# 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 (< 500μA typical)
- Current limit protection
- Thermal overload protection
- Reverse voltage protection
- Thermally-enhanced MSOP-8 package

## Applications

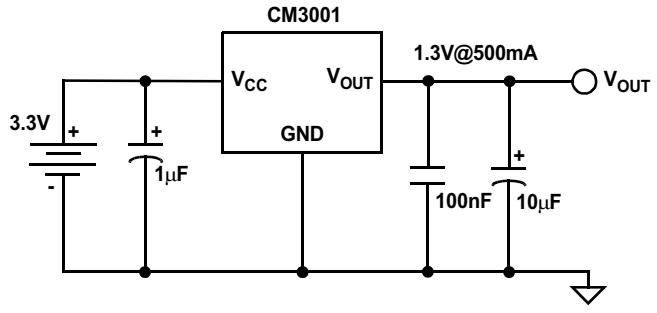
- Low Voltage "Core" Processors
- Peripheral Adapter Cards
- Portable/Battery-Powered Devices

## Product Description

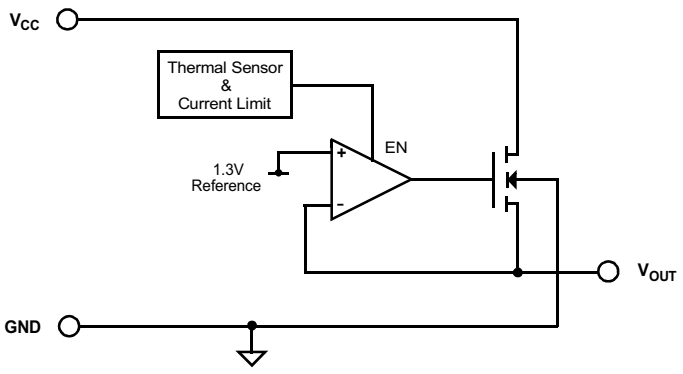
The CM3001 Micropower CMOS Regulator delivers up to 500mA of load current at a fixed voltage output of 1.3 volts. Operating from a single input supply, this device is ideally suited for powering low voltage “core” processors, especially where a 3.3V source is already available.

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

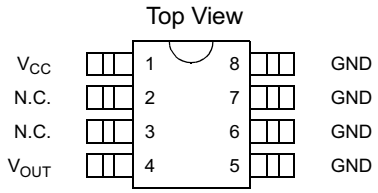
### Typical Application Circuit




### Simplified Electrical Schematic



## PACKAGE / PINOUT DIAGRAM




8-pin Power MSOP

Note: This drawing is not to scale.

## PIN DESCRIPTIONS

| PIN(S) | NAME | DESCRIPTION |
|---|---|---|
| 1 | $V_{CC}$ | 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 | $V_{OUT}$ | 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[1] | 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>$V_{CC}$<br>$V_{OUT}$ | <br>[GND - 0.4] to [+6.0]<br>[GND - 0.4] to [+6.0] | <br>V<br>V |
| Storage Temperature Range | -40 to +150 | °C |
| Operating Temperature Range<br>Ambient<br>Junction | <br>0 to +70<br>0 to +150 | <br>°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.

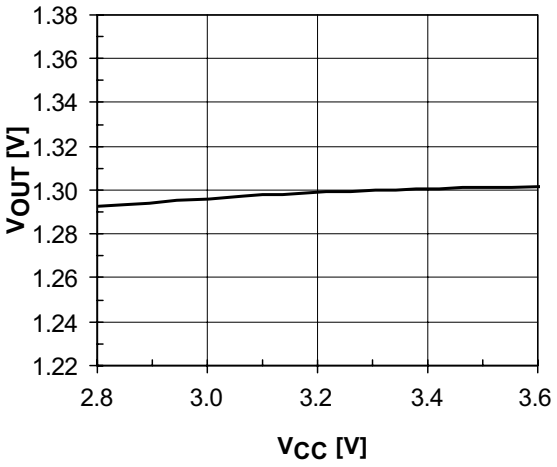
| STANDARD OPERATING CONDITIONS | | |
|---|---|---|
| **PARAMETER** | **RATING** | **UNITS** |
| $V_{CC}$ | 3.0 to 3.6 | V |
| Ambient Operating Temperature Range | 0 to +70 | °C |
| Load Current | 0 to 500 | mA |
| $C_{EXT}$ | 10 ±20% | µF |

