



## Micropower 500mA Low Voltage CMOS Regulator

### Features

- Regulated 1.3 volt output
- Guaranteed 500mA output current
- Operates from 3.3V supply
- Low quiescent operating current ( $< 500\mu\text{A}$  typical)
- Current limit protection
- Thermal overload protection
- Reverse voltage protection
- Thermally-enhanced MSOP-8 package

### Applications

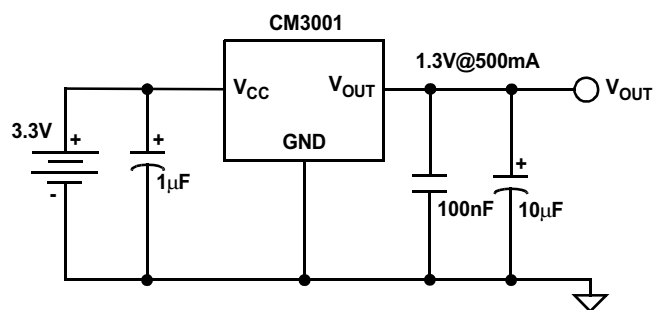
- Low Voltage "Core" Processors
- Peripheral Adapter Cards
- Portable/Battery-Powered Devices

### Product Description

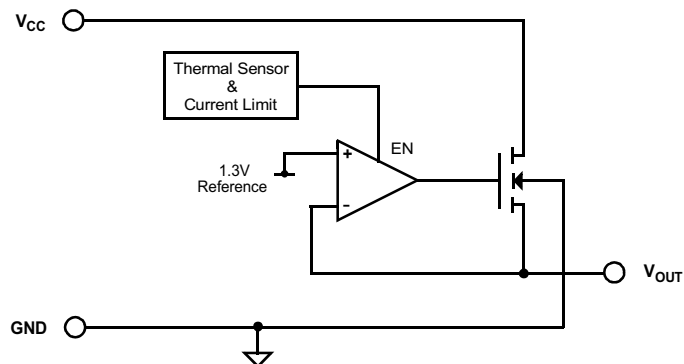
The CM3001 Micropower CMOS Regulator delivers up to 500mA of load current at a fixed voltage output of 1.3 volts. Operating from a single input supply, this device is ideally suited for powering low voltage "core" processors, especially where a 3.3V source is already available.

The CM3001 is fully protected, offering both overload current limiting and high temperature thermal shut-down. Housed in a space-saving thermally-enhanced MSOP-8 package, this device ensures maximum junction-to-ambient power dissipation.

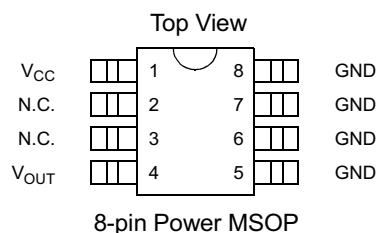
### Typical Application Circuit



### Simplified Electrical Schematic



### PACKAGE / PINOUT DIAGRAM



Note: This drawing is not to scale.

### PIN DESCRIPTIONS

| PIN(S)  | NAME             | DESCRIPTION                                                                                                                                                                                                                                    |
|---------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | V <sub>CC</sub>  | The input power supply for the regulator. If this input is within a few inches of the main supply filter, a capacitor may not be necessary. Otherwise an input filter capacitor of approximately 1uF to 10uF will ensure adequate filtering.   |
| 2       | N.C.             | This pin has no connection to the internal device. To provide additional thermal performance, these pins can be connected directly to the PC board GND plane.                                                                                  |
| 3       | N.C.             | This pin has no connection to the internal device. To provide additional thermal performance, these pins can be connected directly to the PC board GND plane.                                                                                  |
| 4       | V <sub>OUT</sub> | The regulated voltage output. A nominal output capacitor of 10uF is sufficient to minimize any transient disturbances under normal operating conditions. Additional output capacitance can be used to further improve transient load response. |
| 5,6,7,8 | GND              | The negative reference for all voltages.                                                                                                                                                                                                       |

## Ordering Information

### PART NUMBERING INFORMATION

| Regulator   | Pins | Package    | Ordering Part Number <sup>1</sup> | Part Marking |
|-------------|------|------------|-----------------------------------|--------------|
| CM3001-13MA | 8    | Power MSOP | CM3001-13MA                       | 113          |

Note 1: Parts are shipped in Tape & Reel form unless otherwise specified.

