

PRELIMINARY - July 25, 2000

 TEL:805-498-2111 FAX:805-498-3804 WEB:<http://www.semtech.com>

## DESCRIPTION

The SC112 is a 150mA ultra low dropout linear regulator with a built in CMOS/TTL logic level enable, designed specifically for battery powered applications where low quiescent current and low dropout are critical for battery longevity.

The SC112 uses a Semtech proprietary internal PNP device for the pass element, providing a low dropout voltage of 130mV at a load of 60mA.

The output noise is reduced to 30 $\mu$ V (typical) by placing a very low leakage 10nF capacitor on pin 3 (noise bypass).

Each device contains a bandgap reference, error amplifier, PNP pass element, thermal and current limiting circuitry and resistor divider network for setting output voltage.

The SC112 is packaged in a six lead SOT-23 surface mount package for a very small footprint and it requires only a 1 $\mu$ F capacitor on the output and a 0.01 $\mu$ F on the bypass pin for a minimum number of external components.

## FEATURES

- Low dropout voltage
- CMOS/TTL compatible control switch
- Very low quiescent current 60 $\mu$ A (ON, no load)
- Internal thermal shutdown
- Short circuit protection
- Very low standby current 0.1 $\mu$ A maximum (OFF)
- Low noise with external bypass capacitor
- Industrial temperature range

## APPLICATIONS

- Battery powered systems
- Cellular telephones
- Cordless telephones
- Pagers, personal digital assistants
- Portable instrumentation
- Low voltage systems

## ORDERING INFORMATION

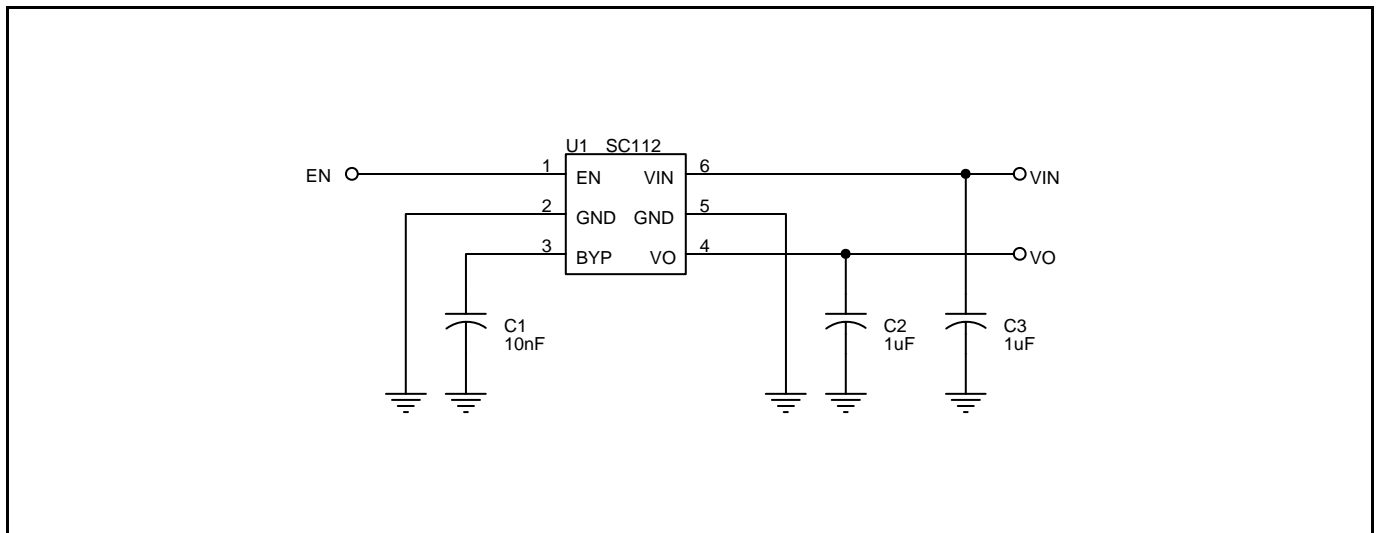
DEVICE <sup>(1)(2)</sup>	PACKAGE
SC112XXCSK.TR	6 pin SOT-23

Notes:

(1) Where XX denotes voltage options. Available voltages are: 2.2V, 2.5V, 2.8V, 3.0V, 3.3V, 3.6V, 3.8V, 4.0V and 5.0V. Contact factory for additional voltage options.

