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19-1791; Rev 0; 10/00

MAXIM

# Micropower Adjustable Overvoltage Protection Controllers



## General Description

The MAX1807/MAX1808 monitor up to five supply rails for an overvoltage condition and provide a latched output when any one of the five supplies exceeds the trip thresholds. The latched output drives an external P-channel load switch to remove power when an overvoltage condition is detected. The latch is reset when a logic low is input to ON or the power supply is cycled.

The MAX1807 provides a 28V open-drain fault output that can be used to trigger an alert, trip a resetable fuse, or for other purposes. The MAX1808 includes a low-battery comparator with hysteresis to drive the DP output high, turning off the external P-channel switch when the input voltage is too low.

The MAX1807/MAX1808 are available in a miniature 10-pin µMAX package.

## Applications

Notebook Computers

Power-Supply Modules

Multi-Output Power Supplies

***Pin Configuration and Typical Operating Circuit appear at end of data sheet.***

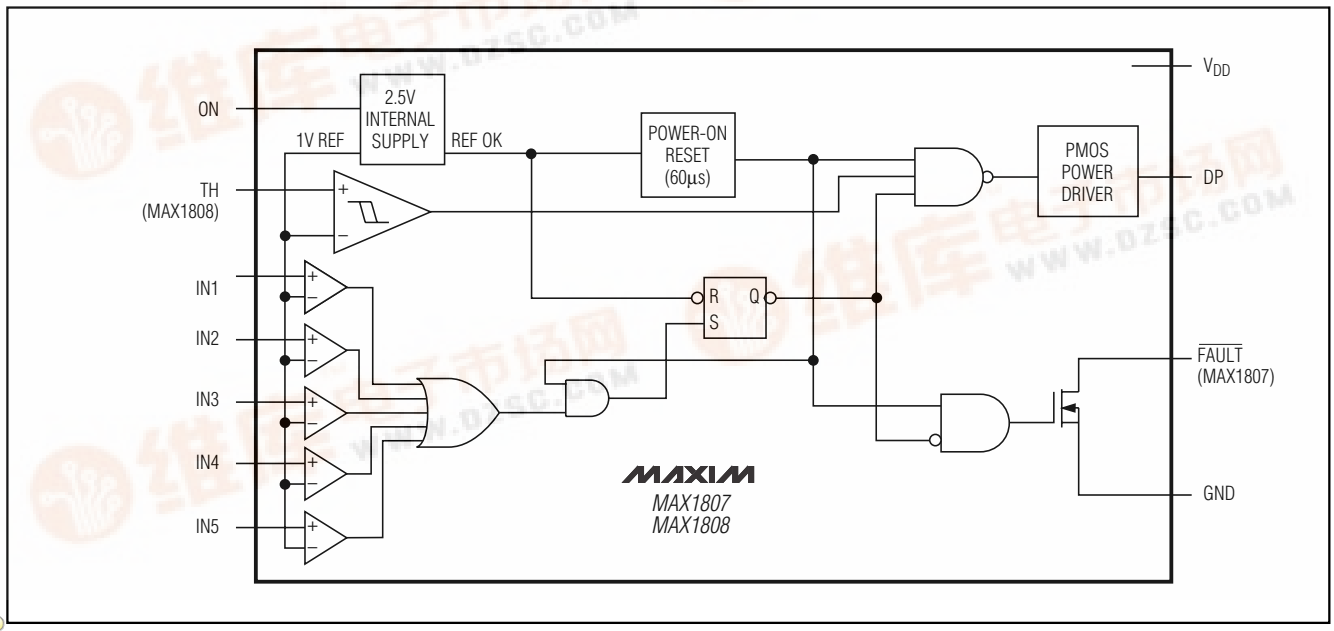
## Features

- ♦ **Five 3% Accurate Overvoltage Comparators**
- ♦ **Series PFET Gate Driver with VGS Limiter**
- ♦ **21µA Quiescent Supply Current**
- ♦ **4µA Shutdown Current**
- ♦ **4.4V to 28V Operating Voltage Range**
- ♦ **3% Accurate Comparator with 10% Hysteresis for Low-Battery Detection (MAX1808)**
- ♦ **28V Open-Drain N-Channel Output (MAX1807)**
- ♦ **Small 10-Pin µMAX Package**

