current	Internally limited		
Temperature	Operating Temperature Range	-40	125	℃
	Storage Temperature	-40	150	℃
Thermal Resistance (Junction to Ambient)	SOT89	135		℃/W
	SOT23	250		℃/W
Power Dissipation	SOT89	800		mW
	SOT23	400		mW

Note (1): Exceeding the range specified by the rated parameters will cause damage to the chip, and the working state of the chip beyond the range of rated parameters cannot be guaranteed. Exposure outside the rated parameter range will affect the reliability of the chip.

ESD RATINGS

Parameter	Description	Range	Unit
VESD	Human Body Model(HBM)	4	KV
	Charged Device Model(CDM)	200	V

Note:

JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

JEDEC document JEP157 states that 200-V CDM allows safe manufacturing with a standard ESD control process.

ELECTRICAL CHARACTERISTICS

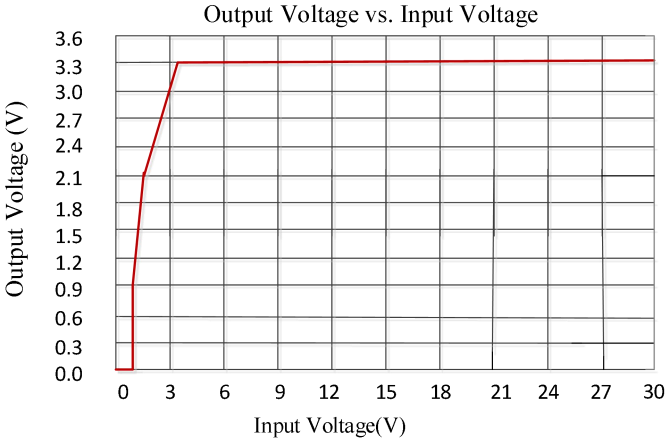
V_{IN} = V_{OUT} + 1 V, T_A = 25℃, C_{IN} = 1μf, C_{OUT} = 10μf, unless otherwise noted.

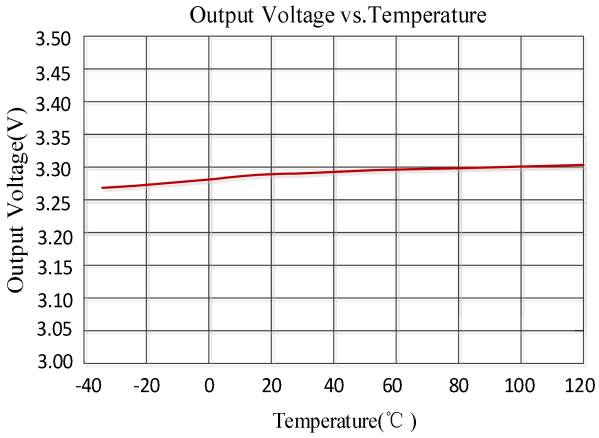
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Operating input voltage		3		30	V
I_{GND}	Quiescent Current	V_{IN}=12V, No load		1.6	1.8	uA
I_{SHUT}	Shutdown Current	V_{IN}=12V, V_{EN}=0V		130		nA
V_{OUT}	Output Voltage	I_{OUT}=1mA	-2%		+2%	V
I_{OUT_MAX}	Output Current			200		mA
V_{DROP}	Dropout Voltage(Note 1)	I_{OUT}=100mA, V_{OUT}=5.0V		500		mV
		I_{OUT}=150mA, V_{OUT}=5.0V		700		
		I_{OUT}=100mA, V_{OUT}=3.3V		500		
		I_{OUT}=150mA, V_{OUT}=3.3V		800		
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	1mA ≤ I_{OUT} ≤ 150mA, V_{IN} =V_{OUT}+2V		5	25	mV
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	V_{IN} = V_{OUT} +1V to 30V, I_{OUT} = 10mA		0.01	0.04	%/V
I_{LIMIT}	Current Limit			370		mA
I_{SHORT}	Short Current	V_{IN}=12V		120		mA
T_{SHDN}	Thermal Shutdown Temperature	Shutdown, temperature increasing		154		℃
		Reset, temperature decreasing		125		