(2) Only available in tape and reel packaging. A reel contains 3000 devices

## TYPICAL APPLICATION CIRCUIT



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**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Maximum	Units
Input Supply Voltage	V <sub>IN</sub>	-0.3 to +16	V
Enable Input Voltage	V <sub>EN</sub>	-0.3 to V <sub>IN</sub>	V
Power Dissipation	P <sub>D</sub>	Internally Limited	W
Thermal Resistance Junction to Ambient	θ <sub>JA</sub>	230	°C/W
Operating Ambient Temperature Range	T <sub>A</sub>	-40 to +85	°C
Operating Junction Temperature Range	T <sub>A</sub>	-40 to +125	°C
Storage Temperature Range	T <sub>STG</sub>	-55 to +150	°C
Lead Temperature (Soldering) 10 sec.	T <sub>LEAD</sub>	300	°C
ESD Rating	ESD	2	kV

**ELECTRICAL CHARACTERISTICS**

 Unless specified, T<sub>A</sub> = 25°C, V<sub>IN</sub> = V<sub>O(NOM)</sub> + 1V, C<sub>IN</sub> = 1μF, C<sub>BYP</sub> = 10nF, C<sub>O</sub> = 1μF.  
 Values in **bold** apply over full operating temperature range.

Parameter	Symbol	Test Conditions	MIN	TYP	MAX	Units	
<b>VIN</b>							
Supply Voltage Range	V <sub>IN</sub>		<b>2.5</b>		<b>14.5</b>	V	
Ground Pin Current	I <sub>GND</sub>	I <sub>O</sub> = 0mA		60	75	μA	
			<b>90</b>				
		I <sub>O</sub> = 60mA		1.0	1.25	mA	
			<b>1.5</b>				
		I <sub>O</sub> = 100mA		2.1	2.5		
			<b>3.0</b>				
I <sub>O</sub> = 150mA		4.2	4.75				
	<b>5.25</b>						
		V <sub>IN</sub> = 8V, Output OFF			<b>0.1</b>	μA	
<b>VO</b>							
Output Voltage	V <sub>O</sub>	I <sub>O</sub> = 30 mA	-2.5	V <sub>O</sub>	+2.5	%	
			<b>-3.0</b>		<b>+3.0</b>		
Line Regulation	REG <sub>(LINE)</sub>	V <sub>IN</sub> = (V <sub>O(NOM)</sub> + 1V) to (V <sub>O(NOM)</sub> + 6V), I <sub>O</sub> = 1mA		5	10	mV	
			<b>20</b>				
Load Regulation	REG <sub>(LOAD)</sub>	I <sub>O</sub> = 1mA to 60mA		7.5	<b>35</b>	mV	
			I <sub>O</sub> = 1mA to 100mA		20		<b>65</b>
			I <sub>O</sub> = 1mA to 150mA		35		<b>110</b>
Temperature Coefficient	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 10mA		40		ppm/°C	

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**ELECTRICAL CHARACTERISTICS**