## Ordering Information

| PART | TEMP. RANGE | PIN-PACKAGE |
|---|---|---|
| **MAX1807**EUB | -40°C to +85°C | 10 µMAX |
| **MAX1808**EUB | -40°C to +85°C | 10 µMAX |

## Functional Diagram






For price, delivery, and to place orders, please contact Maxim Distribution at 1-888-629-4642,

# Micropower Adjustable Overvoltage Protection Controllers

## ABSOLUTE MAXIMUM RATINGS

IN1_, TH to GND .....-0.3V to +6V
ON, $V_{DD}$, $\overline{FAULT}$ to GND .....-0.3V to +30V
DP to GND .....-0.3V to ($V_{DD}$ + 0.3V)
Continuous Power Dissipation
10-Pin µMAX (derate 5.6mW/°C above +70°C) .....448mW

Operating Temperature Range .....-40°C to +85°C
Junction Temperature .....+150°C
Storage Temperature Range .....-65°C to +150°C
Lead Temperature (soldering, 10s) .....+300°C

*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

## ELECTRICAL CHARACTERISTICS

($V_{DD}$ = $V_{ON}$ = 15V, $V_{IN1}$–$V_{IN5}$ = 0.5V, $V_{TH}$ = 2.0V, $C_{DP}$ = 5nF, $\overline{FAULT}$ = open, **$T_A$ = 0°C to +85°C**, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| **GENERAL** | | | | | | |
| $V_{DD}$ Input Voltage Range | | DP and $\overline{FAULT}$ in correct state (Table 1) | 2 | | 28 | V |
| $V_{DD}$ Operating Voltage Range | | | 4.4 | | 28 | V |
| $V_{DD}$ Undervoltage Lockout Threshold | | Rising trip level, typical 2% hysteresis; when $V_{DD}$ is below this level, DP = Hi and $\overline{FAULT}$ = Hi-Z | 2 | 2.7 | 4.0 | V |
| Supply Current | | $V_{TH}$ = 2V or 0.5V | | 21 | 45 | µA |
| Shutdown Current | | $V_{DD}$ = 15V, $V_{ON}$ = GND, $V_{IN1}$–$V_{IN5}$ = $V_{TH}$ = GND | | 4 | 8.5 | µA |
| **COMPARATORS (IN1–IN5, TH)** | | | | | | |
| IN1–IN5 Input Trip Level | | Rising edge, typical 1% hysteresis, $V_{DD}$ = 4.4V to 28V | 0.97 | 1 | 1.03 | V |
| TH Input Trip Level, Falling | | $V_{DD}$ = 4.4V to 28V (MAX1808 only) | 0.97 | 1 | 1.03 | V |
| TH Input Trip Level, Rising | | $V_{DD}$ = 4.4V to 28V (MAX1808 only) | 1.045 | 1.1 | 1.155 | V |
| IN1–IN5 Propagation Delay | | IN1–IN5 rising, 10mV overdrive, $V_{DD}$ = 4.4V | | 40 | | µs |
| TH Propagation Delay | | TH rising, 10mV overdrive, $V_{DD}$ = 4.4V (MAX1808 only) | | 11 | | µs |
| | | TH falling, 10mV overdrive, $V_{DD}$ = 4.4V (MAX1808 only) | | 40 | | |
| IN1–IN5 Input Leakage Current | | $V_{IN}$ = 1.5V | | 0.5 | 50 | nA |
| TH Input Leakage Current | | $V_{TH}$ = 1.5V (MAX1808 only) | | 0.5 | 50 | nA |
| ON Input High Logic Level | | $V_{DD}$ = 4.4V to 28V | 1.6 | | | V |
| ON Input Low Logic Level | | $V_{DD}$ = 4.4V to 28V | | | 0.5 | V |
| ON Input Leakage Current | | $V_{ON}$ = 5V | | 0.03 | 1.2 | µA |
| | | $V_{ON}$ = 28V | | | 10 | |
| $\overline{FAULT}$ Output High Leakage Current | | $V_{\overline{FAULT}}$ = 28V (MAX1807 only) | | 0.01 | 2 | µA |
| $\overline{FAULT}$ Output Low Voltage | | $I_{SINK}$ = 4mA (MAX1807 only) | | | 0.4 | V |