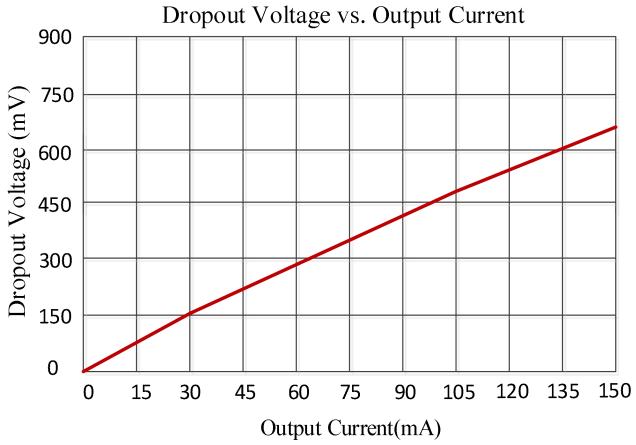
Note(1): Dropout Voltage is the voltage difference between the input and the output at which the output voltage drops 2% below its nominal value.

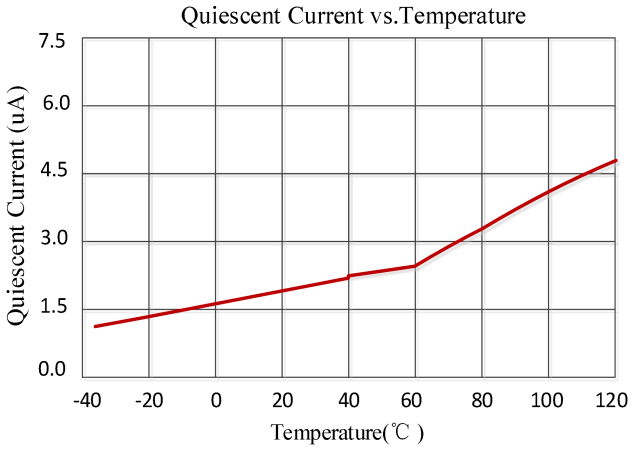
TYPICAL PERFORMANCE CHARACTERISTICS

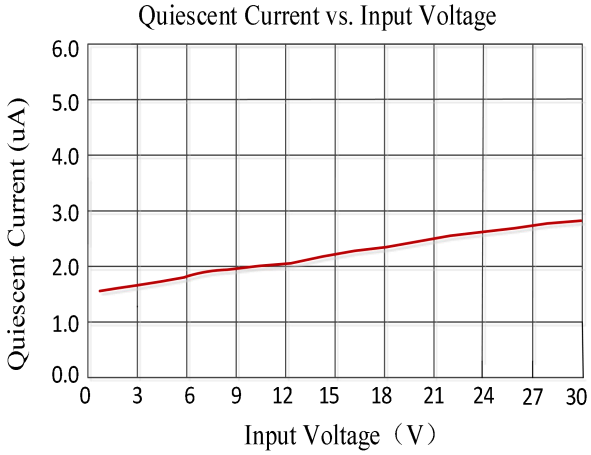
(T_A=25°C, V_{IN}=12V, I_{OUT}=1mA, C_{OUT}=10uF, V_{OUT}=3.3V, unless otherwise note)

