

PRELIMINARY - June 15, 2000

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

## DESCRIPTION

The SC1456 contains two low dropout linear regulators that operate from a +2.5V to +6V input range and deliver up to 150mA. PMOS pass transistors allow a low 110µA supply current per device to remain independent of load, making these devices ideal for battery operated portable equipment such as cellular phones, cordless phones and personal digital assistants.

Each device can be powered from a separate supply voltage or the same supply voltage for maximum flexibility. The output voltage of each device can be preset or adjusted with an external resistor divider. Other features include independant low powered shutdown, short circuit protection, thermal shutdown protection and reverse battery protection for each regulator. The SC1456 comes in the tiny 10 lead MSOP package.

## ORDERING INFORMATION

| Part Number                    | Package |
|--------------------------------|---------|
| SC1456XIMSTR <sup>(1)(2)</sup> | MSOP-10 |

Notes:

(1) Where X denotes voltage options - see table on page 4. Consult factory for other voltage options.

(2) Only available in tape and reel packaging. A reel contains 2500 devices.

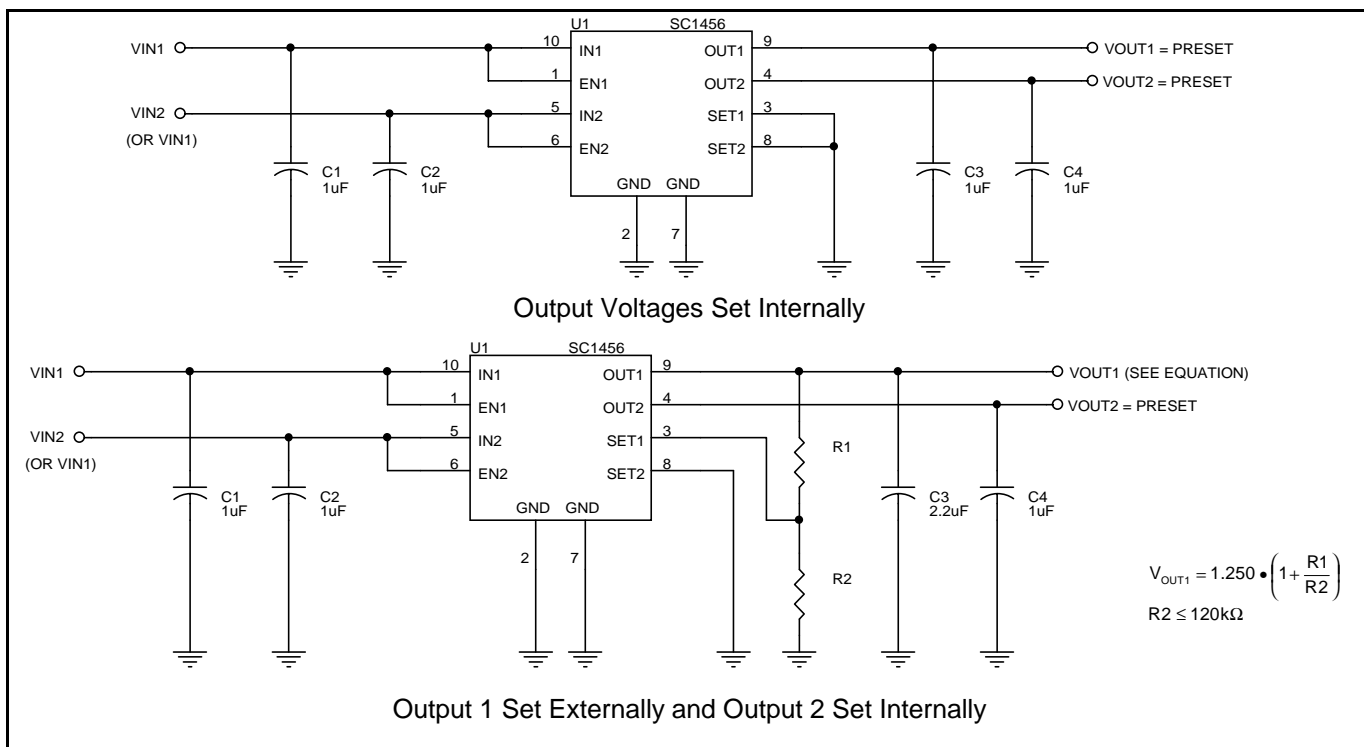
## FEATURES

- Two guaranteed 150 mA outputs
- Designed to operate with ceramic capacitors
- Fixed or adjustable outputs
- Very small external components
- Low 75µV<sub>RMS</sub> output noise
- Very low supply currents
- Thermal overload protection
- Reverse battery protection
- Individual low power shutdown
- Surface mount packaging (10 pin MSOP)
- Full industrial temperature range