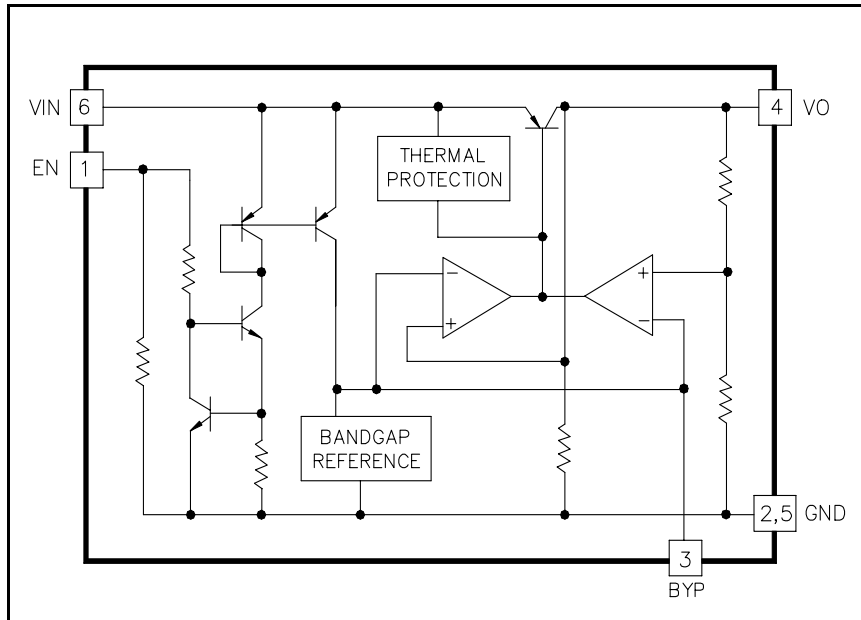
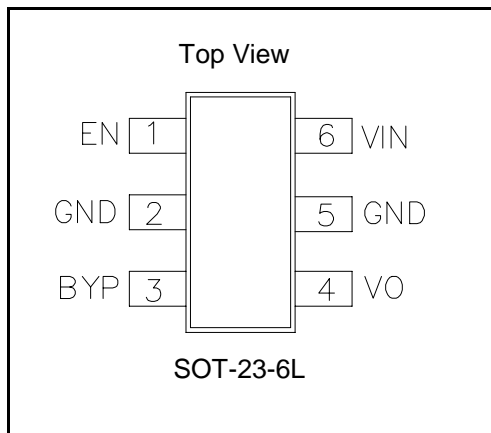
 Unless specified,  $T_A = 25^\circ\text{C}$ ,  $V_{IN} = V_{O(NOM)} + 1\text{V}$ ,  $C_{IN} = 1\mu\text{F}$ ,  $C_{BYP} = 10\text{nF}$ ,  $C_O = 1\mu\text{F}$ .  
 Values in **bold** apply over full operating temperature range.

Parameter	Symbol	Test Conditions	MIN	TYP	MAX	Units
<b>VO (Cont.)</b>						
Current Limit <sup>(1)</sup>	$I_{LIM}$		<b>180</b>	200		mA
Dropout Voltage	$V_D$	$I_O = 60\text{mA}$		130	150	mV
					<b>180</b>	
		$I_O = 100\text{mA}$		165	195	
					<b>225</b>	
$I_O = 150\text{mA}$		200	245			
			<b>275</b>			
Power Supply Rejection Ratio	RR	$V_{RIPPLE} = 100\text{mV(rms)}$ , $f = 400\text{Hz}$ , $I_O = 30\text{mA}$		60		dB
Output Noise Voltage	$e_n$	$10\text{ Hz} \leq f \leq 80\text{ kHz}$ , $I_O = 60\text{mA}$		30		$\mu\text{V(rms)}$
<b>BYP</b>						
Noise Bypass Terminal Voltage	$V_{BYP}$			1.250		V
<b>EN</b>						
Enable Input Threshold Voltage	$V_{IH}$	Output ON	<b>1.8</b>			V
	$V_{IL}$	Output OFF			<b>0.5</b>	
Enable Input Bias Current	$I_{EN}$	$V_{EN} = 1.8\text{V}$ , Output ON		6	<b>10</b>	$\mu\text{A}$

**NOTE:**

 (1) As the load resistance further decreases, the SC112 folds back the output current to approximately 100mA at  $V_O = 0\text{V}$ .