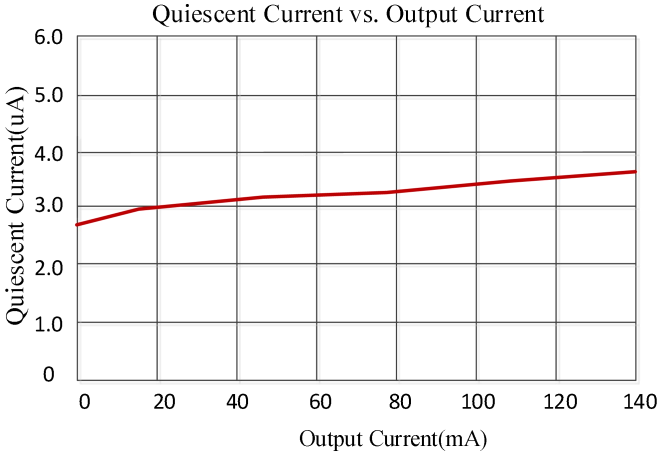








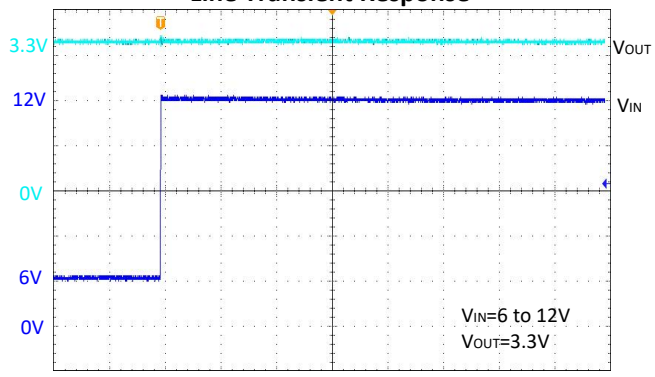




TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

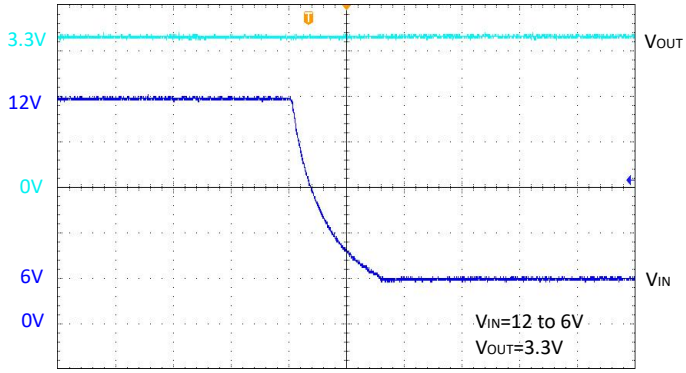
(T_A=25°C, V_{IN}=12V, I_{OUT}=1mA, C_{OUT}=10uF, V_{OUT}=3.3V, unless otherwise note)

Line Transient Response



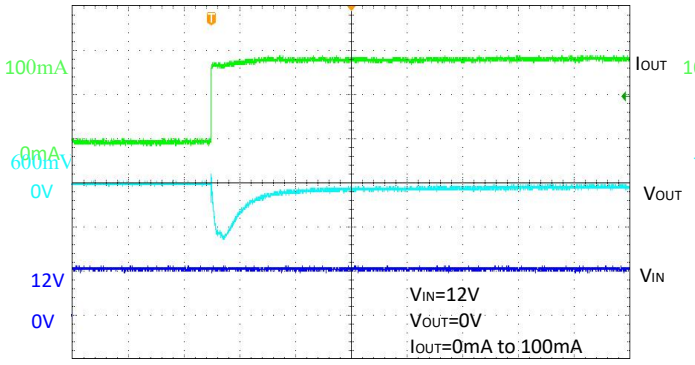
Time(4us/div)

Line Transient Response



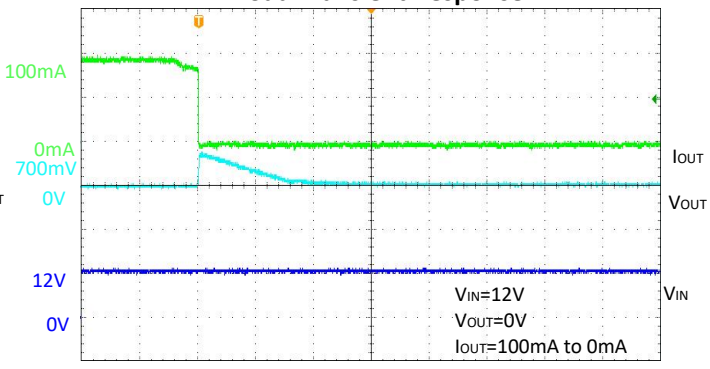
Time(4us/div)