## APPLICATIONS

- Battery Powered Systems
- Cellular Telephones
- Cordless Telephones
- Personal Digital Assistants
- Portable Instrumentation
- Modems
- PCMCIA cards

## TYPICAL APPLICATIONS



PRELIMINARY - June 15, 2000

| <b>ABSOLUTE MAXIMUM RATINGS</b>         |               |             |       |
|---|---------------|-------------|-------|
| Parameter                               | Symbol        | Maximum     | Units |
| Input Supply Voltage                    | $V_{IN}$      | -0.3 to +7  | V     |
| Thermal Resistance Junction to Ambient  | $\theta_{JA}$ | 113         | °C/W  |
| Operating Ambient Temperature Range     | $T_A$         | -40 to +85  | °C    |
| Operating Junction Temperature Range    | $T_J$         | -40 to +125 | °C    |
| Storage Temperature Range               | $T_{STG}$     | -65 to +150 | °C    |
| Lead Temperature (Soldering) 10 seconds | $T_{LEAD}$    | 300         | °C    |
| ESD Rating (Human Body Model)           | ESD           | 1.25        | kV    |

**ELECTRICAL CHARACTERISTICS<sup>(1)</sup>**

 Unless specified:  $V_{IN} = 3.6V$ ,  $V_{SET} = GND$ ,  $V_{EN} = V_{IN}$ ,  $T_A = 25^\circ C$ . Values in **bold** apply over full operating ambient temperature range.

| Parameter                                     | Symbol         | Conditions   | Min          | Typ       | Max          | Units   |
|---|----------------|--|--------------|-----------|--------------|---------|
| <b>IN1, IN2</b>                               |                |  |              |           |              |         |
| Supply Voltage Range                          | $V_{IN}$       |  | <b>2.5</b>   |           | <b>6.0</b>   | V       |
| Supply Current                                | $I_Q$          | $I_{OUT} = 0mA$  |              | 90        | 130          | $\mu A$ |
|   |                |  |              |           | <b>160</b>   |         |
|   |                | $50mA \leq I_{OUT} \leq 150mA$                                       |              | 110       | 160          | $\mu A$ |
|   |                |  |              |           | <b>200</b>   |         |
|   |                | $V_{EN} = 0V$  |              | 0.0001    | 1            | $\mu A$ |
|   |                |  |              |           | <b>2</b>     |         |
| <b>OUT1, OUT2</b>                             |                |  |              |           |              |         |
| Output Voltage <sup>(2)</sup>                 | $V_{OUT}$      | $I_{OUT} = 1mA$  | -2.0%        | $V_{OUT}$ | +2.0%        | V       |
|   |                | $1mA \leq I_{OUT} \leq 150mA$ , $V_{OUT}+1V \leq V_{IN} \leq 5.5V$   | <b>-3.5%</b> |           | <b>+3.5%</b> |         |
| Line Regulation <sup>(2)</sup>                | $REG_{(LINE)}$ | $2.5V \leq V_{IN} \leq 5.5V$ , $V_{SET} = V_{OUT}$ , $I_{OUT} = 1mA$ |              | 5         | 10           | mV      |
|   |                |  |              |           | <b>12</b>    |         |
| Load Regulation <sup>(2)</sup>                | $REG_{(LOAD)}$ | $I_{OUT} = 0mA$ to 50mA  |              | -10       | -15          | mV      |
|   |                |  |              |           | <b>-20</b>   |         |
|   |                | $I_{OUT} = 0mA$ to 100mA   |              | -15       | -20          | mV      |
|   |                |  |              |           | <b>-25</b>   |         |
|   |                | $I_{OUT} = 0mA$ to 50mA, $V_{SET} = V_{OUT}$                         |              | -2.5      | -7.5         | mV      |
|   |                |  | <b>-15.0</b> |           |              |         |
| $I_{OUT} = 0mA$ to 100mA, $V_{SET} = V_{OUT}$ |                | -5   | -15          | mV        |              |         |
|   |                |  | <b>-30</b>   |           |              |         |