## Specifications

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                           | RATING                                         | UNITS    |
|-----------------------------------------------------|------------------------------------------------|----------|
| ESD Protection (HBM)                                | ±2000                                          | V        |
| Pin Voltages<br>V <sub>CC</sub><br>V <sub>OUT</sub> | [GND - 0.4] to [+6.0]<br>[GND - 0.4] to [+6.0] | V<br>V   |
| Storage Temperature Range                           | -40 to +150                                    | °C       |
| Operating Temperature Range<br>Ambient<br>Junction  | 0 to +70<br>0 to +150                          | °C<br>°C |
| Power Dissipation (Note 1)                          | Internally Limited                             | W        |

Note 1: The MSOP package used is thermally enhanced through the use of a fused integral leadframe. The power rating is based on a printed circuit board heat spreading capability equivalent to 2 square inches of copper connected to the GND pins. Typical multi-layer boards using power plane construction will provide this heat spreading ability without the need for additional dedicated copper area. Please consult with factory for thermal evaluation assistance.

### STANDARD OPERATING CONDITIONS

| PARAMETER                           | RATING     | UNITS |
|-------------------------------------|------------|-------|
| V <sub>CC</sub>                     | 3.0 to 3.6 | V     |
| Ambient Operating Temperature Range | 0 to +70   | °C    |
| Load Current                        | 0 to 500   | mA    |
| C <sub>EXT</sub>                    | 10 ±20%    | µF    |

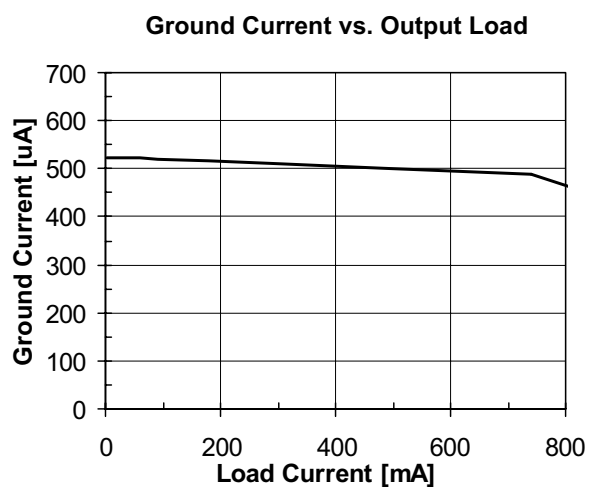
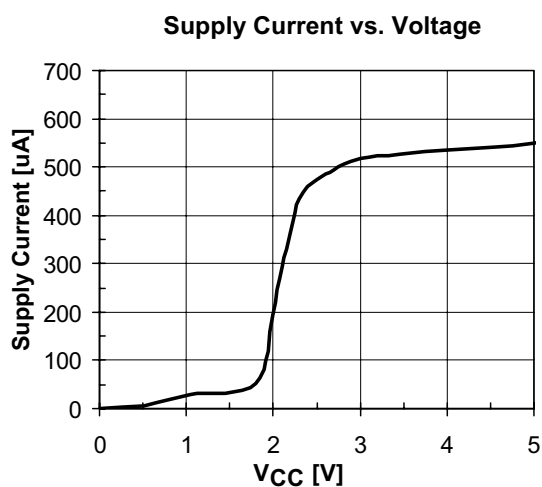
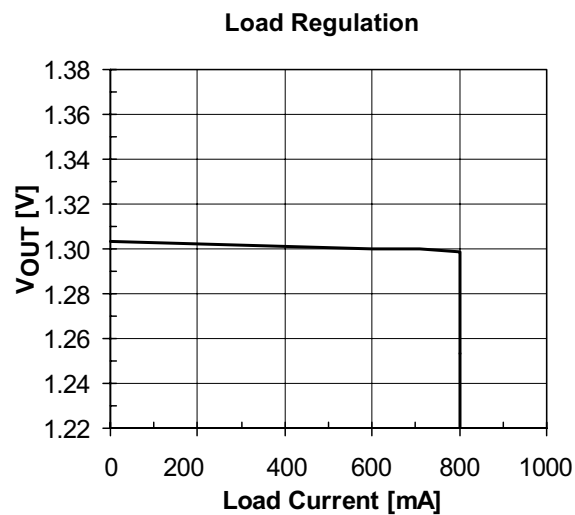
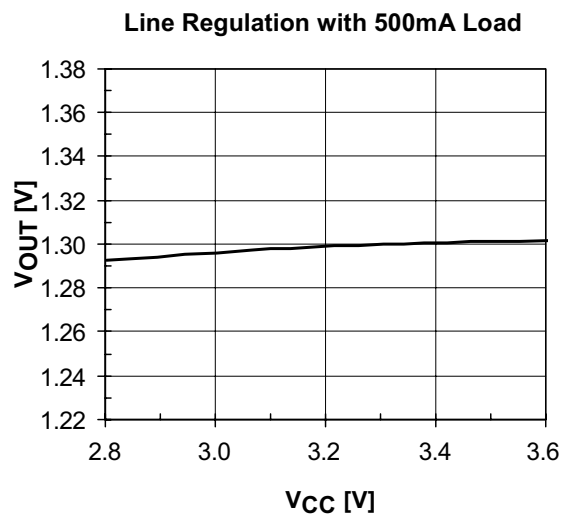
### ELECTRICAL OPERATING CHARACTERISTICS