Load Transient Response



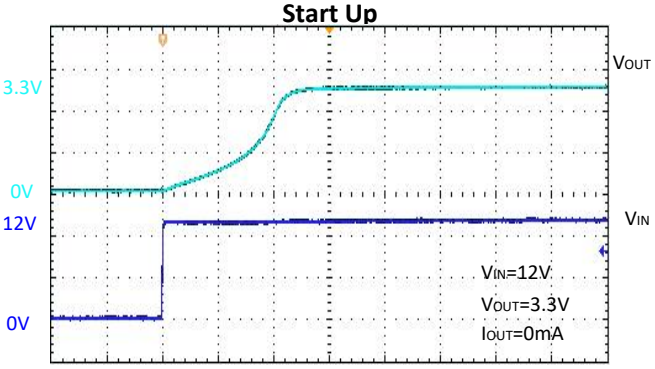
Time(200us/div)

Load Transient Response



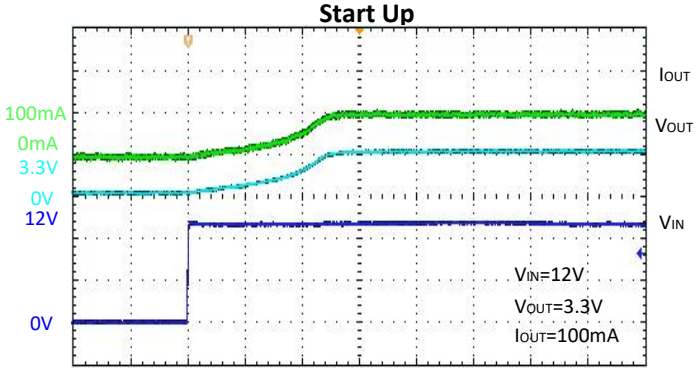
Time(200us/div)

Start Up



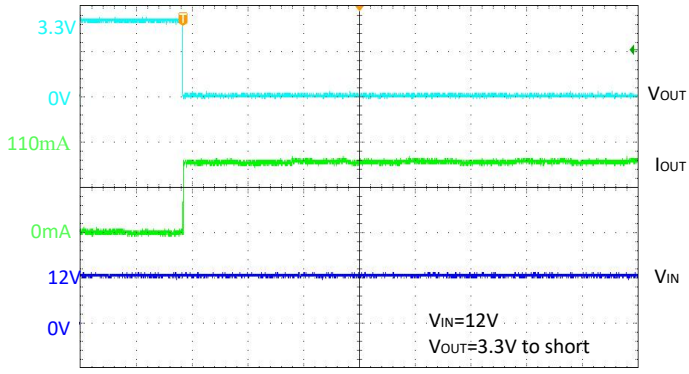
Time(40us/div)

Start Up



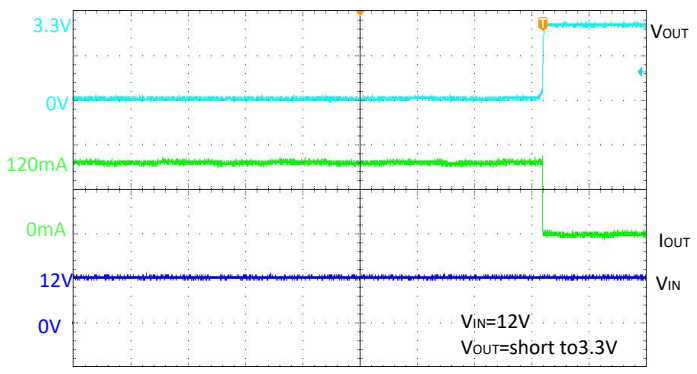
Time(40us/div)