| ELECTRICAL OPERATING CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|
| **SYMBOL** | **PARAMETER** | **CONDITIONS** | **MIN** | **TYP** | **MAX** | **UNITS** |
| $V_{OUT}$ | Regulator Output Voltage | 0mA < $I_{LOAD}$ < 500mA | 1.23 | 1.30 | 1.37 | V |
| $I_{LIM}$ | Overload Current Limit | | | 800 | | mA |
| $V_{R\ LOAD}$ | Load Regulation | 10mA < $I_{LOAD}$ < 500mA; $V_{CC}$=3.3V | | 20 | | mV |
| $V_{R\ LINE}$ | Line Regulation | $I_{LOAD}$ = 5mA; 3.0V ≤ $V_{CC}$≤ to 5.5V | | 20 | | mV |
| $I_Q$ | Quiescent Current | $I_{LOAD}$= 0mA | | 500 | 900 | µA |
| $I_{GND}$ | Ground Current | $I_{LOAD}$ = 0mA<br>$I_{LOAD}$ = 1000mA | | 500<br>500 | 900<br>900 | µA<br>µA |
| $I_{RCC}$ | $V_{CC}$ Pin Reverse Leakage | $V_{OUT}$ = 3.3V; $V_{CC}$ = 0V | | 1 | 100 | µA |
| $T_{DISABLE}$<br>$T_{HYST}$ | Shutdown Temperature<br>Thermal Hysteresis | | | 160<br>25 | | °C<br>°C |