## ELECTRICAL CHARACTERISTICS (continued)

($V_{DD}$ = $V_{ON}$ = 15V, $V_{IN1}$–$V_{IN5}$ = 0.5V, $V_{TH}$ = 2.0V, $C_{DP}$ = 5nF, $\overline{FAULT}$ = open, **$T_A$ = 0°C to +85°C**, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| DP Source Current (PMOS Turn-Off) | | $V_{ON}$ = $V_{DD}$, $V_{IN1}$ = 1.5V | $V_{DP}$ = $V_{DD}$ - 0.4V | 1 | 50 | | µA |
| | | | $V_{DP}$ = $V_{DD}$ - 2V | 5 | 20 | | mA |
| DP Sink Current (PMOS Turn-On) | | $V_{DP}$ = $V_{DD}$ - 5V | | 4 | 50 | | mA |
| DP Pullup Current (PMOS Off) | | $V_{DP}$ = $V_{DD}$ - 2V, $V_{ON}$ = GND, in shutdown state | | | 25 | | µA |
| DP Turn-On Clamp Voltage ($V_{DD}$ - $V_{DP}$) | | $V_{ON}$ = $V_{DD}$, $I_{DPSINK}$ = 10µA | $V_{DD}$ = 8.5V to 28V | 7.5 | 9.5 | 11.5 | V |
| | | | $V_{DD}$ = 4.4V | 3.4 | 4.1 | 4.4 | |