Short Circuit Protection



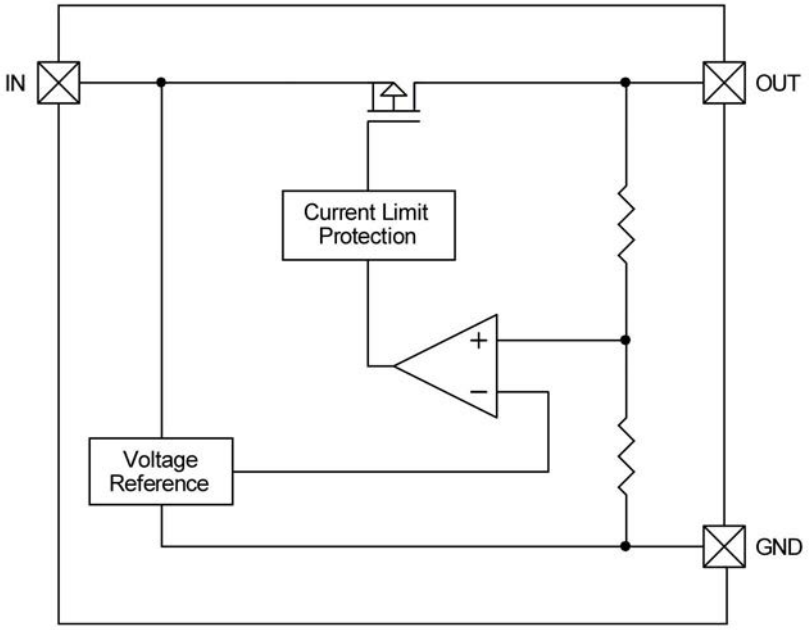
Time(2ms/div)

Short Circuit Protection



Time(2ms/div)

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

Input Capacitor

A 1μF ceramic capacitor is recommended to connect between VIN 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 VIN and GND. When VIN≥18V, it is recommended to add R1(R1>1Ω, The resistance shall be adjusted according to the actual application) at the input end.

Output Capacitor

To ensure loop stability, the SK6512 series products requires an output capacitor with a minimum effective capacitance value of 3.3μF. And the series products could support output capacitor range from 3.3uF to 220uF and with an ESR range between 0.001Ω and 5Ω. It recommends selecting a X5R- or X7R-type 4.7uF~10uF ceramic capacitor with low ESR over temperature range to improve the load transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to VOUT and GND pins.