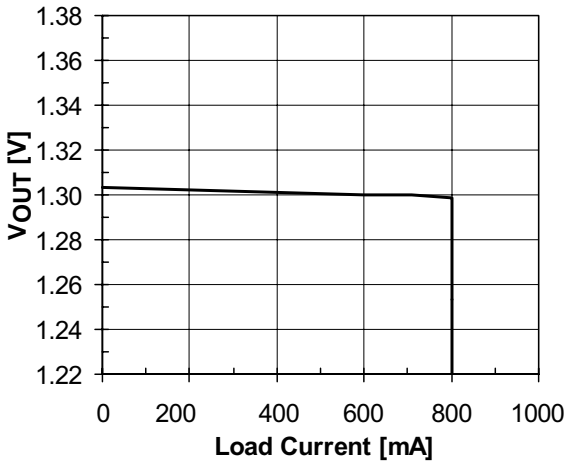
## Performance Information

**CM3001 Typical DC Characteristics (nominal conditions unless specified otherwise)**

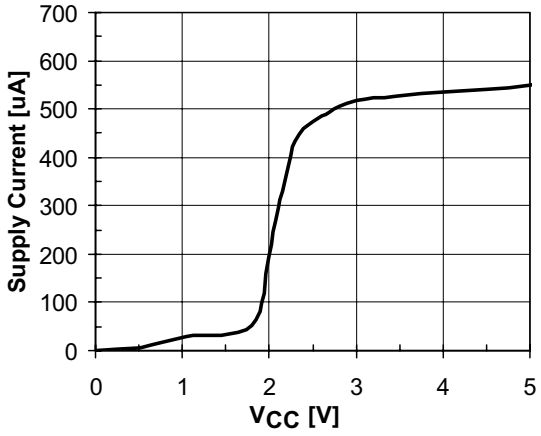
**Line Regulation with 500mA Load**



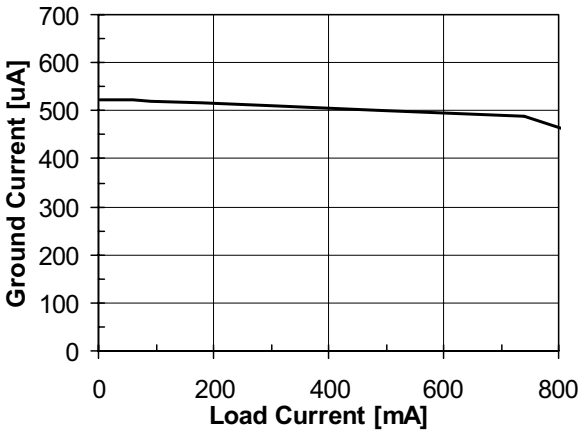

**Load Regulation**




**Supply Current vs. Voltage**



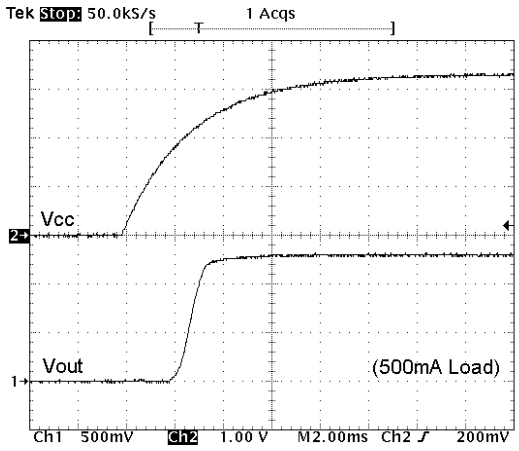

**Ground Current vs. Output Load**



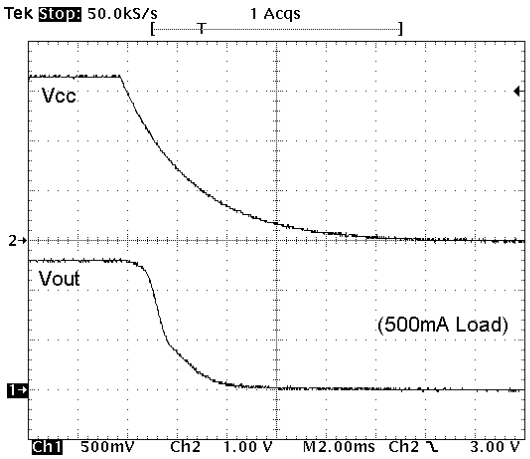
# Performance Information (cont'd)

**CM3001 Typical Transient Characteristics (nominal conditions unless specified otherwise)**

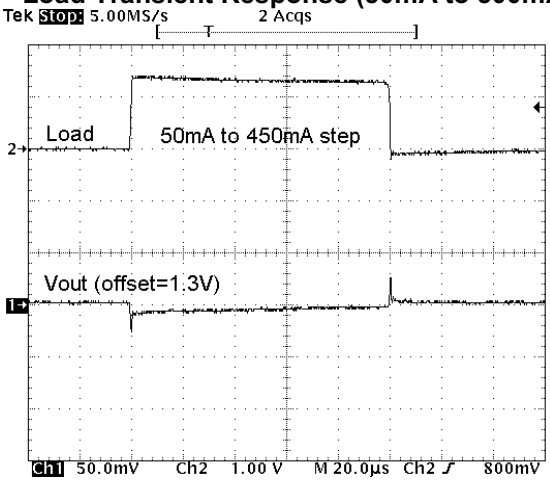
**Cold Start Power-up with Rated Load**



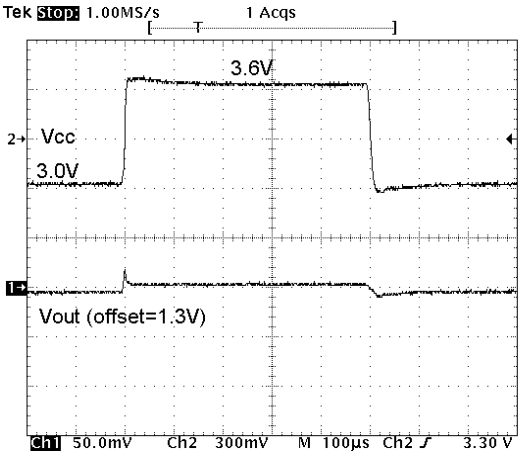

**Full Power Down with Rated Load**




**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:

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

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:

$$T_{JUNC} = T_{AMB} + P_D * (\theta_{JA})$$
$$= 70°C + .8W * (70°C/W)$$
$$= 70°C + 55°C = 125°C$$