## ELECTRICAL CHARACTERISTICS

($V_{DD}$ = $V_{ON}$ = 15V, $V_{IN1}$–$V_{IN5}$ = 0.5V, $V_{TH}$ = 2.0V, $C_{DP}$ = 5nF, $\overline{FAULT}$ = open, **$T_A$ = -40°C to +85°C**, unless otherwise noted.) (Note 1)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| **GENERAL** | | | | | | | |
| $V_{DD}$ Input Voltage Range | | DP and $\overline{FAULT}$ in correct state (Table 1) | | 2 | | 28 | V |
| $V_{DD}$ Operating Voltage Range | | | | 4.4 | | 28 | V |
| $V_{DD}$ Undervoltage Lockout Threshold | | Rising trip level, typical 2% hysteresis; when $V_{DD}$ is below this level, DP = Hi and $\overline{FAULT}$ = Hi-Z | | 2 | | 4.0 | V |
| Supply Current | | $V_{TH}$ = 2V or 0.5V | | | | 45 | µA |
| Shutdown Current | | $V_{DD}$ = 15V, $V_{ON}$ = GND, $V_{IN1}$–$V_{IN5}$ = $V_{TH}$ = GND | | | | 8.5 | µA |
| **COMPARATORS (IN1–IN5, TH)** | | | | | | | |
| IN1–IN5 Input Trip Level | | Rising edge, typical 1% hysteresis | | 0.95 | | 1.05 | V |
| TH Input Trip Level, Falling | | $V_{DD}$ = 4.4V to 28V (MAX1808 only) | | 0.95 | | 1.05 | V |
| TH Input Trip Level, Rising | | $V_{DD}$ = 4.4V to 28V (MAX1808 only) | | 1.045 | | 1.155 | V |
| IN1–IN5 Input Leakage Current | | $V_{IN}$ = 1.5V | | | | 50 | nA |
| TH Input Leakage Current | | $V_{TH}$ = 1.5V (MAX1808 only) | | | | 50 | nA |
| ON Input High Logic Level | | $V_{DD}$ = 4.4V to 28V | | 1.8 | | | V |
| ON Input Low Logic Level | | $V_{DD}$ = 4.4V to 28V | | | | 0.4 | V |
| ON Input Leakage Current | | $V_{ON}$ = 5V | | | | 1.2 | µA |
| | | $V_{ON}$ = 28V | | | | 10 | |
| $\overline{FAULT}$ Output High Leakage Current | | $V_{\overline{FAULT}}$ = 28V (MAX1807 only) | | | | 2 | µA |
| $\overline{FAULT}$ Output Low Voltage | | $I_{SINK}$ = 4mA (MAX1807 only) | | | | 0.4 | V |
| DP Source Current (PMOS Turn-Off) | | $V_{ON}$ = $V_{DD}$, $V_{IN1}$ = 1.5V | $V_{DP}$ = $V_{DD}$ - 0.4V | 1 | | | µA |
| | | | $V_{DP}$ = $V_{DD}$ - 2V | 4 | | | mA |
| DP Sink Current (PMOS Turn-On) | | $V_{DP}$ = $V_{DD}$ - 5V | | 2 | | | mA |
| DP Turn-On Clamp Voltage ($V_{DD}$ - $V_{DP}$) | | $V_{ON}$ = $V_{DD}$, $I_{DPSINK}$ = 10µA | $V_{DD}$ = 8.5V to 28V | 7.5 | | 11.5 | V |
| | | | $V_{DD}$ = 4.4V | 3.4 | | 4.4 | |

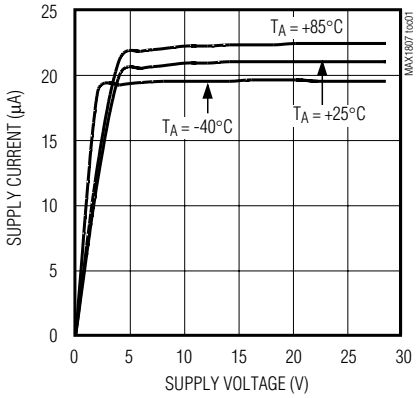
**Note 1:** Specifications to -40°C are guaranteed by design, not production tested.

# Micropower Adjustable Overvoltage Protection Controllers

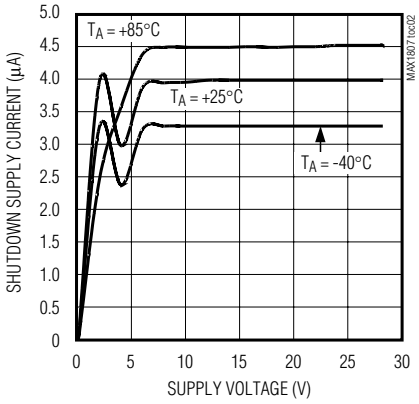
## Typical Operating Characteristics

(Typical Operating Circuit, $V_{DD}$ = 15V, $T_A$ = +25°C, unless otherwise noted.)