| SYMBOL               | PARAMETER                           | CONDITIONS                                              | MIN  | TYP        | MAX        | UNITS    |
|----------------------|-------------------------------------|---------------------------------------------------------|------|------------|------------|----------|
| V <sub>OUT</sub>     | Regulator Output Voltage            | 0mA < I <sub>LOAD</sub> < 500mA                         | 1.23 | 1.30       | 1.37       | V        |
| I <sub>LIM</sub>     | Overload Current Limit              |                                                         |      | 800        |            | mA       |
| V <sub>R LOAD</sub>  | Load Regulation                     | 10mA < I <sub>LOAD</sub> < 500mA; V <sub>CC</sub> =3.3V |      | 20         |            | mV       |
| V <sub>R LINE</sub>  | Line Regulation                     | I <sub>LOAD</sub> = 5mA; 3.0V ≤ V <sub>CC</sub> ≤ 5.5V  |      | 20         |            | mV       |
| I <sub>Q</sub>       | Quiescent Current                   | I <sub>LOAD</sub> = 0mA                                 |      | 500        | 900        | µA       |
| I <sub>GND</sub>     | Ground Current                      | I <sub>LOAD</sub> = 0mA<br>I <sub>LOAD</sub> = 1000mA   |      | 500<br>500 | 900<br>900 | µA<br>µA |
| I <sub>RCC</sub>     | V <sub>CC</sub> Pin Reverse Leakage | V <sub>OUT</sub> = 3.3V; V <sub>CC</sub> = 0V           |      | 1          | 100        | µA       |
| T <sub>DISABLE</sub> | Shutdown Temperature                |                                                         |      | 160        |            | °C       |
| T <sub>HYST</sub>    | Thermal Hysteresis                  |                                                         |      | 25         |            | °C       |



## Performance Information

CM3001 Typical DC Characteristics (nominal conditions unless specified otherwise)

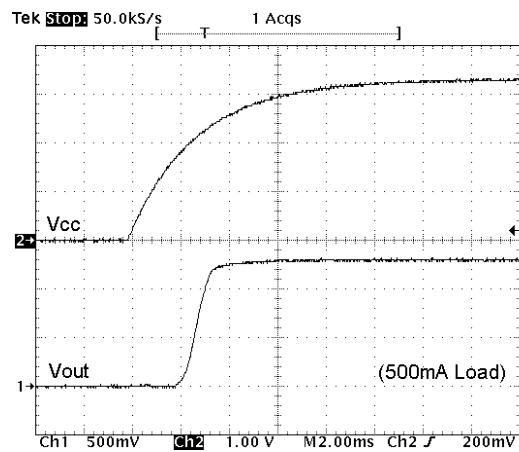




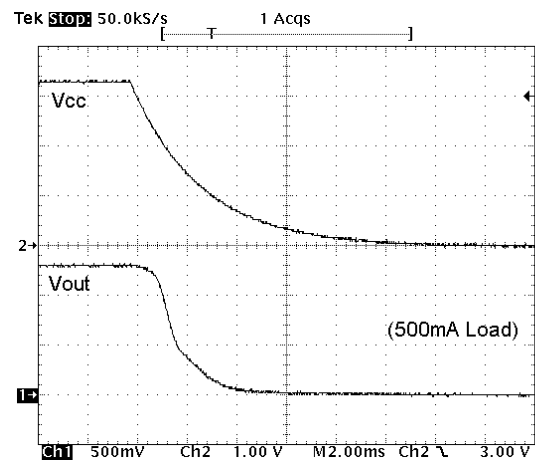
## Performance Information (cont'd)

CM3001 Typical Transient Characteristics (nominal conditions unless specified otherwise)