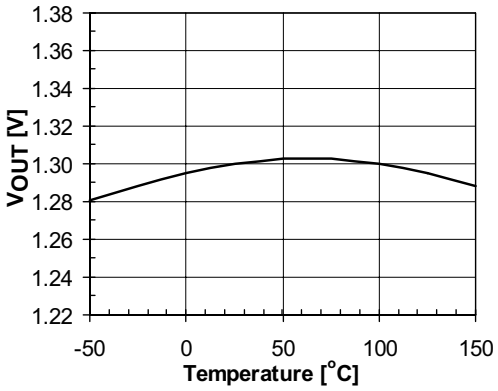
Thermal characteristics were measured using a double sided board with two square inches of copper area connected to the GND pins for "heat spreading".

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.

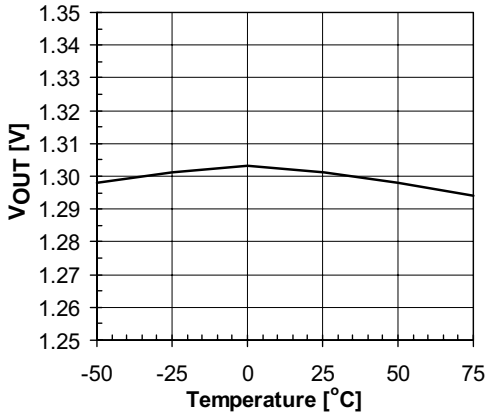
**Note:** The use of multi-layer board construction with separate ground and power planes will further enhance the overall thermal performance. In the event of no copper area being dedicated for heat spreading, a multi-layer board construction using only the minimum size pad layout will typically provide 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)**

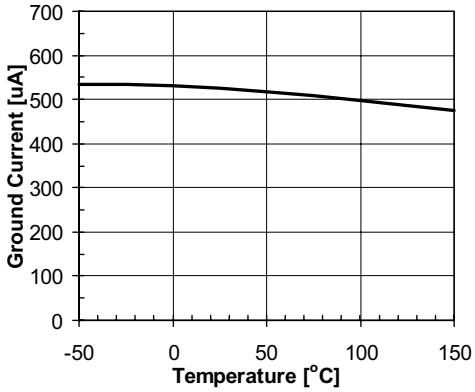



**Figure 1. CM3001 Performance vs. Temperature**

## Mechanical Details

**MSOP-8 Mechanical Specifications:**

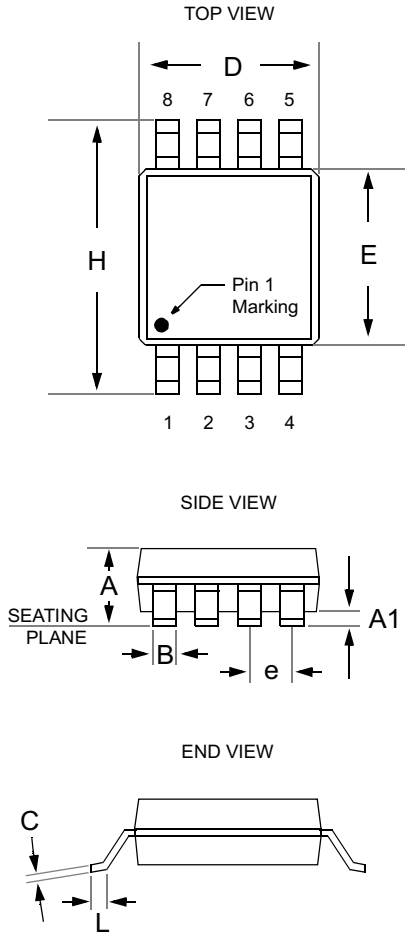
CM3001-13MA device is packaged in 8-pin MSOP package. Dimensions are presented below.

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**