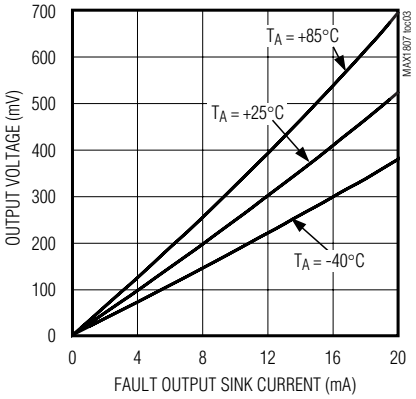
**SUPPLY CURRENT vs. SUPPLY VOLTAGE**



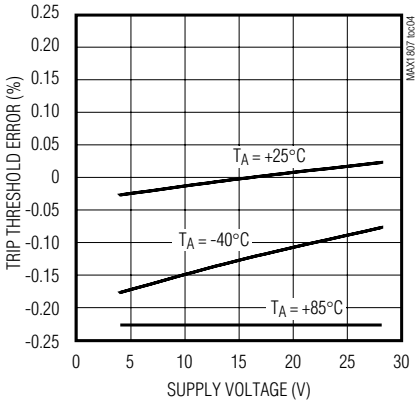

**SHUTDOWN SUPPLY CURRENT vs. SUPPLY VOLTAGE**



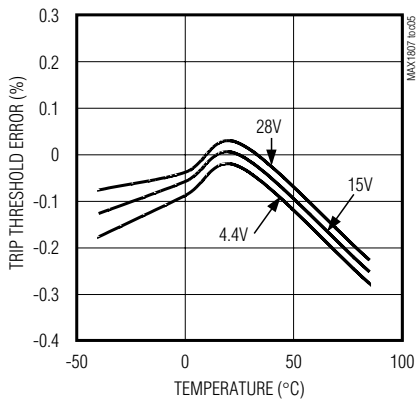

**$\overline{FAULT}$ OUTPUT VOLTAGE LOW vs. $\overline{FAULT}$ OUTPUT SINK CURRENT**



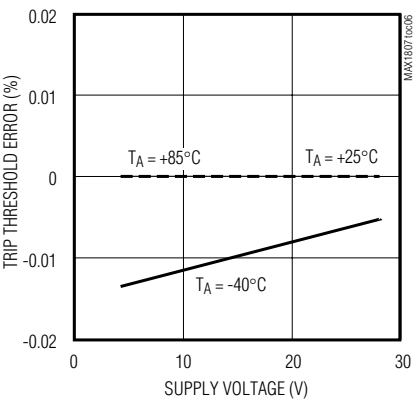

**NORMALIZED IN_ TRIP THRESHOLD ERROR vs. SUPPLY VOLTAGE**



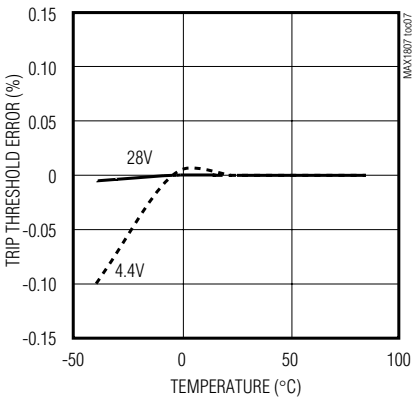

**NORMALIZED IN_ TRIP THRESHOLD ERROR vs. TEMPERATURE**



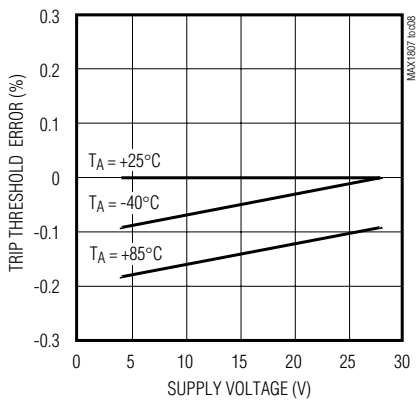