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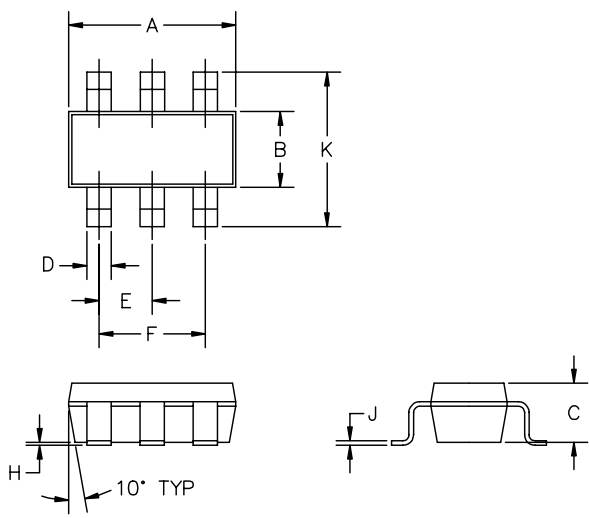
**BLOCK DIAGRAM**

**PIN CONFIGURATION**

**APPLICATION HINTS (Refer to Sheet 1):**

- (1)  $C_{IN}$  (C3) is needed if the device is far from the supply's filter capacitors, or for operation from a battery. A value of  $1.0\mu\text{F}$  or greater should be used.  $C_{IN}$  may be tantalum or ceramic.
- (2)  $C_O$  (C2) should be a  $1\mu\text{F}$  or greater tantalum or ceramic capacitor, with an Equivalent Series Resistance (ESR) between  $10\text{m}\Omega$  and  $1\Omega$  over temperature. Larger value capacitors will improve the overall transient response.
- (3)  $C_{BYP}$  (C1 - required) should be placed as close as possible to pin 3 and ground. A  $10\text{nF}$  ceramic capacitor is recommended.
- (4) EN may be tied to  $V_{IN}$  if the shutdown feature is not required. Maximum EN voltage =  $V_{IN}$ .
- (5) Connect both ground pins (2 and 5) to ground to maximize heat conduction.

**PIN DESCRIPTION**

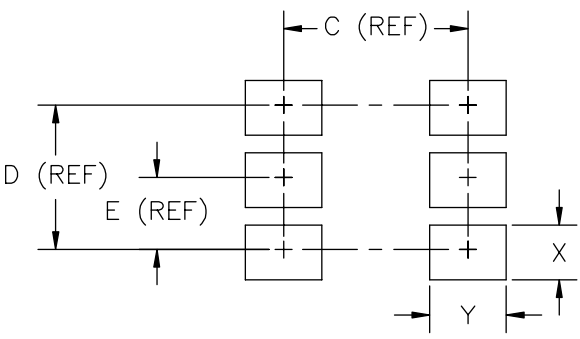
Pin #	Pin Name	Description
1	EN	Active high enable pin. Connect to $V_{IN}$ if not being used.
2	GND	Ground pin. Use for heatsinking along with Pin #5.
3	BYP	Noise bypass pin. Connect a $10\text{nF}$ capacitor (required) between this pin and GND.
4	VO	Regulator output, supplying a guaranteed $150\text{mA}$ .
5	GND	Ground pin. Use for heatsinking along with Pin #2.
6	VIN	Power input pin.

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**DEVICE OUTLINE - SOT23-6L**


DIMENSIONS ①					
DIM <sup>N</sup>	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.110	.120	2.80	3.05	—
B	.059	.070	1.50	1.75	—
C	.036	.051	.90	1.30	—
D	.014	.020	.35	.50	—
E	.033	.040	.85	1.05	—
F	.067	.083	1.7	2.1	—
H	.0004	.006	.010	.150	—
J	.0035	.008	.090	.20	—
K	.102	.118	2.6	3.00	—

② PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH AND METAL BURR.  
 ① CONTROLLING DIMENSIONS: MILLIMETERS.

**MINIMUM LAND PATTERN - SOT23-6L**


DIMENSIONS			
DIM <sup>N</sup>	INCHES	MM	NOTE
C	.094	2.4	—
D	.074	1.9	—
E	.037	.95	—
X	.028	.7	—
Y	.039	1.0	—

ECN00-1203