PRELIMINARY - June 15, 2000

**ELECTRICAL CHARACTERISTICS <sup>(1)</sup>(Cont.)**

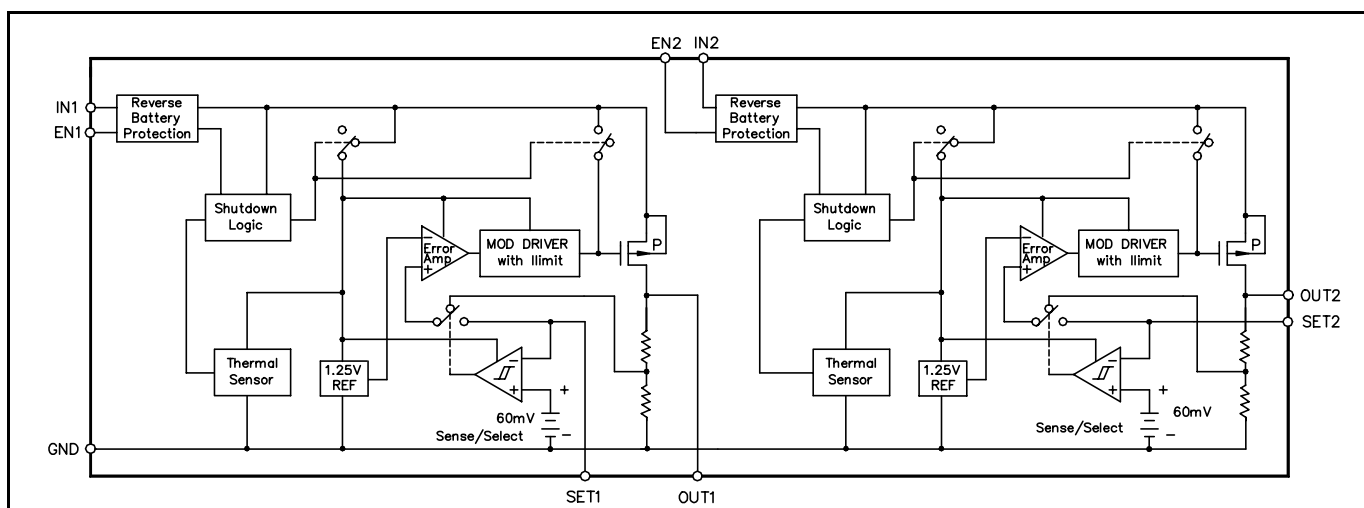
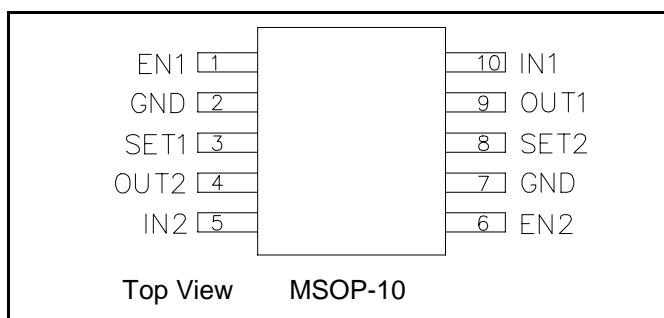
 Unless specified:  $V_{IN} = 3.6V$ ,  $V_{SET} = GND$ ,  $V_{EN} = V_{IN}$ ,  $T_A = 25^{\circ}C$ . Values in **bold** apply over full operating ambient temperature range.