**NORMALIZED TH TRIP THRESHOLD ERROR vs. SUPPLY VOLTAGE (TH FALLING)**



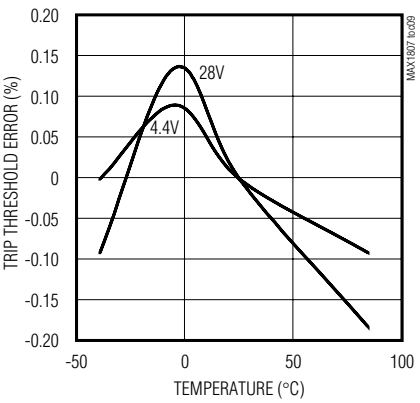

**NORMALIZED TH TRIP THRESHOLD ERROR vs. TEMPERATURE (TH FALLING)**




**NORMALIZED TH TRIP THRESHOLD ERROR vs. SUPPLY VOLTAGE (TH RISING)**



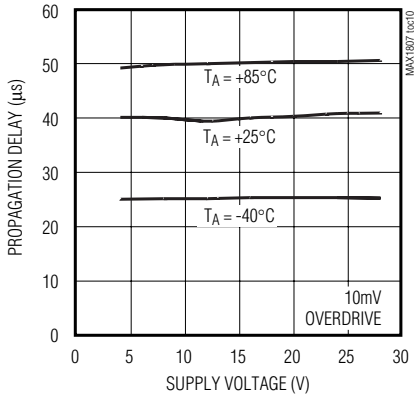

**NORMALIZED TH TRIP THRESHOLD ERROR vs. TEMPERATURE (TH RISING)**



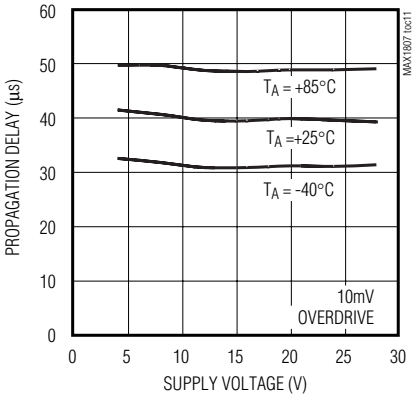
## Typical Operating Characteristics (continued)

(Typical Operating Circuit, $V_{DD}$ = 15V, $T_A$ = +25°C, unless otherwise noted.)

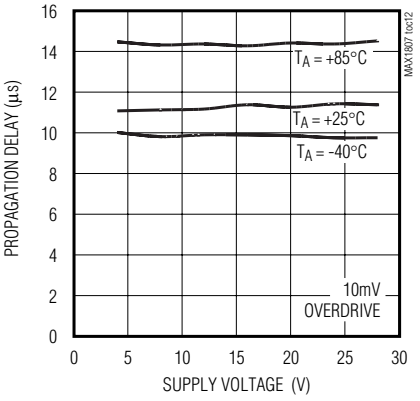
**IN_ PROPAGATION DELAY vs. SUPPLY VOLTAGE**