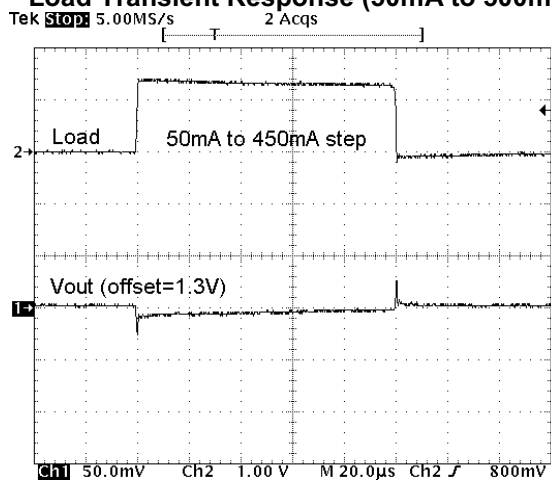
**Cold Start Power-up with Rated Load**



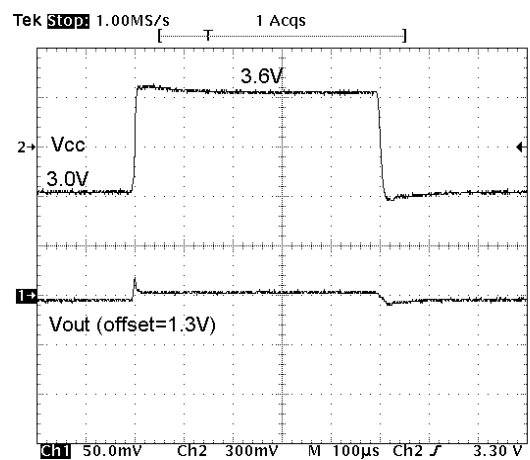
**Full Power Down with Rated Load**



**Load Transient Response (50mA to 500mA)**



**Line Transient Step Response (0.6Vp-p)**





## Performance Information (cont'd)

### Typical Thermal Characteristics

The overall junction to ambient thermal resistance ( $\theta_{JA}$ ) for device power dissipation ( $P_D$ ) consists primarily of two paths in series. The first path is the junction to the case ( $\theta_{JC}$ ) which is defined by the package style, and the second path is case to ambient ( $\theta_{CA}$ ) thermal resistance which is dependent on board layout. The final operating junction temperature for any set of conditions can be estimated by the following thermal equation:

$$\begin{aligned} T_{JUNC} &= T_{AMB} + P_D * (\theta_{JC}) + P_D * (\theta_{CA}) \\ &= T_{AMB} + P_D * (\theta_{JA}) \end{aligned}$$

The CM3001 uses a thermally enhanced MSOP package in which the GND pins (5 through 8) are integral to the leadframe. When this package is mounted on a double sided printed circuit board with two square inches of copper allocated for "heat spreading", the resulting  $\theta_{JA}$  is about 70°C/W.

Based on a power dissipation of .8W (Load x Vin-Vout = .4A x [3.3V-1.3V]) with an ambient of 70°C, the resulting junction temperature will be:

$$\begin{aligned} T_{JUNC} &= T_{AMB} + P_D * (\theta_{JA}) \\ &= 70^\circ\text{C} + .8\text{W} * (70^\circ\text{C/W}) \\ &= 70^\circ\text{C} + 55^\circ\text{C} = 125^\circ\text{C} \end{aligned}$$

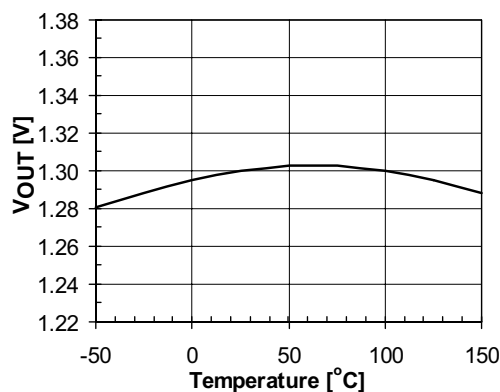
Thermal characteristics were measured using a double sided board with two square inches of copper area connected to the GND pins for "heat spreading".

Measurements showing performance up to a junction temperature of 125°C are presented in Figure 1. They were performed under light load conditions (5mA); this allows the ambient temperature to be representative of the internal junction temperature.