| Parameter                                | Symbol     | Conditions   | Min          | Typ   | Max          | Units         |
|--|------------|--|--------------|-------|--------------|---------------|
| <b>OUT1, OUT2 (Cont.)</b>                |            |  |              |       |              |               |
| Dropout Voltage <sup>(2)(3)</sup>        | $V_D$      | $I_{OUT} = 1mA$  |              | 1.1   |              | mV            |
|  |            | $I_{OUT} = 50mA$   |              | 55    | 90           | mV            |
|  |            |  |              |       | <b>120</b>   |               |
|  |            | $I_{OUT} = 100mA$  |              | 110   | 180          | mV            |
|  |            |  | <b>240</b>   |       |              |               |
| Current Limit                            | $I_{LIM}$  |  | <b>150</b>   | 240   | <b>350</b>   | mA            |
| Output Voltage Noise                     | $e_n$      | 10Hz to 99kHz, $I_{OUT} = 50mA$ , $C_{OUT} = 1\mu F$         |              | 90    |              | $\mu V_{RMS}$ |
|  |            | $C_{OUT} = 100\mu F$   |              | 75    |              |               |
| Power Supply Rejection Ratio             | PSRR       | $f = 120Hz$  |              | 55    |              | dB            |
| <b>EN1, EN2</b>                          |            |  |              |       |              |               |
| EN Input Threshold                       | $V_{IH}$   |  | <b>1.8</b>   |       |              | V             |
|  | $V_{IL}$   |  |              |       | <b>0.4</b>   |               |
| EN Input Bias Current <sup>(4)</sup>     | $I_{EN}$   | $V_{EN} = V_{IN}$  |              | 0     | 100          | nA            |
|  |            |  |              |       | <b>200</b>   |               |
| <b>SET1, SET2</b>                        |            |  |              |       |              |               |
| Sense/Select Threshold                   | $V_{TH}$   |  | <b>20</b>    | 55    | <b>80</b>    | mV            |
| SET Reference Voltage <sup>(2)</sup>     | $V_{SET}$  | $I_{OUT} = 1mA$  | 1.225        | 1.250 | 1.275        | V             |
|  |            | $1mA \leq I_{OUT} \leq 150mA$ , $2.5V \leq V_{IN} \leq 5.5V$ | <b>1.206</b> |       | <b>1.294</b> |               |
| SET Input Leakage Current <sup>(4)</sup> | $I_{SET}$  | $V_{SET} = 1.3V$   |              | 0.015 | 2.500        | nA            |
|  |            |  |              |       | <b>5.000</b> |               |
| <b>OVER TEMPERATURE PROTECTION</b>       |            |  |              |       |              |               |
| High Trip Level                          | $T_{HI}$   |  |              | 170   |              | $^{\circ}C$   |
| Hysteresis                               | $T_{HYST}$ |  |              | 10    |              | $^{\circ}C$   |

**NOTE:**

- (1) This device is ESD sensitive. Use of standard ESD handling precautions is required.
- (2) Low duty cycle pulse testing with Kelvin connections required.
- (3) Defined as the input to output differential at which the output voltage drops 100mV below the value measured at a differential of 2V.
- (4) Guaranteed by design.