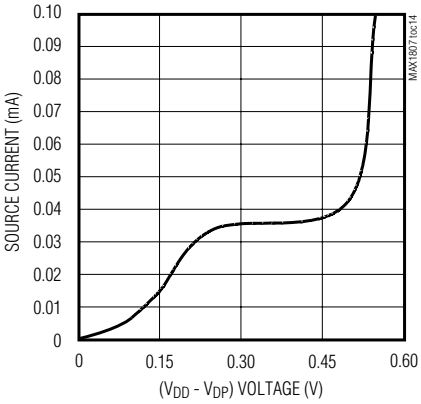

**TH PROPAGATION DELAY vs. SUPPLY VOLTAGE (TH FALLING)**



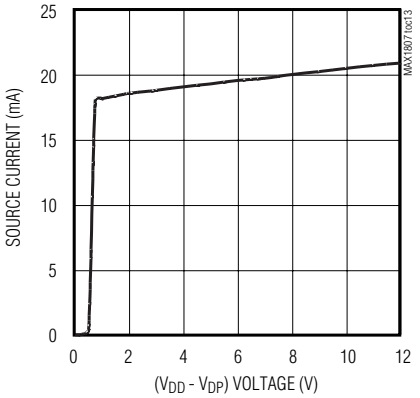

**TH PROPAGATION DELAY vs. SUPPLY VOLTAGE (TH RISING)**



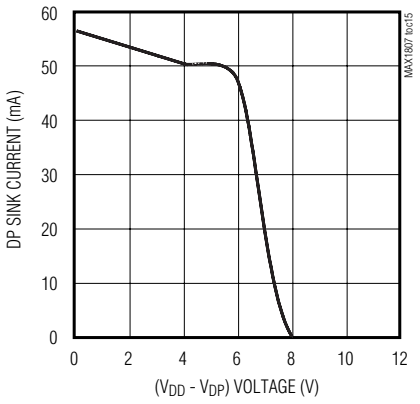

**DP SOURCE CURRENT vs. ($V_{DD}$ - $V_{DP}$) VOLTAGE**



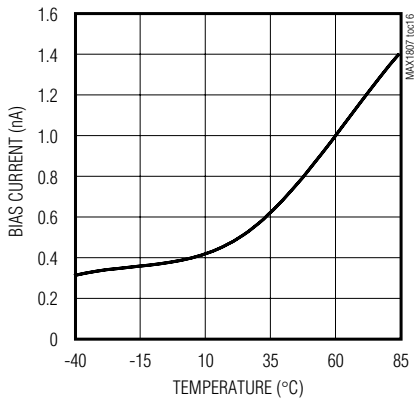

**DP SOURCE CURRENT vs. ($V_{DD}$ - $V_{DP}$) VOLTAGE**



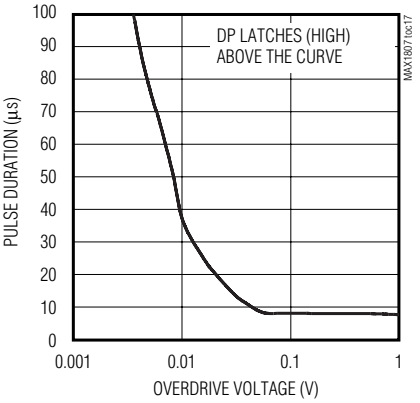

**DP SINK CURRENT vs. ($V_{DD}$ - $V_{DP}$) VOLTAGE**



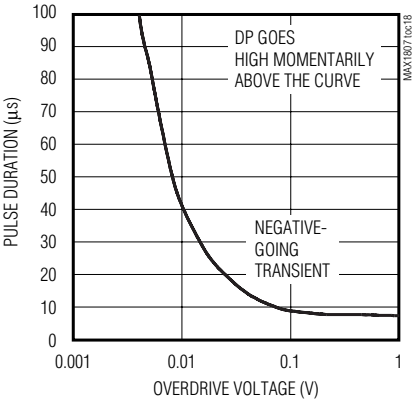

**IN_ AND TH BIAS CURRENT vs. TEMPERATURE**




**IN_ MAXIMUM TRANSIENT PULSE DURATION vs. PULSE OVERDRIVE VOLTAGE**

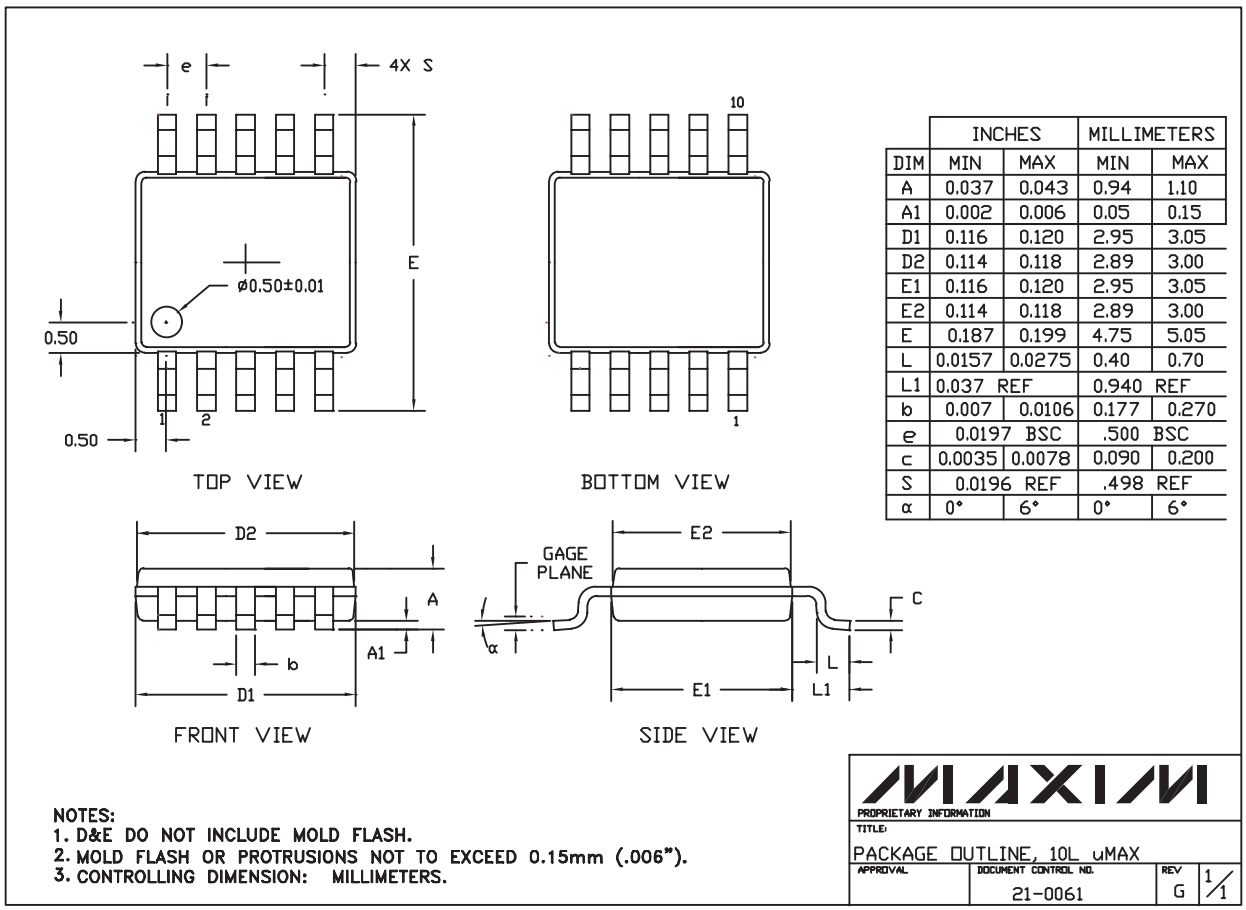



**TH MAXIMUM TRANSIENT PULSE DURATION vs. PULSE OVERDRIVE VOLTAGE**



# Micropower Adjustable Overvoltage Protection Controllers

## Package Information




| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.037 | 0.043 | 0.94 | 1.10 |
| A1 | 0.002 | 0.006 | 0.05 | 0.15 |
| D1 | 0.116 | 0.120 | 2.95 | 3.05 |
| D2 | 0.114 | 0.118 | 2.89 | 3.00 |
| E1 | 0.116 | 0.120 | 2.95 | 3.05 |
| E2 | 0.114 | 0.118 | 2.89 | 3.00 |
| E | 0.187 | 0.199 | 4.75 | 5.05 |
| L | 0.0157 | 0.0275 | 0.40 | 0.70 |
| L1 | 0.037 REF | | 0.940 REF | |
| b | 0.007 | 0.0106 | 0.177 | 0.270 |
| e | 0.0197 BSC | | .500 BSC | |
| c | 0.0035 | 0.0078 | 0.090 | 0.200 |
| S | 0.0196 REF | | .498 REF | |
| α | 0° | 6° | 0° | 6° |

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