Current Limit and Short Circuit Protection

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

Power Dissipation and Thermal Protection

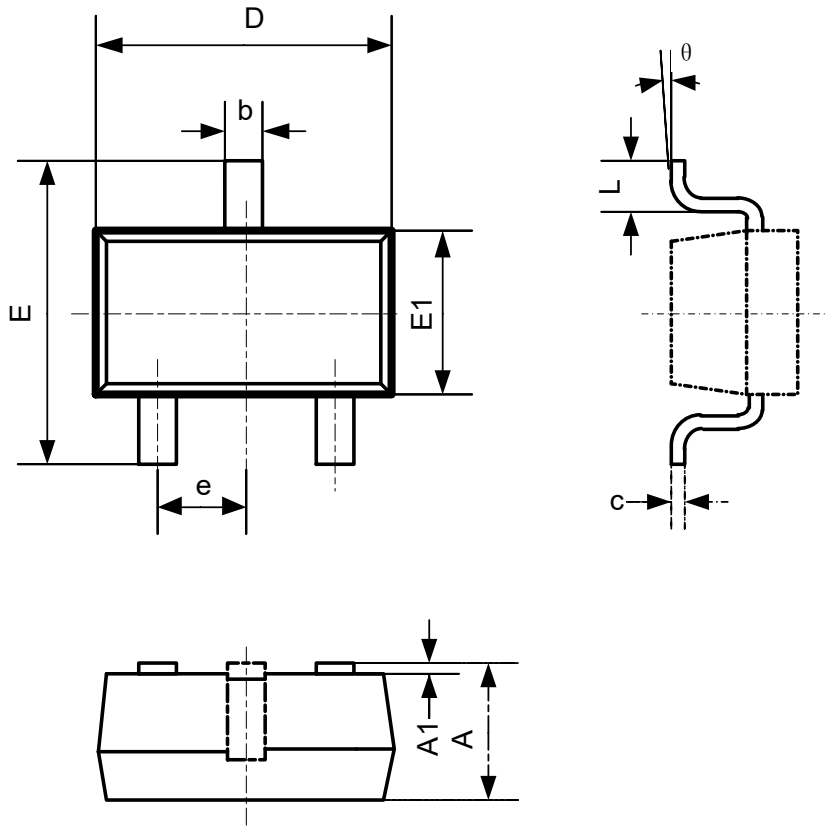
The SK6512 has internal thermal sense and protection circuits. When excessive power dissipation happens on the device, such as short circuit at the output pin or very heavy load current with a large voltage drop across the device, the internal thermal protection circuit will be triggered, and it will shut down the power MOSFET to prevent the LDO from damage. As soon as excessive thermal condition is removed and the temperature of the device drops down, the thermal protection circuit will lease the control of the power MOSFET, and the LDO device goes to normal operation.

Power dissipation caused by voltage drop across the LDO and by the output current flowing through the device needs to be dissipated out from the chip. The maximum junction temperature is dependent on power dissipation, package, the PCB layout, number of used Cu layers, Cu layers thickness and the ambient temperature. During normal operation, LDO junction temperature should not exceed 150°C, or else it may result in deterioration of the properties of the chip. Using below equations to calculate the power dissipation and estimate the junction temperature.

The power dissipation can be calculated using Equation1 .

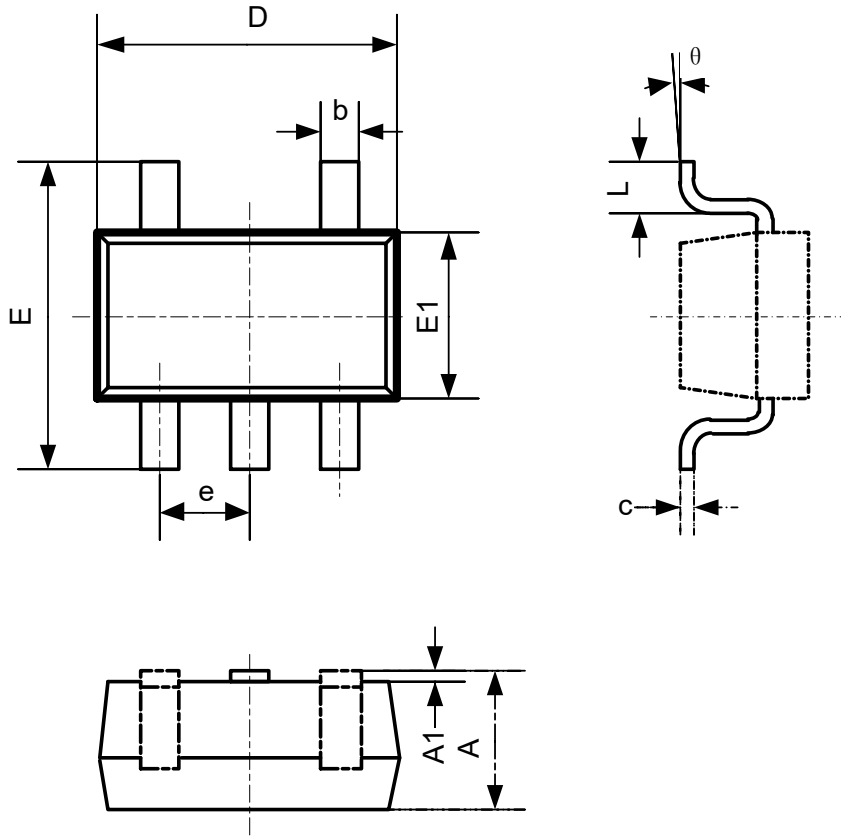
$$P_D = (V_{IN} - V_{OUT}) * I_{OUT} \qquad (1)$$