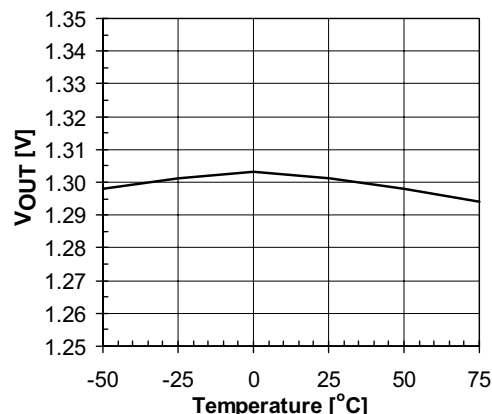
**Note:** The use of multi-layer board construction with separate ground and power planes will further enhance the overall thermal performance. In the event of no copper area being dedicated for heat spreading, a multi-layer board construction using only the minimum size pad layout will typically provide the CM3001 with an overall  $\theta_{JA}$  of 70°C/W, which allows up to 0.8W to be dissipated safely.

Please consult CAMD Technical Support for assistance with thermal analysis of the CM3001 with respect to a specific application.

Output Voltage with temperature (5mA Load)



Output Voltage with temperature (500mA Load)



Ground Current with Temperature (No Load)

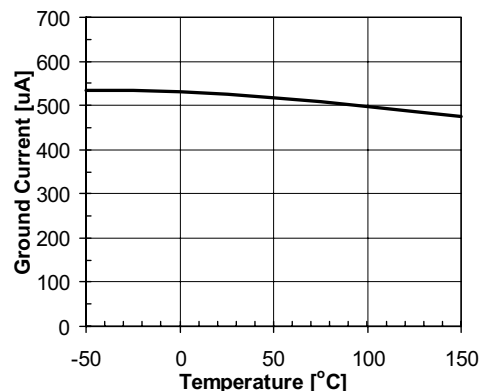


Figure 1. CM3001  
Performance vs. Temperature



## Mechanical Details

### MSOP-8 Mechanical Specifications:

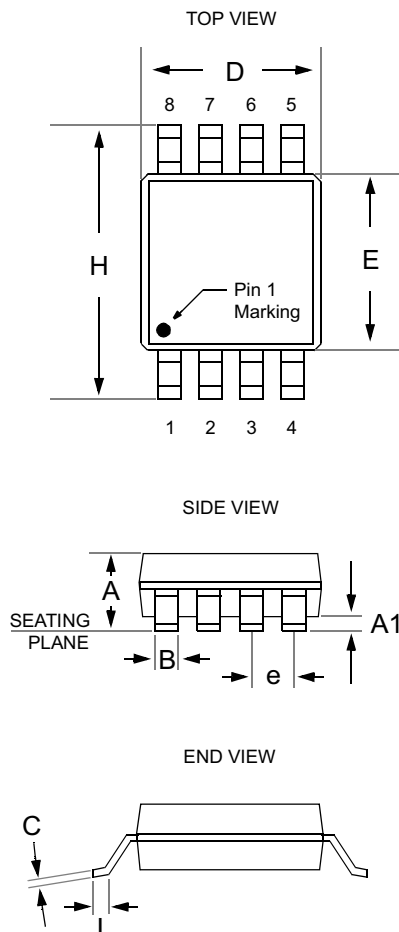
CM3001-13MA device is packaged in 8-pin MSOP package. Dimensions are presented below.

For complete information on the MSOP-8 package, see the California Micro Devices MSOP Package Information document.

| PACKAGE DIMENSIONS            |             |      |             |       |
|-------------------------------|-------------|------|-------------|-------|
| Package                       | MSOP        |      |             |       |
| Pins                          | 8           |      |             |       |
| Dimensions                    | Millimeters |      | Inches      |       |
|                               | Min         | Max  | Min         | Max   |
| A                             | 0.87        | 1.17 | 0.034       | 0.046 |
| A1                            | 0.05        | 0.25 | 0.002       | 0.010 |
| B                             | 0.30 (typ)  |      | 0.012 (typ) |       |
| C                             | 0.18        |      | 0.007       |       |
| D                             | 2.90        | 3.10 | 0.114       | 0.122 |
| E                             | 2.90        | 3.10 | 0.114       | 0.122 |
| e                             | 0.65 BSC    |      | 0.025 BSC   |       |
| H                             | 4.78        | 4.98 | 0.188       | 0.196 |
| L                             | 0.52        | 0.54 | 0.017       | 0.025 |
| # per tube                    | 80 pieces*  |      |             |       |
| # per tape and reel           | 4000 pieces |      |             |       |
| Controlling dimension: inches |             |      |             |       |

\* This is an approximate number which may vary.

### Mechanical Package Diagrams



Package Dimensions for MSOP-8