PRELIMINARY - June 15, 2000

**BLOCK DIAGRAM**

**PIN CONFIGURATION**

**VOLTAGE OPTIONS**

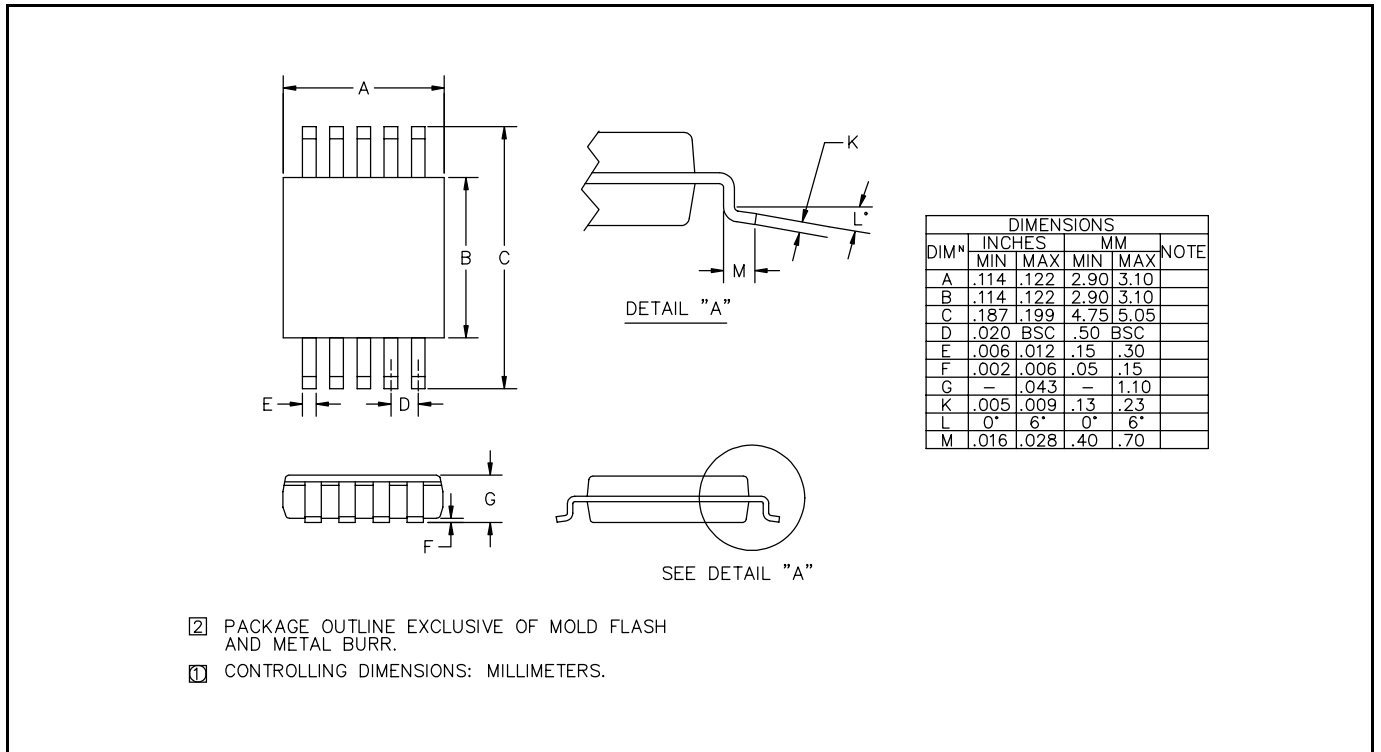
Replace X in the part number (SC1456XIMS) by the letter shown below for the corresponding voltage option:

| X | V <sub>OUTA</sub> (V) | V <sub>OUTB</sub> (V) |
|---|-----------------------|-----------------------|
| A | 2.5                   | 2.5                   |
| B | 2.8                   | 2.8                   |
| C | 3.0                   | 3.0                   |
| D | 3.3                   | 3.3                   |

**PIN DESCRIPTIONS**

| Pin # | Pin Name | Description  |
|-------|----------|--|
| 1     | EN1      | Active high enable pin for device 1. Connect to VIN1 if not being used.  |
| 2     | GND      | Ground pin. Can be used for heatsinking if needed. Electrically connected to pin 7.  |
| 3     | SET1     | Connecting this pin to ground results in the internally preset value for V <sub>OUT1</sub> . Connecting to an external resistor divider changes V <sub>OUT1</sub> to:<br>$V_{OUT1} = 1.250 \cdot \left(1 + \frac{R1}{R2}\right)$ |
| 4     | OUT2     | Regulator output for device 2, sourcing up to 150mA  |
| 5     | IN2      | Supply input pin for device 2.   |
| 6     | EN2      | Active high enable pin for device 2. Connect to VIN2 if not being used.  |
| 7     | GND      | Ground pin. Can be used for heatsinking if needed. Electrically connected to pin 2.  |
| 8     | SET2     | Connecting this pin to ground results in the internally preset value for V <sub>OUT2</sub> . Connecting to an external resistor divider changes V <sub>OUT2</sub> to:<br>$V_{OUT2} = 1.250 \cdot \left(1 + \frac{R1}{R2}\right)$ |
| 9     | OUT1     | Regulator output for device 1, sourcing up to 150mA  |
| 10    | IN1      | Supply input pin for device 1.   |

PRELIMINARY - June 15, 2000

**DEVICE OUTLINE - MSOP-10**


ECN 00-1167