PACKAGE DIMESIONS: SOT23-3



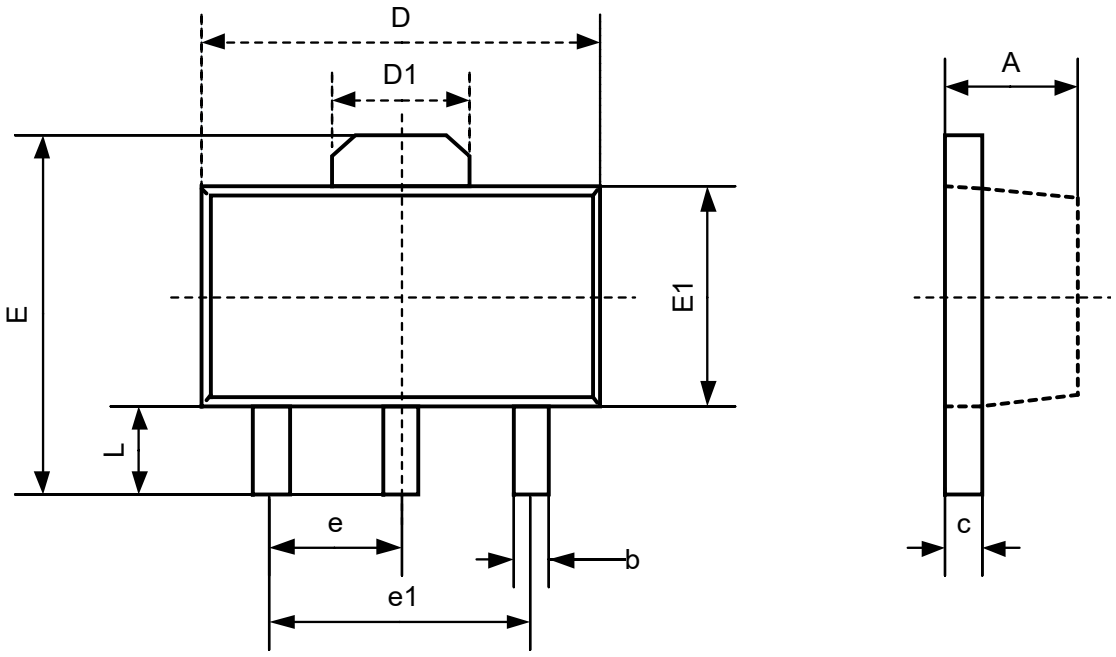
Symbol	Dimensions In Millimeters	
	Min	Max
A	1.05	1.35
A1	0.00	0.10
b	0.35	0.55
c	0.10	0.20
D	2.82	2.92
E	2.65	2.95
E1	1.56	1.60
e	0.95BSC	
L	0.30	0.60
θ	0°	10°

PACKAGE DIMESIONS: SOT23-5



Symbol	Dimensions In Millimeters	
	Min	Max
A	1.05	1.25
A1	0.00	0.10
b	0.30	0.50
c	0.10	0.20
D	2.85	3.05
E	2.65	2.95
E1	1.50	1.70
e	0.95BSC	
L	0.30	0.60
θ	0°	8°

PACKAGE DIMESIONS: SOT89-3



Symbol	Dimensions In Millimeters	
	Min	Max
A	1.40	1.60
b	0.38	0.55
c	0.36	0.46
D	4.40	4.60
D1	1.60	1.80
E	4.00	4.30
E1	2.40	2.60
e	1.50BSC	
e1	3.00BSC	
L	0.80	1.00